THE ANALYSIS OF COMPETING HYPOTHESES (ACH) IN THE ASSESSMENT OF CHEMICAL WARFARE ACTIVITIES

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National Defence University
Department of Strategic and Defence Studies
Series 1: Strategic Research No 34

MAANPUOLUSTUSKORKEAKOULU
STRATEGIAN LAITOS
JULKAISUSARJA 1: STRATEGIAN TUTKIMUKSIA No 34

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AKATEEMINEN VÄITÖSKIRJA

Esitetään Maanpuolustuskorkeakoulun tutkimusneuvoston suostumuksella julkisesti tarkastettavaksi sotatieteiden tohtorin tutkintoa varten Maanpuolustuskurssien luentosalissa, Maneesikatu 6, Helsinki, keskiviikkona 17. joulukuuta 2014 kello 12.

ACADEMIC DISSERTATION

To be presented, with the permission of the Research Council of National Defence University, for public criticism for the degree of Doctor of Military Sciences at the lecture hall of the National Defence Courses, Maneesikatu 6, Helsinki, on Wednesday, 17th December 2014 at 12 o'clock.

NATIONAL DEFENCE UNIVERSITY

Department of Strategic and Defence Studies

HELSINKI 2014

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Julkaisusarja 1: Strategian tutkimuksia No 34
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National Defence University, Department of Strategic and Defence Studies
Series 1: Strategic Research No 34
Doctoral dissertation

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Cover photo: Empty 130 mm chemical weapons artillery shells awaiting internationally-verified destruction in 2009.

Layout: Anna Lind

ISBN 978-951-25-2574-4 (pbk.)
ISBN 978-951-25-2575-1 (PDF)
ISSN 1236-4959

Maanpuolustuskorkeakoulu – National Defence University
Strategian laitos – Department of Strategic and Defence Studies

Juvenes Print
Tampere 2014

TO ALICE M. HART

ABSTRACT

Analysis of Competing Hypotheses (ACH) in the Assessment of Chemical Warfare Activities

This study contributes to the theory and practice of how chemical weapons programmes and activity can be evaluated in the context of the international prohibition against their development, production, stockpiling, transfer and use as reflected in the 1993 Chemical Weapons Convention. It presents an application of a hybrid and qualitative variation of Heuer's Analysis of Competing Hypotheses (ACH) directed towards arms control verification and intelligence practice using three case studies: the Soviet Union, Iraq and suspected al-Qaeda affiliates. The study is comprehensive and multidisciplinary in approach, rather than reductionist. It draws on a large array of data as they relate to the technical, military and politico-strategic characteristics of chemical warfare, linking a large number of historical detail with conceptual insight into the nature of chemical warfare and chemical weapons arms control.

The work also places intelligence operational art on a more secure theoretical academic foundation in the chemical weapons-related context, partly by providing a useful basis for the understanding of the operational- and strategic-level analysis of chemical weapons threat assessments and appropriate policy responses. It shifts ACH practice closer to theoretical international relations models with respect to higher-level strategic and defence analysis, and international relations theory as it relates to WMD-related international peace and security questions. It does so partly by suggesting that a corollary exists between the role played by national intelligence requirements, on the one hand, and, on the other hand, that played by arms control verification. In particular, the information taskings for both weapons-specific arms control verification and national intelligence overlap to a great extent.

However, the priorities and perceived political acceptability for arms control verification and intelligence assessments are distinct and, in many respects, opposed to each other. For example, an arms control assessment carried out within a multilateral legal regime tends to possess greater overall international credibility and weight so long as it is done in a professional technical manner whose findings then inform the subsequent political and legal considerations. National based intelligence assessments are, as a rule, necessarily kept secret to protect sources and methods and are also more likely to be questioned on the grounds that the conclusions support national policy. Nevertheless, the information taskings should, on the basis of their respective technical requirements, yield similar outcomes. While in practice this does not necessarily occur, the gap can perhaps be narrowed on the basis of better operational-level understanding of how such assessments should ideally be carried out. National intelligence-driven processes, procedures and purposes can perhaps be better described at the strategic level by realism international relations theory, while those for arms control verification can perhaps be better described by neoliberal institutionalism.

Those in academia, government and the public can usefully refer to this study for a baseline of authoritative information with which to evaluate the derivation and use of information relevant to verification processes and requirements and their broader relevance for security and defence studies. Such evaluations can assist the consideration of what verification data actually mean and how technical and scientific findings relate to the question of treaty compliance by states and the resulting implications for the strength of the rule-of-law at the inter- and intra-state levels, as well as for strategic and defence studies in general.

CONTENTS

Figures and Tables

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John D. Hart is a Senior Researcher and Head of the Chemical and Biological Security Project (Arms Control and Non-proliferation Programme) at the Stockholm International Peace Research Institute (SIPRI) where he has worked for more than 14 years. In 2011 he headed a European Commission expert group to support public health in Central Asia and the South Caucasus under the Instrument for Stability. He was previously a researcher at the Monterey Institute of International Studies' Center for Nonproliferation Studies and the London-based Verification Research, Training and Information Centre (VERTIC). He was also a paid intern in the Verification Division of the Provisional Technical Secretariat to the Preparatory Commission to the Organisation for the Prohibition of Chemical Weapons (OPCW) where he prepared draft Chairmen's papers, discussion papers and Expert Group reports (Working Group B) and contributed to the drafting of the OPCW Declaration Handbook.

His publications include *Chemical Weapons Destruction in Russia: Political, Legal and Technical Aspects* (Oxford University Press: 1998, co-editor) and *Historical Dictionary of Nuclear, Biological and Chemical Warfare* (Scarecrow Press: 2007, co-author). He is also the author of 'The Soviet biological weapons program', in *Deadly Cultures: Biological Weapons Since 1945* (Harvard University Press, 2006); and 'The ALSOS Mission: 1943-1945: a secret US scientific intelligence unit' in *International Journal of Intelligence and CounterIntelligence* (fall 2005). He is co-author of 'WMD inspection and verification regimes: political and technical challenges' in *Combating Weapons of Mass Destruction: the Future of Non-Proliferation Policy* (University of Georgia Press, 2009); 'Science, technology, and the Biological Weapons Convention', *Arms Control Today* (Oct. 2012); and *The Future of the Chemical Weapons Convention: Policy and Planning Aspects*, SIPRI Policy Paper no. 35 (SIPRI: Stockholm, Apr. 2013).

ACKNOWLEDGEMENTS

I would like to thank the colleagues who have been involved in various ways with this study. They include Ambassador Serguei Batsanov, Col. (Ret.) Erik Erroll, Professor Stefan Forss, Alice M. Hart, Dr Peter Krejsa, Anna Lind, Ronald G. Manley, Dr William L. Mitchell, Jeffrey Osborne, Roger Roffey, Lt.-Col. Dr Torsti Sirén, Professor Pekka Sivonen, C. L. Vago, Dr Paula Vanninen and the Verification Institute (VERIFIN). I thank the anonymous reviewers. I also thank all of those who—more generally—have made me more 'situationally aware' of the topics covered in this work, including Jetta Gilligan-Borg, Dr Donald Clagett, Dr Peter Clevestig, Eric Croddy, Ambassador Rolf Ekéus, Dr Benjamin C. Garrett, Dr Frida Kuhlau, Milton Leitenberg, Dr Robert J. Mathews, Professor Matthew S. Meselson, Dr Ronald R. Nelson, Julian P. Perry Robinson, Dr Yaugen Ryzhkau, Dr Thomas Stock, Professor Ronald G. Sutherland, Dr Ralf Trapp, Dr Jean Pascal Zanders and Dr Raymond A. Zilinskas. I also thank the Finnish National Defence University Library and the SIPRI Library for their invaluable assistance in locating much of the lesser-known material cited in this work. I am responsible for any mischaracterizations, errors or omissions.

ABBREVIATIONS AND ACRONYMS

AC	Hydrogen cyanide
ACDA	Arms Control and Disarmament Agency
ACH	Analysis of Competing Hypotheses
ACINT	Acoustic Intelligence
ACW	Abandoned Chemical Weapon
AKhS	Artilleriisky khimichesky snaryad [chemical artillery shell]
AQ	al-Qaeda
AQIM	al-Qaeda in the Islamic Maghreb
ATAS	Academic Technology Approval Scheme
ATT	Arms Trade Treaty
BAL	British Anti Lewisite
BDA	Bilateral Destruction Agreement
BND	Bundesnachrichtendienst [Federal Intelligence Service]
BZ	3-quinuclidinyl benzilate
BTWC	Biological and Toxin Weapons Convention
C	Consistent
CAM	Chemical Agent Monitor
CAS	Chemical Abstracts Service
CATS	Center for Asymmetric Threat Studies
CBIAC	Chemical and Biological Defense Information Analysis Center
CBM	Confidence-Building Measure
CBRN	Chemical, Biological, Radiological and/or Nuclear
CBRNIAC	Chemical, Biological, Radiological & Nuclear Defense Information Analysis Center
CBT	Chemical, Biological, Toxin
CBW	Chemical and Biological Weapons/Chemical and Biological Warfare
CD	Conference on Disarmament
CEO	Chief Executive Officer
CIA	Central Intelligence Agency
CMV	Controlling the Means of Violence
CN	2-chlorobenzalmalononitrile
COI	Coordinator of Information
COMINT	Communications Intelligence
CTBT	Comprehensive Nuclear-Test-Ban Treaty
CWA	Chemical Warfare Agent
CWC	Chemical Weapons Convention
CWS	Chemical Warfare Service
CX	Phosgene oxime
DC	Diphenylcyanoarsine
DD	Distantsiya destvie [proximity fuze] [also: nekontaktnogo vzrivatel'ya]
D&D	Deception and denial
DDR	Disarmament, demobilization and reintegration
DEG	Diethylene glycol

DHS	Department of Homeland Security
DI	Directorate of Intelligence
DIA	Defense Intelligence Agency
DM	Adamsite
DMC	Dimethyl carbonate
DNI	Directorate of National Intelligence
DO	Directorate of Operations
DOD	Department of Defense
DRDC	Defence Research and Development Canada
DTIC	Defense Technical Information Center
ELINT	Electronic Intelligence
ELISA	Enzyme Linked Immunosorbent Assay
EMPTA	*O*-Ethyl methylphosphonothioic acid
FAS	Federation of American Scientists
FAST	Future Attribute Screening Technology
FATF	Financial Action Task Force
FBI	Federal Bureau of Investigation
FBIS	Foreign Broadcast Information Service
FFCD	Full, Final and Complete Declaration
FFI	Forsvarets forskningsinstitutet [Norwegian Defence Research Establishment]
FOA	Försvarets forskningsanstalt [Defence Research Institute]
FOI	Totalförsvarets forskningsinstitut [Swedish Defence Research Agency]
FTCA	Federal Tort Claims Act [United States]
GA	Tabun
GCHQ	Government Communications Headquarters [UK]
GC/MS	Gas chromatography/mass spectrometry
GD	Soman
GEOINT	Geographical Intelligence
GF	Cyclosarin
GosNIIOKhT	State Scientific Research Institute of Organic Chemistry and Technology
GPC	General Purpose Criterion
GRU	Main Intelligence Directorate
GWOT	Global War on Terror
HEPA	High Efficiency Particulate filter
HFP	1,1,1,3,3,3-hexafluoro-2-propanol
HI	Hazard index
HN-1, 2, 3	Nitrogen mustard [principal formulations]
HS	Harmonized Commodity Description and Coding System (Harmonized System)
HUMINT	Human Intelligence
I	Inconsistent
IAEA	International Atomic Energy Agency
IARPA	Incisive Analysis Office in the Intelligence Advanced Research Projects Activity
ICBM	Intercontinental Ballistic Missile
ICI	Imperial Chemical Industries
ICRC	International Committee of the Red Cross

ICT	Information and Communications Statistics
IISS	International Institute for Strategic Studies
IMEMO	Institute of World Economy and International Relations [Moscow]
IMINT	Imagery Intelligence
IMPA	Isopropylmethylphosphonic acid
INR	Bureau of Intelligence and Research [Department of State]
IR	International Relations/Information Request
ISP	Inspected State Party
ITU	International Telecommunications Union
IWM	Imperial War Museum
JASON	[US defence advisory group operated by the Mitre Corporation]
JIC	Joint Intelligence Committee [UK Cabinet Office]
KGB	Committee for State Security [russian]
KhAB	Chemical Air Bomb [russian]
KPI	Key Performance Indicator
L	Lewisite
LOCINT	Location Intelligence
LSD	Lysergic acid diethylamide
M	Mina [mine]
MAD	Mutually Assured Destruction
MAPS	Multidisciplinary Association for Psychedelic Studies
MASTINT	Measurement and Signature Intelligence
MFA	Ministry for Foreign Affairs
MFR	Memorandum for the Record
MKh	Mina khimicheskaya [chemical mine]
MIC	Methyl isocyanate
MOF	Metal-organic framework
MIG	Militant Islamic Group
MOU	Memorandum of Understanding
MRI	Magnetic Resonance Imaging
N/A	Not Applicable
NAM	Non-aligned Movement
NATO	North Atlantic Treaty Organization
NBC	Nuclear, Biological, Chemical
NDRC	National Defense Research Committee
NFAC	National Foreign Assessment Center
NIC	National Intelligence Council
NIE	National Intelligence Estimate
NISO	National Information Standards Organization
NKVD	People’s Commissariat for Internal Affairs
NMR	Nuclear magnetic resonance
NPT	Nuclear Non-proliferation Treaty
NSA	National Security Agency
NSC	National Security Council
NTM	National Technical Means
ODNI	Office of the Director of National Intelligence
OFF	Oil-for-Food Programme
OMV	Ongoing Monitoring and Verification

ONI	Office of Naval Intelligence
OFS	Office of Field Service
OPA	Organophosphorus Agent
OPCW	Organisation for the Prohibition of Chemical Weapons
OPER RECSYR	Operation Removal of Chemical Agents from Syria
OSINT	Open Source Intelligence
OSOAviaKhim	General Society for Aviation and Chemistry
OSRD	Office of Scientific Research and Development
OSS	Office of Strategic Services
OTA	Office of Technology Assessment
PBS	Public Broadcasting Service
PCB	Polychlorinated biphenyls
PCTEG	Policy Counter Terrorism Evaluation Group
PFIB	Perfluorisobutylene
POW	Prisoner-of-war
PPC	Penetrant protective carbon
PrepCom	Preparatory commission
PROTINT	Protected Information
PTFE	Polytetrafluoroethene
PTS	Provisional Technical Secretariat
RAND	Research ANd Development [Corporation]
RBM	Results Based Management
RCA	Riot Control Agent
RKKA	Worker-Peasant Red Army [USSR]
SACH	Structured Analysis of Competing Hypotheses
SACH-CW	Structured Analysis of Competing Hypotheses-Chemical Warfare
SALT	Strategic Arms Limitation Talks
SAT	Structured Analytic Technique
SEPP	State Establishment for Pesticide Production [Iraq]
SIBCRA	Sampling and Identification of Biological, Chemical, and Radiological agents
SIGNIT	Signals Intelligence
SIPRI	Stockholm International Peace Research Institute
SMA	Strategic Multi-Layer program (United States)
SOP	Standard Operating Procedure
SPRU	Science Policy Research Unit
SSR	Security Sector Reform
S&T	Science and Technology
TDG	Thiodiglycol
TEA	Triethanolamine
TIC	Toxic Industrial Chemical
TLC	Thin Layer Chromatography
UAV	Unmanned aerial vehicle
UBL	Usama bin Ladin
UD	Udarnoe deistvie [impact fuze]
UNMOVIC	United Nations Monitoring, Verification and Inspection Commission
UNODA	United Nations Office for Disarmament Affairs
UNSCOM	United Nations Special Commission on Iraq

UXO	Unexploded Ordnance
VTUZ	Vysshee Tekhnicheskoe Uchebnoe Zavedenie [Technical College]
VUZ	Vysshie Uchebnoe Zavedenie [Institution of Higher Learning]
VERIFIN	Verification Institute
VERTIC	Verification Research, Training and Information Centre
WHO	World Heath Organization
WI	Work Instruction
WINPAC	Weapons, Intelligence, Nonproliferation, and Arms Control
WMD	Weapon of Mass Destruction
WYSIATI	What you see is all there is

And thus do we of wisdom and of reach,
With windlasses and with assays of bias,
By indiscretions find directions out.
(*Hamlet*, Polonius, Act 2, Scene 1, William Shakespeare)

The great advantages of simulation and dissimulation are three. First, to lay asleep opposition, and to surprise. For where a man's intentions are published, it is an alarum to call up all who are against them. The second is, to reserve to a man's self a fair retreat. For if a man engage himself by a manifest declaration, he must go through or take a fall. The third is, the better to discover the mind of another. For to him that opens himself men will hardly shew themselves adverse; but will (fair) let him go on, and turn their freedom of speech to freedom of thought. And therefore it is a good shrewd proverb of the Spaniard, 'Tell a lie and find the truth.' As if there were no way of discovery but by simulation. There be also three disadvantages, to set it even. The first, that simulation and dissimulation commonly carry with them a shew of fearfulness, which in any business doth spoil the feathers of round flying up to the mark. The second, that it puzzleth and perplexeth the conceits of many, that perhaps would otherwise co-operate with him; and makes a man walk almost alone to his own ends. The third and greatest, is, that it depriveth a man of one of the most principal instruments for action; which is trust and belief. The best composition and temperature is to have openness in fame and opinion; secrecy in habit; dissimulation in seasonable use; and a power to feign, if there be no remedy.
(*The Essays or Counsels, Civil and Moral (1625)*, Francis Bacon)[1]

'If nature abhors a vacuum, politics abhors complexity'.
(James Carville, 2009)[2]

SUMMARY

The purpose of this study is to develop and test a methodology to evaluate whether a fundamental violation of the international prohibition of chemical warfare, as defined by the 1993 Chemical Weapons Convention (CWC), might have occurred.[3] Such a violation is understood to mean the development, production, stockpiling, transfer or use of chemical weapons. As general background, human understanding and perception of the external world

[1] Francis Bacon, *The Major Works, Including New Atlantis and the Essays* (Oxford University Press: Oxford, 2008), annotated by Brian Vickers, p. 351.

[2] James Carville, 'Daddy, Tell Me, What Exactly is a Derivative?', *Financial Times*, 26 Mar. 2009, p. 9.

[3] This is irrespective of whether the analysis, including the case studies, covers activity before the CWC's entry-into-force (e.g., for Iraq or the Soviet Union). The application of the methodology is also meant to be future-oriented (e.g., relevant for non-state actor threats). This risks introducing a form of hindsight bias ('presentism') whereby the knowledge and resources currently available is applied to problems encountered in the past. See James M. Nyce, 'Hindsight Bias, Scientism and Certitude: Some Problems in the Intelligence Literature', *Kungl. Krigsvetenskaps Akademiens Handlinger och Tidskrift* [The Royal Swedish Academy of War Sciences Proceedings and Journal], no. 2 (summer 2011), p. 116 (in English). To reiterate, the application of a contemporary definition of a chemical weapon prohibition is meant as a simplifying assumption in order to better structure and focus the analytical methodology.

are briefly considered within a political science and intelligence studies context. This includes the introduction of the concept of the intelligence cycle. The analytical framework is an adaptation of the Analysis of Competing Hypotheses (ACH) methodology developed by Richards J. Heuer, Jr. It is also informed by the work of Kristan J. Wheaton and Diane E. Chido who have sought to refine the methodology, which they term the Structured Analysis of Competing Hypotheses (SACH).[4] Heuer worked for the Central Intelligence Agency (CIA) for some 45 years and published the ACH methodology in *Psychology of Intelligence Analysis* (1999). In 2010 Heuer, together with Randolph H. Pherson (also a former CIA employee), revised and further developed the methodology in *Structured Analytic Techniques for Intelligence Analysis* (2011). Both works are standard training texts for many intelligence practitioners. The application of didactive intelligence training methods to academic curricula has become increasingly common in the United States since 2001.[5] It has also often been observed that intelligence analysis is both an art and science.[6]

It is hypothesized that the application of a hybrid, qualitative and CW-focused formulation of ACH directed to arms control verification and intelligence techniques will yield sufficient operational-level dichotomies that can then be used to inform a strategic analysis of neoliberal institutionalism and realist International Relations (IR) theoretical models. By employing a variation of established training methodologies for intelligence purposes, such distinctions (i.e., operational-level dichotomies) can help to explain and further develop these schools' modeling of WMD deterrence theory, both in a traditional Cold War state-to-state context and a contemporary non-state actor context. In so doing, the gap between intelligence art and academic IR theory can be partially reconciled.

This study also integrates arms control CW verification and compliance literature into a variation of ACH that is linked to a form of 'argument mapping' developed by the author. This is done partly in order to facilitate more general qualitative strategic analysis on the role of CW assessments in the arms control, and security and defence fields. ACH is an appropriate analytical technique for inter alia: (*a*) assessing the possibility of deception, (*b*) challenging one's mental model and (*c*) managing conflicting mental models or opinions.[7] ACH should be used in cases where it is difficult to decide between alternate explanations, where

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[4] Kristan J. Wheaton and Diane E. Chido, 'Structured Analysis of Competing Hypotheses: Improving a Tested Intelligence Methodology', *Competitive Intelligence Magazine*, vol. 9, no. 6 (Nov.–Dec. 2006), pp. 12–15.

[5] Carl Jensen, the Director of the Center for Intelligence and Security Studies at the University of Mississippi states that Heuer's and Pherson's Structured Analytic Techniques for Intelligence Practitioners (2011) is 'destined to become a classic' and that he will integrate the volume into his centre's intelligence and security curriculum 'at the earliest opportunity'. Richards J. Heuer Jr. and Randolph H. Pherson, *Structured Analytic Techniques for Intelligence Analysis* (CQ Press: Washington, DC, 2011), back cover. See also Scott Gold, '9/11 Spawned Big Changes on Campus', *Los Angeles Times*, 31 Aug. 2011, <http://articles.latimes.com/2011/aug/31/nation/la-na-911-homeland-security-colleges-20110901>, (accessed 14 June 2013). The wiki entry on ACH seems to have appeared in 2013. The entry did not exist when the author began this study. <https://en.wikipedia.org/wiki/Analysis_of_competing_hypotheses>, (accessed 5 Aug. 2013).

[6] Klaus Knorr, *Foreign Intelligence and the Social Sciences*, Research Monograph no. 17 (Woodrow Wilson School of Public and International Affairs (Center of International Studies): Princeton, 1 June 1964), pp. 36–37.

[7] Heuer Jr. and Pherson (note 5), pp. 36–37.

one requires a systematic approach to help uncover unsuspected outcomes, in cases where it is useful to leave behind an 'audit trail' that indicates how evidence was understood and used in order to permit other analysts to reach alternate conclusions, and where a 'robust flow of data' must be absorbed and evaluated.[8] Heuer and Pherson note that ACH is 'well-suited for addressing questions about technical issues in the chemical, biological, radiological, and nuclear arena'.[9]

The literature on ACH has not been sufficiently developed on the basis of specific intelligence problems and case studies.[10] There appears to have been no attempt to apply ACH to chemical weapons in the published literature (such application to biological and nuclear weapon assessments appear lacking as well).[11] Therefore, a chemical weapons context for the ACH has been developed. It is informed by the stages of proliferation as defined by the fundamental study published by the US Congress Office of Technology Assessment (OTA), *Technologies Underlying Weapons of Mass Destruction* (1993).[12] The structure is also informed by Milton Leitenberg's work to elucidate the distinction between 'offensive' and 'defensive' biological warfare indicators, most of which is also relevant to the chemical side. The extent to which ACH can or should be termed a 'cycle' is also considered.[13]

Three case studies are then considered: (*a*) a large state programme (Soviet Union), (*b*) a medium state programme (Iraq) and (*c*) non-state actors (al-Qaeda affiliates).[14] A technical dimension is indispensable to a proper understanding of this topic. Data acquisition issues (e.g., data mining and 'deep packet inspection') and sampling and analysis of possible CW agents (including toxic industrial chemicals, TICs) and their degradation products are discussed. In addition, the results of sampling and analysis can determine the extent to which a

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[8] Heuer Jr. Pherson (note 5), pp. 160–161.

[9] Heuer Jr. and Pherson (note 5), p. 161.

[10] For a more general application of case studies approach, see Sarah Miller Beebe and Randolph H. Pherson, *Cases in Intelligence Analysis: Structured Analytical Techniques in Action* (CQ Press: Washington, DC, 2011).

[11] The author cannot exclude that such work has been done, but is classified and thus unavailable. Heuer and Pherson state, however, that 'structured analysis' (of which ACH is one component) is 'the new kid on the block'. Heuer Jr. and Pherson (note 5), p. 23.

[12] US Congress, Office of Technology Assessment, *Technologies Underlying Weapons of Mass Destruction*, OTA-BP-ISC-115 (US Government Printing Office: Washington, DC, Dec. 1993), p. 20.

[13] Analysts sometimes present ACH as an alternative to the intelligence management cycle. However, ACH shares the broad objective of how to organize the derivation and use of information which, arguably, is a 'cycle'. David Omand presents an alternative structure to the traditional 'cycle'. See David Omand, *Securing the State* (Hurst and Company: London, 2010), p. 119. These questions will be analyzed below.

[14] The CWC provisions are applicable to individuals and groups through the adoption and effective implementation of relevant legislation and laws by the member states. The OPCW carries out some consultation, fact-finding and capacity building to address non-state actor threats, including through the holding of meetings and training exercises, with inter alia customs and licensing officials and representatives of various other international bodies. In 2013 the US Supreme Court considered a case as to whether the US Government should prosecute domestic poisoning cases (e.g., Carol Anne Bond) using the Chemical Weapons Convention statutes. In 2014 it rejected the applicability of the US CWC statute in this case. For the CWC definition of a chemical weapon, see Annexe A.

hypothesis can be validated or a fact can be said to be 'knowable' or sufficiently definite to support decisionmaking processes. Sampling and analysis are nevertheless distinct from the processes of political and legal interpretation of hypotheses and facts. These points were highlighted by the work of United Nations Special Commission on Iraq (UNSCOM) (and its successor the United Nations Monitoring, Verification and Inspection Commission, UNMOVIC) in terms of how their findings were subsequently interpreted by governments and other interested actors in a manner to support politically-preferred outcomes. Perhaps the most important overarching international security question in the context of this study was whether the work of UNSCOM and UNMOVIC provided a sufficient technical basis for supporting the decision by the United States to attack Iraq in April 2003.[15] The relevance of such factors has been highlighted again by the establishment of a fact-finding mission by the UN Secretary-General in 2013 to investigate CW use in Syria and subsequently by the OPCW.

A progressively broader view is provided in the analysis and conclusions in which points raised in the general background section are revisited. This broader analysis includes possible motivations for CW acquisition or standby capacities and the future prospects (policy and technical) for ensuring that the international prohibition against chemical warfare is effectively maintained, despite fundamental changes in science and technology (S&T) and evolving political and international security interests. A strategic theoretical application of ACH is also considered in an IR theory context.

Scope and Focus

A number of simplifying assumptions have been taken in order to improve the study's focus. The framework is on the *analytical process* only. It therefore focuses on what a single, well-informed analyst (e.g., government employee or international civil servant) or small analytical unit might produce if asked whether the prohibition against chemical warfare—as defined by the CWC—has occurred (i.e., to determine whether chemical weapons have been developed, produced, stockpiled, transferred or used). It should be noted that, while structured analytical techniques (SATs)[16] can be employed by individuals, they are often applied to facilitate (inter- and intra) group collaboration.[17] ACH also often involves sorting through varied and numerous data points. This often occurs through the use of specially developed software.[18] The approach taken in this study is to use ACH to inform site-specific estimates and their implications for strategic and defence analysis. An attempt is made to bridge the gap between scholarly analysis and the functional utility of an established intelligence

[15] 'Sufficient' is necessarily subjective.

[16] Randy Pherson's wife, Kathy, has been credited with originating the term SAT, which builds on the earlier US intelligence term 'alternative analysis'. In June 2005, SATs entered official US intelligence terminology when updated training materials were approved. Heuer Jr. and Pherson (note 5), pp. 8 & 10.

[17] Heuer Jr. and Pherson (note 5), p. 23.

[18] See Pherson Associates, <www.pherson.org>, (accessed 26 May 2013); and Palo Alto Research Center, '$ACH_{2.0.5}$ Download Page', <www2.parc.com/istl/projects/ach/ach.html> (accessed 26 May 2013).

technique when directed towards a particular weapon system. It should be noted, however, that intelligence products have generally taken the form of an analytical synthesis that addresses a given set of points (i.e., taskings). Policymakers, for example, do not generally wish to read extra text that describes the underlying structured analytical technique or a mass of disparate and conflicting data. To do so, would also risk (from the intelligence agency's perspective) opening up the report's conclusions to criticism and skepticism which, in turn, should generally be done at other stages of the intelligence cycle, including in a consultative/peer review context.

Some universities may consider much of the activity of intelligence analysts' work as insufficiently 'academic' or 'scholarly'.[19] Thus, Dr Allan E. Goodman, the President and CEO of the nonprofit Institute of International Education and formerly the academic dean of the School of Foreign Service at Georgetown University, has observed:

'Information about such things as radar parameters, weapons systems performance characteristics, C3I (command, control, communication, and intelligence) hardening, and the state of readiness of certain military and paramilitary forces is central to national security planning and decisionmaking. These are not the usual subjects of inquiry for dissertation writers or contributors to academic journals, nor is the press very skilled at (or interested in) conducting detailed military assessments and maintaining the databases to do so'.[20]

This study attempts to reconcile partially this dichotomy between academic analysis and operational utility. It does so partly by presenting an analytical process that can then be subjected to checks concerning the validity (or applicability) of procedure and underlying assumptions.

Another simplification in the analysis is to focus on the question of *production* and/or *stockpiling* of chemical weapons. Development and transfer of chemical weapons are considered only insofar as they inform the analysis of stockpiling or use of such weapons. This has been done partly in order to avoid 'proliferation sensitive speculation'. In addition, only gas chromatography/mass spectrometry (GC/MS) is considered in any detail.[21] The use of handheld GC/MS detectors, in particular, is more straightforward to describe and use in the field, as opposed to the wide and varied capabilities and techniques employed by various national defence and research laboratories. A further simplification is to focus on three of the principal chemical warfare agents that have been traditionally stockpiled in past military programmes: the blister agent sulphur mustard and the organophosphorus nerve agents sarin and VX.[22] Anti-material,

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[19] On the gap between intelligence scholarship and practice, see Stephen Marrin, *Improving Intelligence Analysis: Bridging the Gap Between Scholarship and Practice* (Routledge: London, 2011); and Knorr (note 6). A functional training guide for intelligence practioners is Heuer Jr. and Pherson (note 5).

[20] Allan E. Goodman, 'Intelligence in the Post-Cold War Era', p. 59 in Allan E. Goodman, Gregory F. Treverton and Philip Zelikow, *In From the Cold: the Report of the Twentieth Century Fund Task Force on the Future of US Intelligence* (Twentieth Century Fund Press: New York City, 1996).

[21] Instrumentation and associated analytical techniques for CW evaluation purposes are extensive and intricate topics in their own right.

[22] Since Nov. 2009 the OPCW has been carrying out confidence-building exercises for the laboratory testing of biomedical samples for biomarkers of CW agents. M. Koller, 'Participation in the Second Confidence Building Exercise on Biomedical Sample Analysis', p. L-25 in

anti-animal and anti-crop programmes are also excluded from this study.[23] Only selected sub-aspects of the totality of the activity in the case studies are analysed. Incomplete or ambiguous information is generally the norm in intelligence anlaysis.

In addition, many broader issues raised in the intelligence studies field have been excluded or touched on only in passing. These include bureaucratic imperatives, budgetary oversight and intelligence taskings to support combat operations.[24] This is because such factors do not directly inform the question of whether a CWC-defined violation has occurred.

The field of intelligence studies is, alternatively, heavily historical, or focused on general principles of human understanding and policy processes[25] (e.g., from a 'rational actor' or organizational theory perspective), or concerned with ways to automate the collection, sifting and analysis of data. Such automation is often done to discover meaning (or 'significance') and to avoid 'cognitive traps' (arising from mental biases or illogical thought patterns). The analytical approaches generally taken by military and civilian intelligence units and among states may also differ. Mentalities and priorities also vary according to the language, culture and implicit assumptions concerning state interests and state power.[26] Finally, much of the literature is in English and draws heavily on US publications.[27] The interests and perceptions of other states do not necessarily coincide with those of the United States.

The question posed in each of the case studies is whether the actors involved are or might be carrying out programmes or activities that violate the CWC prohibition against chemical warfare (i.e., production or stockpiling). The

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Proceedings of the *14th Medical Chemical Defence Conference 2013*, Bundeswehr Institute of Pharmacology and Toxicology; 23–25 Apr. 2013, Munich (unclassified).

[23] The prohibitions of the 1993 Chemical Weapons Convention and the 1972 Biological and Toxin Weapons Convention also cover anti-animal and anti-crop agents if used as a method of warfare or for hostile purposes.

[24] For a review of theoretical and conceptual bases for intelligence analysis to support contemporary military operations, see Wayne Michael Hall and Gary Citrenbaum, *Intelligence Analysis: How to Think in Complex Environments* (ABC-CLIO: Denver, 2010).

[25] E.g., Paul R. Pillar, *Intelligence and US Foreign Policy: Iraq, 9/11, and Misguided Reform* (Columbia University Press: New York City, 2011); and Thomas Fingar, *Reducing Uncertainty: Intelligence Analysis and National Security* (Stanford Security Studies, Stanford University Press: Stanford, California, 2011).

[26] Charles A. Duelfer remarked on this when describing his involvement in attempting to uncover NBC weapons and longer-range ballistic missiles in Iraq following the US-UK led invasion of the country in 2003. E.g., he observes 'In retrospect, it is obvious that analysts had too little direct contact or experience…Except for some former military recruits, most new analysts have no personal experience with any of the conflicts or emotions of much of the world…Edging closer to insanity seemed sometimes to bring some greater understanding. Cool analysis does not always produce truth. The Internet does not transmit those insights. There are atavistic instincts that drive events that are not obvious when the world is experienced through a computer screen'. Charles Duelfer, *Hide and Seek: the Search for the Truth in Iraq* (PublicAffairs: New York City, 2009), p. xv.

Daniel Kahneman, a recipient of the Nobel Prize in Economics Sciences, has researched judgement and decision making, including cognitive biases. See Daniel Kahneman, *Thinking, Fast and Slow* (Farrar, Straus and Giroux: New York City, 2011). His work is a useful complement to Heuer's 1999 study.

[27] E.g., Heuer Jr. and Pherson (note 5); and National Intelligence University, 'Welcome to the National Intelligence Press!', <http://ni-u.edu/ni_press/press.html> (accessed 20 May 2013).

evidence for the two main hypotheses and select key sub-themes are then compared against the evidence in a structured and systematic manner. The hypotheses are then further refined, and examined for sensitivity and consistency. The focus of the case studies is further refined according to a limited number of topics which are defined in the section introducing Heuer's 8 steps and the CW-specific matrices (developed by the present author).

As far as the author is aware, no such structured theoretical analysis based on case studies has been carried out (or at least been published).[28] Some governments have undoubtedly issued training guidance for intelligence analysts that is specific to chemical weapons. General frameworks developed for assessing traditional state programmes in the literature include: (*a*) chemical weapon systems models, (*b*) chemical weapon system test models and (*c*) chemical weapon development organisation models.[29] The 1993 OTA report provides a model depicting chemical weapon acquisition pathways.[30] Another methodology for assessing possible offensive chemical weapon-related activity is to categorize information according to 'defensive' and 'offensive' indicators, as has been done by Milton Leitenberg in the biological field.[31]

Such models act as organizing principles with which to analyse information, including for case studies. However, national intelligence estimates (NIEs), the UK's Joint Intelligence Committee (JIC) (or equivalent), and 'status-of-proliferation' reports are not, as a rule, theoretically structured.[32] Their structure rather reflects functional or practical difficulties associated with defining intelligence problems and linking them to policy options and other state requirements. This leaves them open to the criticism of merely presenting 'informed opinion', rather than being products that are based on, for example, the latest findings in social science research.[33] Conversely, the relevance of social science research (and academia more generally) to intelligence practice has also been questioned.[34]

Thus declassified intelligence assessments (either in part or in their entirety) offer insight into how the analytical problems are understood and analysed. Some are functionally or operationally-oriented. Some reporting is meant to convey information as a factual narrative instead of using predictive or analytical language. The format for inspection reports prepared by the

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[28] The US defence contractor Mitre published a case study based on ACH to assess the relative likelihood of three hypotheses explaining why an April 1989 explosion on the battleship *USS Iowa* occurred. The study found that confirmation bias (i.e., information that tends to confirm a person's beliefs) was less evident among those not trained in ACH. Nevertheless, ACH requires analysts to develop their own hypotheses, while those who participated as the subject of this study were presented with ready-made hypotheses. Brant A. Cheikes, Mark J. Brown, Paul E. Lehner and Leonard Adelman, *Confirmation Bias in Complex Analyses* (Mitre: Bedford Massachusetts, Oct. 2004) (unclassified).

[29] Based on Robert M. Clark, *Intelligence Analysis: a Target-Centric Approach*, 3rd edtn. (CQ Press: Washington, DC, 2010), pp. 44–45.

[30] US Congress, Office of Technology Assessment (note 12), p. 20.

[31] E.g., Milton Leitenberg, 'Biological Weapons Arms Control', *Contemporary Security Policy*, vol. 17, no. 1 (Apr. 1996), pp. 57–58.

[32] See, for e.g., Director, Central Intelligence Agency, *Special National Intelligence Estimate: Prospects for Further Proliferation of Nuclear Weapons*, SNIE 4-1-74 (CIA: 1974).

[33] See Marrin (note 19).

[34] Marrin (note 19).

Organisation for the Prohibition of Chemical Weapons (OPCW), the body that implements the CWC, and the procedures under which teams sent to investigate alleged chemical or biological weapon use under the United Nations Secretary-General also offer models for how assessments of compliance of specific CW cases can be structured.[35]

It is hoped that this study can assist in providing context to past and future verification of the non-production and use of chemical weapons. It is also hoped that it can indicate useful political and technical options to support the prohibition against chemical warfare and contribute to the study of intelligence methodologies. The study also attempts to present a specific application (or 'puzzle'), which is later analysed in terms of strategic and defence studies paradigms. Finally, it is hoped that this study provides useful cross-cutting analysis that breaks down some of the specialisation that characterizes many contemporary academic endeavours thus presenting a synthesis that encompasses both broad policy questions and focused technical issues.[36]

An objective of this study is to develop and to test a CW structured analysis of competing hypotheses. Four overarching strategic security questions are posed:

1. What are the motivations for actors to pursue CW programmes and activities (e.g., the relevance of the relationship between capabilities and intentions)?
2. How does the present study fit into the theory and practice of strategic and defence studies?
3. How might an ACH on CW be integrated into current arms control and disarmament regimes where the derivation and use of information for CW verification purposes presents systemic political and technical challenges (both in terms of general process and for particular cases)?
4. What are the major elements of a strategic theoretical application of ACH with regard to CW assessment in the fields of arms control verification and intelligence analysis?

Study results and areas for further research are provided in the conclusions.

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[35] On the UN Secretary-General's mechanism for the investigation of alleged use of chemical and biological weapons, see United Nations Office for Disarmament Affairs (UNODA), 'Index to the appendices', <http://www.un.org/disarmament/WMD/Secretary-General_Mechanism/appendices/>, (accessed 14 June 2013). The OPCW forms, while not marked restricted, are nevertheless not readily available outside the organization. See also 'United Nations Mission to Investigate Allegations of the Use of Chemical Weapons in the Syrian Arab Republic, Report on the Alleged Use of Chemical Weapons in the Ghouta Area of Damascus on 21 August 2013', Note by the UN Secretary-General, <http://www.un.org/disarmament/content/slideshow/Secretary_General_Report_of_CW_Investigation.pdf>, accessed 4 Nov. 2013.

[36] E.g., Chris M. Golde and Hanna Alix Gallagher, 'The Challenges of Conducting Interdisciplinary Research in Traditional Doctoral Programs', *Ecosystems*, no. 2 (1999), pp. 281–285.

Key Words and Terms

ACH, al-Qaeda, Heuer's analysis of competing hypotheses, arms control, biological weapon/warfare, chemical weapon/warfare, cognitive biases, intelligence, international relations, Iraq, law enforcement, Organisation for the Prohibtion of Chemical Weapons, Russia, sampling and analysis, Soviet Union, structured analytical techniques, structured argumentation, Syria, terrorism, UNSCOM, UNMOVIC, verification, weapon of mass destruction.

PART I

INTRODUCTION AND METHODOLOGY

1

INTRODUCTION

States continually seek to identify and mitigate threats to their national security. This includes determining force levels and the structure necessary to meet perceived threats over the near- to longer-term. The formulation of national security policy is partly informed by determining which weapon systems actual or potential adversaries wish to develop in order to devise strategies to counter them through various military or political means, including through participation in regional and international security arrangements. This is a study of a methodology for the determination of the existence and nature of work associated with a weapon system that is among the most difficult to evaluate in the absence of access to internal, often classified, policy documentation or information from defectors: chemical weapons. National estimates concerning chemical weapons are often ambiguous and provide—to varying degrees—provisional or tentative conclusions. This is because most of the materials, equipment and technology associated with such programmes are dual purpose—having both peaceful and non-peaceful applications.[37] Information is also often incomplete and ambiguous and some of the historical information and important context have been lost. Political and ideological factors can purposely or inadvertently promote ambiguity.[38] Doctrine for use of a given weapon system should also not be overlooked. If a state agrees to forego a weapon system through its adherence to a legally-binding agreement or if the weapon system is prohibited under customary international law, it must still consider the security risks associated with the weapon system through possible clandestine programmes or similar activities by both state and non-state actors (i.e., individuals and sub-national groups).[39]

National estimates on possible chemical weapon activities traditionally fall within the purview of military establishments which generally have established procedures for determining their own weapon-system requirements.[40]

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[37] Such materials, technology and equipment may also be used to support non-military activity or be an element of national protection programmes against CW.

[38] In the lead up to the April 2003 invasion of Iraq, for e.g., there was strong political support in some quarters to overthrow Saddam Hussein. Any intelligence indicating that Hussein had continued to develop chemical weapons or wished to retain a chemical warfare capability would strengthen the political argument in favour of his overthrow. For further discussion on this, see Chapter 4.

[39] For a review of customary international humanitarian law that encompasses chemical and biological warfare, see Jean-Marie Henckaerts, *Study on Customary International Humanitarian Law: a Contribution to the Understanding and Respect for the Rule of Law in Armed Conflict*, vol. 87, no. 857 (ICRC: Geneva, Mar. 2005).

[40] For a consideration of political pressure to promote, retain or terminate two US conventional weapon systems, see Christopher M. Jones and Kevin P. Marsh, 'The Politics of

Where a weapon system is prohibited under international law, as chemical weapons are by the 1993 Chemical Weapons Convention (CWC), the state's evaluation dynamic is different. In this case, the weapon assessment becomes more a question of treaty verification and, perhaps, the substitution of a military capacity that has been given up in favour of another weapon system.[41] Vulnerabilities that result from foregoing a given weapon system can also be mitigated when states participate in various bilateral, regional and international security arrangements. Security cost-benefit calculations are consequently more complex and likely to be disputed.[42] Thus the evaluation process of a given

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Weapons Procurement: Why Some Programs Survive and Others Die', *Defence & Security Analysis*, vol. 27, no. 4 (2011), pp. 359–373.

[41] In the case of the Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on their Destruction (Ottawa Treaty), Finland met its perceived security gap (i.e., to protect a long, thinly populated border with Russia) by enhancing its mobile anti-armour capabilities. During the Vietnam War, the United States used riot control agents (RCAs) to flush out opposing forces from tunnels in order to capture or to kill them. The United States also used defoliants to deny opponents foilage for concealment. However, the CWC prohibits the use of toxic chemicals and their precursors when used as a 'method of warfare'. White phosphorus is not prohibited by the CWC as long as it is used as a tracer round, rather than to cause death or harm through its toxic properties. Thus parties to the CWC who possess military doctrines that call for the use in combat of defoliants or RCAs during combat operations, must revise their doctrines. This has been partly done by redefining certain types of fighting as 'law enforcement' or 'counter-terrorism' operations. In such cases, the treaty norm against chemical warfare is potentially undermined. Some observers continue to periodically question whether a given use of RCAs or white phosphorus is consistent with CWC obligations. E.g., see United Nations, Human Rights Council, 'Human Rights in Palestine and Other Occupied Arab Territories', Report of the United Nations Fact-finding Mission on the Gaza Conflict (Goldstone Report), A/HRC/12/48, 25 Sep. 2009, p. 16. For US doctrine for using the CN and adamsite for domestic riot control prior to the contemporary arms control context, see War Department, *Domestic Disturbances*, Field Manual 19-15, declassified (US Government Printing Office: Washington, DC, July 1945). It should also be noted that Protocols I and II to the Geneva Conventions prohibit the use of inhumane weapons in armed conflict. White phosphorus has secondary incendiary effects that appear not to fall under the Protocol on Prohibitions or Restrictions on the Use of Incendiary Weapons (Protocol III), Geneva, 10 Oct. 1980, article I.

Julian Perry Robinson and Jean Pascal Zanders have considered the integration of chemical weapons into military doctrine and the substitution of 'functionally equivalent' weapons or capabilities as compensation for a state's foregoing chemical weapons. Eric Arnett provides a useful analysis on the relation between military capacity for war and the integration of weapons by military establishments of states. Thus a state's capacity for war is determined by various factors in addition to the possession of a given weapon system including: command and control, and integration of a weapon system into military doctrine and training. See Julian P. Perry Robinson, 'Supply, Demand and Assimilation in Chemical-warfare Armament', pp. 112–123 in Ed. Hans Günther Brauch, *Military Technology, Armaments Dynamics and Disarmament: ABC Weapons, Military Use of Nuclear Energy and of Outer Space and Implications for International Law* (Macmillan Press: Basingstoke, 1989); and Ed. Eric Arnett, *Military Capacity and the Risk of War: China, India, Pakistan and Iran* (Oxford University Press: Oxford 1997).

[42] For insight into how national security is affected by participation in an arms control regime using a software-based cost-benefit analysis, see John A. H. Futterman, Charles H. Hall, Francis A. Handler, Robert V. Homsy, Michael J. Lippitz and Alan Sicherman, *Cost-Benefit Analysis of Proposed Confidence-Building Measures for the Biological and Toxin Weapons Convention*, Report no. UCRL-ID-119414, unclassified (Lawrence Livermore National Laboratory, Nonproliferation, Arms Control, and International Security Directorate: California, 31 Oct. 1994).

weapon system, traditionally the responsibility of intelligence or military analysts, can profoundly affect the rather complicated and uncertain policy mechanisms underpinning international peace and security. Strategic studies may be said to encompass threat assessments and the development and implementation of military and other defensive measures to counter identified threats, including through the employment of arms control verification and intelligence analysis.[43]

Much remains unclear (within and outside governments) with regard to how the various types of expertise and knowledge can be utilised to evaluate possible chemical warfare programmes. This is partly because such evaluations are multi-disciplinary and include epistemology (i.e., theory of knowledge), history, information management, political analysis and science and technology (S&T). An academic synthesis of these fields with respect to chemical weapons (CW) evaluation appears lacking. This study attempts to explore major areas of expertise associated with the derivation and use of CW-related information from a strategic studies perspective and to elucidate how the various fields of inquiry can—taken as a whole—promote improved operational relevance and strategic theoretical understanding (including methodological). A framework for the analysis of allegations of CW programmes and activities, which is based on a variation of Heuer's Analysis of Competing Hypotheses (ACH), is therefore developed and tested.

One threat to international security is that weak states can, on their own or by promoting violence through non-state actors, threaten civil society or undermine even great powers. Partly for this reason, it is important for those interested in chemical and biological warfare (CBW) allegations (including those professionally responsible for evaluating them) to have a sufficient conceptual understanding of the basic S&T of sampling and analysis; the physiological effects of toxic chemicals and infectious biological agents; and the theory and practice of information acquisition and use for the evaluation of suspected illegal activities and programmes.[44]

Media allegations of the use of CW continue to be made where conflicts occur and government 'status of proliferation' statements generally accuse some states and non-state actors of attempting to acquire, develop, stockpile or use CW.[45] This is despite the fact that chemical and biological warfare (including the misuse of toxins and a broad range of physiologically active compounds) is prohibited under international law and no state (with the notable 2003 exception of Libya and the 2013 exception of Syria) openly admits to the possession with

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[43] See Annexe A. Definitions and Terms.

[44] There is overlap between international prohibitions against chemical and biological warfare. Partly for this reason, some aspects of biological warfare will also be considered, including toxins.

[45] E.g., SIPRI has published allegations of CBW development or use annually since 1968. See *SIPRI Yearbook on Armaments, Disarmament and International Security.* See also Daniel Steinvorth and Yassin Musharbash, 'Turkey Accused of Using Chemical Weapons Against PKK', *Der Spiegel*, 12 Aug. 2010, <http://www.spiegel.de/international/world/0,1518,711536,00.html>, (accessed 23 July 2013). Such reports may be the result of disinformation, ignorance or lack of analytical clarity. For a recent status of proliferation report, see *Adherence to and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements and Commitments* (US Department of State: Washington, DC, 2012), <http://www.state.gov/t/avc/rls/rpt/197085.htm>, (accessed 23 July 2013).

the option of using of such weapons.[46] The CWC prohibits the use of toxic chemicals and their precursors as a 'method of warfare', while the 1972 Biological and Toxin Weapons Convention (BTWC) prohibits the use of biological materials for 'hostile' or other prohibited purposes.[47]

Uncertainties regarding the legality of activities and purposes for which bio-chemical substances are produced and stockpiled remain.[48] Non-lethal or less-than-lethal weapons or incapacitants meant for counter-terrorism, law enforcement or peacekeeping operations may effectively undermine prohibitions against CW.[49] States may also undertake to maintain standby offensive CW capacities, while non-state actors may seek such capabilities with possible state involvement. These problems are inherent to all future consideration of how best to maintain and strengthen the international prohibition against CBW. Analysts must, as a practical matter, consider such factors periodically in the context of specific activity and individual cases that trigger concern.[50]

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[46] Some allusions to the stockpiling of chemical or biological weapons are sometimes publicly stated for possible political purposes. For example, some states in the Middle East do not wish to join the CWC until or unless Israel joins the Non-proliferation Treaty (NPT). In a 2009 interview with *Der Spiegel*, Syrian President Assad made a statement that some observers have understood to be an allusion to a Syrian CW stockpile. When asked 'So you have no ambitions to produce weapons of mass destruction, not even chemical weapons?', Assad responded 'Chemical weapons, that's another thing. But you don't seriously expect me to present our weapons program to you here? We are in a state of war'. 'SPIEGEL Interview with Syrian President Bashar Assad, "Peace without Syria is unthinkable"', *Der Spiegel*, 19 January 2009, <http://www.spiegel.de/international/world/0,1518,602110-2,00.html>, (accessed 14 June 2013).

More dramatically, on 23 July 2012 a Syrian MFA spokesman strongly implied that the country has chemical weapons and was prepared to use them against 'external' opponents. The following day, Russia's MFA issued a statement pointing out that as a party to the 1925 Geneva Protocol Syria was obligated not to employ chemical or biological weapons. The Syrian MFA statement and questions and answers are available at <http://www.youtube.com/watch?v=fqjWzGfOLlE>, (accessed 23 July 2013). For the Russian MFA statement, see Ministry of Foreign Affairs of the Russian Federation, 'Kommentarii Departamenta informatsii i pechati MID Rossii v svyazi s vyskazivaniem predstavitelya MID Sirii' [Russian Ministry of Foreign Affairs Department of Information and Press Commentary in connection with a statement by the representative of the Ministry of International Affairs of Syria], 24 July 2012, <http://www.mid.ru/brp_4.nsf/newsline/1297AE8CCFEDDDEB44257A45005232B3>, (accessed 23 July 2013). In Mar. 2013 the UN Secretary-General authorized an investigation of alleged CW use in Syria based on a longstanding UN legal authority and a Syrian Government request made the same month. As of May 2013 the team, which had technical support from the OPCW and the World Health Organization (WHO), entered the country in August 2013 and concluded that sarin had been used at Ghouta. See 'United Nations Mission to Investigate Allegations of the Use of Chemical Weapons in the Syrian Arab Republic, Report on the Alleged Use of Chemical Weapons in the Ghouta Area of Damascus on 21 August 2013' (note 35).

[47] CWC, Article I, para. 5; and BTWC, Article I, para. 2. The BTWC does not contain the word 'use'. The member states nevertheless agree that this convention covers use.

[48] Ronald G. Sutherland, *Chemical and Biochemical Non-lethal Weapons*, SIPRI policy paper no. 23 (2008).

[49] Sutherland (note 48); and Michael Crowley, *Drawing the Line: Regulations of "Wide Area" Riot Control Agent Delivery Mechanisms under the Chemical Weapons Convention* (Bradford Non-lethal Weapons Project, Omega Research Foundation: Apr. 2013).

[50] In June 2013 the UN Human Rights Council 'documents' the 'use of chemical agents', it states that the Syrian government possesses chemical weapons and acknowledges that rebel forces 'may have access [to] and use chemical weapons'. UN Human Rights Council, 'Report

In recent years states have also undertaken efforts to extend control and oversight of chemical and biological materials beyond traditional chemical warfare agents and certain listed biological agents (which typically originate from agents evaluated by past state military programmes) to include toxic industrial chemicals (TICs) and a wider range of infectious disease-causing agents.[51] Many of these oversight measures complement efforts to promote biosafety and chemical safety.[52] There is also an increasing interface[53] between chemistry and the life sciences as exemplified by the increasing use of biological and biologically-mediated processes in the chemical industry.[54] The interface should be seen both in terms of production processes and physiological effects. It is also possible that future CBW agents might increasingly be evaluated utilizing chemicals databases, genomic sequencing technology and modeling software to search for compounds that affect human physiology in a preconceived manner with little laboratory bench work.[55] Dr Peter Clevestig predicts that pathogen strains will routinely be shared digitally within 10 years.[56] Equipment and technology advances are also lowering skill requirements for some types of chemistry and life sciences work.[57]

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of the Independent International Commission of Inquiry on the Syrian Arab Republic', document A/HRC/23/58, 4 June 2013, pp. 1 & 21.

[51] 'Select agent' regulations (including certain terminology) were revised in Oct. 2012. Agents that meet four criteria are currently placed in the highest risk category ('Tier 1' agents). See Federal Experts Security Advisory Panel, <http://www.phe.gov/Preparedness/legal/boards/fesap/Pages/default.aspx>, (accessed 16 June 2013). For a list of TICs, see Annexe C.

[52] E.g., Eds. Philip Wexler, Jan van der Kolk, Asish Mohapatra and Ravi Agarwal, *Chemicals, Environment, Heath: a Global Management Perspective* (CRC Press: Boca Raton, Florida, 2012).

[53] Some scientists and analysts prefer to characterize the 'overlap' as an 'interface', thus signifying a continuing distinctiveness between the two scientific fields. The author is grateful to Dr Ralf Trapp for drawing his attention to this distinction over the course of an earlier research project.

[54] Frank Hollmann, et al., 'Enzyme-mediated Oxidations for the Chemist', *Green Chemistry* (Nov. 2011), pp. 226–265; and Benjamin G. Davis and Viviane Boyer, 'Biocatalysis and Enzymes in Organic Synthesis', *Natural Product Reports*, vol. 18 (Oct. 2001), pp. 618–640.

[55] On the state of computational biology, see Valda Vinson, Beverly A. Purnell, Laura M. Zahn and John Travis, 'Introduction: Does It Compute?', special section, *Science*, vol. 336 (13 Apr. 2012), pp. 171–174.

[56] Discussion at Security Aspects of Microbiology, Medical Research and Health. Course presentation to Karolinska Institutet Biosafety and Sustainability Course, held at SIPRI, 20 Sep. 2012, Stockholm. Dr Clevestig has kindly permitted me to mention this discussion point here. J. Craig Venter discusses similar developments for the downloading and sharing of DNA information for reproduction by so-called digital biological converters. These converters are the biological equivalent of 3-D printers. Venter has also characterized life as 'DNA software driven'. J. Craig Venter interview by Charlie Rose, 21 Oct. 2013, <http://charlierose.com/watch/60285321>, (accessed 3 Nov. 2013). See also J. Craig Venter, *Life at the Speed of Light: From the Double Helix to the Dawn of Digital Life* (Viking: New York City, 2013).

[57] John Hart and Ronald G. Sutherland, 'Chemical industry verification under the Chemical Weapons Convention: scientific and technological developments and diplomatic practice', pp. 247–265 in Ed. Ralf Trapp, *Academic Forum, The Hague, 18 & 19 September 2007, Conference Proceedings* (Netherlands Institute for International Relations Clingendael and TNO Netherlands Organisation for Applied Scientific Research: The Hague, 2008). On developments in computer modeling simulation of cell behaviour, see Jonathan R. Karr,

Such developments imply that attention should be given to the chemical (or 'bio-chemical') industries in at least two respects. One is within the arms control context and consists of the verification of the non-production of chemical warfare agents. The second context consists of more general analytical efforts by states to determine the nature and scope of possible CW programmes and activities, including for standby production capacity and related support mechanisms. This latter context is more centred in the law enforcement and defence establishment structures (e.g., biodefence-related activity), rather than possible non-state actor threats.

1.1 Contribution to the Literature

Factors that have been cited as evidence of a gap between the work produced by academics and intelligence analysts include the extent to which: (*a*) analyses should be qualitative or quantitative (or mixed), (*b*) intelligence practioners employ social sciences research methodologies, and (*c*) academics and intelligence practitioners reflect relevant S&T developments. Thus former CIA analyst Stephen Marrin has observed: 'Since very few scholars have written doctoral dissertations on intelligence-related subjects, the literature on intelligence has not been explored or exploited for the lessons it might provide in the same way that other literatures have'.[58]

James M. Nyce observes that intelligence practitioners (especially those in military intelligence) require scholarly studies that 'can provide empirical and analytic insight as they attempt to define and acquire [relevant] resources, competences and structures necessary' to implement their mandates.[59] He also observes that most scholarly literature in the intelligence studies field 'tend to focus on intra-governmental processes/structures and state to state relations'.[60] One area where open academic literature has played a large role in intelligence studies is on technical or scientific methodology or instrumentation. For example, during World War II the Office of Scientific Research and Development's (OSRD) research mandate was partly informed by US Government efforts to define its defence and intelligence requirements and to match them with civilian expertise and research programmes.[61]

The derivation and use of information to evaluate chemical warfare programmes and activities are also relevant to the study of strategic studies in several respects. The topic deals with a weapon system which poses a distinct potential threat to international peace and security that is usually outside the

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Jayodita C. Sanghvi, Derek N. Macklin, Miriam V. Gutschow, Jared M. Macobs, Benjamin Bolival, Nacyra Assad-Garcia, John I. Glass and Markus W. Covert, 'A Whole-Cell Computational Model Predicts Phenotype from Genotype', *Cell*, vol. 150, no. 2 (20 July 2012), pp. 389–401.

58 Marrin (note 19), pp. 148–149.

59 Nyce (note 3).

60 Nyce (note 3). It should also be noted that there are those (mainly in academia and NGOs) who compare specific news reports agains official intelligence and arms control compliance assessments. This type of activity may be understood to a form of data mining by individuals and/or small groups.

61 US National Archives, 'Records of the Office of Scientific Research and Development [OSRD]', <http://www.archives.gov/research/guide-fed-records/groups/227.html>, (accessed 2 Aug. 2013).

mainstream of weapon system analysis.[62] It is also concerned with expanding the concept of a type of analysis that has traditionally been the sole competence of security analysists and intelligence services. The increase in information availability and greater access to technical means of verification—informed by open-source information, declassified materials and the work of international bodies that implement arms control, nonproliferation and disarmament regimes—suggest that more insightful analyses by nongovernmental analysts and academics are feasible. A better understanding of threat perceptions and response capacities in the arms control and verification context should, in particular, help to inform defence and strategic studies.

This study attempts to extend the literature in several respects. First, less attention has been paid to CW as opposed to nuclear or conventional weapon capabilities, intentions and holdings.[63] Second, CW violation scenarios are often ambiguous, particularly in the non-state context.[64] Third, some information regarding the Soviet, Iraqi and al-Qaeda affiliates remains little known or has not been sufficiently well-placed in a usable, analytical context. Fourth, there are limits to human understanding regarding CW capabilities and intentions (where much of the equipment, technology and material is dual-purpose).[65] Fifth, insufficient attention has been devoted to the role of S&T in CW assessments aimed at the national security policymaking community. By considering the role of sampling and analysis, additional technical context to the suspected prohibited activities is provided. Such factors, should be further elucidated using a suitable analytical framework that highlights the underlying logic of the analysis.

This study does not attempt to comprehensively capture all information and literature, but rather focuses on the *processing* and the identification of the *significance* of some key data. It is hoped that this study can assist to bridge a gap between the operational requirements of policy and the context provided by a broader analytical study done from an academic perspective.

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[62] Mauroni observes that currently ‘combating WMD’ is not part of mandatory coursework at defence colleges in the US and that ‘many’ US defence acquisition programmes ‘routinely waive CBRN survivabilty requirements’. Albert J. Mauroni, ‘A Counter-WMD Strategy for the Future’, *Parameters*, vol. 40, no. 2 (summer 2010), ref. 32, p. 73. At the international level, it is worth noting that no activity carried out by the US Department of State’s Office of the Coordinator for Counterterrorism with respect to CBRN weapons was solely dedicated to CW. However, some of the activities under this action were solely dedicated to biological and nuclear weapons, respectively. Office of the Coordinator for Counterterrorism, ‘Chapter 4: the Global Challenge of Chemical, Biological, Radiological, and Nuclear (CBRN) Terrorism, Country Reports on Terrorism 2011 Report’ (Department of State: Washington, DC, 31 July 2012), <http://www.state.gov/j/ct/rls/crt/2011/195548.htm>, (accessed 20 May 2013).

[63] In broad terms, this is reflected by the numbers of analysts, publications and funding line items for research. It is also reflected in the relative space devoted to CBRN weapon types in threat assessments and in military operations training manuals. Nuclear and conventional weapon-related programme requirements are invariably better funded and supported as compared to CW-related programme activities (where such activities exist).

[64] Violation scenarios include: (*a*) traditional state CBW development programmes; (*b*) standby capacity by states for either traditional military or non-traditional agents; (*c*) non-lethal and less-than-lethal agents developed by states for law enforcement, peacekeeping and the like which may also serve as a basis for a standby capacity for faster CBW ‘breakout’; and (*d*) non-state actor activity.

[65] I.e., the equipment, technology or material can also be used for peaceful purposes.

In the early 1960s Knorr observed that no satisfactory theory of intelligence existed. In particular, there was no adequate descriptive theory that described how intelligence work was actually carried out, or a normative theory on how such work ought to be carried out.[66] He further observed that no criteria or 'indicators' existed in the United States on how well intelligence work was being done or to suggest ways to improve it.[67] Knorr called for the following problems to be considered as part of any effort to develop a descriptive and normative theory of intelligence:

(*a*) 'the procurement and processing of data (including indicators)';
(*b*) 'the use of hypotheses for specifying what sorts of data are desirable for various intelligence tasks';
(*c*) 'the use of general hypotheses in generating particular hypotheses about concrete situations';
(*d*) 'the determinants and uses of good judgment, intuition, and superior insight';
(*e*) 'the limits of intelligence forecasting, and criteria for ascertaining the success or failure of intelligence';
(*f*) 'the types of biased vision and their minimization'; and
(*g*) 'the committee and bargaining aspects of intelligence production—their uses and control'.[68]

Knorr emphasized the importance of developing and refining an 'intelligence doctrine' (i.e., 'the operational expression of the theory') which defines: (*a*) the tasks to be carried out, (*b*) the methods to be employed, and (*c*) errors to be avoided.[69] He underlined the importance of discovering the determinants of 'good intuition', 'judgment' and 'insight'.[70] Knorr also stated 'The indifference, suspicion, and sometimes built-in hostility with which not a few intelligence officers (as well as other government officials) look on the social sciences are well known'.[71]

More recently, Stephen Marrin observed that 'very little knowledge has been developed over the past 50 years on the utility and efficacy of various structured methods' and that proof that analytic methods improve intelligence analysis remains elusive.[72] Although over 200 analytic methods relevant to intelligence work have been developed, analysts are unaware if any of them are demonstrably superior to experience and intuition.[73] Even though analytic intelligence techniques are taught, their actual use is 'much less frequent' and 'in many cases the structured methods are ignored in favor of a more intuitive approach'.[74] Nevertheless there is a continuing interest, including in Denmark, the UK and the United States, to explore options for improving analytical rigour

[66] Knorr (note 6), p. 46.
[67] Knorr (note 6), p. 47.
[68] Knorr (note 6), p. 48.
[69] Knorr (note 6), p. 50.
[70] Knorr (note 6), p. 49.
[71] Knorr (note 6), p. 53.
[72] Marrin (note 19), p. 33.
[73] Marrin (note 19), p. 34.
[74] Marrin (note 19), p. 95. A recent, more general application approach of ACH is provided in Beebe and Pherson (note 10).

and consistency within and between organizations, including large bureaucracies.[75]

1.2. The Problem of Data Overload and Related Considerations

An important principle of scholarship is 'to review the literature' prior to carrying out an analysis. Another is to pose and structure the research questions prior to addressing them. This can entail long hours of attempting to come to grips with difficult (and perhaps rather dull) concepts. Reviewing the literature should result in developing a good sense of what material is available, what topics are generally covered within a given framework and what information is key. Detailed analysis can then be done on more narrowly-defined topics within a chosen field throughout the academic's or analyst's career without, generally speaking, restating first principles.[76]

Information on CW assessment is both excessive and insufficient. The problem of data overload has been called 'data asphyxiation', 'data smog', 'information fatigue syndrome' and 'cognitive overload'.[77] The information that can be obtained from academic databases alone is sufficient reading material for many lifetimes.

The sheer volume of information that can be accessed through keyword searches on databases has implications for future scholarship that have perhaps not been fully appreciated by academia and government, especially at the top level.[78] First, it accelerates 'the review of the literature' phase of a study. However, this does not necessarily result in a corresponding reduction of the time required to acquire depth and breadth of understanding—regardless of whether the person is a 'hedgehog' or 'fox'.[79] Referring to work carried out by Philip E. Tetlock on political predictions, Nate Silver also states that foxes 'have developed an ability to emulate' a 'consensus process'.[80] Thus, a review, in

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[75] On interest by US intelligence to improve analytical rigour and consistency, see Marrin (note 19), p. 35. The point regarding the size of US bureaucracies and the desire to have better consistency within and between them is mine.

[76] With the further caveat that people should not be overly certain.

[77] William van Winkle, David Shenk, David Lewis and Eric Schmidt, respectively, are credited with originating these terms. Anonymous, 'Too Much Information', *The Economist*, vol. 400, no. 8740 (2–8 July 2011), p. 59.

[78] Kenneth Cukier and Viktor Mayer-Scheonberger, 'The Rise of Big Data', *Foreign Affairs*, vol. 92, no. 3 (May/June 2013), pp. 28–40. For historical perspective, see Ann M. Blair, *Too Much to Know: Managing Scholarly Information Before the Modern Age* (Yale University Press: New Haven, Connecticut, 2010).

[79] Isaiah Berlin, drawing on the work of the classical Greek poet Archilochus, expanded on the notion that the fox knows many things, while the hedgehog is focused on a single object. See Isaiah Berlin, *The Hedgehog and the Fox: an Essay on Tolstoy's View of History* (Weidenfeld & Nicolson: 1953).

[80] Nate Silver, *The Signal and the Noise: Why So Many Predictions Fail – but Some Don't* (Penguin Press: New York, 2012), p. 67. David R. Mandel and Alan Barnes (the former with the Defence Research and Development Canada, DRDC and the latter a retired official of Canada's Intelligence Assessment Secretariat) reviewed the accuracy of 1514 strategic intelligence forecasts generated by the Middle East and Africa Division of the Canada's Intelligence Assesment Secretariat. They found that both the discrimination and calibration of the forecasts were 'very good' and that discrimination was better among senior analysts'

itself, is perhaps today less indicative of whether the person actually understands the topic, if the information selected is in fact representative or if the material has even been read. Today people are in an increasingly better position to produce pseudo-scholarly work. Such work is less systematic and exhibits a 'curious' mix of understanding and lack of sensitivity to important factors and information. 'Sensitivity' should be apparent in both scholarly analysis and in terms of awareness of operational requirements and practice.

The analyst should also possess sufficient 'sense' (partly based on experience) to identify the important information, while avoiding cognitive traps.[81] The economics Nobel prize winning cognitive psychologist Daniel Kahneman cautions against the 'what you see is all there is' (WYSIATI) phenomenon (i.e., reaching for the first seemingly plausible explanation based on initial—or seemingly complete or otherwise sufficient—information).[82] Analysts should understand operational requirements of those who use their products. The 'consumer' may, in fact, know more (or understand) the topic better than the analyst. Brian D. Nordmann, a longserving US State Department official, thus observes that an intelligence consumer may have 'many more years of expertise in the subject' than the intelligence analyst. He also cites George Washington University research on the 'skill levels' of individuals that supports this observation.[83]

Analysts should also consider the parameters associated with determining whether available information is representative of the whole (a criterion for success in applying ACH to chemical warfare assessments is the extent to which the *analytical process* has didactic value irrespective of the case study conclusions).[84]

Analysts should ideally trace the original source of an item of information. Incorrect information enters the literature and has been repeated so often that it can become generally accepted to be true. This is a particular difficulty in the field of CBW-related studies where the tracing back to authoritative sources can be difficult or problematic.[85] Such disputes can take on the character of a

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forecasts. David R. Mandel and Alan Barnes, 'Accuracy of Forecasts in Strategic Intelligence', *Proceedings of the National Academy of Sciences*, (14 July 2014) <http://www.pnas.org/content/early/2014/07/10/1406138111.abstract?tab=author-info>, (accessed 19 July 2014).

[81] The author is employing 'sense' in its ordinary meaning. This is distinct from the concept of 'sense making' in the intelligence literature.

[82] Kahneman (note 26), pp. 85–88.

[83] Brian D. Nordmann, *The Tyranny of Experts: Analytic Misperception and the Rise of State-Run Biological Weapons Programs*, pp. 238–239. Doctoral dissertation, George Mason University (2008).

[84] The question of whether a given amount of information is 'representative' of information when the total 'universe' of information is not known remains problematic. In the intelligence studies literature, this problem is sometimes referred to as 'the black hole' problem (representing missing data), the 'keyhole' problem (the ability to see only part of the analysis target or a subset of data) and 'brown worms' (how to deal with misleading or deceptive data). B. L. William Wong and Margaret Varga, 'Black Holes, Keyholes and Brown Worms: Challenges in Sense Making', *Proceedings of the Human Factors and Ergonomic Society Annual Meeting* (2012), pp. 287–291. Some foresee a future where all data (although not necessarily validated, including through human intervention) will essentially become digitized (i.e., 'N=all'). Cukier and Mayer-Schoenberger (note 78), pp. 30–31.

[85] The view that the US engaged in biological warfare during the Korean War is not uncommon in China, North Korea and Russia who often point out that the USA granted

theological dispute. Some information cannot be recovered because the original material has been destroyed or those directly involved are no longer working, while other data remain classified.

People are also constrained in the amount of information they can evaluate.[86] Those who are exposed to large quantities of data or information can become 'passive' and less likely to put forth the effort to actively consider the meaning or significance of the subject matter. In describing the challenges associated with the role of scientists and expertise in policy making, the Swedish theoretical physicist Kjell Andersson observes that overwhelming data flows tend to make the general public passive and that information must be filtered in order to allow people to meaningfully absorb it.[87] Today, both the public and 'technical experts' increasingly 'surf' the data. Many people, including in government, simply do not have much, if any, time for quiet reflection.

More broadly, a generation shift is perhaps occurring whereby students are increasingly likely to understand where and how to access vast amounts of information. Some information can be checked against internet sites and paraphrased to make the analysis appear to be more informed or insightful than it is. Some authors, including many intelligence practioners and those in the media, are focused on getting a report issued by a given date, rather than trying to check its integrity or usefulness by taking any additional time that may be required.[88]

Digitized information or indexes to publications distort the 'universe' of all the data in existence, including that which is classified or is located on the

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immunity from prosecution members of the Japanese biological warfare programme at the end of World War II in exchange for information on their activity and research results. Many who are today inclined to believe the US conducted BW refer to Stephen Endicott and Edward Hagerman, *The United States and Biological Warfare: Secrets from the Early Cold War and Korea* (Indiana University Press: Bloomington, 1998). This book, while suggestive, does not, among other things, properly describe and analyze the derivation and use of information to determine whether such weapons have been employed. Soviet archives indicate that at least part of these allegations came out of a disinformation campaign. Kathryn Weathersby, 'Deceiving the Deceivers: Moscow, Beijing, Pyongyang, and the Allegations of Bacteriological Weapons Use in Korea', pp. 176–99 in Ed. Christian F. Ostermann, *Cold War International History Project,* Bulletin no. 11 (Woodrow Wilson International Center for Scholars: Washington, DC, winter 1998). Finally, for authoritative background on these allegations, see Jeanne Guillemin, *Biological Weapons: From the Invention of State-Sponsored Programs to Contemporary Bioterrorism* (Columbia University Press: New York, 2004), p. 100; and Martin Furmanski, and Mark Wheelis, 'Allegations of Biological Weapons use', pp. 253–61 in Eds. Mark Wheelis, Lajos Rózsa and Malcolm Dando, *Deadly Cultures: Biological Weapons since 1945* (Harvard University Press: Cambridge, Mass., 2006).

In the interest of full disclosure, it should be noted that the text in this reference is taken from comments the author provided in 2012 on a draft report (focused on nuclear arms control) by another researcher. Any possible similarity in the selection of references regarding BW allegations during the Korean War is therefore due to this.

[86] For breakdowns of Internet usage by language, country and the like, see International Telecommunications Union (ITU), 'Statistics & Database', <http://www.itu.int/ITU-D/ict/statistics/>, (accessed 17 Oct. 2012).

[87] Kjell Andersson, *Transparency and Accountability in Science and Politics: the Awareness Principle* (Palgrave Macmillan: Basingstoke, 2008), p. 2.

[88] In 2012, a US Senate subcommittee criticized the DHS saying the fusion centers had not produced a single report of usable intelligence. See *Federal Support for and Involvement in State and Local Fusion Centers*, Majority and Minority Report, Permanent Subcommittee on Investigations (Permanent Subcommittee on Investigations: Washington, DC, 2012).

'dark web' (i.e., non-public).[89] Another distortion is language: not all material in the various relevant languages are digitized in a comparable manner. Variations also exist with respect to whether and to what extent states have undertaken CW-related activities or analyzed them. Much of the relevant information—either in terms of volume or importance—is classified for reasons-of-state. Although statements have been periodically made that up to 95 per cent (or more) of the information available to the US Government is publicly available, this situation does not necessarily hold for all states or all topics.[90] Also, the denominator representing the total amount of information available to the US Government is probably exceedingly large.[91] Another distortion is the largescale US effort in recent years to systematically capture all digital information.[92] A preference by some for presentation slides (as opposed to analytical studies) further distorts in favour of volume over quality of information. A small numerator may nevertheless represent an enormous amount of data in its own right (i.e., petabytes).

Despite such caveats, it should be possible to systemize the consideration of the derivation and use of information for CW assessment purposes using reasonably focused, accurate and representative information. It is hoped that the analytical structure can function usefully regardless of the completeness or reliability of the data. It is also hoped that any interested readers will be able to determine whether the information presented is reliable using the analytical framework together with the analysis as a basis for other CW-related cases.

Although information can be retrieved from libraries, databases and the internet and summarized without end, each 'main' topic should be treated in sufficient detail to convey a good fundamental understanding. This objective is admittedly subjective. However, as with 'pornography' or 'obscenity', some have argued that they know what is meant when they see it.[93]

Numerous uncertainties, gaps and questions nevertheless exist and are unavoidable. I have therefore attempted to identify and to 'explore' what appear

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[89] See Sarah Kendzior, 'Worlds Unknown: the Regions Ignored by Google Translate', *Atlantic*, 1 May 2012 <http://www.theatlantic.com/technology/archive/2012/05/worlds-unknown-the-regions-ignored-by-google-translate/256585/>, (accessed 16 June 2013); and International Telecommunications Union (ITU), 'Information and Communication Technology (ICT) Statistics', <http://www.itu.int/ITU-D/ict/>, (accessed 16 June 2013). The ITU is the UN organization which has information and communications technologies at the centre of its mandate.

[90] The figure of 95 per cent is somewhat proverbial in the US context. E.g., President Harry Truman apparently said this. Allen Dulles, *The Craft of Intelligence* (Harper & Row, Publishers: New York City, 1963), pp. 239–240.

[91] The United States is pursuing a 'total information awareness' approach to capture digital data. See James Bamford, 'The NSA is Building the Country's Biggest Spy Center (Watch What You Say)', Wired Danger Room, 15 Mar. 2012, <http://www.wired.com/threatlevel/2012/03/ff_nsadatacenter/all/1>, (accessed 19 July 2013).

[92] Bamford (note 91). Bamford is the author of fundamental works on the history and activity of the US National Security Agency (NSA). See also Intelligence and Security Committee, *Access to Communications Data by the Intelligence and Security Agencies* (Stationary Office Limited: London, Feb. 2013). For more recent information on the scope and scale of US data collection capabilities and practice, see 'Edward Snowden', *Guardian*, <http://www.guardian.co.uk/world/edward-snowden>, (accessed 23 July 2013).

[93] See Paul Gewitz, 'On "I Know It When I See It"', *Yale Law School*, paper no. 1706 (1996), <http://digitalcommons.law.yale.edu/fss_papers/1706> (accessed 18 May 2013).

to be the main, relevant points connected to the derivation and use of information for CW assessments. I have attempted to do this at a level of detail that does justice to the subject, while not losing the narrative thread or structural integrity of the methodological approach. It is thus hoped to elucidate principles and methods in order to help conceptualize and systemize thinking on the derivation and use of information as it relates to chemical warfare.

Possible philosophical objections to seeking any pattern inherent in such a conceptualization should be noted. The late author and social commentator Christopher Hitchens observed that humans are 'pattern-seeking mammals' who prefer a bad theory to no theory. He said that arguments that explain everything, explain nothing.[94] However, for the purposes of this study, I have decided not to focus on why 'pattern seeking' might be an unwarranted mental failing that does not reflect reality. The focus of this study is rather 'instrumental' and should, therefore, have relevance to tradecraft. As previously mentioned, it is hoped that this study can help to bridge operations analysis and academic research.

Asserting that objective reality has no pattern (the characterizations of the natural world by mathematics and physics notwithstanding) also presupposes that there is no utility in the effort to discover principles and methods for thinking about CW-related activity. Efforts to discover and to employ principles and methods for such purposes will continue as a practical matter (i.e., to apply against problems for which people wish to obtain 'answers' and which can inform policy, including for arms control verification and security and defence acquisition). It should be sufficient to note this philosophical point regarding the nature of human understanding as a part of the general discussion on human perception and thought processes.

[94] E.g., 'A theory that tries to explain everything explains nothing'. Christopher Hitchens, 'An Anglosphere Future', *Arguably: Essays by Christopher Hitchens* (McClelland & Stewart: Toronto, 2011), p. 102.

2

THE RISE OF 'MODERN' CHEMICAL WARFARE

Throughout history, humans have harboured feelings of abhorrence towards substances that might cause them to contract disease (e.g., through the poisoning of wells) or to be choked to death (e.g., by noxious fumes). Such feelings have been exacerbated by little or no understanding of how to avoid falling victim to such weapons. The poems of Wilfred Owen and Siegfried Sassoon, and John Singer Sargent's 1919 painting *Gassed* which depicts a line of soldiers with bandaged eyes being led to an aid station, have influenced popular imagination regarding World War I as the start of the 'modern age' of chemical warfare.[95] The painting leaves one in doubt as to whether the blindness is permanent.[96]

Traditional chemical warfare agents are based on World War I and World War II-era technology. Sulphur mustard was synthesised as early as 1822 by Despretz.[97] The agents used or considered for use during World War I were primarily those already produced in quantity by the chemical industry, including, perhaps most notably, chlorine and phosgene. French forces used grenades filled with the lachrymator ethyl bromoacetate in August 1914 and later switched to chloroacetone because of shortages of bromine.[98] However, the German forces failed to notice the effects as they were masked by the effects of various other gases and smokes generated by conventional munitions. On 22 April 1915 German forces released chlorine at Ypres, Belgium. In July 1917 German forces employed sulphur mustard, also at Ypres. Both attacks were, in a sense, effective in that the opposing front lines weakened or (in the case of the April 1915

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[95] See 'Dulce Et Decorum Est', (8 Oct.–Mar. 1918), by Wilfred Owen, <http://www.oucs.ox.ac.uk/ww1lit/collections/document/5215/4631>, (accessed 21 July 2014).

[96] The painting is located at London's Imperial War Museum (IWM). There is conflicting information on whether the painting is dated 1918 or 1919. The IWM gives 1919 as the date. For an image, see IWM, 'Gassed', <http://www.iwm.org.uk/collections/item/object/23722> (accessed 17 Oct. 2012).

[97] The literature usually credits Guthrie and Niemann of independently synthesizing the chemical in 1859–60. Riche may also have synthesized it in 1855. See Frederick Guthrie, 'On Some Derivatives from the Olefines', *Quarterly Journal of the Chemical Society*, vol. 12 (1860), pp. 128–142; and Frederick Guthrie, 'On Some Derivatives from the Olefines', *Quarterly Journal of the Chemical Society*, vol. 13 (1861), pp. 129–135. Further information and citations are provided by Julian P. Perry Robinson and Ralf Trapp, 'Production and Chemistry of Mustard Gas', p. 4 in Ed. S. Johan Lundin, *Verification of Dual-use Chemicals under the Chemical Weapons Convention: the Case of Thiodiglycol*, SIPRI Chemical and Biological Warfare Studies no. 13 (Oxford University Press: Oxford, 1991). Frank C. Whitmore credits Guthrie with an 1860 synthesis of sulphur mustard. Guthrie, Ann. 113 (1860), cited in Frank C. Whitmore, *Organic Chemistry: Part I, Aliphatic Compounds* (Dover Publications: Mineola, New York, 1951), p. 33.

[98] SIPRI, *The Problem of Chemical and Biological Warfare,* vol. 1, The Rise of CB Weapons (Almqvist & Wiksell: Stockholm, 1971), p. 42.

chlorine attack) temporarily abandoned. The CW attacks also had a great psychological impact on their opponents, as well as their respective leaderships and societies.

Augustin M. Prentiss of the US Chemical Warfare Service (CWS) estimates that the Austrian-Hungarian Empire, Germany, Italy, France, the United Kingdom, the United States and Russia together produced 150 000 tonnes[99] of CW agents during the war, of which 25 000 tonnes were left unused when hostilities ended on 11 November 1918.[100] During the war, some 66 million CW artillery shells were fired and both conventional and chemical munitions continue to be recovered annually from World War I European battlefields.[101]

Analysts have since argued over the CW casualty numbers. Sulphur mustard, although introduced on the battlefield in 1917, caused more than half of all CW casualties. This is despite the fact that the French and British did not possess battlefield supplies until June 1918 and September 1918 respectively and could not respond in kind in the intervening period.[102] Yet the percentage of those exposed to sulphur mustard who died appears to be under five per cent.[103] Second, discrepencies exist between the statistics given by Gilchrist, Hanslian and Prentiss, three of the most widely cited authorities on CW casualty figures.[104] Third, of all the belligerant countries, Russia's statistics are the most uncertain.[105] This is partly because of the government's collapse and the country's subsequent disintegration into civil war that did not subside until 1921. In addition, many of Germany's World War I archives were destroyed during World War II. Haber provides an authoritative analysis on the difficulties

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[99] The type of 'ton' is not specified (long ton, short ton, metric tonne, etc.).

[100] Augustin M. Prentiss, *Chemicals in War: a Treatise on Chemical Warfare* (McGraw-Hill Book Co., Inc.: New York, 1937), p. 661.

[101] Ron Manley, 'The Problem of old chemical weapons which contain "mustard gas" or organoarsenic compounds: an overview', p. 2, in Eds. Joseph F. Bunnett and Marian Mikolojczyk, *Arsenic and Old Mustard: Chemical Problems in the Destruction of Old Arsenical and 'Mustard' Munitions* (Kluwer Academic Publishers: Dordrecht, 1998).

[102] SIPRI (note 98), p. 49.

[103] Gilchrist states that 599 of 27711 sulphur mustard casualties died (i.e., 2.2%). Harry L. Gilchrist, *A Comparative Study of World War Casualties from Gas and Other Weapons* (US Government Printing Office: Washington, DC, 1928), table no. VII, p. 21. The percentages may not be reliable. Longer-term health effects of exposure to sulphur mustard include genetic mutations, the formation of holes and pitting in the cornea, and an increased incidence in cancer of the windpipe.

[104] Gilchrist (note 103); Rudolf Hanslian, *Der Chemische Krieg* [Chemical Warfare], vol. 1 (Von E. S. Mittler & Son: Berlin, 1937), pp. 35–36; and Prentiss (note 100), p. 653.

[105] In fact, Basil Gourko (the Chief of the Russian Imperial General Staff in November 1916–March 1917 and Commander-in-Chief of Western Armies in March 1917–June 1917) downplayed the military utility of CW against Russian forces. He argued that CW's actual utility was generally marginal, especially the cylinder attacks, partly because the agent would not infrequently blow back over German positions. He did believe that CW was useful when it was filled into artillery shells and used in conjunction with conventional explosives prior to an attack. He noted that even in such cases, the Germans were themselves often the ones affected because if they succeeded in taking a Russian trench they were themselves contaminated and hence more vulnerable to counter-attack. Basil Gourko, *Memories & Impressions of War and Revolution in Russia 1914–1917* (John Murray: London, 1918), pp. 166–167. Possible increased effectiveness of use of CW by Germany in 1918 and variation in German CW use according to sector of operations should not be overlooked when considering Gourko's assessment.

associated with determining World War I CW casualty and death statistics, the uncertainties of which will probably not be elucidated further to any significant degree.[106]

Table 2.1 World War I CW casualty estimates

Country	No.	Deaths	% of deaths/casualties
Russia*	475 340	56 000	11.7
France	190 000	8 000	4.2
Italy*	13 300	4 627	34.7
United States	70 752	1 421	2
United Kingdom	180 983	6 062	3.3
Germany	78 663	2 280	2.9
Total	1 009 038	78 390	7.7

Source: Gilchrist, Harry L., *A Comparative Study of World War Casualties from Gas and Other Weapons* (Edgewood Arsenal: Maryland, 1928), p. 7. *Deemed by Gilchrist to be unreliable. Gilchrist's numbers are partly based on the UK's *Official History of the War, Medical Services, British Army*, vol. 2 (1924?); and, probably, W. D. Bancroft, et al, *The Medical Department of the United States Army in the World War, Medical Aspects of Gas Warfare*, vol. XIV (US Government Printing Office: Washington, DC, 1926). The UK issued similar studies of WW I casualties and deaths. It is not known how many World War I veterans suffered died earlier than they would have otherwise. Their longerterm health problems were also not properly documented. Thousands of Iranian soldiers who were exposed to sulphur mustard during the 1980-1988 Iran-Iraq War remain under regular medical care due to longerterm health effects, including late onset blindness. The relevant scientific literature should be consulted for further information. See, for e.g., Kawa Dizaye, 'Case Report: Victims of the Long Term Effects of Chemical Weapons in Kurdistan of Iraq', *Middle East Journal of Internal Medicine*, vol. 5, no. 4 (July 2012), pp. 27-35. With one exception, a 1941 Soviet publication provides (with no citation) numbers identical to those in the first column, including the cumulative total. The publication states that Russia lost 475390 personnel (a probable typo). S. I. Azar'ev and N. A. Balashov, *Boevaya Sluzhba Krasnoarmeitsa-Khimika* [Military Service of a Red Army Chemist] (Military Publisher of the Peoples' Comissariat of the Defence of the USSR: Moscow, 1941), p. 8.

The contemporary understanding of chemical warfare emerged during World War I.[107] This was partly because a reasonably well-developed scientific understanding of the cause and effect of chemical and biological substances had, hitherto, not been developed sufficiently.[108] Nor had such an understanding yet been incorporated into weapons development, training programmes and doctrine. World War I exemplified a new, more highly-refined mode of military planning and organization that involved the large-scale use of materials and manpower,

[106] Ludwig F. Haber, *The Poisonous Cloud: Chemical Warfare in the First World War* (Oxford University Press: Oxford, 2002, reprint), pp. 239–258.

[107] Various proposals for the use of noxious fumes were in recent modern times, including for the Crimean War and the US Civil War. See Charles Stephenson, *The Admiral's Secret Weapon: Lord Dundonald and the Origins of Chemical Warfare* (The Boydell Press: Woolbridge, UK, 2006).

[108] E.g., one not infrequently encountered discussion of the ill health effects of miasmas or 'bad humours' in marshlands and swamps. Benjamin C. Garrett and John Hart, *Historical Dictionary of Nuclear Biological, and Chemical Warfare*, Historical Dictionaries of War, Revolution, and Civil Unrest no. 33 (The Scarecrow Press, Inc.: Lanham, Maryland, 2007), 'Introduction', p. xxviii.

including civilian industrial production and research capacity.[109] 'Industrialized' warfare (or 'total war') entailed the mass mobilization and coordination of manpower and natural resources, such as using the expertise of university chemists for CW-related work.

In addition, the military strategist and historian John F. C. Fuller favoured the use of riot control agents and authored a UK memoradum on 5 November 1918 entitled *Bloodless Means of Quelling Civil Disturbances*.[110] In this memorandum and a later book, he maintains that the Jallianwalabagh massacre[111] and Cawnpore massacre[112] would have been averted had non-lethal gases been employed.[113] Fuller has argued that 'Gas, especially in its non-lethal forms, is the ideal weapon, because its production does not detrimentally affect prosperity; it is simple to manufacture; its nature can be kept secret; it can incapacitate without killing and it does no permanent damage to property'.[114] Fuller also argued that chemical weapons, not unlike general surgical anaesthetic, would eventually humanize war.[115] Fuller also said in the interwar period that gas, even if prohibited or restricted, 'will be used in the next war' and that probably 'it will be used as a brutal instrument' (though not necessarily more brutal than the results produced by being blown to pieces or stabbed with a bayonet).[116]

After the war, many military planners and strategists came to view chemical and biological warfare as an inevitable component of science and technology for the development of more effective weapons.[117] They expected such weapons to become commonplace in future wars, or at least felt it prudent to plan accordingly.[118] The influential British military strategist Basil H. Liddell-Hart favoured the use of chemicals for law enforcement and as a method of

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[109] The OSRD was a temporary executive branch organization headed by Dr Vannevar Bush which coordinated civilian war research in the United States during World War II. The OSRD, through its Office of Field Service (OFS), provided the bulk of the scientific expertise to the ALSOS Mission. See also Vannevar Bush, *Modern Arms and Free Men: a Discussion of the Role of Science in Preserving Democracy*, reprint (Greenwood Press: 1985).

[110] John F. C. Fuller, *The Dragon's Teeth: a Study of War and Peace* (Constable & Co. Ltd.: London, 1932), p. 221.

[111] Jallianwala Bagh (or Amritsar) massacre is the more common current spelling. The killings referred to a 13 April 1919 shooting in present-day northwest India. A British commander was convinced that a rebellion was incipient and ordered a Gurkha detachment to fire repeatedly into an unarmed crowd resulting in the deaths of at least 379. Other estimates are closer to 1500.

[112] In 1857 Indians (Sepoys) besieged British forces at Cawnpore, many of whom were killed (including women and children). See Byron Farwell, *Queen Victoria's Little Wars* (Harper & Row, Publishers: 1972). Reprinted by Norton in 1985.

[113] Fuller (note 110), p. 221.

[114] Fuller (note 110), p. 221.

[115] Fuller (note 110), p. 222.

[116] Fuller (note 110), pp. 222–223.

[117] Two fundamental works that influenced military planners in this regard were Prentiss (note 100); and Amos A. Fries and Clarence J. West, *Chemical Warfare* (McGraw-Hill Book Co., Inc.: New York, 1921).

[118] See, for e.g., Fuller (note 110); and Henry F. Thuillier, *Gas in the Next War* (Geoffrey Blis: London, 1939).

warfare.[119] To support his case, he pointed to the work of a sub-committee to the Preparatory Commission on Disarmament in Geneva that was tasked in 1926 to consider the possibility that the chemical industry could be converted to produce chemical warfare agents.[120] This body concluded that 'chemical factories, especially dyeworks and factories connected therewith, can be very quickly adapted' to CW manufacture, that 'it is impossible to prevent or hinder the manufacture' of CW and that 'there is no technical means of preventing chemical warfare'.[121] This sense of urgency and inevitability of CW use has since subsided except with regard to non-state actor threats as understood by some governments, analysts and sections of the public.[122]

In the 1930s the three main types of nitrogen mustards were developed (HN1, HN2, HN3) and further work was carried out on the lewisites (named for Captain Winford Lee Lewis who headed a group of chemical weapon researchers at Catholic University in the United States).[123] In the 1930s the major discoveries of organophosphates were made by German scientists. Tabun (GA) was discovered in 1936 by the I. G. Farben scientist Gerhard Schrader. The compound, Ethyl N,N-dimethylphoroamidocyanidate, was reported to the chemical warfare section of the German army under a regulation that required that scientific discoveries of potential military value or affecting national defence be reported.[124] Sarin (GB), O-isopropyl methylphosphonofluoridate, was discovered in 1939. Soman (GD), O-pinacolyl methylphosphonofluoridate, was discovered in 1944 by either Richard Kuhn or Konrad Henkel.[125] Of the

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[119] Liddell-Hart observed: 'Those apparent sentimentalists, but actual brutalists, to whom the word "gas" is still anathema, may find the fact worth noting that the United States has been the one country to develop this humanising force in quelling disorder. First used against criminals in the cities and against the boll-weevil on the plains, it is now being used with satisfactory results against lynch-mobs in the South. May the proof of its humane effectiveness in quelling disorder pave the way for its recognition as the means of lessening the evils of war! To continue the prohibition on gas is not only to maintain the horrors of high-explosive warfare, but is futile'. Basil H. Liddell-Hart, *The Remaking of Modern Armies* (John Murray: London, 1927), pp. 86–87.

[120] The work was carried out under the League of Nations. For a description of the work of the League of Nations on control over and prohibition of chemical warfare by a Secretariat official, see Salvador de Madariaga, *Disarmament* (Oxford University Press: London, 1929), pp. 158–164.

[121] Liddell-Hart (note 119), pp. 80–81.

[122] While it is true that CW threat perceptions increased in a number of mainly Western states following the attacks in 2001 against politicians and members of the media using powdered *Bacillus anthracis* spores (the causative agent for anthrax) in the United States through the post, most states do not feel directly threatened by such attacks. As of 2012 (with the accession of South Sudan in 2011), the UN had 193 members. The sense of urgency associated with possible CBW attacks by non-state actors was probably the highest in the period immediately following the 2001 attacks which resulted in five confirmed fatalities. For information on the investigation into the attacks, see Department of Justice, 'Amerithrax Documents', <http://www.justice.gov/amerithrax/>, (accessed 16 June 2013); and Federal Bureau of Investigation, 'Amerithrax or Anthrax Investigation', <http://www.fbi.gov/about-us/history/famous-cases/anthrax-amerithrax>, (accessed 16 June 2013).

[123] See Joel A. Vilensky, *Dew of Death: The Story of Lewisite, America's World War I Weapon of Mass Destruction* (Indiana University Press: Bloomington, Indiana, 2005).

[124] SIPRI (note 98), pp. 71–72.

[125] Kuhn, as head of the laboratory, has traditionally received credit for the synthesis. Recent research suggests that Henkel was more directly responsible for the discovery. Florian

organophosphorus nerve agents produced during World War II, only sarin and tabun were produced in significant quantities and by Germany only.[126] Allied forces were surprised to learn of the existence of such agents at the end of the war. The Allies, in turn, started (or redoubled) their own development and stockpiling programmes of organophosphorus nerve agents.[127] In late 1944, a group of Soviet officers from Shikhany examined a German sarin and tabun production plant in Silesia where samples of sarin, pinacolyl alcohol (a key ingredient for the manufacture of soman) and paperwork were recovered. The plant was dismantled and reassembled in the Soviet Union.[128]

German prisoners-of-war (POWs) returning to the West in the years following World War II (most who survived were repatriated by 1955) identified CW facilities in Dzerzhinsk, Yerevan and Beketovka (factory no. 91, south of Stalingrad).[129] The dismantled German organophosphorus nerve agent production equipment taken from Dyhernfurth was reportedly reassembled at the Beketovka Plant (part of the Khimprom facility in Volgograd). While knowing that the Dyhernfurth facility had been dismantled and reassembled in the Soviet Union, the British were uncertain as to when the Soviet Union had begun the full-scale production of any of the organophosphorus nerve agents. At one point in the post-World War II period, the UK estimated, partly on the basis of former POW reports, that this full-scale production would occur in 1951 or 1952.[130]

The nerve agent VX was discovered in the 1950s. The USA weaponized O-ethyl S-(2-diisopropylaminoethyl) methylphosphonothiolate.[131] Soviet V-agent is an isomer of VX and its synthesis was partly informed the work of the Swedish chemist Lars-Erik Tammelin who later headed the Swedish Defence

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Schmaltz, 'Neurosciences and Research on Chemical Weapons of Mass Destruction in Nazi Germany', *Journal of the History of Neurosciences*, vol. 15 (2006), pp. 186–209.

[126] The actual production is difficult to ascertain for various reasons including conflation of agent weight with that of munition bodies, and uncertaintly over whether the nameplate production capacities of facilities were fully utilized. SIPRI estimated that one German plant site had a 1 000 tonne/month capacity, while 2 other plant sites may have had 100 and 500 tonne/month production capacities. Further context is provided by figures on amounts and types of CW captured and later tested or disposed of. See, for e.g., SIPRI (note 98), pp. 282 & 305. On post-WW II UK stocks of trophy German tabun, see Roy Sloan, *The Tale of Tabun* (Gwasg Carreg Gwalch: Llanrwst, Wales, 1998).

[127] See below for Reginald V. Jone's summary of the UK's understanding of Germany's CW activity.

[128] N. I. Alimov (et. al), *Khimicheskaya Oborona Rossii: k 70-letiyu Tsentral'nogo Nauchno-Issledovatel'skogo Ispytatel'nogo Instituta Radiatsionnoi, Khimicheskoi i Biologicheskoe Zashchity* [Chemical Defence of Russia on the 70th Anniversary of the Central Scientific-Research and Experimental Institute of Radiological, Chemical and Biological Protection] (Letopis' Publisher: Saratov, 1998), p. 39. The plant was almost certainly at Dyhernfurth. Some sources date the Soviet capture of Dyhernfurth at early 1945.

[129] STO/2/DE48, DEFE 41/145; JSJT/STO(49)31, DEFE 41/146; STIBs 'A' and 'C' series files, DEFE 41/30; STO/11NO/48; STO/25/NO/48, DEFE 41/145; STO/16/NO/48, DEFE 41/145; and JSJT/STO(49)11, DEFE 41/146 as cited in Paul Maddrell, *Spying on Science: Western Intelligence in Divided Germany 1945–1961* (Oxford University Press: Oxford, 2006, reprinted 2008), p. 111.

[130] Maddrell (note 129), p. 112.

[131] The UK filled GB into some artillery shells. It did not, however, weaponize VX. The UK initially synthesized VX using the so-called water process before abandoning it. The US used the Newport process. Personal communication, Sep. 2013. On the Newport process, see US Congress, Office of Technology Assessment (note 12), p. 26.

Research Establishment (FOA) and, in the early 1950s, synthesized an unstable form of sulphur-containing acetylcholinesterase inhibitors called Tammelin esters.[132] As isomers, V-agent and VX are chemically similar, but structurally different. Their physico-chemical effects therefore differ somewhat.

After World War II, work was also carried out on various hallucinogenic agents. This included British and US work on 3-quinuclidinyl benzilate (BZ) and lysergic acid diethylamide (LSD).[133] Some experiments induced fear in cats of mice and caused soldier volunteers to drop their weapons and to wander about oblivious to orders.[134]

In 1987–1990 the US produced binary nerve agent weapons (in the sense of two, relatively non-toxic chemicals being mixed within a weapon as it is fired).[135] One such munition was the Big Eye, which contained canisters of elemental sulphur (NE) and O'ethyl methylphosphonite (QL) which, when mixed, formed VX. Another US binary involved the mixing of methylphosphonyl difluoride (DF) with a mixture containing isopropyl alcohol to produce sarin. Despite their reputation for being a 'second' or 'third generation' weapon, such munitions sometimes produced incomplete mixing.[136] While safer to manufacture and handle, they tended to deliver less actual agent to target than unitary munitions. The term 'binary weapon' was also used politically to imply that a state had a more sophisticated, and therefore more dangerous, chemical weapon stockpile.[137] During the 1980–1988 Iran-Iraq War, Iraqi forces mixed

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[132] In the 1960s Tammelin headed FOA's chemico-medical department (kemisk-medicinska avdelningen) before becoming FOA's General Director (1984–1985). Lennart Larsson, 'Kemiska stridsmedel – verkan and skydd [Chemical warfare agents – work and protection]', pp. 185–187 in *Försvarets Forskningsanstalt: 1945–1995* [Defence Research Institute: 1945–1995] (PROBUS Förlag HB: Stockholm 1995).

[133] LSD was first synthesized by the Swiss chemist Albert Hoffmann. See Albert Hoffmann, *LSD, My Problem Child: Reflections on Sacred Drugs, Mysticism and Science* (Multidisciplinary Association for Psychedelic Studies (MAPS): Santa Cruz, California, 2009); and Malcolm Dando and Martin Furmanski, 'Midspectrum incapacitant programs', pp. 236–51, in Wheelis, Rózsa and Dando (note 85).

[134] For an example of a contemporary US Army publicity film of a cat becoming fearful of a mouse due to the effects of an unnamed agent, see 'Psychoactive Agents Research Chemical Warfare Edgewood Maryland 1950s US Army', <http://www.youtube.com/watch?v=X6Z41exm3T0> (accessed 16 June 2013). See also James S. Ketchum, *Chemical Warfare Secrets Almost Forgotten: A Personal Story of Medical Testing of Army Volunteers with Incapacitating Agents during the Cold War (1955–1975)* (James S. Ketchum: Tehachapi, CA, 2006); and Malcolm Dando and Martin Furmanski, 'Midspectrum Incapacitant Programs', pp. 236–51, in Wheelis, Rózsa and Dando (note 85).

[135] Another understanding of 'binary' involves the mixing of two toxic chemicals that are chemical warfare agents in their own right.

[136] The effectiveness of the mixing has ranged from very poor to complete and effective. The variance is partly due to munition design and the technical capacity of the personnel involved. Personal communication, Sep. 2013.

[137] In World War I and the inter-war period, 'binary' in the chemical weapon context was understood to mean artillery shells with at least two CW agents in separate chambers (e.g., glass containers). A typical example of such a munition was Germany's WW I 7.7 cm Blue Cross projectile. Blue Cross shells (so named because of blue cross paint markings) contained various formulations of irritant agents, usually based on diphenylchloroarsine (Clark I) or ethylcarbazol (Clark II). The author viewed these and other projectiles at Munsterlager (Germany) in 2006.

some nerve agent precursors in the field in order to generate the agent in the weapon immediately prior to use.[138]

Finally, the entry-into-force of the CWC in 1997 has resulted in the release of further information on past CW programmes and their legacies. As of December 2013, 190 states were party to the CWC.[139] Since the treaty entered into force, the following declarations have been submitted to the OPCW. A total of 14 of the parties have declared to the OPCW that they possessed one of more chemical weapon production facilities since 1 January 1946. Four of the parties have declared chemical weapons that have been abandoned on their terroritory by others.[140] Also 15 of the parties have declared the possession of old chemical weapons, while eight of the parties have declared the possession of chemical weapon stockpiles.[141] The states that had declared chemical weapon stockpiles to the OPCW are Albania, India, Iraq, South Korea, Libya, Russia, Syria and the United States. Albania, India and South Korea have destroyed all of their declared chemical weapons. The largest possessors of CW stockpiles were (and remain) Russia and the United States. As of December 2013 58 528 metric tonnes of 72 531 metric tonnes declared have been destroyed. As of July 2013, previously undeclared Libyan CW (sulphur mustard and some unfilled munitions) were scheduled for destruction.[142]

Starting in late 2013 international verification and destruction operations were also ongoing in Syria.[143] Syria declared to the OPCW on 19 September and 4 October the possession of sulphur mustard agent, sarin precursors and VX precursors. It declared having 41 facilities at 23 sites, 18 chemical weapon production facilities, 12 chemical weapon storage facilities, 8 mobile filling units, 3 CW-related facilities, 1000 tonnes of Category 1 chemicals (mainly precursors), 290 tonnes of Category 2 chemicals, 1230 unfilled munitions, 2

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[138] To an extent, this practice is described in rather general terms with respect to the al-Husayn warhead unitary and binary warheads. *Comprehensive Report of the Special Advisor to the DCI on Iraq's WMD*, vol. 3 (30 Sep. 2004), p. 9. Report of the US Iraq Survey Report ('The Duelfer Report'). See also Ron G. Manley, 'UNSCOM's Experience with Chemical Warfare Agents and Munitions', p. 242 in Eds. Thomas Stock and Karlheinz Lohs, *The Challenge of Old Chemical Munitions and Toxic Armament Wastes*, SIPRI Chemical and Biological Warfare Studies no. 16 (Oxford University Press: Oxford, 1997).

[139] The states that had signed, but not acceded, to the CWC were Israel and Myanmar. The states that had neither signed nor acceded to the CWC were Angola, Egypt, North Korea and South Sudan.

[140] The countries that have declared ACWs to the OPCW are China, Iran, Italy and Panama. The Technical Secretariat determined the ACW munitions declared by Iran to be conventional. ACWs are defined as chemical weapons that were abandoned by a state after 1 Jan. 1925 on the territory of another state without the permission of the latter. CWC, Article II, para. 6.

[141] The countries that have declared OCWs to the OPCW are Austria, Australia, Belgium, Canada, France, Germany, Italy, Japan, Poland, Russia, Slovenia, Solomon Islands, Switzerland, the UK and the USA. OCWs are defined as chemical weapons that were produced before 1925 or chemical weapons produced between 1925 and 1946 that have deteriorated to such an extent that they are no longer usable in the manner in which they were designed. CWC, Article II, para. 5.

[142] OPCW, 'Libya Completes Destruction of its Bulk Sulfur Mustard Stockpile', OPCW Press Release, 6 May 2013, <http://www.opcw.org/news/article/libya-completes-destruction-of-its-bulk-sulfur-mustard-stockpile/>, (accessed 8 May 2013). The completion of sulphur mustard destruction refers to that stored at the Ruwagha depot.

[143] OPCW, 'Syria and the OPCW', <http://www.opcw.org/special-sections/the-opcw-and-syria/>, (accessed 4 Nov. 2013).

cylinders not claimed by the Syrian Government and possibly filled with CW, and site diagrams for CW storage facilities.[144]

A focus of the inspection and verification effort (which was hindered by a lack of effective security measures within the country) was on ensuring the completeness and correctness of the declarations and to finish the destruction of Category 3 CW in 2013. A major component to the internationally-verified destruction of the weapons stockpile was also the removal by ship in January-June 2014 of organophosphorus nerve agent precursors, isopropanol (diluted in water) and sulphur mustard agent. The removal operation (Operation Removal of Chemical Agents from Syria (OPER RECSYR)) was under the overall direction of OPCW and included the transfer of toxic chemicals to a shipboard hydrolysis unit in the Mediterranean Sea.[145] Denmark and Norway agreed to transfer the toxic chemicals from the Syrian port of Latakia, while the USA provided a ship specially fitted with the CW destruction hydrolysis unit. Hydrolysates (i.e., degradation products formed during the hydrolysis of the chemical agents) were to be used for peaceful purposes by private companies awarded public tenders circulated by the OPCW.[146]

2.1. Preparedness and Awareness Raising

In the inter-war period, preparedness and awareness compaigns were also begun mainly in Europe to inform the public of the risks of chemical and biological warfare. Groups interested in the promotion of peace wrote on the scale of destruction that could be expected in future wars by armoured formations and aerial attack (including with incendiary devices and chemical or biological warfare agents).[147] Some feared that aerial attack would be decisive in any future

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144 'Note by the Director-General: Progress in the Elimination of the Syrian Chemical Weapons Programme', OPCW document EC-M-34/DG.1, 25 Oct. 2013.

145 Seaborne hydrolysis was decided upon after consultations among the parties to the CWC resulted in no state being willing to accept these chemicals onto its terriory. This appears to have been mainly due to an unwillingness to face public opposition.

146 For documentation and related information, see OPCW (note 143).

147 E.g., Thuillier (note 118). This volume is part of *The Next War Series* edited by Basil Liddell-Hart. See also Norman Angell, et al, *What Would be the Character of a New War?* (Victor Gollancz Ltd.: London, 1933). The chapters in Angell were produced under the auspices of an enquiry organised by the Inter-Parliamentary Union in Geneva. The Soviet Union also published a translation of the work of a certain General Groves in which the Soviet author of the forward indicated that chemical weapons would be a decisive means in future war. Grovs [Groves], *Za Dymovoi Zavesoi* [Behind the Smoke Screen] (State Military Publisher 'Ogiz': Moscow, 1934), p. III. Translated from English with a foreward by E. Tatarchenko.

The first name of Groves is not provided. However, the author is probably 'General Groves' who was the Director of Aerial Operations for the British front in 1918. See Gertrud Woker, 'Chemical and Bacteriological Warfare', p. 358 in Norman Angell, et al, *What Would be the Character of a New War?* (Victor Gollancz Ltd.: London, 1933). Thuillier was Director of Gas Services at General Headquarters in France during World War I. He later became Controller of the Chemical Warfare section of the UK Ministry of Munitions. In 1939 he had achieved the rank of Major-General. Thuillier (note 118), p. x.

More generally, it should perhaps also be noted that the Soviet Union issued translations of the standard chemical and biological warfare works published by Western states (without, one suspects, obtaining copyright permission). Professor Hermann Büscher's popular gas awareness book (Giftgas! Und Wir?) states that all copyright is asserted 'including in Russian' ('Alle Rechte, insbesondere das Übersetzungsrecht – auch ins Russische – vorbehalten'). Hermann

war. In the 1920s-1930s, numerous popular books were devoted to the nature of future warfare (given the mass deaths and the industrial and technological nature of World War I).[148] Some of this literature pertained to the activity of peace societies or arms limitation talks by the League of Nations. Notable commentators, such as the military historian and strategist John F. C. Fuller, the scientist John B. S. Haldane, the philosopher, mathematician and peace activist Bertrand Russell and the author and social commentator Herbert G. Wells, gave lectures and wrote on future conflict, international tensions, and civil defence. Others sought to clarify the military strategic implications of technological developments, modes of warfare and weapons.[149]

Fuller, one of the more influential inter-World War proponents of chemical warfare, had little patience for arms control and disarmament advocates then active in the League of Nations and elsewhere. He argued 'To paralyse an army by chemical action is surely more beneficial to humanity than blowing it to pieces; to send a city to sleep is surely preferable to bombarding it or starving it into surrender, and even to burn a man's skin with mustard gas is surely more humane than digging out his entrails with a bayonet. Yet these humane methods are not the ideals of the humanitarians; to them, if war is to continue, then blowing to pieces, starving and mutiliating are the rightful methods of war'.[150] To Fuller, future warfare would be characterized by: 1. machine guns, 2. the motor-car, 3. the tank, 4. the submarine, 5. aircraft and 6. gas.[151] Liddell Hart held similar views and believed that another war with Germany was probable and edited a series of books entitled *The Next War Series* with such views in mind.[152]

In addition, various officials and public commentators issued disturbing estimates on the effects of CW agents. On 14 July 1928 Lord Halsbury (Chief of the Explosives Department in the UK Ministry of War) informed the House of Lords that 40 tonnes of diphenylchlorarsine would be sufficient to destroy the

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Büscher, *Giftgas! Und Wir?, Die Welt der Giftgas: Wesen und Wirkung/Hilfe und Heilung* [Poison Gas! And Us? The World of Poison Gas: Nature and Effects/Help and Healing] (Verlag R. Himmelheber & Co.: Hamburg, 1932), front inside cover. Although it should perhaps also be noted that V. I. Shvemberger of the Red Army Chemical Directorate published in 1927 was said to be an authorized edition of Julius Meyer's *Der Gaskampf und die Chemischen Kampsoffe* [Gas Warfare and Chemical Warfare Agents], 2nd edtn. (Leipzig, 1926) (Shvemberger also confirms in his preface that Yakov Fishman held a doctorate in chemistry. I mention the point about Fishman's academic credential because at least one US scientist with a deep expertise and interest in CBW history has had a longstanding interest in clarifying this point.)

148 E.g., Herbert Timm, *Röda Armén Marsherar* [The Red Army on the March] (Albert Bonniers Förlag: Stockholm, 1936), transl. by C. F. Palmstierna.

149 E.g., J. M. Kenworthy, *New Wars: New Weapons*, Colonial Edtn. (Elkin Mathews & Marrot: London, 1930); J. M. Kenworthy, *Peace or War?* (Boni & Liveright: New York City, 1927). Kenworthy served on the UK Admiralty War Staff in London and was a Member of Parliament. For a Francophone view on the disarmament provisions of the Treaty of Versailles, see M. De Lavallaz, *Essai Sur Le Désarmement et le Pacte de la Société des Nations* [Essays on Disarmament and the League of Nations Treaty], fascicule II (Collection de L'École des Sciences Sociales de L'Université de Lausanne: Paris, 1926), (edited by Arthur Rousseau).

150 Fuller (note 110), p. 222.

151 Fuller (note 110), p. 277.

152 The titles of The Next War Series, edited by Liddell, were *Sea Power in the Next War*, by Russell Grenfell; *Air Power in the Next War*, by James M. Spaight; *Propaganda in the Next War*, by Sidney Rogerson; *Tanks in the Next War*, by E. W. Sheppard; *Infantry in the Next War*, by T. A. Lowe; *Gas in the Next War*, by Henry F. Thuillier; *The Territorial in the Next War*, by W. E. Green; and *The Civilian in the Next War*, by J. D. Bernal.

entire population of London.[153] A Soviet AVIAKhim publication translated by a Bern paper and subsequently referred to by the Swiss organic chemist and peace activist Gertrud Woker stated that a city of 500 000 inhabitants covering a territory of approximately 200 sq km could 'if unprotected, be turned into a field of corpses by a squadron of 40 to 50 aeroplanes'.[154]

Professor Philip Noel Baker, a former British member of the League of Nations Secretariat and author of *Disarmament* (1926), stated that 'three drops' of Lewisite is sufficient to kill a person and that 'No reasonable person can hope that General Groves[155] was mistaken when he said that millions of lives could be lost in a few hours [to aerial chemical and perhaps conventional explosives attack].[156] The alleged lethality of Lewisite was echoed in a 1927 speech by Stalin (see Chapter 12). Such estimates are uninformed hyperbole.[157]

The extent to which Soviet CW specialists accepted the assertions regarding the effectiveness of Lewisite in Western publications is not clear. In addition, to the quotation ascribed to Baker, the US CWS in the immediate post-World War I period viewed Lewisite as the US's own special contribution and not infrequently promoted its effectiveness as a blister agent alternative to sulphur mustard. According the Russian and US chemist Vladimir Nikolayevich Ipatiev who assisted in the development of Russia's CW programme during World War I, *Chemical Warfare* (a book published in 1921 by two US army officers, Amos Fries and Clarence West) was popular in the Soviet Union partly because of the interest it generated about Lewisite, often referred to as the 'dew of death'.[158]

In 1924 the Study Commission of the League of Nations on Chemical Warfare issued a report on threats posed by chemical and biological weapons in future conflict which provides better context in which to place the various sensationalist claims, including one made by Joseph Stalin regarding Lewisite at the 15th Congress of the Communist Party held in 1927 (see Chapter 12).[159] Such efforts also tended to prompt speculation on the existence of secret 'super weapons' and attendant sensational news stories.[160] Even unusual disease

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153 Gertrud Woker, 'Chemical and Bacteriological Warfare', p. 363 in Angell (note 147).

154 Gertrud Woker, 'Chemical and Bacteriological Warfare', p. 364 in Angell (note 147).

155 'General Groves' in this instance was the Director of Aerial Operations for the British front in 1918, *not* Leslie Richard Groves who headed the Manhattan Project in World War II. Gertrud Woker, 'Chemical and Bacteriological Warfare', p. 358 in Angell (note 147).

156 Gertrud Woker, 'Chemical and Bacteriological Warfare', p. 362 in Angell (note 147).

157 On CW lethality effects, see *Military Chemistry and Chemical Agents*, US Army Technical Manual TM 3-215 (unclassified) (Department of Defense: Washington, DC, Dec. 1963).

158 Ipatieff states that Lewisite was investigated 'in especial detail'. Vladimir N. Ipatieff, *The Life of a Chemist* (Stanford University Press: Stanford, California, 1946), p. 387. Fries is discussed in Soviet military journals and books dealing with CW issues (i.e., his publications, speeches and opinions).

159 Document A.16 (1924), IX, League of Nations. As cited by Gertrud Woker, 'Chemical and Bacteriological Warfare', p. 385 in Angell (note 147).

160 For pre-World War I fears of biological warfare, see Anonymous, 'Plague Missiles, New War Scheme', *Washington Post*, 4 Feb. 1912, p. M6 (accessed via ProQuest Historical Newspapers database); and Anonymous, 'Smallpox Shells for War: Death-Dealing Horrors [the] British Government are Considering Will Make Peace Desirable', *Washington Post*, 11 Feb. 1912, p. M1 (accessed via ProQuest Historical Newspapers database). This item was apparently a reprint of an article that appeared in *Pearson's Weekly*.

outbreaks might therefore acquire a more sinister meaning. Such factors heightened the threat perceptions that states had of each other.[161]

2.2. CW Evaluation and War Planning

During World War I a series of events occurred that provide useful context to the consideration of 'offensive' versus 'defensive' chemical weapon programme indicators. In April 1916 Field Marshal Douglas Haig instructed that defensive and offensive services of the UK chemical warfare activity be placed under the command of Brigadier-General Henry F. Thuillier in order to 'secure unity of organisation and direction'.[162]

Thuillier subsequently summarized British CW evaluation (including intelligence principles) and war planning carried out by the British during the war. Parallels exist between the World War I military intelligence CW evaluation context and subsequent technical discussions on CW arms control verification that were conducted under the auspices of the League of Nations.

With respect to the general indicators of a CW programme, Thuillier states:

> *'The gas warfare directors must study not only the nature of the chemical substances that would make valuable war weapons, but also the capacity of the country's industries to produce them, and the availability of materials, especially metals of various kinds, for the appliances in which they are to be used. With metals carefully rationed, as they were in the last war, it is useless to contemplate the introduction of such an appliance as the Livens projector[163] unless the rationing committee can be prevailed on to allot the necessary supply of steel for their manufacture'.*[164]

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[161] E.g., see Heinz Liepmann, *Death from the Skies*: *a Study of Gas and Microbial Warfare* (Martin Secker & Warburg: London, 1937); and Wickham Steed, 'Aerial warfare: secret German plans', *The Nineteenth Century and After*, no. 689 (July 1934), pp. 1–15. For a discussion on threat perceptions in the biological field, see Erhard Geissler, John Ellis van Courtland Moon, and Graham S. Pearson, 'Lessons from the History of Biological and Toxin Warfare', chap. 12, pp. 255–276 in Eds. Erhard Geissler and John Ellis van Courtland Moon, *Biological and Toxin Weapons: Research, Development and Use from the Middle Ages to 1945*, SIPRI Chemical & Biological Warfare Studies no. 18 (Oxford University Press: Oxford, 1999). *Nineteenth Century and After* was first issued in 1877. It was subsequently renamed *Twentieth Century*. The journal received British and US government (including intelligence) funding to support those governments' cultural struggle against their communist counterparts. Frances Stonor Saunders, *The Cultural Cold War: the CIA and the World of Arts and Letters* (The New Press: New York, 1999), pp. 109–110.

[162] Thuillier (note 118), unnumbered footnote, p. 39.

[163] Named for William Howard Livens, a British civil engineer who served in the Special Brigade (a WW I British chemical weapons unit), the device consists of a mortar tube embedded into the ground in rows which eject drums of CW agent simultaneously via an electrical firing mechanism. The system was able to generate quickly lethal concentrations of CW agents with little to no warning. Those who prepared the rows were liable to be hit by CW agent if German forces became aware of their work and brought down an artillery barrage. Garrett and Hart (note 108), pp. 131–132.

[164] Thuillier (note 118), p. 161.

With respect to CW protective equipment, Thuillier continues:

> *'The same applies to the materials required for protective appliances, especially gas respirators which are required in [the] millions. For these the supplies of rubber, textile fabrics, light metals, special charcoals, etc., have to be ensured. In 1917 it was found difficult to obtain the materials required for the production of the special charcoal for respirators, so advertisements were inserted in newspapers asking the public to collect and send in all stones of fruit, such as peaches, plums, cherries, etc., which, when burned produced charcoal of the requisite standard. Quantities of them soon poured in. In addition, agents were sent to South America to obtain large consignments of special nuts the shells of which were specially suitable for the same purpose'.*[165]

Thuillier also observes:

> *'The converse of such forms of investigations is the necessity for examining the enemy's resources, both of chemicals and of other substances, in order to see what he is likely to use against us, and also to discover whether he can command the substances necessary for the protection of his troops against the chemicals we are contemplating using. The necessity for a highly organised chemical intelligence service at the front in order to discover the enemy's gas warfare plans, and the state of his defence against ours, has already been described in Chapter V, but a farther reaching intelligence service is necessary to discover the enemy's industrial capacity, his stocks of the chemical and other raw materials required for chemical warfare, and his ability or otherwise to replace exhausted stocks or obtain those materials which his own country cannot produce'.*[166]

A chemical warfare intelligence service must: (*a*) 'gather, evaluate, sift and collate all information available from every possible source in regard to the intentions of the enemy to use gas, to the nature of the gases he is likely to use, and to the methods and appliances by which he will use it'; and (*b*) collect information regarding the effects of one's own CW agents on the enemy (e.g., in light of the enemy's state of protection).[167]

Thuillier also emphasized the importance of having trained chemists in the intelligence service with a couple of World War I examples. Prior to the April 1915 chlorine attack, the Allies had intercepted German messages that displayed

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[165] Thuillier (note 118), pp. 161–162. During WW I, coconut shells were often used as the source of carbon for respirator filtres. In this war, the US found that the corozo nut (produced by the Corozo—also known as the Manaca—palm tree) was the best substitute for coconut and thousands of tonnes of the nut were shipped into the country (e.g., to a respirator manufacturer on Long Island). Leo P. Brophy, Wyndham D. Miles and Rexmond C. Cochrane, *The Chemical Warfare Service: From Laboratory to [the] Field* (Office of the Chief of Military History (US Army): Washington, DC, 1959), pp. 21–22. Coal, wood and seed-based carbon remain the best general absorbent against toxic vapours. Research efforts are underway to seek alternatives which can capture or detoxify a wider range of TICs, including ammonia. Part of this effort entails the further investigation of fibers and the placing of absorbents within so-called metal-organic frameworks (MOFs) (a molecular scaffolding approach).

[166] Thuillier (note 118), p. 162.

[167] Thuillier (note 118), p. 26.

anxiety over the unfavourable wind direction and that mentioned the name '[Fritz] Haber' the German chemist who subsequently became known as 'the father of chemical warfare' for successfully prompting the German High Command to initiate a CW attack at Ypres in April 1915. One message in particular clearly stated that Haber believed the wind to be unfavourable.[168] The same month (prior to the initial chlorine attack) British forces had captured Hill 60 in the Ypres sector and discovered numerous metal cylinders which, as it later transpired, were meant to hold chlorine. The significance of the cylinders was not appreciated until after the chlorine attack.[169] Finally Private August Jaeger, a captured German soldier informed the Allies at the French 11th Divisional Headquarters that Germany was planning a CW attack in the sector. Shortly after his name was published in the 1930s in an article in France, German authorities arrested and imprisoned him. Jaeger was later confined at the Buchenwald, Malthusen and Dachau concentration camps before being released by the Soviet Army at the close of World War II.[170]

Thuillier characterizes the UK's World War I methodology for CW evaluation as follows:

> *'Between April, 1915, and the end of the war an exhaustive investigation was carried out to discover chemical substances that could be used in gas warfare. Every single compound described in Beilstein's Handbook of Organic Chemistry [Beilstein Handbook of Organic Chemistry], that well-known compilation which contains a description of every chemical compound known to science, was subjected to careful consideration and every one that showed under this preliminary enquiry any chance of being utilisable for gas warfare was subjected to physiological examination and trial in a laboratory. For this immense investigation many of the ablest scientific men in the country gave their assistance and a large number of chemical workers carried out researches in every university laboratory in the United Kingdom. The few substances which from these researches gave promise of being of real war value were then carried on to the stage of field experiment'.*[171]

British military intelligence received a flood of reports in February or early March 1918 that Germany was about to employ an extremely effective CW agent.[172] They originated from POW interviews, captured documents, reports from third countries and 'from other secret services sources'.[173] Several factors led the UK to doubt the veracity of these reports. First, they began suddenly. Second, such a large number of reports had not previously occurred, particularly prior to the German first use of sulphur mustard in July 1917. Third, France, the UK and United States were preparing for largescale deployment of Adamsite and diphenylchloroarsine. The Allies suspected that these two agents in particular would cause great damage to the opposing forces and that Germany, therefore,

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168 Thuillier (note 118), p. 26.

169 Thuillier (note 118), p. 26.

170 Rapsahl [no first name available] was another German deserter who gave the French similar CW attack information. His fate is unknown. Garrett and Hart (note 108), pp. 116–117.

171 Thuillier (note 118), pp. 150–151.

172 Thuillier (note 118), p. 163.

173 Thuillier (note 118), p. 163.

wished to forestall their use. Fourth, the reports had the common theme that no respirator could defend against the CW agent and no information (speculative or otherwise) was available concerning the mystery agent's composition.[174] Fifth, the occurrence of the reports appeared to be 'regular'.[175]

The UK chemical warfare intelligence personnel were not overly concerned that Germany might possess such a highly effective agent. This was partly because of the confidence the British had in their own protective equipment and because the UK had systematically reviewed the chemistry literature.[176] British intelligence analysts then learned that the Council of the International Red Cross Society[177] based in Berne[178] was about to issue an appeal to all belligerants to cease chemical warfare.[179] The analysts also learned that a member of the Council was a German chemist and pacifist who had recently returned from a visit to Germany where he had apparently been asked to join CW-related activity.[180] This chemist was reportedly horrified at the prospect and returned to Switzerland where he spoke of the terrible effects of CW. This prompted British suspicion that the chemist was being manipulated by Germany to try to stop or delay Allied CW attacks. The British speculated that this was prompted by Germany's diminishing resources.[181] The UK nevertheless had to consider the risk of exposing Allied forces to a potentially highly effective agent when a humanitatarian opportunity presented by the Red Cross Council could instead be followed up.[182]

Thuillier continues the story:

> *'In a very short time, the appeal from the International Red Cross Council duly arrived, addressed to the British Government, and to the Governments of all the belligerants, to enter into an agreement to stop the use of gas or chemicals in any form, on the grounds of humanity, and [es]specially in view of the terrible sufferings to the troops and civil populations that would be likely to ensure from the use of the more deadly gases which it was believed that belligerants on both sides were preparing to employ'*.[183]

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[174] Thuillier (note 118), p. 163.

[175] Thuillier (note 118), p. 164.

[176] Thuillier (note 118), p. 164.

[177] The actual title was (and is) the International Committee of the Red Cross. E.g., see 'Appel contre l'emploi des gaz vénéneux', *Bulletin International de la Croix-Rouge*, no. 194 (Apr. 1918), p. 185.

[178] The ICRC headquarters is in Geneva. The appeal to which Thuillier apparently refers, was issued in Geneva on 6 February 1918.

[179] Thuillier (note 118), p. 165. The appeal about which Thuillier speaks appears to be 'Appel contre l'emploi des gaz vénéneux', (note 177), pp. 185–192. I thank the Library and Public Archives Unit of the International Committee of the Red Cross (ICRC) for providing me a copy of this document. A copy resides with the SIPRI Library.

[180] The committee members and appeal signatories were Edourd Naville (President), Adolphe D'Espine (Vice President), Dr F. Ferriere, Afred Gautier, Adolphe Moynier (Treasurer), Horace Micheli, Edmond Boissier, Frédéric Barbey, William E. Rappard and Paul Des Gouttes (Secretary-General). 'Appel contre l'emploi des gaz vénéneux' (note 177), p. 187.

[181] Thuillier (note 118), pp. 165–167.

[182] Thuillier (note 118), pp. 166–168.

[183] Thuillier (note 118), pp. 167–168.

The UK provided a 'sympathetic and diplomatic reply which, however, in effect declined' and the other Allies gave similar responses. The reports of the super CW agent then suddenly ceased.[184] Later, a member of the Council visited the UK and met with the head of the British Chemical Warfare Service.[185] This member assured the head that the German chemistry professor was true to his stated convictions.[186]

CW analysts must also consider the offensive, defensive or deterrent character of a state's military doctrine.[187] Most states planned to use chemical weapons against staging areas, to slow enemy advances and to protect one's flanks.[188] A perennial question is whether CW can play a useful tactical or strategic military role (or is envisaged as such). A tactical role would be to protect the flanks of a military column with sulphur mustard, as was done by Italian forces during its war in Abyssinia,[189] while a strategic role could be the delivery of a persistent CW agent (e.g., VX) behind enemy lines.

Thus James M. Spaight observes that, for some, the major lesson from the Italo-Abysssinia conflict was that a future war could be won by using aircraft loaded with CW.[190] The Soviet Union may have drawn just such a lesson. According to one Russian chemical weapon history, Italian forces employed 15000 chemical air bombs, and up to 400 tonnes of sulphur mustard and lewisite over a three month period in 1936.[191] This source maintains that 30 per cent of Ethiopian casualties from the war were due to CW.[192] In addition, a Soviet officer attached to Ras Kassa's army was quoted by G. Martelli as stating:

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[184] Thuillier (note 118), pp. 168–169.

[185] Thuillier (note 118), p. 169.

[186] Thuillier (note 118), p. 169.

[187] See Barry R. Posen, *The Sources of Military Doctrine: France, Britain and Germany Between the World Wars* (Cornell University Press: Ithaca, New York, 1984).

[188] E.g., Victor Lefebure discusses in World War I practice and future trends. It is also a common theme to analyses of the Italo-Ethiopian War. Victor Lefebure, *The Riddle of the Rhine* (W. Collins Sons & Co. Ltd.: London, 1921), pp. 220 & 221; and Grip, Lina and Hart, John, 'The Use of Chemical Weapons in the 1935–36 Italo-Ethiopian War', *ASA Newsletter*, no. 134 (30 Oct. 2009), pp. 1, 18–21. The Soviet edition of Lefebure's study is Viktor Lefebure, *Zagadka Reina: Khimicheskaya Strategiya v Mirnoe Vremya i vo Vremya Voiny* (Voenny Vestnik: Moscow, 1938). Translated from English 3rd edtn. by E. F. Den'gin under the direction of Academician V. N. Ipatieff with forward by M. P. Pavlovich.

[189] Angelo Del Boca, *The Ethiopian War, 1935–1941* (University of Chicago Press: Chicago, 1969). Translated from Italian by P. D. Cummins; George W. Baer, *Test Case: Italy, Ethiopia, and the League of Nations* (Hoover Institution Press: Stanford, California, 1976); and Anthony Mockler, *Haile Selassie's War* (Oxford University Press: Oxford, 1984). See also Grip and Hart (note 188), pp. 1, 18–21.

[190] G. Martelli, *Italy Against the World* (1936), p. 269, cited by James M. Spaight, *Air Power in the Next War* (Geoffrey Blis: London, 1938) [part of *The Next War* series edited by Liddell-Hart], p. 75.

[191] Eds. O. S. Kochubina and V. S. Lebedevsky, *75 Let Khimicheskhikh Voisk: Istorichesky Ocherk* [75th Anniversary of the Chemical Forces: a Historical Outline] (Directorate of the Radiological, Chemical and Biological Forces Command (Ministry of Defence of the Russian Federation): Moscow, 1993), p. 9. The authors are N. P. Skibinsky, D. M. Dmitriev, N. N. Leveshchev, V. E. Osipenko and S. P. Pavlov. No further source is referenced.

[192] Kochubina and Lebedevsky (note 191), p. 9. Authors: N. P. Skibinsky, D. M. Dmitriev, N. N. Leveshchev, V. E. Osipenko and S. P. Pavlov. On this point, the authors reference *Khimiya i Oborona* [Chemistry and Defence], no. 8 (1939), pp. 22–23. No further bibliographic information is provided.

> *'The moral effect of aviation in this war was enormous. If the land space was unconquered as yet, the aerial belonged to the Italians. From their heights they penetrated our life, turned it upside down. They could intervene in all our movements. They prevented us from eating and warming ourselves after a heavy march round our camp fires, which they were afraid to light. They turned us into moles who dashed into their burrows at the slightest alarm. Insignificant though the losses which they inflicted on us might be, each Ethiopian thought that he was the special target of the bomb released. All the day under the menace of an enemy who followed us step by step, with something near impunity, since he knew he was master'.*[193]

It should also be noted that the author Evelyn Waugh, who was a war correspondent in Ethiopia, as well as a British intelligence agent during World War II, disputed the decisiveness in the conflict of Italy's use of CW. He concluded: 'It is difficult to get reliable figures, but it seems that at no time was gas or yperite very effective as a lethal weapon. Nor was it primarily used as such. Its value to the invading army was to sterilize the bush along the line of advance, so that the mechanized column could push forward rapidly without fear of ambush'. He argued instead that Ethiopian morale was broken primarily by machine gunning from the air.[194]

Both chemical and biological weapons were employed extensively by Japan on mainland China and were incorporated into extensive human experimentation against mainly Chinese nationals.[195] CW stocks were positioned in all major theatres of operation.[196] It is also worth noting that France experimented with munitions containing flechettes that combined the delivery of *Bacillus anthracis*. The flechettes were meant to increase casualty and lethal effects.[197]

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[193] Spaight (note 190).

[194] Evelyn Waugh, *Waugh in Abyssinia* (Penguin Books: London, 2006), p. 85.

[195] See John Hart, 'The Investigation of Members of Japan's World War II Biological Warfare Programme: a Preliminary Enquiry'. Paper presented in Military History Working Group at *International Society of Military Sciences, 2nd International Conference*: 'Turning Research and Knowledge into Use'; 10–11 Nov. 2010; Stockholm.

[196] The United States had a policy, not always fully implemented, of maintaining a 45-day reserve of CW munitions in all theatres of operation. E.g., see Memo by A. B. King from Headquarters, North African Theater of Operations, United States Army, addressed to Adjutant General, War Department, Washington, DC, 'Subject: Theater Plans for Chemical Warfare, North African Theater of Operations', document AG 385/292 C-O, APO 534, 12 Jan. 1944. Memo located in US National Archives. See also Brooks E. Kleber and Dale Birdsell, *The Chemical Warfare Service: Chemicals in Combat*, United States Army in World War II, the Technical Services (Center of Military History: Washington, DC, 1990); and Peace Research Centre, Research School of Pacific Studies, *The Gillis Report: Australian Field Trials with Mustard Gas, 1942–1945*, Peacedoc. no. 1 (Australian National University: 1992, reprint). The university edition is a reprint of a public 1985 Australian Ministry of Defence report.

[197] Germany concluded this based on captured French military laboratory photos that showed anthrax spores mixed with metal shards. J. M. Barnes, William J. Cromartie, Carlo Henze and Jesse W. Hofer, *A Review of German Activities in the Field of Biological Warfare*, report no. B-C-H-H/305 (Washington, DC, 12 Sep. 1945), p. 53 (declassified), ALSOS Mission final BW report, US National Archives. The personal papers of the Chief of Mission (Boris Pash) are located at the Hoover Institution (Stanford University), while those of the Chief Scientific Officer (Samual A. Goudsmit) are located at the Niels Bohr Library & Archive (College Park,

In general, countries that established chemical officer training courses usually chose to have a separate chemical corps in the army. University chemists were sometimes given military rank and sent into the field to observe chemical attacks and to offer assistance on production and storage problems.[198] The units responsible for using chemical weapons were often responsible for smoke and flame operations.[199] While chemical weapon units have often had some responsibility for biological warfare development and protection measures, most of the specialists in the biological area appear to have come out of (or had some affiliation with) military medical academies.[200] Offensive biological weapons work has generally been highly secret and, not infrequently, kept separate from the chemical units (i.e., a military medical *versus* a chemical corps career path).

Simultaneously the major military powers, principally in Europe, increased their inter-World War research efforts to discover suitable chemical warfare agents and methods for their dispersion, including by aircraft.[201] Volunteer organizations were established in order to promote physical fitness and various skills deemed important for national defence. For example, OSOAVIAKhIM was established in 1927 in the Soviet Union to promote chemistry and chemical defence.[202] OSOAVIAKhIM is the Russian acronym for the 'the General Society for Aviation and Chemistry (Obshchoe Soyuznoe Obschestvo Aviatsy i Khimy), a voluntary patriotic military organization that existed in the USSR from 1927-1948 and underwent several name changes.[203] Its

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Maryland). For an overview of the French BW programme, see Olivier Lepick, 'French Activities Related to Biological Warfare, 1919–45', pp. 70–90 in Geissler and Moon (note 161).

198 See, e.g., 'Report no. 1'. Letter by James K. Senior to Captain Frederick Pope, 18 July 1918, US Chemical Warfare Service. In the letter, Senior details working conditions and difficulties associated with achieving higher purity sulphur mustard at a French CW production facility at Pont de Claix in Grenoble. The letter is located in the Boris T. Pash Collection at the Hoover Institution, Stanford University. Senior was later a professor in the Department of Chemistry at the University of Chicago. He still attended department meetings as a Professor Emeritus in the early 1960s [Private communication with the author and a colleague of Senior (1998).]

During World War I, the Netherlands sent observers to Belgium and France to observe CW field trials. In the 1950s the Netherlands also participated in French CW field tests in Algeria at Beni Ounif. See Roozenbeek, H. and van Woensel, J., *De Geest in de Fles: De Omgang van de Nederlandse Defensieorganisatie met Chemesche Strijdsmeddelen 1915–97* [The Genie in the Bottle: the Development of the Dutch Defence Organization of Chemical Warfare Agents in 1915–97] (Boom: Amsterdam, 2010), p. 241.

199 See John Wyndham Mountcastle, *Flame On! US Incendiary Weapons, 1918–1945* (White Mane: Shippensburg, Pa., 1999).

200 This observation is personal and necessarily rather subjective.

201 Heinz Liepmann (note 161).

202 See Anonymous, *Kratkoe Rukovodstvo po Protivovozhdushnoi Oborone Tyla* [Short Handbook on Rear Area Anti-Aircraft Defence], second edtn. (OSOAVIAKhim L. O.: [no location], 1930). The book consists of collected OSOAVIAKhim lectures of 1928. Those who 'participated' (i.e., they may or may not be authors or lecturers) in the publication of the book were I. Ya. Sudakov, G. B. Kartashev, N. Salmin, V. Zhadrinsky, A. Subbotin, A. Ezergailo, A. Ol'shevsky, V. Gertso-Vinogradsky, V. Shperk, G. Globychev and I. Zeberg-Zabelin.

203 Operation Osoaviakhim was also the code name for a 1946 Soviet deportation of approximately 2300 German scientists and technicians, and their families. This operation may have represented 84 per cent of the German technical experts taken to the Soviet Union in the post-World War II period. Maddrell (note 129), p. 30. The UK and United States accepted German technicians and scientists in the post-World War II period as well. The most famous such programme was Operation Paperclip. See Linda Hunt, *Secret Agenda: the United States*

purpose was to assist with the development of the aviation industry, promote chemistry in Soviet society and to better prepare the country against possible air or chemical attack. The organization promoted its work under the slogan 'chemicalization' and justified its role in terms of (*a*) the drive towards collectivization of Soviet agriculture, (*b*) acquiring and developing the means for domestic production of the most modern technology and equipment and (*c*) strengthening the military capabilities of the country.[204] In the 1930s factories typically had an 'OSOAViaKhim Corner' and in 1936 some one million workers in Leningrad were trained in anti-aircraft and anti-gas defence.[205]

Another analytically relevant consideration is whether CW capabilities, declared stockpiles or ambiguous holdings are meant to play a military role or merely serve a (perhaps implicit) political function. In terms of elucidating CW motivations, it is important to consider whether military doctrine derives principally from processes internal to the state, or if the doctrine is primarily shaped by international developments and processes.[206] With respect to the assessment of capability, it is important to consider the degree to which CW has been integrated into military doctrine, including the extent to which such weapons are included in logistics planning, the manner in which they are reflected in military manuals, and the extent to which military personnel are proficient in the use of CW, protective equipment and decontamination procedures.[207]

These points are mainly relevant for the assessment of state activities. With respect to non-state actors, the corresponding questions focus more on intent and capability.[208] Distinctions exist between the objectives normally

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Government, Nazi Scientists and Operation Paperclip, 1945 to 1990 (St. Martin's Press: New York City, 1991).

[204] Yakov M. Fishman, *Khimizatsiya i vozdushno-khimicheskaya oborona SSSR (doklad na II vsesoyuznom sezde OSOAVIAKhIMA) [Chemicalization and chemical air defense of the USSR (report on the second all-union meeting of OSOAVIAKhIM]*, ("OSOAVIAKhIM" Publishers: Moscow, 1930); and S. Enyukov, *Khimicheskii Otryad OSOAVIAKhima: Uchebnoe Posobie* [The Chemical Detachment of OSOAVIAKhim: Study Guide], Second Edtn with corrections and additions (Central Committee of the OSOAVIAKhim Union of the USSR: Moscow, 1938); and Anonymous, *Kratkoe Rukovodstvo* (note 202).

[205] Timm (note 148), p. 106. For a photo of such a 'corner', see picture opposite p. 100. Translated from unknown language by C. F. Palmstierna with technical assistance provided by Curt Sixten Reinhold Kempff of the Swedish General Staff Foreign Department where he had responsibility for evaluating Soviet military capabilities. Timm was a journalist who fought in WW I and worked in Russia until 1934, including for four years in the Russian (perhaps Soviet) civil service. He was apparently from one of the Baltic countries. At the time the book was issued, the author was probably living outside the Soviet Union. During World War II Kempff had frequent contact with the Finnish Commander-in-Chief Baron Carl Gustaf Emil Mannerheim and the Finnish-Swedish politician Karl August Fagerholm, in large part to consult on strategies to limit Soviet influence and the geopolitical fallout of German military defeat.

[206] For a consideration of political pressure to promote, retain or terminate two US conventional weapon systems, see Jones and Marsh (note 40), pp. 359–373.

[207] Robinson (note 41), pp. 112–123.

[208] The statement that 'threat = (capability) x (intent)' is common in the current consideration of non-state actor threats. Partly because intent is the more difficult to assess, some argue that threat assessments should reflect a worst-case approach. This means that the intent should be presumed to be positive towards the use CW and that the sub-elements that underpin capability should be maximised. For an example of quantitative bioterrorism threat modeling, see Eds. Harvey Thomas Banks and Carlos Castillo-Chavez, *Bioterrorism: Mathematical Modeling*

pursued by states *versus* objectives pursued by individuals and groups. Assessing intent and capability requires a deeper understanding of divergent ideologies (including those derived from ethics, social norms and religion) which will tend to produce greater ambiguity than that resulting from officially sanctioned state ideology or national security requirements.[209] For example, states may be interested in artillery and rocket firing and bomb dropping tables for the various calibre munitions (so as to avoid having to conduct their own field trials which, in turn, are potentially discoverable through the intelligence gathering efforts of other states). Non-state actors, by contrast, would almost certainly find such data to be irrelevant or of 'academic interest' only.

For those working in state military programmes in the 20th century, the identification of chemical agents outside the laboratory for possible use as weapons was a longstanding analytical objective.[210] It has never been as fully addressed in the academic literature as compared to nuclear weapon development programmes.[211] This probably also reflects a desire by states to limit the spread of proliferation sensitive information. In addition, military planners dislike having to factor into their scenarios the logistical requirements for protecting troops against such weapons and possibly supplying them with CW—both for the planned first use and for retaliatory-only purposes, as well as the potentially burdensome medical care consequences.[212] Planners and commanders have also tended to view with dissatisfaction the wide variability in possible killing or casualty-causing effects of such weapons.[213] They have instead preferred weapons whose effects can be predicted reliably and may decide not to expend

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Applications in Homeland Security (Society for Industrial and Applied Mathematics: Philadelphia, 2003).

[209] Frances V. Harbour, 'Islamic Principles and the Chemical Weapons Convention of 1993', *Journal of Religious Ethics*, vol. 23, no. 1 (spring 1995), pp. 69–92; and Anne Stenersen, *Al-Qaida's Quest for Weapons of Mass Destruction: the History Behind the Hype* (VDM Verlag Dr Müller Aktiengesellschaft & Co. KG: Saarbrücken, Germany, 2008), pp. 29–90.

[210] E.g., Jeffrey K. Smart, 'History of Chemical and Biological Detectors, Alarms and Warning Systems', *CBIAC Newsletter* [Chemical and Biological Defense Information Analysis Center], vol. 7, no. 1 (2006), p. 5. Smart is the US Army Research, Development and Engineering Command Historian. The *CBRNIAC Newsletter* [Chemical, Biological, Radiological & Nuclear Defense Information Analysis Center] was previously called the *CBIAC Newsletter*.

[211] On nuclear forensics, see Kenton J. Moody, Ian D. Hutcheon and Patrick M. Grant, *Nuclear Forensic Analysis* (CRC Press: Boca Raton, Florida, 2005).

[212] SIPRI (note 98), pp. 294–295.

[213] Various militaries produced firing tables that, for e.g., provide guidance on how many shells of a given type and fill should be fired under various weather conditions to generate optimal numbers of casualties and deaths. Simulants have also been used to better understand building and public transportation contamination patterns. Taking such literature into account, a World Health Organization (WHO) working group produced estimates on inter alia numbers of people at risk from CBW attack in urban environments, including water supplies. The consideration of such data have periodically led into discussions on problems of delivery to target, how clean is 'clean' in decontamination scenarios, the relative lethality of CBW as opposed to conventional munitions (e.g., fuel air explosives), and the extent to which psychological fear of CBW is grounded in fact. See table 8 (Numbers of persons at risk from an attack with chemical or biological weapons on the most densely populated areas of typical urban targets) and table 12 (Possible effects of limited sabotage of city communal water supply), World Heath Organization, *Heath Aspects of Chemical and Biological Weapons: Report of a WHO Working Group of Consultants* (WHO: Geneva, 1970), pp. 96, 118.

resources on protective measures required if chemical weapon use is undertaken.[214] Determining the effects of such weapons is further complicated by the fact that the enemy might only wish to cause his opponent to 'suit up' and thus degrade operational effectiveness.[215] Military planners have also devoted attention to the creation and validation of firing tables.[216] States have also analysed possible threats posed by non-state actors especially since the end of World War II.[217] Finally, it is noteworthy that chemical and biological weapons have been linked to and disassociated from each other to varying degrees (including in the arms control context since the Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare (1925 Geneva Protocol) was concluded).[218] However, the growing interface between chemistry and the life sciences means that the two types of weapons are inextricably linked in terms of the evaluation

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[214] Mauroni observes that currently 'combating WMD' is not part of mandatory coursework at defence colleges in the US and that 'many' US defence acquisition programmes 'routinely waive CBRN survivabilty requirements'. Mauroni (note 62), ref. 32, p. 73.

[215] E.g., J. Daigneault, R. Welander and P. White, *USPACOM Study Program: Chemical Warfare Analysis* (Science Applications International Corporation: McLean, Virginia, 25 Mar. 1988), 'Table 6. Contamination profile of a missile filled with thickened soman', p. 49. Report is partially declassified and available from US Defense Technical Information Center (DTIC), <http://www.dtic.mil/>, (accessed 16 June 2013). On CW lethality effects, see *Military Chemistry and Chemical Agents* (note 157).

[216] These tables indicate how many munitions of a given type and fill should be employed to achieve a desired effect. They are based on extensive field testing during which CW concentrations are measured using characteristic grid patterns and sample towers to allow for testing at multiple heights. Test animals may also be placed on the range. Such 'signatures' are susceptible to overhead imagery analysis. Simplified firing tables along with an overview of associated factors (e.g., weather) are provided in *Employment of Chemical and Biological Agents*, US Army Field Manual FM 3-10 (unclassified) (Department of Defense: Washington, DC, Mar. 1966).

[217] A 1963 US National Intelligence Estimate (NIE) stated 'The USSR has an extensive chemical warfare program which could produce a variety of chemical agents suitable for clandestine introduction into the US. However, large quantities would be required to obtain effective concentrations on most types of targets, and delivery with precise timing would be subject to unpredictable conditions of wind and weather. Nevertheless, chemical agents could be used effectively on a small scale against personnel in key installations. A supply of nerve gases ample for this purpose could be clandestinely produced in the US without great difficulty or great risk of detection. Psychogenic agents could not readily be produced in the US and would probably have to be introduced clandestinely. We believe, however, that the possible advantages of psychogenic agenst over nerve agents would not be sufficient in the Soviet view to warrant the risk of clandestine introduction'. *The Clandestine Introduction of Weapons of Mass Destruction into the US*, NIE report no. 11-7-63, declassified (Central Intelligence Agency: 13 Mar. 1963), p. 3. An early 1950s estimate stated 'The only method of clandestine attack with chemical warfare agents likely to be employed by the USSR is the smuggling of limited quantities of nerve gas into the US for dissemination against personnel in key installations. The possiblity of small-scale nerve gas attacks cannot be overlooked'. CIA, *Soviet Capabilities for Clandestine Attack Against the US with Weapons of Mass Destruction and the Vulnerability of the US to Such Attack (Mid-1951 to Mid-1952)* (1952?), para. 4.

[218] In the late 1968, states agreed to negotiate a separate agreement against biological warfare within the framework of the present-day Conference on Disarmament (CD), while the 1925 Geneva Protocol would continue to inform further consideration of strengthening the international prohibitions against chemical and biological warfare. On the split, see SIPRI, *The Problem of Chemical and Biological Warfare: CB Disarmament Negotiations, 1920-1970*, vol. IV (Almqvist & Wiksell: Stockholm, 1971), pp. 253–260.

of their development, production and use (i.e., compounds that affect the physiology of animals, humans and plants). The OPCW Scientific Advisory Board (SAB) therefore established a temporary working group devoted to the convergence of biology and chemistry.[219]

2.3. International Cooperation on Chemical Weapons

Perhaps the most notable inter-World War CW cooperation was that carried out between Germany and the Soviet Union. The 1922 Treaty of Rapallo permitted Germany to circumvent restrictions placed on its military by the 1919 Treaty of Versailles which *inter alia* required that Germany not develop or stockpile CW. From the 1920s until the early 1930s Germany and the Soviet Union cooperated on the development and testing of chemical warfare agents. The establishment of the Shikhany Central Military Chemical Proving Ground was the most lasting result of the German-Soviet cooperation in the field of CW.[220]

The Germans contributed approximately 1 million Reichsmarks worth of equipment for the Tomka facility and the facility eventually included: a decontamination chamber, four laboratories, two vivariums and five barracks where the Germans lived.[221] The Germans were also not allowed to carry out CW work without Soviet participation. The work conducted at Tomka was concealed through a German-Soviet trade agreement between, on the Soviet side, the Joint Stock Company on the Fight against Vermin and the Use of Synthetic Fertilizers (code-named 'M') and, on the German side, the Joint Stock Company on the Use of Raw Materials (code-named 'V'). The Soviets became increasingly dissatisfied with the German contribution to the joint CW projects because they felt that the Germans were not sufficiently open or forthcoming with information and assistance. Hitler ended joint military cooperation with the Soviet Union following his rise to power in 1933. Tomka was dismantled between 26 July and 15 August 1933.[222]

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[219] 'Opening Statement by the Director-General to the Conference of the States Parties at its Seventeenth Session', OPCW document C-17/DG.16*, 26 Nov. 2012, p. 12. For a listing of SAB reports, see OPCW, 'Reports', <http://www.opcw.org/documents-reports/subsidiary-bodies/scientific-advisory-board/reports/>, (accessed 28 May 2013).

[220] Tomka, sometimes spelled 'Tomko', was the name of the village that once existed at the site where a field test facility was established in 1926 adjacent to the Shikhany military chemical establishment during secret German-Soviet CW cooperation within the framework of the 1922 Treaty of Rapallo. Points on the Shikhany proving ground are generally named for the villages that once stood there.

[221] The decision on where to build the facility was based partly on the fact that the region was populated by Volga Germans who had settled in the region in the 18th century. Soviet authorities believed that the presence of the German-speaking visitors would therefore attract less attention. However, the German visitors were generally confined to their base and were forbidden from traveling without special permission. The Germans were not allowed to take photographs or to have private conversations with the Soviet security details. John Hart, 'Historical Note: the Shikhany Central Scientific-Research [and] Experimental Institute of Radiological, Chemical and Biological Defense', *ASA Newsletter*, no. 104 (29 Oct. 2004), pp. 16–19. See also F. L. Carsten, 'Reports by Two German Officers on the Red Army', *Slavonic and East European Review*, vol. 41, no. 96 (1962), pp. 217–244.

[222] Alimov (note 128), p. 17. See also Edward H. Carr, *German-Soviet Relations Between the Two World Wars: 1919–1939* (Johns Hopkins Press: Baltimore, Maryland, 1951); and Eds. V. N. Orlov, (*et al*), *My Zashchitily Rossiyu: Istoricheskii Ocherk o Sozdanii i Deyatel'nosti*

Another German-Soviet joint venture of the same period, code-named 'Bersol', was a project for the manufacture of chemical warfare agents and weapons. The venture was also called 'The Russo–German Factory Bersol'. The Bersol Company was set up through a May 1923 agreement, calling for German assistance for the design and construction of a factory to produce various CW agents, including phosgene and sulphur mustard. The factory was to be constructed in Ivashchenkovo (Samara oblast') on the site of a WW I-era chlorine plant. The Bersol venture failed and was cancelled by a Soviet Politburo resolution on 13 February 1927. One source reports that chlorine trifluoride (ClF_3) was to have been among the chemicals to be produced by the venture. However, the claim is uncertain as its synthesis was not reported until 1930, three years after the Bersol project was cancelled. It is therefore unlikely that chlorine trifluoride would have been part of plans for Bersol if those plans were completed well before the chemical had been synthesized.[223] Some military planners suspected that the chemical could be used to ignite peoples' hair (the chemical is not, however, suitable for this purpose).

In the 1920s-1930s the German chemist and entrepreneur Hugo Stoltzenberg also sold 'off-the-shelf' sulphur mustard plants (or otherwise facilitated their construction) to a number of countries, including Brazil, Italy, the Soviet Union (at Samara), Spain and Yugoslavia.[224]

2.4. Evolution of Chemical Weapons Threat Assessments

In the inter-World War period states viewed patriotic organizations as a form of military preparedness standby capacity and attempted to infer military intentions and capabilities in view of the existence and activities of such organizations.[225]

States have often reviewed the publications by researchers and academics affiliated with chemical weapon-related work in order to obtain insight into the CW programmes of other states. The CW work by the United States was looked at and perhaps even emulated in some respects by the Soviet Union. For example, a Soviet historical account states that the 1921 study *Chemical Warfare*

Nauchno-Tekhnicheskogo Komiteta, Upravleniya Zakazov, Proizvodstva i Snabzheniya i Upravleniya Biologicheskogo Zashchity UNV RKhB Zashchity MO RF [We Defended Russia: Historical Outline on the Establishment and Activities of the Scientific-Technical Committee, the Directorate of Orders, Production and Supply and the Directorate of Biological Defence of the Directorate of Radiological, Chemical and Biological Defence Forces Command of the Russian Federation Ministry of Defence] (Ministry of Defence of the Russian Federation: Moscow, 2000).

[223] This paragraph was published in Hart (note 221), pp. 16–19. This text was provided by Dr Benjamin C. Garrett and was published with minor changes.

[224] Garrett and Hart (note 108), 'Stoltzenberg, Hugo (1883–1974)', pp. 200–201. Chan discusses the chemical warfare capabilities of some Chinese warlords during the inter-World War period, including the role of technical assistance provided by international partners. See Anthony Bernard Chan, *Chinese Warlords and the Western Armaments Trade, 1920-1928*, pp. 262–265. Doctoral dissertation, York University, 1979. See also Benjamin Garrett, 'The CW Almanac: August 1998, the Chinese Warlords' Chemical Arms Race', *ASA Newsletter*, no. 67 (14 Aug. 1998), pp. 16–17. British archival documents describing Spain's CW production and use against Morocco in the 1920s are provided in Sebastian Balfour, *Deadly Embrace: Morocco and the Road to the Spanish Civil War* (Oxford University Press: Oxford, 2002). The study is partly based on declassified UK intelligence reports located at the UK's Public Record Office.

[225] Timm (note 148).

by Amos Fries and Clarence J. West was the impetus for the Soviets to produce Lewisite because the CWS officers spoke so highly of it.[226]

In the 1980s binary chemical weapons were often characterized as being more advanced—although their effectiveness was not especially notable due to problems of delivery and ballistics (e.g., of liquid-filled warheads). By contrast, incomplete mixing was in some cases sufficiently addressed, but was in any event, a secondary challenge.[227] The US decision to resume chemical weapons (binary) production in the early 1980s, according to some, prompted the Soviets to do likewise.[228]

Today, perhaps the most problematic target of analysis are non-state actors, including their capabilities and intentions regarding the possible use of toxic chemicals and their precursors to cause death or other harm. A wide range of non-traditional chemical and bio-chemical agents could theoretically prove attractive to non-state actors, partly due to the ease with which they might be obtained and possibly so as to maintain ambiguity as to who is responsible for an attack. An attack may not necessarily be recognizable against the background of disease burden, chronic exposure to toxic chemicals and industrial accidents. Forensics techniques are therefore being developed to meet this analytical problem.[229] Such techniques include exploring the technical possibilities for determining the manner and route by which a chemical agent was manufactured.[230] Evaluating the intentions of disparate, decentralized groups and individuals poses further analytical difficulties since this increasingly depends on a proper understanding of the derivation and use of relevant information. For example, efforts to assess CW threats posed by non-state actors is heavily dependent on analysis of Internet traffic, including attempts to uncover social networks. This can entail attempts to identify key actors who are often lower level people who are only prominent in social networks because of their 'connectiveness'. Analysts have also attempted to discover the 'structural signatures' that indicate the degree of 'connectiveness' of group participants.[231]

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[226] Fries and West (note 117); and Ipatieff (note 158), p. 387.

[227] Personal communication, Sep. 2013.

[228] Whether the Soviets produced binaries (as commonly understood during the 1980s rather than the binary artillery designs of WW I) was one of the points of contention between the Soviet Union and the United States in the implementation of a 1989 Memorandum of Understanding on chemical weapons that included a data exchange on the countries' respective CW stockpiles. The US assessed that the Soviet phase I declaration deficiencies included: (*a*) a declared CW stockpile of 39 927 tonnes (rather than the US intelligence estimate of 50–70 000 tonnes, and (*b*) a failure to declare 'many of their known CW development, production and storage facilities, including some of which the former Soviet Union declared under Phase I and the US subsequently visited'. [Accuracy of Russia's Reporting on Chemical Weapons], declassified Aug. 2005, pp. 7–8, <http:www.foia.cia.gov>, (accessed 23 July 2013).

[229] Eds. Bruce Budowle, Steven E. Schutzer, Roger G. Breeze, Paul S. Keim and Stephen A. Morse, *Microbial Forensics*, second edtn. (Elsevier Academic Press: Burlington, Mass., 2011).

[230] E.g., Carlos G. Fraga, et al., 'Impurity Profiling to Match a Nerve Agent to its Precursor Source for Chemical Forensics Applications', *Analytical Chemistry*, vol. 83 (31 Oct. 2011), pp. 9564–9572; and D. Noort, et al., 'Chemical Profiling of Chemical Warfare Agents for Forensics Purposes'. Paper presented by TNO Prins Maurits Laboratory at *10th International Symposium on Protection against Chemical and Biological Warfare Agents*; Swedish Defence Research Agency (Totalförsvarets forskningsinstitutet, FOI); 8–11 June 2010; Stockholm, Sweden.

[231] Anonymous, 'Untangling the Social Web', *Technology Quarterly*, 4 Sep. 2010, p. 13 in *The Economist*, vol. 396, no. 8698 (4–10 Sep. 2010).

2.5. Chemical Industry

The chemical industry has been both supportive and non-supportive of chemical weapon programmes in history. It not infrequently provided raw material to military chemical weapon production facilities.[232] The chemicals producers were sometimes operated by the government (e.g., the US Army Phosphate Development Works located on the property of the Tennessee Valley Authority near Muscle Shoals, Alabama).[233] The Soviet Union was perhaps unique in placing chemical production facilities within sometimes very large chemical industry facilities such as at Novocheboksarsk, the site of the largest concentration of post-World War II Soviet chemical weapon production facilities, as well as Berezniki, Derzhinsk and Volgograd.[234]

Between the two World Wars, most leading military powers gave some consideration of their chemical industry in terms of how it could support their war fighting capacity (e.g., as a standby mobilization capacity).[235] In addition, chemical industry and chemical infrastructure were adapted to support chemical warfare starting in World War I.[236] The incorporation of chemical industry and civilian scientists into a chemical warfare programme is of continuing relevance to the assessment of possible CW activities and the verification of the CWC. University chemists and laboratories were employed, for example, at the United States at American University and the Catholic University, in order to develop or adapt chemicals for warfare and to develop means to protect against them.[237] Much of the original expertise in respirators originated in the mining sector.[238] Rubber product manufacturers, such as the Pirelli company, produced chemical protection equipment (including respirators).[239]

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[232] For a review of the chemical industry in support of WW I chemical warfare activity, see Haber (note 106), pp. 150–166.

[233] T. L. Ferguson, A. R. Hylton and C. E. Mumma, *Studies on the Technical Arms Control Aspects of Chemical and Biological Warfare,* 4 vols., contract no. ACDA/ST-197, unclassified (Midwest Research Institute: 13 Nov. 1972) vol. I, pp. 6–8; and vol. IV, pp. 4–58. Report prepared for Arms Control and Disarmament Agency.

[234] Russia declared 24 CWPFs to the OPCW following the entry-into-force of the CWC.

[235] S. M. Vishnev, *Kapitalisticheskaya Tekhnika i Podgotovka k Voine* [Capitalist Technology and the Preparation for War] (State Socialist-Economic Publisher: Moscow, 1936), pp. 147–157.

[236] E.g., see Haber (note 106), pp. 139–175. For a Soviet survey of the chemical industry, see Porokhin, N., 'Sostoyanie Mirovoi Khimicheskoi Promyshlennosti [The Status of the international chemical industry], *Voina i Tekhika* [War and Technology], no. 8 (Aug. 1927), pp. 69–84.

[237] E.g., see Martin K. Gordon, Barry R. Sude and Ruth Ann Overbeck, 'Chemical testing in the Great War: the American University Experiment Station', *Washington History*, vol. 6, no. 1 (spring/summer 1994), pp. 28–45. Magazine of the Historical Society of Washington, DC.

[238] See Van H. Manning, 'War gas investigations', *War Work of the Bureau of Mines*, Bulletin 178 (Government Printing Office: Washington, DC, 1919). In addition, the British phsyiologist J. B. S. Haldane advised the UK on chemical weapons development and protection. See John B. S. Haldane, *Callinicus: A Defence of Chemical Warfare* (Kegan Paul, Trench, Trubner & Co.: London, 1925).

[239] For the company's inter-war product line, see *Protezione Contro Gas, Liquidi, Polveri, Sostanze Tossiche* [Protection against Gas, Liquids, Powders [and] Toxic Substances] (Società Italiana Pirelli: Milan, 1932).

In a 1927 article aimed at the Soviet military establishment N. Porokhin identified four factors necessary for the Soviet chemical industry to support national defence requirements: (*a*) the presence of raw materials in the Soviet Union, (*b*) the need to develop scientific-research work, (*c*) the facilitation of such work through the establishment of a strong economic basis and (*d*) the necessity to consider the national security relevance of various chemical industry sectors.[240]

According to Pirokhin, the Soviet Union possessed virtually all of the raw materials necessary for chemical industry (especially pyrites and coal). He recommended that geological surveys be expanded with state support and that chemical industry factories working with primary raw materials be located in the regions where such materials were to be found in order to reduce transportation costs or (in the case of sulphuric acid)[241] establishing the factories closer to their consumer. Transportation costs could thus be rationalized and, for example, pyrite imports minimized.

In order to develop the Soviet scientific research work, Pirokhin recommended the expansion of academic programmes (through Institutions of Higher Learning (Vysshie Uchebnoe Zavedenie, VUZ) and Technical Colleges (Vysshee Tekhnicheskoe Uchebnoe Zavedenie, VTUZ)), the establishment of production scientific-research laboratories attached to large chemical factories (or, at least, attached to chemical associations or trusts that supervise the factories), and the raising of import duties to encourage domestic production and to make the factories competitive internationally.

As to key defence-related sectors, Pirokhin stated that the Soviet Union must develop its synthetic nitrogen production capacity (i.e., through nitrogen fixation) and be capable of synthesizing various nitrate compounds (organophosphorus, nitrogen-based fertilizers and potash). He also emphasized the necessity of establishing more aniline dye factories. The Soviet Union could thus free itself of the need to import intermediate chemicals and aniline dyes in future.[242]

Chemical industry has often been reluctant to become involved with chemical weapon programmes. The profits were generally lower than those derived from civilian commercial purposes and involvement with the military on chemical weapon-related programmes could, it was not infrequently feared, adversely affect commercial operations. For example, the companies involved in providing the US Government chemicals to produce riot control agents (RCAs) during the Vietnam War often received negative publicity and various forms of public scrutiny (e.g., Congressional hearings). Producers of chemicals suitable for use as defoliants (perhaps most notably Agent Orange of which approximately 75 million liters were used) became the target of a number of class

[240] Porokhin (note 236), p. 83.

[241] Sulphuric acid and nitric acid are perhaps the most important chemicals for basic chemical industry.

[242] Porokhin (note 236), pp. 83–84.

action lawsuits.[243] In the 1980s US Congress drafted legislation to compel companies to provide starter materials to the US Army for binary production.[244]

Chemical industry facilities and specialists have nevertheless periodically contributed to the chemical weapon expertise and capacities of, for example, France, Germany and the UK since World War I.

[243] See William A. Buckingham, Jr., *Operation Ranch Hand: the Air Force and Herbicides in Southeast Asia, 1961–1971* (Office of Air Force History: Washington, DC, 1982), unclassified.

[244] Julian P. Perry Robinson, 'Disarmament and Other Options for Western Policy-Making on Chemical Warfare', *International Affairs*, vol. 63, no. 1 (Winter 1986–1987), pp. 65–80.

3

ARMS CONTROL, DISARMAMENT AND NON-PROLIFERATION: CONTEMPORARY VERIFICATION CONTEXT

Elements of arms control and disarmament activity and principles can be found in various post-conflict settlements imposed by the victors. Verification elements of greater contemporary relevance to arms control were incorporated into the 1919 Treaty of Versailles which required Germany to demilitarize the Rhineland and were to be verified by the Inter-War Allied Commission.[245] States also negotiated limitations on chemical and biological warfare in the inter-war period, including within the framework of the League of Nations.[246] States negotiated the Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or other Gases and of Bacteriological Methods of Warfare (Geneva Protocol of 1925) and discussed its implementation with League of Nations Secretariat support.[247]

In addition, consideration of whether and how to use RCAs in the arms control context dates at least to the implementation of the 1925 Geneva Protocol. For example, in 1932 the General Disarmament Conference of the League of Nations attempted to divide known CW agents into two categories in order to agree the conditions under which lachrimatory (referred to as 'tear gases' in the 1930s) and sternutators (referred to as 'sneezing gases' in the 1930s) could be permitted (as opposed to CW agents meant to cause death or serious, longer lasting harm).[248]

The League of Nations discussed a range of proposals to limit or prohibit weapons. With respect to disarmament they fell under three main categories: (*a*) disarmament of Germany, (*b*) international force reductions and budget cuts, and (*c*) international naval arms limitations. League of Nations disarmament activity may also be classified according to three phases: (a) League disarmament I: the limited approach, (b) League disarmament II: disarmament for security and (c) League disarmament III: general disarmament.[249]

Under the limited disarmament approach (activity I), states concluded several agreements, including a Convention for the Control of the Trade in Arms

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[245] Richard J. Shuster, *German Disarmament after World War I: the Diplomacy of International Arms Inspection 1920-1931* (Routledge: New York City, 2006), p. 66. See also 'Special Issue, Enforcing Arms Limits: Germany Post 1919; Iraq Post 1991', *Journal of Strategic Studies*, vol. 29, no. 2 (Apr. 2006).

[246] On League of Nations efforts to constrain chemical warfare, see De Madariaga (note 120), pp. 158–164.

[247] De Madariaga (note 120), pp. 158–164.

[248] Thuillier (note 118), pp. 144–145.

[249] Andrew Webster, 'From Versailles to Germany: the Many Forms of Interwar Disarmament', *Journal of Strategic Studies*, vol. 29, no. 2 (Apr. 2006), pp. 225–246.

and Ammunition (1919) which called for the adoption of a system of published licenses for arms transfers. However, this Convention never entered-into-force.[250] In the early 1920s the League of Nations also passed several resolutions on the desirability of restricting the activity of private arms manufacturers and suppliers. Approaches to limit state military expenditure were also considered. The 1925 Geneva Protocol was notable. Japan and the United States, however, did not join the Protocol until 1970 and 1975, respectively.[251] Andrew Webster observes that this phase of League of Nations activity set the important precedent in arms control agreements that such agreements should be open to universal participation and enjoy universal adherence.[252]

Under disarmament for security (activity II), the League of Nations undertook activities to achieve 'extensive reductions' in military forces to help establish a new framework of international security.[253] These negotiations proceeded along two tracks: one for disarmament and one for mutual security guarantees. Proposals on security guarantees were reflected in draft versions of the Treaty of Mutual Assistance which were considered by the League of Nations Assembly in September 1923.[254] Because Germany, the Soviet Union and the United States were not League of Nations members, the Coordination Commission was renamed in December 1925 the Preparatory Commission for the Disarmament Conference in order to permit their participation in these negotiations.[255]

Under general disarmament (activity III), the Preparatory Commission engaged in wide ranging technical and philosophical debates on the nature of general disarmament.[256] Starting in 1927 the Soviet delegation (cynically or idealistically) proposed the abolition of air, ground and naval forces.[257] This phase of negotiations ground to a halt when the World Disarmament Conference of 1932-1934 failed to agree anything. Further proposals through 1938 similarly failed.[258]

During the Washington Naval Conference (held from 12 November 1921-6 February 1922), a technical sub-committee considered the matter of 'poison gas'. The sub-committee could not agree any method by which states could verify that toxic substances were not being developed or stockpiled for chemical warfare purposes. This sub-committee was generally of the view that any verification of specific CW agents would necessitate a politically unacceptable

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[250] The Arms Trade Treaty (ATT) was opened for signature in 2013.

[251] The Soviet Union acceded to the Protocol on 15 April 1928 with the reservations that it would not consider itself bound by the protocol with respect to states that had not acceded to the protocol or if it was engaged in conflict with any enemy state whose armed forces or whose allies *de jure* or in fact do not responect the protocol's prohibitions. The Russian Federation has since withdrawn these reservations. SIPRI, *The Problem of Chemical and Biological Warfare: CBW and the Law of War*, vol. 3, (Almqvist & Wiksell: Stockholm, 1973), pp. 157 & 164–165.

[252] Webster (note 249), p. 234.

[253] Webster (note 249), p. 238.

[254] Webster (note 249), p. 239.

[255] Webster (note 249), p. 240.

[256] Webster (note 249), p. 241.

[257] League of Nations, 'Draft Disarmament Convention submitted by the Delegation of the Union of Soviet Socialist Soviet Republics' (20 Feb. 1928), C.46.M.23.1928.IX. Quoted in Webster (note 249), pp. 241–242, ref. 36.

[258] Webster (note 249), pp. 242–244.

degree of intrusiveness and restriction over civilian chemical industries.[259] The UK was concerned that it was too simple to violate a ban against chemical warfare and that verification measures could expose state vulnerability to such weapons.[260] By contrast, US General John J. Pershing, who led a 1913 incursion against Francisco 'Pancho' Villa in Mexico and commanded the US expeditionary force in Europe during World War I, supported the complete and unequivocal renouncement of chemical warfare.[261] Following the Washington Conference, an eight member technical sub-committee under the League of Nations auspices (perhaps the same one) further evaluated the manufacture and use of CBW agents and, in 1924, expressed skepticism over the ability of states to verify non-production and warned against the dangers of such agents to civilians as well as to military personnel.[262]

Martin S. Alexander and John F. V. Keiger observe that '…long-term enforcement of disarmament requires either a permanent change in mindset, moral disarmament (which is rare), or complete defeat and overthrow of the enemy regime followed by long-term and nationwide occupation with a large military force—the "models" imposed on Germany and Japan in 1945'.[263] Nevertheless the Washington Conference approved a resolution that was incorporated into Article V of the Washington Treaty that condemned 'the use in war of asphyxiating, poisonous or other gases, and all analogous liquids, materials or devices'.[264] The parties to the Treaty, which formed a partial basis for the later 1925 Geneva Protocol, undertook to uphold the international ban on chemical warfare. However, verification of non-production of CW agents was left unresolved.

3.1. Arms Control During the Cold War

Former CIA Director Allen Dulles observed in the early 1960s that the United States considered onsite inspection 'essential to a controlled [nuclear] disarmament'[265] and that in the absence of international acceptance of this principle, it was the responsibility of state intelligence services to fulfil the task

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[259] Edward M. Spiers, 'Gas Disarmament in the 1920s: Hopes Confounded', *Journal of Strategic Studies*, vol.29, no. 2 (Apr. 2006), pp. 287–288.

[260] Key, The National Archives, Foreign Office records 371/7245, A. J. Balfour to D. Lloyd George, 22 Dec. 1921; and War Office records 188/144, British Empire Delegation, 'Report of Committee with Respect to Poison Gas', 22 Dec. 1921. Quoted in Spiers (note 259), p. 288, ref. 25.

[261] Spiers (note 259), p. 288.

[262] Spiers (note 259), p. 291.

[263] Martin S. Alexander and John F. V. Keiger, 'Limiting Arms, Enforcing Limits: International Inspections and the Challenges of Compellence in Germany post-1919, Iraq post-1991', *Journal of Strategic Studies*, vol. 29, no. 2 (Apr. 2006), p. 387.

[264] *The Problem of Chemical and Biological Warfare: CBW and the Law of War*, vol. 3 (note 251), 'Chapter 1. General survey of the CBW prohibitions and of pertinent evidence', pp. 21–22.

[265] E.g., through President Dwight D. Eisenhower's 1955 'Open Skies' proposal which helped to lay the groundwork of the acceptance by the Cold War blocs in the 1980s and 1990s of 'Trust, but verify' principle.

of 'evening the balance of knowledge and hence of preparation [for conflict] by breaking through this [Soviet] shield of secrecy'.[266]

Thomas C. Schelling and Morton H. Halperin have observed that any given arms control purpose is also generally a 'continuing urgent objective of national military strategy'.[267] In 1961 they postulated that arms control could eventually be seen as 'a step in the assimilation of military policy in over-all national strategy'.[268] This reflects the fact that military strategy must concern itself with both winning (or at least not losing) armed conflicts and exercising influence over potential opponents.[269] Attempting to influence potential enemies through engagement (e.g., through arms control processes and—more recently—cooperative threat reduction activities) grew out of a partial recognition by some analysts that the post-World War II nuclear armed Cold War blocks were headed for long-term strategic confrontation interspersed with limited regional wars. The alternative, all-out conflict, implied mutual annihilation—for combatants and non-combatants alike.[270]

Schelling and Halperin characterized arms control to include 'all the forms of military cooperation between potential enemies in the interest of reducing the likelihood of war, its scope and violence if it occurs, and the political and economic costs of being prepared for it'.[271] They also state that arms control can be viewed 'as an effort, by some kind of reciprocity or cooperation with potential enemies, to minimize, to offset, to compensate or to deflate' certain characteristics of modern weaponry and military expectations, including an apparent perceived advantage accruing to the side that initiates a nuclear weapon strike.[272] Thus a 'hair trigger' nuclear first strike posture could be switched to a more defensive or retaliatory only strike posture. Arms control and disarmament advocates maintained that such a change would reduce the likelihood for misunderstanding and inadvertent escalation to fullscale nuclear war.

Schelling and Halperin also argue that the essential feature of arms control is 'the recognition of the common interest, of the possibility of reciprocation and cooperation even between potential enemies with respect to their military

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[266] Dulles (note 90), p. 49.

[267] Thomas C. Schelling and Morton H. Halperin, *Strategy and Arms Control* (Twentieth Century Fund: New York, 1961), p. 4.

[268] Schelling and Halperin (note 267), p. 143.

[269] Schelling and Halperin (note 267), p. 142.

[270] Numerous books were published (including for the general public) that sought to explore the extent to which traditional concepts of warfare or military strategy remained relevant in a nuclear-armed world. E.g., P. M. S. Blackett, *Military and Political Consequences of Atomic Energy* (Turnstile Press: London, 1948); E. W. Titterton, *Facing the Atomic Future* (Macmillan & Co. Ltd.: London, 1956); Edward Teller and Albert L. Latter, *Our Nuclear Future: Facts, Dangers and Opportunities* (Criterion Books: New York, 1958); Ed. Per Edvin Sköld, *Svenska Atom Vapen? Fakta och Problem, Sex Fackmannauppsatser* [Swedish Atomic Weapons? Facts and Problems, Six Specialist Essays] (Tidens Förlag: Stockholm, 1959); F. O. Miksche, *The Failure of Atomic Strategy & a New Proposal for the Defence of the West* (Faber and Faber Ltd.: London, 1959); and Utrikespolitiska Institutet, *Svenska Kärnvapen Problem* [The Swedish Nuclear Weapon Problem] (Aldus/Bonnier: Stockholm, 1965).

[271] Schelling and Halperin (note 267), p. 2.

[272] Schelling and Halperin (note 267), p. 3.

establishments'.[273] Activities associated with arms control can include: (*a*) 'reductions in certain kinds of military force', (*b*) 'increases in certain kinds of military force', (*c*) 'qualitative changes in weaponry', and (*d*) 'different modes of deployment, or arrangements superimposed on existing military systems'.[274]

In addition, beginning in the 1960s the Cold War superpowers tended to focus on arms control, rather than disarmament. Disarmament was usually associated with the anti-nuclear movement and was not embraced by negotiators or state weapon experts.[275] By contrast, the term 'arms control' reflected the 'technocratic' or 'problem-solving' aspect of arms control practice which therefore represented a 'techno-managerial' project.[276] It should be noted that the argument that arms control and disarmament differ by virtue of the former being 'techno-managerial' in nature is disputed by some academics and analysts.[277] Implicit to arms control and disarmament is the view that the state enjoys a monopoly on the exercise of force and violence.[278] The fact that the superpowers acknowledged the vulnerability of civilian populations and infrastructure as reflected by theories of nuclear deterrence, such as the doctrine of Mutually Assured Destruction (MAD), was also implicit to Cold War arms control.[279] However, the ethics (or morality) of largescale deaths were not generally explicit in policy and the periodic modification by possessor states of their nuclear force postures.

Intelligence capabilities during the Cold War provided the Soviet Union and the United States a baseline of data from which to negotiate strategic nuclear arms limitation agreements starting in the 1960s.[280] Some argue that without this baseline, negotiations between these states could not have been started.[281] The two sides' NTM consisted mainly of overhead imagery and telemetry interception and their respective intelligence capabilities shaped the arms control negotiations.[282] This meant, for example, that the verification provisions of the 1991 Strategic Arms Reduction Treaty (SALT) I focused on counting launchers, rather than on non-strategic nuclear weapons or missile production. Article XII contains measures to enhance the effectiveness of NTM measures (i.e., overhead

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[273] Schelling and Halperin (note 267), p. 2.

[274] Schelling and Halperin (note 267), p. 2.

[275] Keith Krause, 'Leashing the Dogs of War: Arms Control from Sovereignty to Governmentality', *Contemporary Security Policy*, vol. 32, no. 1 (Apr. 2011), p. 26.

[276] Krause (note 275), pp. 26–27.

[277] I am grateful to one of the anonymous reviewers for drawing my attention to this.

[278] Krause (note 275), p. 27.

[279] An influential source for nuclear warfare planning and strategy is Herman Kahn, *On Thermonuclear War*, second edtn. (Princeton University Press: Princeton, New Jersey, 1961). Stanley Kubrick used Kahn's work to inform the production of the 1964 movie *Dr Strangelove or: How I Learned to Stop Worrying and Love the Bomb*. Kenneth Waltz, who held not dissimilar views to Kahn, famously argued that the spread of nuclear of weapons tends to reduce the likelihood of nuclear war. Kenneth Waltz, 'The Spread of Nuclear Weapons: More May be Better', Adelphi Papers, no. 171 (IISS: London, 1981).

[280] Chemical and biological verification remains a sub-set within a broader nuclear weapons arms control and disarmament context.

[281] Michael Herman, 'Intelligence Effects on the Cold War: Some Reflections', p. 33 in Eds., Michael Herman, J. Kenneth McDonald, and Vojtech Mastny, *Did Intelligence Matter in the Cold War?* (Norwegian Institute for Defence Studies: Oslo, 2006).

[282] Michael Herman, 'Intelligence Effects on the Cold War: Some Reflections', p. 33 in Herman, McDonald, and Mastny (note 281).

imagery) upon request of one of the parties, such as displaying in the open road-mobile ICBM launchers.[283] In the late 1970s when US Senator John Glenn suggested that NTM be defined in the draft SALT II text, both the Soviet and US delegations reacted negatively. Thomas Graham Jr., the former General Counsel of the US Arms Control and Disarmament Agency (ACDA), said that no one wished to declare the NTM or associated technology 'least of all the United States'.[284] According to Graham, the Soviet Ambassador leading SALT negotiations, reacted somewhat cryptically by saying: 'Minerva's owl flies only at night'.[285] In the late 1970s the Soviet Union and the United States agreed a ban on telemetry encryption as part of SALT II negotiations.[286] Russia and the United States have reduced their nuclear weapon stockpiles further since they signed the 2010 Russian-US Treaty on Measures for the Further Reduction and Limitation of Strategic Offensive Arms (New START Treaty).[287] Today the CWC verification regime would be fundamentally undermined without the incorporation of NTM through *inter alia* the convention's challenge inspection mechanism.[288]

3.2. Post-Cold War Arms Control

Contemporary arms control and disarmament practice is also increasingly concerned with coping with varied and diffuse groups of non-state actors (such as through oversight of the financial sector to prevent criminal acts or the tracing of support for illicit activity), organized criminals and violent non-conformists and violent separatists.[289] International relations deterrence theory has yet to adequately explain (much less predict) the behaviour and motivations of non-state actors in this context.[290]

Current nonproliferation measures include activity underaken within the frameworks of the Financial Action Task Force (FATF), the G-8 Global Partnership Against the Spread of Weapons and Materials of Mass Destruction, the Proliferation Security Initiative (PSI) and UN Security Council Resolution 1540 (2004).[291] The Security Council resolution requires states to adopt and

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[283] START I, article XII.

[284] Thomas Graham Jr., *Disarmament Sketches: Three Decades of Arms Control and International Law* (University of Washington Press: Seattle, Washington, 2002), pp. 82–83.

[285] Graham Jr. (note 284), p. 83.

[286] Graham Jr. (note 284), p. 85.

[287] See Hans M. Kristensen, 'US nuclear forces', pp. 285–292; and Vitaly Fechenko, Hans M. Kristensen and Philip Schell, 'Russian Nuclear Forces', pp. 293–299 in *SIPRI Yearbook 2013: Armaments, Disarmament and International Security* (Oxford University Press: Oxford, 2013).

[288] CWC, Verification Annex, Part X, paras. 1–61; and CWC, Verification Annex, Part XI, paras. 1–27.

[289] Neil Cooper and David Mutimer, 'Arms Control for the 21st Century: Controlling the Means of Violence', *Contemporary Security Policy*, vol. 32, no. 1 (Apr. 2011), p. 8.

[290] Andreas Wenger and Alex Wilner, 'Deterring Terrorism: Moving Forward', pp. 301–324 in Eds. Andreas Wenger and Alex Wilner, *Deterring Terrorism: Theory and Practice* (Stanford University Press: Stanford, Calif., 2012).

[291] As of Feb. 2013, 100 states had 'committed formally to PSI participation'. As of Jan. 2013, there were 25 members of the Global Partnership: Australia, Belgium, Canada, Czech Republic, Denmark, the EU, Finland, France, Germany, Ireland, Italy, Japan, Kazakhstan,

enforce laws criminalizing acts by citizens or legal persons related to developing, acquiring, manufacturing, possessing, transporting, transferring or using nuclear, biological and chemical weapons and their means of delivery.[292]

Another arms control characteristic of the post-Cold War period is that stronger powers must show greater flexibility in their interaction with other states in order to agree common understandings and to mitigate shared security concerns. This dynamic is evident within multilateral arms control and disarmament regimes such as at the 2012-2015 annual Meetings of Experts and Meetings of Parties to the BTWC in Geneva, the OPCW and at the UN Office for Disarmament Affairs (UNODA).

Areas of disagreement, such as the cross linkage of issues within and from outside the arms control context in order to block consensus, must be managed in a constructive and sensible manner. As such, states may agree general principles, while avoiding explicit or detailed discussion on sensitive points, including those having operational relevance, in the near term. Alternatively, states can consult informally at the margins of meetings until the broader political situation develops in a manner that allows for a more formal understanding and agreement on specific detail. For example, during the 1993-1997 OPCW Preparatory Commission (PrepCom), China and Japan were the two 'most interested parties' on abandoned chemical weapons (ACW). However, they could not agree ACW phrasing in the draft OPCW Handbook during the PrepCom because a higher-level political understanding between the two governments had not yet been achieved.[293] Thus, the more the ACW topics were discussed, the more complicated the language became partly thanks to a cross-linkage of political and technical issues by other delegations.[294]

Keith Krause argues that contemporary arms control practice can also be understood 'through the lense of governmentality'.[295] Arms control can therefore be redefined as being concerned with 'who can possess, use, develop and transfer the technologies of violence, under what circumstances, against whom, and for what ends?'[296] Members of the Non-aligned Movement (NAM) generally oppose such characterizations within multilateral arms control and disarmament fora. This is partly reflected by literature on the 'post-proliferation world' in which

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Mexico, Netherlands, New Zealand, Norway, Poland, Russia, South Korea, Sweden, Switzerland, Ukraine, the UK, USA. Amy F. Woolf, Paul K. Kerr and Mary Beth D. Nikitin, *Arms Control and Nonproliferation: a Catalogue of Treaties and Agreements*, report no. RL33865 (Congressional Research Service: Washington, DC, 15 July 2013), pp. 26 & 36. Aaron Dunne, *The Proliferation Security Initiative: Legal Considerations and Operational Realities*, SIPRI Policy Paper no. 36 (SIPRI: Stockholm, May 2013), <http://books.sipri.org/product_info?c_product_id=459>, (accessed 23 July 2013). Since the start of the Ukrainian crisis in 2014, Russia has become marginalized within the G8 Global Partnership.

[292] UN Security Council resolution 1540 (2004), UN document S/RES/1540(2004), 28 Apr. 2004.

[293] The author attended meetings on ACW issues during part of the PrepCom in 1995. At the time he was an intern in the Verification Division of the Provisional Technical Secretariat.

[294] In 1995 the author helped to support the drafting of the OPCW Handbook at the PrepCom's Provisional Technical Secretariat.

[295] Krause (note 275), p. 29.

[296] Krause (note 275), p. 29.

S&T and development gaps between 'the West' and 'the rest' have effectively disappeared.[297]

Political and more philosophical differences exist among states in the multilateral arms control and disarmament context that have implications for how verification and compliance issues are handled both in theory and practice. The NAM state delegations at arms control and disarmament forums generally (in the absence of specific, convincing actual cases, such as that of the A. Q. Khan nuclear smuggling network) tend towards greater skepticism of the possible threats posed by the spread of dual-purpose material, technology and know-how.[298] They also tend to focus more on the full and effective implementation of technological cooperation and assistance provisions (Article XI, CWC).[299]

Similar tensions are evident in the nuclear arms control context. The former Director General of the IAEA Mohamed Elbaradei, for example, characterized the behaviour of Western involved in the nuclear arms control discussions and involvement in clarifying Iran's status of adherence with the 1968 Non-proliferation Treaty (NPT) as:

> *'typical' in that these states 'always wanted to be perceived as being in charge—to push, to prod, to put pressure [on], to set deadlines, to dominate the debate, to inflict punishments—which inevitably gave them the appearance of the schoolyard bully and undermined precisely the objectives they hoped to achieve'.*[300]

Dichotomies are also evident in discussions regarding strategic trade controls of dual purpose material, technology and know-how which may be misused for NBC weapon purposes. For example, a perception exists among many, mainly NAM, states that the UN Security Council (in particular at least three of the P-5 permanent members) is unduly responsive to the wishes of Western states.[301] This is reflected in discussions at the UN of the respective roles of the UN Security Council and the UN General Assembly in which the NAM and other states generally maintain that the latter is the body with greater

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[297] On the biological arms control implications of a 'post-proliferation' world, see Catriona McLeish and Ralf Trapp, 'The Life Sciences Revolution and the BWC', *Nonproliferation Review*, vol. 18, no. 3 (Nov. 2011), pp. 527–543. For a broader geopolitical analysis comparing the West with 'the rest', see Niall Ferguson, *Civilization: the West and the Rest* (Penguin Books: London, 2012).

[298] On the Khan network, see *Nuclear Black Markets: Pakistan, A. Q. Khan and the Rise of Proliferation Networks, a Net Assessment* (International Institute for Strategic Studies (IISS): London, 2007); and Feroz Hassan Khan, *Eating Grass: the Making of the Pakistani Bomb* (Stanford University Press: Stanford, Calif., 2012).

[299] The NAM and China statement at the Third CWC Review Conference proposed a detailed plan of action for the full and effective implementation of economic and technological development provisions of the CWC using language that implicitly criticizes strategic trade control regimes that seek to ensure that material, technology, equipment and know-how (intangible technologies) are not misused for NBC-related weapon purposes. 'Working Paper by the NAM CWC States Parties and China, Proposal for a Plan of Action on the Full Imlementation of Article XI of the Chemical Weapons Convention', Apr. 2013, The Hague, pp. 3–4.

[300] Mohamed Elbaradei, *The Age of Deception: Nuclear Diplomacy in Treacherous Times* (Bloomsbury: London, 2011), p. 301.

[301] Personal communication with OPCW PTS official with direct involvement in the negotiation process.

(or only true) legitimacy. This disaffection (or at least perceived lack of legitimacy) with the Security Council was an underlying cause in the delay in finalizing the UN-OPCW agreement regulating the rights and obligations of the two bodies and, in particular, the circumstances under which cases of CWC violations and associated data can be referred to the UN without violating the OPCW's Confidentiality Policy.[302] More generally, the composition and powers of the UN Security Council reflect the international security environment as it existed at the end of World War II. All proposals for restructuring it (e.g., by adding more non-Western states or changing the permanent member status of the P-5 or modifying the P-5 veto power) have been unsuccessful.

Regarding the future of arms control, Krause has expanded on the changed context (using Halperin's definition as a basis) of the purpose of arms control to:

> '1. *Reducing the risk of war*: today involves extensive post-conflict disarmament, demobilization and reintegration programmes designed to eliminate the potential for a resurgence of violent conflict;
>
> 2. *Reducing the destructiveness of war should it break out*: today involves campaigns to promote and extend international humanitarian norms concerning what weapons are used and how they are used by both state and non-state armed actors; as well as the collection and destruction of surplus weapons and restrictions on the international transfer of arms;
>
> 3. *Reducing the costs of preparing for war*: today involves the exercise by international and bilateral donors of intrusive oversight and pressure on client states—as a form of liberal governmentability—over the size, structure, training and armaments of their armed forces, as well as over military spending and the security sector as a whole.'[303]

Neil Cooper and David Mutimer argue that the overall Cold War arms control paradigm should today be thought of as controlling the means of violence (CMV).[304] They propose that Schelling and Halperin's early 1960s arms control aims be restated as:

> *'1. To reduce the likelihood that the instruments of armed violence are used against individuals, communities, or states;*
>
> *2. To reduce the effects of armed violence should it be employed; and*
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> *3. To reduce the resources employed in the development, acquisition and deployment of the instruments of armed violence (a deliberately more ambitious formula than that of classical arms control)'*.[305]

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[302] The agreement was concluded in 2000, three years following the CWC's entry into force. See 'Agreement Concerning the Relationship Between the UN and the OPCW', <http://www.opcw.org/about-opcw/un-opcw-relationship/>, (accessed 24 July 2013). The OPCW confidentiality policy is based on 'Decision', OPCW document C-I/DEC.13/Rev.1, 2 Feb. 2006.

[303] Krause (note 275), p. 30.

[304] Cooper and Mutimer (note 289), pp. 3–19.

[305] Cooper and Mutimer (note 289), p. 11.

This broader conceptualization of arms control and disarmament includes conventional weapon systems and touches on aspects of disarmament, demobilization and reintegration (DDR) in post-conflict areas and security sector reform (SSR) programmes which, in turn, partly seek to transform the sensibilities of participants away from belligerence as part of the CMV concepts.[306] According to CMV proponents, its indirect effect should reduce militarism and promote cultures of peace.[307] The 2 April 2013 adoption of the Arms Trade Treaty (ATT) and its future implementation will perhaps offer further support for this conceptualization.

The future relevance of arms control and disarmament field should also take into account several more trenchant criticisms. Colin S. Gray, a prominent critic, essentially argues that such regimes do not address underlying political conflict and that the absence of weapons does not remove the conflict.[308] Hans J. Morgenthau, a founding father of the Realist School of international reations (IR) theory, reverses the argument by stating 'Men do not fight because they have arms. They have arms because they deem it necessary to fight'.[309] Morgenthau further observes: 'The modern philosophy of disarmament proceeds from the assumption that men fight because they have arms. From this assumption the conclusion follows logically that if men would give up arms, all fighting would become impossible' and that even the arguments of arms control skeptics does not invalidate the existence of 'a direct relation between the possession of arms, or at least of certain kinds and quantities of arms, and the issue of war and peace'.[310] Such efforts should also be considered in terms of efforts to constrain or prohibit inhumane weapons, much of which is institutionally focused on the ICRC.

It should also be noted that immediately after World War I, the Irish author and social commentator Bernard Shaw asserted that disarmament per se cannot prevent war and, even if it could, such a restraint would be a 'sort of preventive' having little moral value. He further argued that any peace that is 'produced by disablement is worth no more than that which is produced by manacles and fetters'.[311] Shaw instead argued that true disarmament at the state level could only be achieved once individuals in society no longer felt compelled

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306 Cooper and Mutimer (note 289), p. 8.

307 Cooper and Mutimer (note 289), p. 11.

308 Colin S. Gray, 'Arms Control Does Not Control Arms', *Strategy and History: Essays on Theory and Practice* (Routledge: London, 2006), pp. 120–133. See also Colin S. Gray, *Weapons Don't Make War: Policy, Strategy, and Military Technology* (University of Kansas: Lawrence, Kansas, 1993). This argument has, at least on the surface, similarities to the debate over whether private gun ownership leads to greater domestic violence and crime. This argument can be parsed into at least two elements. One is that the existence of private gun ownership has a deterrent value against those who would otherwise commit crime or violent acts. Second is the argument that people, not guns, kill (i.e., guns are the instrumental rather than the causative or even 'facilitative' factor). Another element to the debate is the extent to which the interaction between individuals (or between an individual and the state) may be compared or contrasted to interactions between states (i.e., within the international relations context).

309 Hans J. Morgenthau, *Politics Among Nations: the Struggle for Power and Peace*, 4th edtn. (Alfred A. Knopf: New York City, 1967), p. 392.

310 Morgenthau (note 309), p. 391.

311 Bernard Shaw, *Peace Conference Hints* (Constable & Co. Ltd.: London, 1919), p. 80.

to carry weapons in their daily lives and that this state of affairs could only be achieved once the 'wild edges of civilization' were brought under control.[312] In other words, the various societies should share a certain basic level and standard of behavioural and civilizational norms.

The arguments over causes and effects of arms control and the determination of possible precondiations for successful arms control essentially constitute a variation of the 'chicken and egg' argument (in addition to the question of whether arms control either influences or promotes conflict or peace). More precisely, can one attribute the existence or non-existence of conflict to the existence or non-existence of arms control agreements or arrangements? Arms control, to an extent, limits the ability of a state to engage in aggressive or preemptive war.

It should nevertheless be noted that Schelling and Halperin maintained that they do not agree with the 'notion, implicit in many pleas for disarmament, that a reduction in the level of military forces is necessarily desirable if only it is "inspectable" and that it necessarily makes war less likely'.[313] Thus, the argument that the presence of weapons increases the likelihood of war *versus* the existence of arms control arrangements decreasing the likelihood of war (over either the shorter or longer-term) remains contentious (i.e., unproven).

Furthermore, the extent to which the behaviour of individuals and states can be shaped or influenced towards non-violence is limited.[314] The ability of states to evaluate their security needs also requires a degree of military and security capacity or capability. Without this, such evaluations risk devolving into paper writing exercises that are divorced from operational understanding or relevance.[315] Such evaluation capacity can be subsumed somewhat into defence and security institutional frameworks such as the EU and NATO. If so, some national capacities of participating states can (and have) been allowed to become degraded.[316]

3.3. Verification Aspects of Arms Control, Disarmament and Nonproliferation Regimes

Contemporary arms control, disarmament and non-proliferation regimes nevertheless assist to clarify the legal and technical basis of allegations of the development, production, stockpiling, transfer and use of chemical weapons. They also provide a framework for how allegations of violations are handled. The CWC contains measures for consultation, clarification and fact-finding. The

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312 Shaw (note 311), p. 80.

313 Schelling and Halperin (note 267), p. 3.

314 Scott Atran argues that international security literature on terrorist motivations should focus more on human nature and the dynamics of small group dynamics of disaffected youths in order to better understand the motivations of contemporary, religiously inspired violence. Scott Atran, *Talking to the Enemy: Religion, Brotherhood and the (Un)Making of Terrorists*, 3rd edtn. (HarperCollins: New York City, 2010), pp. 48–50.

315 John Hart, 'Threat Assessment Processes and Military Capacity: Structure and Purpose in the Current International Security Environment', *Defence Global* (Feb. 2012), pp. 88–89.

316 Such a degradation of capacity was evident as participating European states implemented a naval blockade, as well as the carrying out of surveillance and air strikes to support anti-Kaddaffi rebel forces in Mar.–Aug. 2011.

BTWC has similar, but distinct and weaker, provisions. The UN Secretary-General has sent teams to investigate allegations of use of chemical or biological weapons without the authority of the General Assembly or the Security Council.[317] The UNODA has continued to develop its relationship with the OPCW and coordinate and support efforts to update the technical guidelines and procedures, as well as the roster of experts and laboratories that the UN Secretary-General may draw on when initiating such investigations (as was done during the 1980-1988 Iran-Iraq War).[318]

The requirements for verifying treaty compliance with an arms control and disarmament agreement (including through the carrying out of onsite inspections) are distinct from the strategic and national security requirements of a state.[319] In particular, data derived from arms control and disarmament are a component of the domestic taskings by states for the collection and analysis of NTM.

Freeman Dyson, a British-born mathematician who later moved to the United States where he became a member of the JASON advisory group, argues:

> *'Verification of treaties is important, just as military strength is important. But verification, like military strength, must be pursued as a means to an end and not as an end in itself. The end which verification is supposed to serve is to discourage the parties to a treaty from serious and deliberate violations. A limited and unobtrusive verification system is usually adequate for the purpose. When verification becomes an an end in itself, it stands in the way of arms control, just as it stood in the way of the comprehensive [nuclear] test ban in 1963'.*[320]

Dyson thus argues that the purpose of verification is to permit action. In practice, however, this is not necessarily possible.[321]

The refusal by the United States to ratify the 1996 Comprehensive Nuclear-Test-Ban Treaty **(**CTBT) was also largely due to the fact that domestic critics of the treaty argued that the agreement was not sufficiently verifiable. The verifiability criticism arose from a more fundamental philosophical objection to the treaty itself (e.g., the creation of another UN-type organization that would constrain US defence and security capacity and options).

Dyson also cautions 'the details of the verification systems' should not outweigh 'the substance of the agreements which are to be verified' by, for example, risking charges of intelligence collection.[322]

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317 The original basis for this authority is 'Chemical and bacteriological (biological) weapons, C, measures to uphold the authority of the 1925 Geneva Protocol and to support the conclusion of a Chemical Weapons Convention', UN General Assembly Resolution A/RES/42/37, 30 Nov. 1987 in *Resolutions adopted on the reports of the First Committee* (United Nations: New York), p. 73.

318 In 2010, 237 CBW experts and 42 laboratories nominated by 41 UN member states were on the draft updated roster and technical guidance. Karin Hjalmarsson, et al., 'Global Watch: the State of Biological Investigations', *Bulletin of the Atomic Scientists*, vol. 66, no. 4 (July/Aug. 2010), p. 73.

319 Schelling and Halperin (note 267), pp. 92–93.

320 Freeman Dyson, *Weapons and Hope* (Harper & Row, Publishers: New York City, 1984), pp. 175–176.

321 Fred C. Iklé, 'After Detection—What?', *Foreign Affairs*, vol. 39, no. 2 (1961), pp. 208–220. I am grateful to one of the anonymous reviewers for drawing my attention to this point.

Schelling and Halperin identify two criteria for judging the utility of onsite inspection systems. The first is how well the verification system can be employed to uncover the truth in cases where the inspected party wishes to conceal a violation. The second criterion ('the positive-evidence principle') is how well the verification system allows the inspected party to display or demonstrate its compliance with the agreement.[323] The international inspection regime put in place by UN Security Council Resolution 687 (1991) is an example of the former type. Multilateral arms control and disarmament regimes such as the BTWC, CWC and NPT are of the latter type. Some analysts seeking lessons from the Iraq experience of UNSCOM and UNMOVIC fail to take this distinction into account.[324] Those states wishing to abide by a treaty's provisions are motivated to be forthcoming in their efforts to demonstrate their intentions. The degree to which a state is willing to actively 'demonstrate' its compliance with arms control agreements or commitments may be influenced by cultural, social and political factors. Suspected non-compliance becomes increasingly apparent as a consequence of active obstructionism or the cumulative effect of persistent ambiguities and unresolved questions.

A key arms control verification objective is to distinguish the political and technical aspects of inspection results and other related activity. Elbaradei cautions that verification (or compliance) assessments should not consist of 'an alignment of unverified data interpreted according to a worst-case scenario' as occurred when US Secretary of State Colin L. Powell presented to the UN his country's assessment of the status of Iraq's NBC weapon and longer-range missile programmes in 2003.[325] A lawyer by training, Elbaradei also cautions against a common misperception concerning the behaviour and purpose of inspections carried out under multilateral arms control and disarmament regimes, namely: 'IAEA inspectors are not detectives, nor are they security officers or police. They are accustomed to looking for and pointing out quantitative and qualitative discrepencies—including deliberate coverups—and they do not shrink from confronting the party under inspection with the evidence'.[326] International inspectors within such regimes should ideally be respectful, situationally aware and consistent irrespective of which state is inspected.

With respect to international inspection and verification activity in Iraq, the IAEA 'action team'—established to implement the nuclear inspection and verification component of the implementation of UN Security Council Resolution 687 (1991)—arguably more represented established multilateral arms control and disarmament practice as compared to UNSCOM.[327] The latter

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[322] Dyson (note 320), p. 176.

[323] Schelling and Halperin (note 267), p. 97.

[324] Elbaradei (note 300), p. 17.

[325] Elbaradei (note 300), p. 3. The UN prohibited Iraq from possessing ballistic missiles with a range greater than 150 km. For a transcript of Powell's speech, see 'A Policy of Evasion and Deception', *Washington Post*, <http://www.washingtonpost.com/wp-srv/nation/transcripts/powelltext_020503.html>, (accessed 20 May 2013).

[326] Elbaradei (note 300), p. 17.

[327] In a general sense, the IAEA Action Team and UNSCOM were both adversarial and ad hoc in their inspection and verification approaches. The extent to which the former was more consensual and more in accord with standard UN-type organization procedures and philosophical approach is perhaps a question of degree. This consideration is also influenced by

represented an ad hoc, adversarial model established as part of the terms for the cessation of hostilities imposed on Iraq for the cessation of hostilities to the First Gulf War in February 1991.[328] Elbaradei described his impression of US nationals—predominantly from national nuclear weapons laboratories—while he was in Iraq as being 'highly qualified technically' but having 'no clue about how to conduct international inspections or, for that matter, about the nuances of how to behave in different cultures'.[329] He further lamented: 'From their brash conversation, it was clear they believed that, having come to a defeated country, they had free rein to behave as they pleased'.[330]

The more adversarial approach taken by UNSCOM and its successor organization, UNMOVIC, (especially during the period immediately following the end of the First Gulf War) was only possible in the context of terms imposed by victorious military powers onto a defeated opponent. This had certain advantages. Arrangements were made for UNSCOM and UNMOVIC to receive information derived by UN member states' NTM. Most of the CBW and ballistic missile experts were seconded from the national defence establishments of primarily Western and Eastern bloc UN member states. In fact, the work of UNSCOM represents one of the first truly cooperative activities between the former Cold War blocs.[331] Some national intelligence services did carry out parallel information collection activity during UNSCOM inspection and verification activity.[332] The UK and the United States were among the first states to provide UNSCOM with intelligence and providers generally assumed that any information provided would eventually spread to other governments and be publicized in some form.[333]

The UN culture is ill-suited to the receipt of intelligence partly because this implies that some staff and states are excluded from having access to such information. Such activity also tends to conflict with the standard UN-type

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the specific actions one looks at when comparing the IAEA Action Team and UNSCOM respectively.

[328] The institutional character of UNMOVIC represented a small, yet significant, shift back towards a more standard UN multilateral character closer to that of the IAEA itself, particularly with respect to personnel policy (including hiring). UNSCOM hiring practice was based on secondments of national experts and the hiring of personnel through informal consultations involving the Executive Chairman.

[329] Elbaradei (note 300), p. 23.

[330] Elbaradei (note 300), p. 23.

[331] I am grateful to one of the reviewers for drawing my attention to this point.

[332] E.g., former US marine Scott Ritter who worked as an UNSCOM inspector has published on aspects of this which have been partially confirmed. His statements should be assessed carefully partly in light of a number of wider strong personality and political differences of opinion and understanding (among states and individuals). Ritter subsequently became estranged with former UNSCOM and US Government colleagues over the question of whether Iraq had terminated its NBC and longer-range ballistic missile programmes (he maintained that Iraq had essentially ceased these programmes). See, for e.g., Scott Ritter, *Iraq Confidential: the Untold Story of the Intelligence Conspiracy to Undermine the UN and Overthrow Saddam Hussein* (I. B. Tauris & Co. Ltd.: London, 2006).

[333] Tim Trevan, 'Exploiting Intelligence in International Organizations', p. 214 in Ed. Raymond A. Zilinskas, *Biological Warfare: Modern Offense and Defense* (Lynne Rienner Publishers: Boulder, Colorado, 2000). Tim Trevan formerly worked in the UK FCO's Arms Control and Disarmament Department. He headed the chemical warfare section of the UK delegation to the CD and was a special advisor to UNSCOM Executive Chairmen between 1992–1995.

organization principle of 'equitable geographic distribution' (i.e., sharing should be done with 'due regard' to this principle). Such activity also tends to undermine the principle (i.e., view) that all states have equal rights and obligations, regardless of other factors such as differences in economic, military and political power and variations between states (and groupings) in terms of their political engagement and interest. UNSCOM took the view that it would, in principle, receive information from states that allowed it to fulfill its mandate and only inform other states if such information helped it to fulfill its mandate (e.g., with regard to questionable shipments of goods and materials from a given country).[334] In practice, particularly in the earliest phases of operation, many of the UNSCOM personnel were technical experts from NATO member states on loan from their governments and who had experience working with secure operational procedures.[335] UNSCOM personnel also had to maintain operational security in order to prevent or minimize the ability of Iraq to anticipate inspection targets and thus remove incriminating evidence.

The former UN inspector Tim Trevan notes that UNSCOM's Information Assessment Unit eventually developed 'a more profound knowledge of Iraq's weapons programs than that available to any one intelligence agency'.[336] However, discussing the relationship between national intelligence services and UNSCOM, former UNMOVIC Executive Chairman Hans Blix states 'Considering how misleading much of the intelligence given us eventually proved to be, perhaps it was a blessing that we did not get more. What we came to discover was that no sites given to us by intelligence were ever found to harbor weapons of mass destruction'.[337] It should also be noted that UNMOVIC established a special office to receive 'outside information sources' which, except for the Executive Chairman, was designated 'the sole entrance point for intelligence provided by governments'.[338] The policy was that intelligence flow into UNMOVIC 'must be one-way only' and 'have regard to matters relevant to the mandate of UNMOVIC'.[339]

It should also be noted that when Richard Butler was asked in an interview to specify malfeascance that occurred under his tenure as UNSCOM Executive Chairman, he replied 'I was perfectly aware that people on my staff were reporting to their home governments, separate and apart from their responsibility to me. Now that's a low level of malfeasance'.[340]

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[334] Tim Trevan, 'Exploiting Intelligence in International Organizations', p. 216 in Zilinskas (note 333).

[335] Tim Trevan, 'Exploiting Intelligence in International Organizations', p. 217 in Zilinskas (note 333).

[336] Tim Trevan, 'Exploiting Intelligence in International Organizations', p. 218 in Zilinskas (note 333).

[337] Hans Blix, *Disarming Iraq: the Search for Weapons of Mass Destruction* (Bloomsbury: London, 2004), p. 93.

[338] UNMOVIC, *Compendium of Iraq's Proscribed Weapons Programmes in the Chemical, Biological and Missile Areas* (UN: New York, June 2007), p. 26.

[339] UNMOVIC (note 338), p. 26.

[340] 'The Lessons and Legacy of UNSCOM: an Interview with Ambassador Richard Butler', *Arms Control Today*, (June 1999), p. 8. Butler went on to cite Scott Ritter's outspokenness on Iraqi compliance with UN Security Resolution 687 (1991) as an example of more serious malfeascance. The interview was published the same month Butler resigned as UNSCOM's Executive Chairman.

With respect to nuclear inspections in Iraq, Elbaradei suggests that a sign of the tension between the requirements of national intelligence acquisition and the procedures normally associated with the handling of information obtained under multilateral arms control and disarmament arrangements is the fact that during an early phase of post-conflict inspections David A. Kay (the head of the IAEA Action Team) and Robert L. Gallucci (of UNSCOM) reportedly transferred 'critical papers' to the US Department of State before the IAEA or UNSCOM had received them.[341]

It will also be important to consider the theory and practice of information sharing in the case of the 2013 international verification and inspection activities concerning chemical weapons in Syria.

3.4. Current and Future Verification Activities

With respect to current and future verification preparations in the CW context, the OPCW is continuing to develop its sampling and analysis guidelines to better ensure it is able to identify and characterize the nature of a CW attack. For example, on 8-9 December 2011 the Finnish Institute for Verification of the Chemical Weapons Convention (VERIFIN) and the OPCW convened the *Third International Workshop on Analysis of Chemical Warfare Agents to Mark the International Year of Chemistry 2011*.[342] NATO was, in principle, scheduled to publish a handbook for the sampling and identification of biological, chemical, and radiological agents (SIBCRA) in 2013. As noted in the Executive Summary, since Nov. 2009 the OPCW has been carrying out confidence-building exercises for the laboratory testing of biomedical samples for biomarkers of CW agents.[343]

Other frameworks for dealing with CW violations include the OPCW Working Group on Terrorism, UN Security Council Resolution 1540 (2004) (via the 1540 Committee) and the 2006 UN Global Counter Terrorism Strategy. The Australia Group (AG), an informal arrangement of states and the European Union, seek to ensure that appropriate and effective strategic trade controls are put in place and harmonized in order to prevent the development or acquisition of chemical and biological weapons.[344]

Verification aspects are considered in further detail in the chapter on sampling and analysis and the case studies (see Chapter 11).

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[341] Elbaradei (note 300), p. 26.

[342] VERIFIN, 'Third International Workshop on Analysis of Chemical Warfare Agents to Mark the International Year of Chemistry 2011', <http://www.helsinki.fi/verifin/VERIFIN/english/cwa3-info.htm>, (accessed 2 Aug. 2013).

[343] Koller (note 22), p. L-25.

[344] As of Jan. 2014, the AG had 42 participants including the European Union. See <http://www.australiagroup.net/en/index.html> (accessed 21 Jan. 2014).

4

INFORMATION ACQUISITION AND MANAGEMENT: TRENDS AND DEVELOPMENTS

The information management and analysis literature appears to focus on data management studies (e.g., on the challenges of the processing of large amounts of data for scientific research or business management purposes), rather than for intelligence or CW verification purposes.[345]

'Intelligence' and 'information' have been used interchangeably, partly because of efforts by states to promote information sharing between intelligence and law enforcement.[346] In particular, the intelligence field's traditional 'need to know' principle has been modified (to varying and controversial degrees) in the post-11 September 2001 counterterrorism context towards a 'need to share' information and intelligence.[347] Information may nevertheless be understood to mean raw data, while intelligence is data that have been collected and/or transformed for a preconceived purpose.[348] Data-driven analysis tends to be inductive, while conceptual driven analysis tends to be deductive.[349]

The United States (and to an extent some other states) decided to attempt the shift towards 'the need to share' largely because of US investigations into its failure to prevent the airplane attacks of 11 September 2001 and the subsequent mailing of letters filled with dried *B. anthracis* spores to politicians and members of the media.[350] Consequently, all 16 of the US intelligence agencies were

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[345] E.g., Boris Kovalerchuk and Evgenii Vityaev, 'Symbolic Methodology for Numeric Data Mining', *Intelligent Data Analysis*, vol. 12, no. 2 (Apr. 2008), pp. 165–188. This assessment is based on the results of keyword searches in various US academic databases over a period of several months during the preparation of this study.

[346] It should perhaps be noted that the US Office of Strategic Services (OSS), which was succeeded by the CIA, was originally called the Coordinator of Information (COI). Dulles (note 90), p. 42.

[347] Robert B. Murphy, 'Problems and Progress in Information Sharing', pp. 163–179, in *Improving the Law Enforcement-Intelligence Community Relationship: Can't We All Just Get Along?* (US National Defense Intelligence College: Washington, DC, June 2007).

[348] In a 1965 documentary film on Cold War espionage, former CIA head (and lawyer) Allen W. Dulles stated that 'intelligence is nothing really, other than information and knowledge'. *The Science of Spying* (1965), minute 3:26, <http://www.youtube.com/watch?v=Fi710fkvLwQ>, (accessed 20 May 2013). This interpretation is not universally accepted, including by academia. See also Dulles (note 90).

[349] Marrin (note 19), p. 24. Marrin cautions that the intelligence literature use of the terms inductive and deductive does not necessarily correspond to the philosophical or epistemological understanding of these terms. See Marrin (note 19), p. 24, ref. 21.

[350] E.g., *Report of the Joint Inquiry into the Terrorist Attacks of September 11, 2001—By the House Permanent Select Committee on Intelligence and the Senate Select Committee on Intelligence*, Senate report no. 107-351, declassified (US Congress: Washington, DC: Dec. 2002), pp. 33, 53. FBI analyst and interpreter Ali H. Soufan describes his frustration about information sharing on al-Qaeda activity between his agency and the CIA prior to the attacks on

nominally consolidated under the Office of the Director of National Intelligence (ODNI).[351] The United States also took steps to ensure better information sharing between the CIA and the Federal Bureau of Investigation (FBI). The CIA was granted some formal authority to operate domestically by, for example, participating in regional 'fusion centers' which have been established since 2001.

Former CIA and US National Intelligence Council (NIC) official Paul R. Pillar warns against Washington's 'rhetorical pendulum' between sharing information and ensuring its secrecy saying 'The next espionage case that is serious enough to become a scandal and in which the spy is found to have exploited access to multiple databases' will result in a renewed emphasis on ensuring secrecy at the expense of sharing.[352] This warning has since been borne out by the 2013 surveillance collection revelations of the former NSA contractor Edward J. Snowden which provided the basis for the awarding of the 2014 Pulitzer Prize for public service to the *Guardian US* and the *Washington Post*, respectively.[353]

The *Washington Post* has also reported on the expansion, secrecy and effectiveness of the current US intelligence establishment.[354] Dana Priest and William M. Arkin have concluded that 'fusion' intelligence work represents one of the most duplicated tasks in the United States with at least 31 located in the

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11 September 2001 in Ali H. Soufan, *The Black Banners: the Inside Story of 9/11 and the War Against al-Qaeda* (W. W. Norton & Company: New York City, 2011).

A focus of subsequent US law enforcement and intelligence miscommunication regarding the perpetrators of the 11 September 2001 attacks was on the interaction between FBI employees Harry Samit and Catherine Kiser. Samit, based at the FBI's Minneapolis field office, had received a tip expressing concern about Zacarias Moussaoui taking flying lessons on how to handle a Boeing 747, but was not interested in practicing take-offs and landings. Samit had interviewed him and become greatly concerned about his intentions and wished to a FISA authorization to search his laptop. To do so, he contacted Catherine Kiser for assistance who worked in the Bureau's counter-terrorism section. Despite their best efforts, they were unable to break through the organization's bureacratic inertia. For an account of this, see Tim Weiner, *Enemies: a History of the FBI* (Random House: New York City, 2012), pp. 413–417. For Weiner's account of Soufan, see pp. 423–427. An authoritative account of Amerithrax is Jeanne Guillemin, *American Anthrax: Fear, Crime, and the Investigation of the Nation's Deadliest Bioterror Attack* (Times Books (Henry Holt and Co.): New York City, 2011).

[351] ODNI and DoD are sometimes also counted as members of the intelligence community. The Executive Order only lists 16, namely: Air Force Intelligence, Army Intelligence, Central Intelligence Agency, Coast Guard Intelligence, Defense Intelligence Agency, Department of Energy intelligence unit, Department of Homeland Security intelligence unit, Bureau of Intelligence and Research (Department of State), Department of the Treasury intelligence unit, Drug Enforcement Administration, Federal Bureau of Investigation, Marine Corps Intelligence, National Geospatial-Intelligence Agency, National Reconnaisance Office, National Security Agency and Navy Intelligence. The mandate of the US intelligence community is based on Executive Order 12333 in 1981. It was modified by Executive Order 13355 in 2004 and again by Executive Order 13470 in 2008. See also Columbia University Libraries, 'The US intelligence community: information resources', <http://library.columbia.edu/subject-guides/social-sciences/intell.html>, (accessed 23 July 2013).

[352] Pillar (note 25), p. 299.

[353] The Pulitzer Prizes, 'The 2014 Pulitzer Prize Winners: Public Service', <http://www.pulitzer.org/citation/2014-Public-Service> (accessed 3 May 2014).

[354] The Washington Post, 'Top Secret America' <http://projects.washingtonpost.com/top-secret-america/>, (accessed 16 June 2013); and Dana Priest and William M. Arkin, *Top Secret America: the Rise of the New American Security State* (Little, Brown and Company: New York, 2011).

Washington, DC area.[355] While some merge intelligence and information to support military operations in the field, Arkin and Priest believe that most such centres are 'simply a kind of super-briefing machine for senior leaders, one that replaced the PowerPoint presentations of the 1990s with flat-screen interactive geo-located presentations'.[356] As with all bureacracies, the effectiveness and appropriateness of the activity are likely to be somewhere in between. The Department of Homeland Security (DHS) funds the fusion centers which are jointly staffed by members of local and regional law enforcement. An October 2012 US Senate report concluded that the centres have provided no useful intelligence and that they 'forwarded intelligence of uneven quality—oftentimes shoddy, rarely timely, sometimes endangering citizens' liberties and Privacy Act protections, occasionally taken from already published public sources, and more often than not unrelated to terrorism'.[357] The report also finds that up to $1.4 billion for the centers are unaccounted for and that four of the 72 fusion centers that DHS publicly states it possesses do not in fact exist.[358] DHS disputed the Senate committee's findings and one Senator argued that the report focused on intelligence sharing between fusion centers and other Washington agencies thereby ignoring the benefits of information sharing among law enforcement organizations.[359]

The DHS interaction with local and regional law enforcement, including through fusion centres, has resulted in extensive equipment (including surveillance) upgrades and a wider, more systematic use of integrated databases to automatically run license plate numbers to provide officers in the field with personal data on people they encounter.[360] This has been done partly to try to avoid the situation where police pulled over the leader of the 9/11 attacks, Mohamed Atta, for speeding when he had an outstanding arrest warrant for not paying a fine for using an expired driver's license.[361]

Arkin and Priest have also estimated that the United States probably currently has twice the number of intelligence analysts as it did prior to 11 September 2001, and 'too many of them can do little but move the same

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[355] Priest and Arkin (note 354), p. 92.

[356] Arkin and Priest state that most fusion centres possess 'the same rows or clusters of computer stations facing two or three wall-sized television screens and maps. More elaborate centers have a VIP balcony where senior policy makers, members of Congress, admirals, and generals can watch the inaction from above. The experience is not that different from sitting in a movie balcony watching six very slow-moving movies at once'. Priest and Arkin (note 354), pp. 92–93.

[357] *Federal Support for and Involvement in State and Local Fusion Centers* (note 88).

[358] *Federal Support for and Involvement in State and Local Fusion Centers* (note 88).

[359] Robert O'Harrow, 'Homeland Security's "Fusion Centers" Defended in Response to Sharply Critical Senate Report', *Washington Post*, 4 Oct. 2012, <http://www.washingtonpost.com/world/national-security/fusion-centers-defendedin-response-to-senate-report/2012/10/03/58841b38-0da2-11e2-a310-2363842b7057_story.html>, (accessed 17 Oct. 2012). See also Gudrun Persson, *Fusion Centres—Lessons Learned* (Center for Asymmetric Threat Studies (CATS), Swedish Defence Colllege: Stockholm, 2013), (in Swedish), <http://www.fhs.se/Documents/Externwebben/forskning/centrumbildningar/CATS/publikationer/Fusion%20Centres%20-%20Lessons%20Learned%20%28svenska%29.pdf>, (accessed 4 Nov. 2013).

[360] Priest and Arkin (note 354), pp. 138–143.

[361] Priest and Arkin (note 354), p. 142.

intelligence around; they lack the expertise and ability to go beyond what has already been packaged and presented. The analysts simply flood their commanders and policy makers with marginally informative and redundant conclusions'.[362] According to Richard H. Immerman, a former Assistant Deputy Director of National Intelligence for Analytic Integrity and Standards and Analytic Ombudsman for the Office of the Director of National Intelligence, 'It's the soccer ball syndrome. Something happens, and they want to rush to cover it'.[363] Arkin estimates that at least 1074 US federal government organizations and just under 2000 private companies are 'involved with programs related to counterterrorism, homeland security, and intelligence' operating at the Top Secret level classification at approximately 17000 locations in the United States.[364] There are currently approximately 800 known intelligence agencies worldwide.[365]

The past decade or so has witnessed a tendency for experienced US Government employees to leave for private companies only to be immediately hired back by the government at substantially higher salaries. Ronald Sanders, an ODNI personnel department official, has stated: 'We could not perform our mission without them. They serve as our reserves, providing flexibility and expertise we can't acquire'.[366] Consequences include: (*a*) about half of the staff of the DHS are private contractors, (*b*) the NSA has expanded the number of private contractors since 11 September 2011 to at least 480, (*c*) translation and interpretation work could not be carried out without private contractors, (*d*) over 400 private contractors provide the US intelligence community with critical computer and communication systems and support services.[367]

Arkin and Priest also state that the quality of intelligence analysis in the United States has been degraded by the fact that experienced, mid-career analysts have moved to the private sector.[368] Two-thirds of the CIA analysts have less than five years experience, while two-thirds of the FBI analyst positions did not exist prior to 11 September 2001.[369] They observe:

> *'in contrast to the cold war era, when there was one primary target and analysts were hired out of specialized Soviet studies programs and spoke fluent Russian, a typical analyst hired these days knows very little about the priority countries – Iraq, Iran, Afganistan, Pakistan and Yemen – when he or she first comes on board. Most are not fluent in the relevant*

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362 Priest and Arkin (note 354), pp. 83–84.

363 Priest and Arkin (note 354), p. 84.

364 Priest and Arkin (note 354), p. 86.

365 The Security Website, 'Global Intelligence Agencies', <http://www.thesecurity website.com/index.php/police-and-intelligence-information/global-intel/eu-intelligence/759-global-intelligence-agencies>, (accessed 8 Aug. 2012). The website appears to be operated by Western military contractor(s).

366 Priest and Arkin (note 354), pp. 182–183.

367 Priest and Arkin (note 354), p. 182. An important summary of US information collection priorities and practice (based on documents leaked by former NSA contractor Edward Snowden) is Scott Shane, 'No Morsel Too Miniscule for All-Consuming NSA', *New York Times*, 2 Nov. 2013, <http://www.nytimes.com/2013/11/03/world/no-morsel-too-minuscule-for-all-consuming-nsa.html>, (accessed 3 Nov. 2013).

368 Priest and Arkin (note 354), p. 83.

369 Priest and Arkin (note 354), p. 83.

> *languages, either. And while the CIA and other agencies have made an effort to recruit native speakers, the number needed far exceeds the number available, particularly in jobs requiring the highest security clearances'.*[370]

As previously mentioned, the type and quantity of information previously difficult to obtain and largely within the purview of classified intelligence work, are today more readily available thanks to declassification of historical documents, the development of large electronic databases and the increased information on the Internet.[371] In addition, some information previously considered sensitive is no longer viewed as such, partly because of the implementation of arms control and disarmament regimes which involve regular declarations and the carrying out of onsite inspections, including at military sites and sensitive civilian industrial facilities under 'managed [i.e., restricted by mutual agreement] access' treaty provisions.[372] Countervailing tendencies or efforts towards greater secrecy are nevertheless also evident and have given rise to the growing field of 'secrecy policy'.[373] Paul R. Pillar has argued that the recommendations of the 9/11 Commission were unnecessary, ineffective and counterproductive. This included the superimposition of a new coordinating body (the ODNI) above the intelligence community.[374] Pillar argues that the 9/11 Commission exemplifies the Washington political establishment mistaking change for 'reform'.[375]

Case study information appears lacking in much of the literature on structured analytical techniques (SATs) directed towards intelligence and law enforcement taskings. Where such information exists, it often focuses on individuals, institutions, and on conventional and nuclear capabilities. By comparison, the least amount of literature concerns CBW. Some information from the CW arms control verification literature can be integrated with that on the intelligence cycle or SATs. This integration does not appear to have been carried out—at least in the open literature—probably in part because the 'verification audience' includes government officials who negotiate or implement multilateral arms control and disarmament agreements. Many (or most) of such officials are not typically 'mainline' consumers of intelligence. They instead tend to have legal or international affairs-oriented perspectives and reading lists and, as foreign ministry officials, they focus on diplomacy (i.e., the sending and receiving of

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370 Priest and Arkin (note 354), p. 83.

371 E.g., George Washington University, 'The National Security Archive', <http://www.gwu.edu/~nsarchiv/>; US Department of Defense, 'Defence Technical Information Center', <http://www.dtic.mil/dtic/>; and Defence Research and Development Canada, <http://pubs.drdc-rddc.gc.ca/pubdocs/pcow1_e.html>, (accessed 9 June 2013).

372 E.g., John Hart, *On-site Inspections in Arms Control and Disarmament Verification*, Verification Matters no. 4, VERTIC research report (VERTIC: London, Oct. 2002).

373 E.g. see Federation of American Scientists (FAS), 'Project on Secrecy' <http://www.fas.org>, (accessed 9 June 2013); and 'Limiting Knowledge in a Democracy: a Social Research Conference at the New School', Feb. 2010, <http://www.socres.org/limitingknowledge/index.html> (accessed 2 Aug. 2013); and Steven Aftergood, 'Reducing Government Secrecy: Finding What Works', *Yale Law & Policy Review*, vol. 27 (2009), pp. 399–416.

374 Pillar (note 25), pp. 293–310.

375 Pillar (note 25), p. 305.

signals). Such officials are also aware of the political sensitivity connected to the use of information derived from NTM.

The manner in which NTM is used in a multilateral framework impinges on political and institutional sensitivities which must be handled with understanding and discretion so as not to undermine the viability of the regime, while achieving the necessary clarification or remedial action to bring a non-compliant state back into good standing with its treaty obligations.[376] Thus, suggestions of non-compliance may be difficult to address operationally within regimes where all the member states have equal obligations and responsibilities.[377] The amount and quality of NTM varies among states. In some regimes the role of NTM is an internal matter left to individual states to determine whether and how to bring it to the attention of the other regime participants.[378]

[376] For a definition and further consideration of NTM, see Annexe A.

[377] Mohamed Daoudi, John Hart, Ajey Lele and Ralf Trapp *The Future of the Chemical Weapons Convention: Policy and Planning Aspects*, SIPRI Policy Paper no. 35 (SIPRI: Stockholm, Apr. 2013), p. 13.

[378] During strategic nuclear arms negotiations in Vienna in 1970 General Nikolai V. Ogarkov asked General Royal Allison of the US delegation not to make a presentation (as it just had) in front of the entire Soviet delegation on Soviet ICBM deployments because the Soviet Ministry for Foreign Affairs (MFA) officials were not cleared to receive such information. Graham Jr. (note 284), p. 55. This also illustrates the principle that members of national delegations should speak only to their respective counterparts and at equivalent levels of seniority. Similar incidents occurred during Soviet-US negotiations on the 1989 Memorandum of Understanding (MOU) and the 1990 Bilateral Destruction Agreement (BDA) on chemical weapons. It should also be noted that the Soviet understanding of the above-mentioned request may hold a different view.

5

RESEARCH QUESTIONS AND FRAMING THE ISSUE

ACH tends to focus on procedure, process and technique, rather than on achieving a greater understanding of motivations and actions of actors (e.g., as is carried out under international relations (IR) regime theory) or the broader political implications. The application of ACH methodology, as developed by this study, is meant to elucidate operational analytical challenges and to inform at least four overarching strategic security questions:

1. What are the motivations for actors to pursue CW programmes and activities (e.g., the relevance of the relationship between capabilities and intentions)?
2. How does the present study fit into the theory and practice of strategic and defence studies?
3. How might an ACH on CW be integrated into current arms control and disarmament regimes where the derivation and use of information for CW verification purposes presents systemic political and technical challenges (both in terms of general process and for particular cases)?
4. What are the major elements of a strategic theoretical application of ACH with regard to CW assessment in the fields of arms control verification and intelligence analysis?

Policy is focused on framing ideas in a manner that promotes its own implementation, often with incomplete or uncertain information and understanding. Policy goals are ostensibly determined for reasons-of-state. The measures and means by which to achieve these goals are then defined and structured in a politically acceptable ('politically correct') manner. Academic research is more predicated on discovering models and structures that explain how policy was implemented and may assume the availability of sufficient (or even complete) information. Intelligence theory, by contrast, has traditionally entailed numerous and large gaps in understanding due to a generally greater lack of information about the target. Information gaps and deception are understood to be the norm in intelligence theory, despite the possible increased amounts of data that are now available to some states.

Policy ideally reflects 'reality' and should have heuristic power (i.e., to suggest actions to take). Some policy processes are internal to the state and need not involve engagement in the policy formation within other states, groups of states or international organizations (e.g., UN-type organizations). However, in international treaty negotiations and implementation, some of the policy formation is 'internalized' through consultation by one state with other states, groups of states, or secretariat staff of UN-type organizations.

Internal government guidance should, within defined or understood parameters, allow for policy implementation (e.g., guidelines, indicators,

parameters, talking points) without referring back to the capital for permission to carry out sub-activities (i.e., to avoid micro-management of operational detail). The authority held by delegations should be sufficiently flexible on negotiation points that are not of fundamental importance to the state. Policy analytical skills include the ability to produce very short papers, memos, and talking points, while academic research attempts to capture or to reflect the policy conditions and process 'drivers'. It is also useful to consider the extent to which 'experts' are correct in their assessments as compared to non-experts. Policymakers and decisionmakers may, in fact, be more knowledgeable than 'the experts'.[379]

Theories or analytical frameworks should strip the world to its essential features. They should assist with the conceptualization of complex processes encountered in the 'real world'. Their validity can be evaluated according to their ability to explain or predict such processes. Consideration of the three cases should result in better geographic scope of available research, as well as the further dissemination of relevant source material. Each case study is also important on its own terms.

Typical research designs in the intelligence field include: (*a*) evaluations, (*b*) case studies, (*c*) longitudinal studies (*d*) comparisons, (*e*) cross-sectional studies, (*f*) longitudinal comparisons, and (*g*) experiments or quasi-experimental studies.[380]

Evaluations are carried out to support possible intervention activity (e.g., to influence an election or to support a covert intervention). *Case studies* inform readers what is occurring. *Longitudinal studies* are designed to determine what changes have occurred over time. *Comparison studies* explore how and why A and B differ. *Cross sectional studies* explore how and why A and B differ at the present time. *Longitudinal comparisons* consider how and why A and B differ over time. Finally, *experiments* or *quasi-experimental studies* seek to elucidate the effect of A on B (i.e., the effect of an independent on a dependent variable).[381]

The principles, definitions and structures provided by Heuer (as well as Prunckun) are principally aimed at intelligence analyst trainees. Thus, they are meant to have a practical application whose structure and content are perhaps unfamiliar to many in academia.

A case study-based approach is appropriate partly because the present analysis is mainly qualitative. According to one heavily cited social science research methods scholar, the use of case studies has advantages over other strategies (i.e., archival analysis, experiment, history, and survey) when the manner and motivation for a given set of events of contemporary relevance is

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[379] Brian D. Nordmann of the US Department of State observes '…the image of the "green eyeshade" intelligence analyst spending years understanding the tiniest nuance of an arcane foreign behavior pattern has evolved into a (not necessarily) young techno-geek sitting in front of a bank of computer monitors, extracting data from a myriad of databases and attempting to make sense of the bytes in front of him. Today's analyst is weaned on the Internet, just as are many of today's intelligence consumers….in fact, the consumer may have many more years of expertise in the subject than the intelligence analyst'. Nordmann (note 83), p. 238.

[380] Hank Prunckun, *Handbook of Scientific Methods of Inquiry for Intelligence Analysis*, Scarecrow Professional Intelligence Education Series no. 11 (Scarecrow Press, Inc.: Lanham, 2010), p. 24.

[381] Prunckun (note 380), p. 24.

being investigated by a researcher who is in an observer position.[382] Case studies also readily allow for the incorporation of other methods (including quantitative) to produce customized, multi-method research approaches.[383]

In addition, Andrew Bennett and Colin Elman emphasize the importance of counterfactual thinking about conditions under which a researcher's predictions could be proved incorrect in order to prevent cognitive biases.[384] They note the importance of broadening and deepening the literature on cognitive biases and developing strategies to avoid them.[385] ACH was developed largely with a view towards the prevention of cognitive biases. Its application to the derivation and use of information for CW-related assessments presents a non-traditional example of a case study-based methodology in strategic and defence studies.

With regard to the formulation of intelligence studies research design, Prunckun identifies three main approaches: (*a*) quantitative research, (*b*) qualitative research and (*c*) mixed methods research.[386] Factors that would indicate the appropriateness of a quantitative approach include the existence of a large data set, the professional or academic interest and background of the analysts (e.g., mathematicians, or computer programmers), the existence of validated data collection instrumentation, a desire to predict future outcomes in a manner that minimizes or eliminates personal views, and the degree to which the consumers of the product are interested in or capable of understanding quantitative analysis (e.g., regression analysis).[387]

Prunckun observes that qualitative research can be either field (i.e., interactive) or documentary (i.e., non-interactive with its subject) and that such research is suitable for pilot studies or to develop a theory that can later be tested using quantitative data techniques.[388] In qualitative analyses, the analyst describes his or her impressions in terms of 'concepts', 'categories', and 'properties'.[389] Further characteristics of an intelligence analytical problem that lend themselves to a qualitative approach include cases where: (*a*) the target's behaviour, emotion or thoughts are of interest, (*b*) existing literature on the topic is limited and an overarching analysis is required and (*c*) an in-depth understanding of the issues that quantitative approaches cannot readily elucidate is required.[390]

The third, and final, approach to a general structuring of intelligence research are the so-called mixed methods (also known as 'methodological pluralism' or 'methodological eclecticism').

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[382] Robert K. Yin, *Case Study Research: Design and Methods*, 4th Edtn. (Sage Publications: London, 2009), pp. 8 & 11.

[383] Andrew Bennett and Colin Elman, 'Case Study Methods', p. 511 in Eds. Christian Reus-Smit and Duncan Snidal, *The Oxford Handbook of International Relations* (Oxford University Press: Oxford, 2008, 2010 paperback edtn.).

[384] Andrew Bennett and Colin Elman, 'Case Study Methods', p. 512 in Reus-Smit and Snidal (note 383).

[385] Andrew Bennett and Colin Elman, 'Case Study Methods', p. 512 in Reus-Smit and Snidal (note 383).

[386] Prunckun (note 380), p. 54.

[387] These factors are based on those provided by Hank Prunckun and are somewhat further developed and rephrased by the author. See Prunckun (note 380), p. 55.

[388] Prunckun (note 380), p. 55.

[389] Prunckun (note 380), p. 56.

[390] Based on Prunckun (note 380), p. 56.

Mixed methods for intelligence research design include: (*a*) experimental, (*b*) quasi-experimental, (*c*) case studies, (*d*) evaluations, (*e*) focus groups, (*f*) in-depth interviews, (*g*) ethnographies, (*h*) grounded theory, (*i*) time series studies, (*j*) pre- and post-design and (*k*) meta-analysis.[391]

In *experimental research designs*, one or more independent variables are manipulated in order to study a dependent variable. *Quasi-experimental designs* are those that cannot be said to be fully experimental, including interrupted and non-interrupted time series analysis. *Case studies* can be understood to be single issue problems that can be elucidated by examining the activity of a person, group, or incident. Case studies allow for more in-depth analysis than approaches that focus on a single dependent variable. Case studies can encompass mixed qualitative and quantitative techniques. *Evaluations* may be defined as 'the systematic assessment of an intelligence operation, a tactical service, or a strategic program'.[392] Such an approach seeks to determine whether the desired outcome of an operation or programme was achieved and recommends improvements. *Focus groups* entail open-ended questions and interactive discussions from a statistically significant group of people. The analyst then evaluates the discussion and statements for meaning. *In-depth interviews* involve a limited number of people and are more suited to ensuring discretion and confidentiality (e.g., during counter-intelligence investigations).[393] *Ethnographies* may be understood as research designed to better understand how people live and think based on social and national factors. *Grounded theory* approaches are those where the theory is developed from data directly, rather than from data that is developed in order to test already established theories. In other words, grounded theory is an inductive method of analysis which starts with specific detail from which generalizations are made.[394] *Time series studies* (also called 'repeated masures studies') involve taking two or more observations (or measures) of a variable at different times. The sequence of resulting observations can then be used as a basis for making predictions.[395] *Pre- and post-design* entails measuring change that results from some sort of intervention where A represents the baseline phase, and B represents the intervention phase. Variations of so-called A-B designs include: A-B-A, A-B-A-B, and B-A-B.[396] Finally, *meta-analysis* entails statistical research that analyzes previously conducted studies and are entirely quantitative.[397]

To reiterate, it is hoped that the evaluation of an older large, traditional state programme, a recent medium state programme and current non-state activities will allow for an ACH analytical framework to be tested against a sufficient range of programmes and activities. Questions regarding the applicability of data acquisition, and sampling and analysis for each of these case studies will probably arise. However, it is hoped that the differences illustrated in the applicability of these two aspects of ACH as applied to CW will also serve to

391 Prunckun (note 380), pp. 56–59.
392 Prunckun (note 380), p. 57.
393 Prunckun (note 380), p. 58.
394 Prunckun (note 380), p. 58.
395 Prunckun (note 380), p. 58.
396 Prunckun (note 380), p. 59.
397 Prunckun (note 380), p. 59.

inform through their differences. Each represents a set of political and technical challenges for their context (e.g., period, political situation).

Case studies also serve to improve understanding of how well a methodological conceptualization can function as a tool to clarify and, perhaps, to systemize seemingly disparate concepts, facts and hunches. It can also be argued that an historical component to any inquiry, including through the use of case studies, is appropriate in view of the original meaning of term history: the Greek word *historia* (*ἱστορία*) can be translated as 'a learning or knowing by inquiry'.[398] It is also hoped that case studies can facilitate the development of structured knowledge by investigation and that the past events reflected in this study will satisfy Benedetto Croce's dictum that 'all history is contemporary'.[399]

[398] Section H, 'History', p. 305, in *The Oxford English Dictionary*, vols. V, H-K (Oxford University Press: Oxford, 1933), reprinted 1978.

[399] For an e.g. of the contemporary relevance of historical case studies, see Robert Jervis, *Why Intelligence Fails: Lessons from the Iranian Revolution and the Iraq War* (Cornell University Press: Ithaca, New York, 2010).

6

STRUCTURING THE ANALYSIS

An objective of this study is to develop and to test a CW structured analysis of competing hypotheses. This section provides background to its conceptualization. The objective is to achieve an 'ordered knowledge based on systematic inquiry'.[400]

6.1. The Political Dimension

The first, most general level of the analysis is the nature of human perception and understanding within a political science context. To achieve this, the basic ontology ('nature of being')[401] and epistemology (view of the world) of the following approaches to political science can be briefly recalled: (*a*) behavioralism, (*b*) rational choice theory, (*c*) institutionalism and (*d*) constructivism (interpretive theory). There are numerous and growing gradations between and within these schools.[402] Human perception and understanding will be considered primarily in a political science context, rather than in a philosophical or purely epistemological framework. This is because the focus of analysis is policy-oriented and more relevant to defence and strategic studies. To do so is consistent with Robert Ayson's definition of strategic studies as 'the political origins, applications, and implications of organized violence in times of both war and peace'.[403]

The principal ontological views connected to SATs for arms control, law enforcement or intelligence purposes are whether objective truth exists and is discoverable *versus* the hermeneutic view that human perception is mediated by a first observer and second person recipient.[404] Thus, a first and second order

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[400] Gerry Stoker and David Marsh, 'Introduction', p. 11, in Eds. David Marsh and Gerry Stoker, *Theory and Methods of Political Science*, second edtn. (Palgrave Macmillan: Basingstoke, United Kingdom, 2002).

[401] The Austrian philosopher Karl Popper questioned whether ontology, as a philosophical theory of being, is a valid concept. He instead argued that the essence of its definition is rather a tautology (i.e., 'what is, is'). Popper observed: 'Many philosophers talk nowadays about ontology, or theory of being, and many philosophers attribute an ontology to Parmenides. I do not think that there is any such thing as ontology, or a theory of being, or that an ontology can be seriously attributed to Parmenides'. 'Essay 6, The World of Parmenides: Notes on Parmenides' Poem and Its Origin in Early Greek Cosmology', p. 130 in Eds. Arne F. Petersen and Jørgen Mejer, *Karl Popper, The World of Parmenides: Essays on the Presocratic Enlightenment* (Routledge: London, 2012).

[402] E.g., Keren Yarhi-Milo, 'In the Eye of the Beholder: How Leaders and Intelligence Communities Assess the Intentions of Adversaries', *International Security*, vol. 38, no. 1 (summer 2013), pp. 7–51.

[403] Robert Ayson, 'Strategic Studies', p. 559 in Reus-Smit and Snidal (note 383).

[404] The latter view has its origins in the allegory of the cave (or Plato's Cave), in which Plato has Socrates describing a thought experiment whereby people are chained inside a cave and are

mediation of observed events exists. The first view (that objective truth exists and is discoverable) emphasizes explanation, while the second view (regarding mediation of human perception) stresses an inherent subjective quality to understanding. Perceptions of truth and whether it is discoverable are implicit to the work of Heuer who approaches intelligence studies from a cognitive psychology perspective. Heuer's ACH takes into account the work of Karl Popper.[405] These factors also inform the work of Daniel Kahneman (the co-winner of the 2002 Nobel prize in economics) who has applied the psychology of judgment to international security threat perceptions and decision making, such as possible psychological reasons for why the views of hawks are organizationally favoured over those of doves in international peace and security policy formation and implementation.[406] Within an intelligence studies context, the hawks are favoured by the cost of failure and, perhaps, lack of time factors.[407]

An overview of human perception and understanding will now be considered within the contexts of the four identified schools of international relations (IR) theory. This is meant to help provide context to the strategic and defence analysis in the conclusions of the study.

6.1.1. Behaviouralism

Behaviouralism claims to be value-free and empirical. It attempts to derive general laws and principles through the generation of theoretical statements that can be tested through falsification. Normative political analysis is avoided.

6.1.2. Rational Choice Theory

Rational choice theory focuses on the generation of value-free, empirical laws and principles having predictive value. Normative political analysis is more commonly incorporated. It assumes that politics are mainly informed by actors making rational decisions, including decisions that are understandable in light of their personal interests which are a function of their position and role within institutions.

6.1.3. Institutionalism

This framework has institutions and institutional processes, rather than individuals, as the main driver of political decisions and processes. It attempts to

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only able to observe the outside world by looking at shadows cast on the cave wall. Those chained may thus mistakenly take the forms reflected on the wall to be 'reality'. The allegory is from Plato's theory of forms.

[405] E.g., *The Logic of Science* (1959). Heuer Jr. and Pherson (note 5), p. 160.

[406] Daniel Kahneman and Jonathan Renshon, 'Why Hawks Win', *Foreign Policy*, 27 Dec. 2006, <http://www.foreignpolicy.com/articles/2006/12/27/why_hawks_win?print=yes&hide comments=yes&page=full>, (accessed 17 Oct. 2012).

[407] Isaac Ben-Israel, 'Philosophy and the Meaning of Intelligence: the Logic of the Estimative Process', *Intelligence and National Security*, vol. 4, no. 4 (1989), pp. 670–671 & 691.

present empirically based, theoretically informed analyses. It attempts to link empirical analysis with normative theory.

6.1.4. Constructivism (Interpretive Theory)

Constructivism claims that knowledge is always provisional and contested. It views political processes as a contested narrative. Bayesian analysis is favoured by many in the intelligence studies field, particularly in the non-state actor context and can be viewed as possessing similarities to constructivism.[408]

Reference to these four approaches should assist to elucidate, in a structured manner, difficulties associated with human perception and understanding. For example, to positivists, an objective truth exists and is, in principle, knowable, including through quantitative methods and through the testing of hypotheses. The question of CW development or use becomes a binary yes or no determination. It is possible to conclude that a positive objective truth can be stated with certainty if large numbers of people display sulphur mustard burns, and nearby spent munitions exhibit traces of sulphur mustard or known degradation products. The sampling and analysis of chemical warfare agents and the determination of their degradation products are objectively 'knowable' truths (i.e., 'facts') that can, in principle, be determined to a degree sufficient to secure criminal convictions. If properly done, the sampling and analysis should not be vulnerable to politicization (i.e., multiple interpretation—deliberate or otherwise) by governments or other actors. In practice, this can be problematic because the presence or absence of a degradation product or its meaning cannot always be established with certainty. Thus a 'first order' truth may be unambiguous, while a 'second order' truth is not. Humans may be able to comprehend the second order truth, but not necessarily comprehend the first order truth.

Constructivism (interpretative theory), by contrast, essentially claims that knowledge is always provisional and contested.[409] This view is more in accordance with the statement attributed to an unnamed US intelligence analyst who said, after the attacks of 11 September 2001 in the United States, 'We are all Bayesians now'.[410]

Gregory F. Treverton, the Director of the RAND Corporation's Center for Global Risk and Security, defines contemporary Bayesian intelligence analysis as 'both an inclination and a process to update subjective probabilities in light of new evidence'.[411] Intelligence analysis—and, by extension, 'all-source analysis'—is characterized less by relatively 'bounded'[412] puzzle solving (as

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[408] See Gregory F. Treverton, *Intelligence for an Age of Terror* (Cambridge University Press: Cambridge, NY, 2009).

[409] Gerry Stoker and David Marsh, 'Introduction', p. 7, in Marsh and Stoker (note 400).

[410] Treverton (note 408), p. 39.

[411] Treverton (note 408), p. 39. Thomas Bayes was an English mathematician and Presbyterian minister.

[412] Herbert Simon used the term bounded to mean limited rationality which were caused by the limitations of the human mind to deal with the complexity of the surrounding environment. Simon's work helped to inform psychological research on attention span, memory, perception and the reasoning capacity associated with the 'mental machinery' of humans. See Herbert Simon, *Models of Man: Social and National* (John Wiley: New York City, 1957). Cited by Richards J. Heuer, 'Strategic Deception and Counterdeception: a Cognitive Process Approach', *International Studies Quarterly*, vol. 25, no. 2 (June 1981), p. 295.

during the Cold War), and more by 'unbounded' 'sensemaking' of complex processes obtained through wider and diffuse means with large amounts of background 'clutter' that interferes with analysts' attempts to understand possible threats. Thus in 2009 the JASON Defense Advisory Group concluded that 'no credible approach' had been documented to 'anticipate the existence and characterization' of terrorism involving weapons of mass destruction (WMD-T) and that there continues to exist a 'significant deficiency in applying standard approaches from engineering and science' towards predicting such events resulting from false alarm rates and signal detection that are obscured by 'massive clutter'.[413] Operational requirements of sensemaking also have the effect of blurring the distinction between intelligence and policy.[414]

This study attempts to clarify the 'real' or 'objective' relations between social phenomena and the manner in which ambiguity can be determined, iteratively reduced or eliminated by referring to the ontology ('nature of being') and epistemology (view of the world) of these four IR schools within an arms control verification and intelligence studies context.

6.2. Intelligence Management Cycle

Another level of analysis (and conceptualization) is the intelligence cycle: the traditional theoretical model of the discipline which arose in the post-World War II US context.[415]

The field of intelligence studies can also be divided according to: (*a*) functional, (*b*) historical/biographical, (*c*) structural and institional and (*d*) political.[416] The *functional school* essentially focuses on problems of human awareness and mechanisms to define and elucidate analytical methods. This includes the Heuer Model (a form of ACH) developed by the UK Defence Intelligence Staff that consists of a structured approach that allows analysts to compare competing hypotheses and to elucidate their underlying assumptions. Fuzzy logic and Bayesian iterative approaches are also components (with strong qualitative elements) to the functional (or analytic) approach. Correct answers may be obtained for the wrong analytical and organizational reasons. Analysts should ideally understand how to verify this. In cases where they are unable to do so, they should be aware of this. Alternatively the 'correctness' of an evaluation or understanding of a 'fact' may never been fully ascertained or demonstrated. Much of this discussion follows from the post-World War II work of the Yale historian and US intelligence analyst Sherman Kent. The *historical/biographical model* consists of historical case studies. The *structural and institional approach* considers the effects of structure and institutions on the preparation of assessments, including the merits of regional *versus* functionally structured

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413 JASON Defense Advisory Group, *Rare Events*, unclassified (MITRE Corporation: McLean, VA, Oct. 2009), p. 8.

414 David T. Moore, *Sensemaking: a Structure for an Intelligence Revolution* (National Defense Intelligence College: Washington, DC, Mar. 2011), p. x.

415 Clark (note 29), pp. 12–13.

416 Michael S. Goodman and David Omand, 'Teaching intelligence analysts in the UK', <https://www.cia.gov/library/center-for-the-study-of-intelligence/csi-publications/csi-studies/studies/vol-52-no-4/teaching-intelligence-analysts-in-the-uk.html>, (accessed 25 Jan. 2010).

analyses, as well as the various overlapping institutional agendas and expectations. Finally, the *political approach* considers intelligence production in terms of producer-consumer relationships. For example, the 'customers' for analyses of non-state actor threats are much broader and include customs officials and police. In this context, a CW threat assessment process is not only 'top down', but is, ideally, also 'bottom up' (i.e., it is a two-way process).

Intelligence studies have often focused on historical events. James M. Nyce argues that the scholarly literature on intelligence studies 'has long been dominated by historians and political scientists'.[417] This is partly because more recent activity tends to remain classified in order to protect sources and methods. The literature on the intelligence management cycle is also rather general because the details of specific cases are deemed sensitive.

In 1964 Knorr offered two reasons to explain the limited amount of published literature on intelligence production: inaccessibility of intelligence operations to academic scholars (due to their being classified) and the recent development of such production as a distinct discipline involving more scholarly research and the use of open sources (as opposed to clandestine field work and the production of analyses based largely on clandestine operations-derived information).[418] Knorr argues that largescale intelligence production using open sources began during World War II.[419] He also credits William ('Wild Bill') J. Donovan for introducing social science academic techniques to the production of intelligence by the Office of Strategic Services (OSS).[420]

Stephen Marrin argues that the academic literature on intelligence should ideally provide the practitioner with 'criteria and metrics' for evaluating: (*a*) 'analytic quality' (*b*) 'best practices in terms of employing analytic methods to support inferences and judgements' (*c*) 'guidance for how to develop core competencies necessary for the production of quality intelligence analysis', and (*d*) providing 'an understanding of the significance of organizational structures and processes in the development and aggregation of different kinds of analytic expertise in a team or unit context'.[421]

Table 6.1 Levels of analysis for understanding information acquisition and relevance

Level 1 Human understanding and political theory
Level 2 Intelligence/Information Management Cycle
Level 3 Analysis of Competing Hypotheses (ACH)
Objective: Conceptualization of derivation and use of information for a CW-oriented Structured Analysis of Competing Hypotheses.

Source: Author compilation.

[417] Nyce (note 3).
[418] Knorr (note 6), pp. 5–6.
[419] Knorr (note 6), p. 5.
[420] Knorr (note 6), p. 6.

6.2.1. Background on Intelligence and Information Management Cycles

Much literature has been produced on the intelligence cycle, especially since World War II.[422] Traditionally, this cycle is a loop starting and ending with the consumer who makes the original request for analysis or data.[423] Much of the literature on the intelligence cycle is unsatisfactory because it consists of long lists of procedures and principles. As such, they provide little insight into specific weapon systems and the significance of actual cases. Much of the literature is also written from a great power perspective.

The 'powerpoint culture' of some government agencies and analysts has also promoted a proliferation of cluttered 'visual aids' which consist of long lists of agencies, lines-of-responsibility and overlapping bubbles and pie charts.[424] Demand for visual aids is often driven by the needs of government bureaucracy, including for organization management and oversight purposes. Visual aids might also support or reflect an organizational requirement for obtaining funding or the implementation of key performance indicator (KPI) (or equivalent) principles. The broader process and requirements of government ought not to be diverted by operationally irrelevant theoretical or historical digressions. The academic literature, some of which is driven by a desire to develop and test IR theory, can also contain many diagrams, tables and charts. An increased reliance on multimodal data sets that incorporate non-textual-based information is also driving this trend towards more (including unusual) visualization techniques in order to promote better understanding.

The founders—all US nationals—of 'the scholarly literature on the methods and processes of intelligence analysis' include Richards J. Heuer, Roger Hilsman, Willmoore Kendall, Sherman Kent, Klaus Knorr, George Pettee, and Washington Platt.[425] Sherman Kent is widely widely cited as 'the father of intelligence analysis' and the Center for Intelligence Analysis at the CIA University is named for him.[426] During World War II, he worked in the Research and Analysis Branch of the OSS. From 1950-67 he was the chairman of the former US Board of National Estimates, the body that originally produced National Intelligence Estimates (NIEs).[427] He also wrote *Strategic Intelligence for American World Policy* (1949). Washington Platt was a lesser-known pioneer in the identification and development of intelligence analysis methods. He elucidated elements of the intelligence management cycle. An instructor of

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421 Marrin (note 19), p. 3.

422 E.g. Washington Platt, *Strategic Intelligence Production: Basic Principles* (Frederick A. Praeger, Publishers: New York, 1957); and Sherman Kent, *Strategic Intelligence for American World Policy* (Princeton University Press: Princeton, New Jersey, 1949).

423 The loop starts with a request for information, the requirements of the request are formalized and issued, the necessary information is collected, followed by analysis and assessment. The results are finalized and disseminated to the user or information requester. Omand (note 13), p. 118.

424 Elisabeth Bumiller, 'We Have Met the Enemy and He is Powerpoint', *New York Times*, 26 Apr. 2010, <http://www.nytimes.com/2010/04/27/world/27powerpoint.html>, (accessed 29 July 2013).

425 Marrin (note 19), p. 3. Marrin does not mention Platt.

426 Kent (note 422).

427 Richards J. Heuer, Jr., *Psychology of Intelligence Analysis* (Center for the Study of Intelligence, Central Intelligence Agency, 1999), p. xiv.

mechanical engineering at Cornell University, a former Brigadier General in the US Air Force and a consultant to the US Government,[428] Platt approached the information cycle under the heading of 'strategic intelligence production' (see Table 6.2).

Table 6.2 Structure of intelligence management and principles according to Platt.

Strategic Intelligence Management
General principles
Intellectual process
Social sciences
Intelligence tools
Questions intelligence officers must ask
Desirability to develop a system of academic study of intelligence
Peculiarities and difficulties associated with pursuing a career in intelligence
Intelligence principles
Purpose
Definition
Exploitation of sources
Significance
Cause and effect
'Spirit of the people'
Trends
Degree of certainty
Conclusions
Act of creative thinking
General survey, Definitions and Collection of Data ('Accumulation stage 1')
Interpretation of data, Form hypotheses and Draw Conclusions ('Illumination, stage 2')
Present conclusions, verify and present

Source: Washington Platt, *Strategic Intelligence Production: Basic Principles* (Frederick A. Praeger, Publishers: New York, 1957), pp. 41-45, 103, 273-274.

S&T also place particular demands on intelligence analysis. Reginald Victor Jones, a British physicist by training and the author of *Most Secret War: British Scientific Intelligence 1939-1945* (1978), has been called 'the founder of modern scientific intelligence'.[429] He observed that one of the British failures in scientific intelligence during World War II was its inability to uncover (i.e., to become institutionally aware of) Germany's organophosphorus nerve agent programme. Jones attributed this to the fact that intelligence in this area 'had been left in the hands of our experts at Porton [Down], who had dismissed reports that the Germans' possessed such agents 'probably because the materials in question were new ones whose behaviour was unknown at Porton'. He concluded that 'while expert advice is often very good, it must be assessed in parallel with information coming through other channels of intelligence'. Where the information from all channels is contradictory, the scientific expert advice 'should be investigated as deeply as would be information coming through any other channel'. In other words, scientific or technical experts should be

[428] Platt (note 422), p. 267.
[429] Omand (note 13), p. 46.

challenged, including by those outside their fields.[430] Otherwise, one risks negative side effects of 'expertism' and sub-optimal analytical conclusions.

6.2.2. The Intelligence Cycle Today: Towards a Conception of Information Acquisition and Management for CW Assessment Purposes

Intelligence and information are sometimes used interchangeably, although the former implies that data have been collected or modified with a particular purpose in mind.[431] Klaus Knorr defined 'intelligence' as 'an operation for procuring and prossessing information about the external environment in which an organization….wants to maximize the net achievement of its various goals'.[432] 'Open-source intelligence' is a related term which has been defined as 'unclassified information that has been deliberately discovered, discriminated, distilled and disseminated to a select audience in order to address a specific question'.[433] Robert M. Clark states 'Intelligence is about reducing uncertainty in conflict'.[434] Hank Pruncken defines four meanings of intelligence: (*a*) actions or processes used to produce knowledge, (*b*) the body of knowledge thereby produced, (*c*) organizations that deal in knowledge (e.g., an intelligence agency), and (*d*) the reports and briefings produced in the process or by such organizations.[435] Information may therefore be said to consist of data points, while intelligence has predictive value.

The word intelligence is misused in some quarters—often for institutional reasons in order to emphasize the importance attached to the work.[436] In view of the fact that much information that was once considered sensitive is more widely and readily available, the term 'information' may be more appropriate in certain situations (e.g., best practices for chemical safety and security modeling some of which may reveal facility-sensitive information from both a physical protection or national security perspective). In addition, the incipient 'age of big data' may

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[430] Reginald V. Jones, 'Some Lessons in Intelligence: Enduring Principles', Remarks at symposium at CIA Headquarters, 26 Oct. 1993, <https://www.cia.gov/library/center-for-the-study-of-intelligence/csi-publications/csi-studies/studies/95unclass/Jones.html> (accessed 24 July 2013).

[431] As previously noted, in a 1965 documentary film on espionage, former CIA head Allen Dulles stated that 'intelligence is nothing really, other than information and knowledge'. *The Science of Spying* (1965), minute 3:26, <http://www.youtube.com/watch?v=Fi710fkvLwQ> (accessed 20 May 2013).

[432] Knorr (note 6), p. 1.

[433] Robert David Steele, 'Open Source Intelligence', p. 129 in Ed. Loch K. Johnson, *Handbook of Intelligence Studies* (Routledge: Abingdon, 2007). Steele is the CEO of OSS.Net.Inc, a US defence contractor. Previously, he worked for the CIA and the Marine Corps Intelligence Command.

[434] Clark (note 29), p. 8.

[435] Prunckun (note 380), p. 3.

[436] The US Senate has questioned whether DHS fusion centres' information products deserve to be called 'intelligence'. In 2012 a Senate sub-committee found that DHS involvement with state and local fusion centres had 'not produced useful intelligence to support federal counterterrorism efforts' and that DHS-assigned personnel to such centres 'forwarded "intelligence" of uneven quality – oftentimes shoddy, rarely timely, sometimes endangering citizens' civil liberties and Privacy Act protections, occasionally taken from already-published public sources, and more often than not unrelated to terrorism'. *Federal Support for and Involvement in State and Local Fusion Centers* (note 88), p. 1.

result in a situation where 'accuracy and precision' will become increasingly viewed as 'an artifact of an information-constrained environment'.[437] The importance people attach to accuracy and the validation of information may therefore tend to become subordinate to the requirements of manipulating large data (not necessarily validated) sets and the limitation of humans to absorb it.

Language is a potential complicating factor. For example, the Chinese 'quingbao' can be interpreted as either 'information' or 'intelligence', and 'ziliao' can be understood as 'data', 'information' or 'material'. The best translation depends on context.[438] Zhongwen and Zongxiao distinguish 'information' and 'intelligence'. They emphasized the importance of doing so both conceptually and in terms of practical experience. They argue in favour of a 'catalyzing and activating process in order to extract intelligence from information'.[439]

Academics have typically viewed open source information as an input in the intelligence cycle.[440] Open source information, sometimes called 'overt intelligence',[441] may also perform an instrumental role in a national intelligence community (and perhaps within international intelligence sharing frameworks) in that such information may be described and utilized in order to promote organizational interests.[442] Hamilton Bean, who has worked in the US intelligence establishment as an analyst, has examined open source information in terms of new institutionalim (neoinstitutionalism) social theory which attempts to develop a sociological view of how organizations and institutions interact with each other and affect society.[443]

As previously noted, some have argued that after the 11 September 2001 attacks in the United States intelligence agencies must change their *modus operandi* from 'the need to know' to 'the need to share' and that institutional and legal barriers between law enforcement and intelligence must be broken down.[444] However, for the United States the need to share policy has also resulted in a

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[437] Cukier and Mayer-Schoenberger (note 78), p. 31.

[438] 'Editor's comment' on translation of *Sources and Techniques of Obtaining National Defense Science and Technology Intelligence*, by Huo Zhongwen and Wang Zongxiao (Kexue Jishu Wenxuan Publishing Co.: Beijing, 1991), <http://www.fas.org/irp/world/china/docs/sources.html>, (accessed 14 May 2013).

[439] Huo Zhongwen and Wang Zongxiao, *Sources and Techniques of Obtaining National Defense Science and Technology Intelligence*, chapter 1 (note 438).

[440] Hamilton Bean, *No More Secrets: Open Source Information and the Reshaping of US Intelligence* (Praeger: Oxford, 2011), p. 49.

[441] Dulles (note 90), p. 56.

[442] For a theoretical treatment of multilateral intelligence sharing, see Björn Fägersten, *Sharing Secrets: Explaining International Intelligence Cooperation* (Lund University: Lund, 2010), doctoral thesis.

[443] Bean (note 440).

[444] The 9/11 Commission recommended the establishment of a National Counterterrorism Center (NCTC) to help break down such barriers. The Commission also reviewed information sharing barriers bertween law enforcement and intelligence. *The 9/11 Commission Report* (Washington, DC, 21 Aug. 2004), pp. 269–275 & 403–405. The releases of information by Wikileaks, particularly documents released in 2010, prompted the US Government to reassess its information oversight and handling procedures.

plethora of pseudo-classification markings and prompted wider discussion on the nature and proper role of secrecy in democratic societies.[445]

One also encounters a rather counter-intuitive situation in which local police departments in the United States produce 'intelligence'.[446] Their output generally appears to consist of listings of generic threats, groups 'of concern' and updates on ongoing criminal investigations (e.g., bulletins and current threats and briefing papers on traditional organized criminal activity).[447]

Possible countervailing tendencies regarding the future availability of information and its type also exist. A *de facto* chilling effect may exist in some states when their inhabitants leave various digital signatures on the Internet.[448] Governments might therefore more easily preempt or shut down an individual's activity (political or otherwise). The Internet structure in China, Iran and Saudi Arabia, for example, allows for restricting or shutting down politically sensitive discourse (via software and hardware product development).[449] Australian internet governance policies have also been criticized for promoting undemocratic tendencies in that country.[450] The Internet may, therefore, not be the instrument for anonymous sharing of information, but rather the footprint that remains in an individual's 'permanent record' which can be accessed, in principle, at any time.[451] Further related issues are the longterm stability and integrity of electronic data held in storage, the surreptitious tapping opportunity for the various states is not equal, and there are huge power consumption

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[445] *Emerging Threats: Overclassification and Pseudo-Classification*, Hearing Before the Subcommittee on National Security, Emerging Threats, and International Relations of the Committee on Government Reform, House of Representatives, 109th Congress, serial no. 109-18 (US Government Printing Office: Washington, DC, 2 Mar. 2005). As of 2011 the US Administration was carrying out a review of classification information (*The Fundamental Classification Guidance Review*). This review requires US Government agencies to review their classification procedures in order to identify and eliminate classification requirements deemed to be obsolete. The deadline for the completion the reviews is 29 June 2012. Executive Order 13526, enacted 29 Dec. 2009, was the prior operative instruction on how classified information in the US should be handled.

On 7 October 2011 Obama issued an Executive Order to improve security of digital information. See Office of the Press Secretary (White House), 'Executive Order, Structural Reforms to Improve the Security of Classified Networks and the Responsible Sharing and Safeguarding of Classified Information', Press Release, 7 Oct. 2011. The order was promulgated partly in order to prevent future occurences of a wiki leak-type incident.

[446] *Federal Support for and Involvement in State and Local Fusion Centers* (note 88).

[447] Priest and Arkin (note 354), pp. 80–82.

[448] For an interview with Fang Binxing (sometimes called 'the father of the Great Firewall of China'), see Fang Yunyu, 'China's Great Firewall Father Speaks Out', *Global Times*, 18 Feb. 2011.

[449] Kathrin Hille, 'Screw Slowly Tightens on Technology Companies', *Financial Times*, 22 Feb. 2010, p. 2.

[450] Daniel Nazer, 'Australia Moves to Massively Expand Internet Surveillance', Center for Internet and Society (Stanford Law School), 28 Aug. 2012, <http://cyberlaw.stanford.edu/blog/2012/08/australia-moves-massively-expand-internet-surveillance>, (accessed 9 May 2013); and *Equipping Australia Against Emerging and Evolving Threats* (Australia, Attorney-General's Department: July 2012).

[451] A number of people have observed that the Internet is the greatest surveillance tool in history. E.g., Bruce Schneier, 'The Internet is a Surveillance State', 16 Mar. 2013, *CNN*, <http://edition.cnn.com/2013/03/16/opinion/schneier-internet-surveillance/index.html>, (accessed 18 Mar. 2013).

requirements necessary to support a 'total data' capture and storage strategy.[452] According to one estimate the NSA collects approximately 1.7 billion 'pieces of intercepted communications' every 24 hours (e.g., emails, telephone calls, radio signals cell phone conversations, web postings, IP addresses).[453]

James Bamford, the author of ground breaking works on the National Security Agency (NSA), has noted that as the agency moves toward achieving exaflop-level computing it risks becoming a sort of Jorge Luis Borge's Library of Babel: 'a place where the collection of information is both infinite and at the same time monstrous, where the entire world's knowledge is stored, but not a single word understood'.[454] According to Borges, this 'labyrinth of letters' contain 'leagues of senseless cacophonies, verbal jumbles and incoherence'.[455] In 2012 Russian Television interviewed William Binney, a mathematician who quit the NSA in 2001, in which he stated that the US policy is to capture and store all internet traffick inside the country, including retaining copies of emails.[456] Starting in June 2013 *The Guardian* confirmed, on the basis of information provided by the former US defence contractor Edward J. Snowden, the existence of a long list of Internet surveillance programmes.[457]

The institutional affiliation, background and interests of analysts also affect their work, including with respect to emphasis and the selection of data.[458] In presenting his review of US intelligence on the Iranian Revolution and Iraq's chemical, biological, radiological and nuclear (CBRN) weapons and ballistic missile programmes, Robert Jervis concludes: 'A final and related surprise was the importance of norms, informal organizational dynamics, and incentive structure that characterized the production of intelligence'.[459] This observation was apparently prompted by the fact that a CIA official who read one of Jervis' reports stated 'Jervis is an expert on misperception, so it is no wonder that he found it'.[460] Jervis admitted that, while there was some truth to this remark, the observation in itself 'illustrates the propensity for people to see' what they expect.[461] Jervis effectively shifts the burden of responsibility for the characterization of perception back onto the anonymous CIA official. Who is deemed 'responsible' for a given perception regarding the derivation and use of

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[452] The electric power supply, a limiting factor to intelligence collection and storage, is sometimes called the 'coin of the realm' (e.g., by James Bamford).

[453] Priest and Arkin (note 354), p. 77.

[454] James Bamford, *The Shadow Factory: the Ultra-Secret NSA from 9/11 to the Eavesdropping on America* (Doubleday: New York City, 2008), p. 340.

[455] Bamford (note 454), p. 340.

[456] '"Everyone in US Under Virtual Surveillance"'—NSA Whistleblower', 4 Dec. 2012, <http://rt.com/usa/surveillance-spying-e-mail-citizens-178/>, (accessed 9 May 2013). Russian Television interview of William Binney.

[457] E.g., Glenn Greenwald and Ewen MacAskill, 'NSA Prism Program Taps in to User Data of Apple, Google and Others', *Guardian*, 7 June 2013, <http://www.guardian.co.uk/world/2013/jun/06/us-tech-giants-nsa-data>, (accessed 9 June 2013); and Glenn Greenwald, 'XKeyscore: NSA Tool Collects "Nearly Everything a User Does on the Internet"', *Guardian*, 31 July 2013, <http://www.theguardian.com/world/2013/jul/31/nsa-top-secret-program-online-data>,(accessed 4 Aug. 2013).

[458] Yarhi-Milo (note 402)

[459] Jervis (note 399), p. 23.

[460] Jervis (note 399), p. 23.

[461] Jervis (note 399), p. 23.

information for a weapon system analysis (and in what manner) is therefore a theme which should be considered further within the context of ACH case studies.

Further analytical risks deserve consideration. One is the balance between analysis and detail. Sufficient detail should be provided in order to allow the consumer to understand the difficulties associated with assessing suspected CW programmes. The interested reader should be able to arrive at a 'reasoned and balanced' opinion that may differ from those of other analysts through the use of the information and methodology provided. Readers should ideally achieve a better understanding of why they believe any given point to be true, as well as to better appreciate the context of any statements (past and future) that allege that an actor has attempted to acquire, develop or use CW.[462]

Another relevant dichotomy is between current (i.e., short term or realtime) intelligence requirements and longer-term intelligence research requirements. The former tends to favour a 'multi-tasking' generalist, while the latter favour specialists with deep expertise and understanding. Institutionally the latter approach may not be tenable. Even in the early 1960s, a longtime US intelligence official told Klaus Knorr:

'You rightly emphasize the fact that the intelligence professionals need to have more time for study and reflection. This is a great weakness of modern government everywhere. If a man is found at his desk reading a book, he is assumed to be a loafer. Actually, he may be most profitably employed. I sometimes think it would be an admirable thing if some of the top [US intelligence community] members could devote the first two hours of the day to reading and study without particular reference to any current problem'.[463]

Analyses should also be sensitive to both qualitative and quantitative approaches (or some combination of the two). Decisions and policies may also be viewed in terms of which actor is the principal motivator (or 'driver') of a process. Such actors may be individuals, institutions or largely undirected (or autonomous) geo-political processes.

6.3. Types of Intelligence Activity

The manner in which intelligence production techniques and principles can be understood in terms of an information management cycle should also be reviewed. The methodology and principles that are elaborated should be evaluated in terms of CW assessments in general and the three case studies in particular. Key questions must be posed and then the methodology tested against the case studies.

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[462] As mentioned in the Summary, it worth recalling Gordon S. Wood's apt description of the ability of the eminent US jurist John Marshall (1755–1835) to balance detail and their broader implications: 'Marshall could grasp a subject in its whole and yet simultaneously analyze its parts and relate them to the whole. He could move progressively and efficiently from premise to conclusion in a logical and rigorous manner and extract the essence of the law from the mass of particulars'. Gordon S. Wood, *Empire of Liberty: a History of the Early Republic*, 1789–1815 (Oxford University Press: Oxford, 2009), p. 434.

[463] Knorr (note 6), p. 54.

The intelligence cycle management has been defined as consisting of: (*a*) intelligence collection management, (*b*) intelligence analysis management and (*c*) intelligence dissemination (see Table 6.3).

Robert M. Clark observes that the INT names in the US intelligence community traditionally reflect 'bureaucratic initiatives, not proper INT descriptions'.[464] For example, the US National Imagery and Mapping Agency was once responsible for IMINT. After it was renamed the National Geospatial-Intelligence Agency, its responsibility was recast as GEOINT.[465]

Table 6.3 Intelligence Cycle Management

Intelligence collection management
Acoustic intelligence (ACINT)
Communications intelligence (COMINT)
Electronic intelligence (ELINT)
Geographical intelligence (GEOINT)
Human intelligence (HUMINT)
Imagery intelligence (IMINT)
Location intelligence (LOCINT)
Measurement and Signature Intelligence (MASINT)
Open source intelligence (OSINT)
Protected information (PROTINT)
Signals intelligence (SIGINT)
Intelligence analysis management
Intelligence analysis
Cognitive traps
Words of estimative probability
Analysis of competing hypotheses
Intelligence cycle (target-centric approach)
Intelligence dissemination
Intelligence cycle security
Counter-intelligence
Counter-intelligence and counter-terrorism organizations
Counter-intelligence failures

Source: Author compilation.

The traditional intelligence cycle consists of a loop with the following elements: 1. Direction setting (i.e., problem formulation and planning), 2. Information collection, 3. Data collection, 4. Data manipulation and processing and 4. Data analysis. The intelligence is then written up as reports and transmitted to the customer (e.g., policymakers) who may then provide feedback.[466] It is the traditional domestic intelligence cycle model.

The intelligence cycle concept is less favoured and David Omand, a former director of the Government Communications Headquarters (GCHQ)—responsible for the UK's signals intelligence and related information assurance support—and currently a visiting professor at King's College, states that it has today largely been replaced with a variation of the '"National security" all-risks

[464] Clark (note 29), p. 88.
[465] Clark (note 29), p. 89.
[466] Prunckun (note 380), pp. 4–5.

intelligence cycle'. This conceptualization has user interaction at the centre surrounded by five interlinked activities: (*a*) action-on, (*b*) direct requirements, (*c*) access, (*d*) elucidate and (*e*) disseminate.[467] This conceptualization reflects the fact that intelligence activity in the non-state actor context has become internationalised to a great extent. A blurring of distinction between strategic and tactical intelligence requirements in the non-state actor threat context has also occurred. Finally, the creation and development of 'situational awareness' is increasingly less a function of uncovering 'secret intelligence', as it is a matter of appreciating the difficulties associated with the identification and accessing of relevant information (e.g., in libraries or on the Internet). The item of information itself may not, in fact, be secret or sensitive. Rather the task is to achieve 'sense-making' of large quantities of data that otherwise tend to lose meaning due to the quantity of information.

Karl E. Weick appears to have originated the term sense making.[468] James M. Nyce states that the term has not been properly defined, and has been used inconsistently in a manner that is often too far removed from the meaning attached to it by Weick. Nyce also argues that Weick's application of the term is insufficiently developed.[469]

The taxonomy of intelligence research can be defined as (*a*) tactical intelligence, (*b*) strategic intelligence and (*c*) operational intelligence.[470] The taxonomy of the present study is strategic intelligence which, in turn, is characterized by: (*a*) being a 'higher form' of intelligence, (*b*) provides a comprehensive view of the target or activity, (*c*) comments on future possibilities or identifies potential issues, (*d*) provides advice on threats, risks and vulnerabilities, (*e*) provides options for planning and policy development, (*f*) assists in the allocation of resources and (*g*) requires extensive knowledge of the target or the area of activity.[471]

Finally, analysts have devoted increased attention to how intelligence management cycle can be extended to better cover non-state actor threats. Treverton has summarized important areas where this distinction exists (see Table 6.4).

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[467] Omand (note 13), p. 119.

[468] Karl E. Weick, 'The Collapse of Sensemaking in Organizations: the Mann Gulch Disaster', *Administrative Science Quarterly*, vol. 38, no. 4 (1993), pp. 628–652. The author was made aware of Weick's work by Nyce (note 3).

[469] Nyce (note 3).

[470] Prunckun (note 380), pp. 6–7.

[471] Prunckun (note 380), pp. 6–7.

Table 6.4 Intelligence target characteristics during Cold War and today.

	During Cold War	Non-state actor era
Target	Superpowers	Transnational actors, some states
Object of scrutiny	Mostly large, rich, central	Many small states, individuals, peripheral to internt'l community
'Story' of target	States are geographic, hierarchal, bureaucratic	No common theme. Variety of sizes and types of non-state actors
Location of target	External	Domestic and international
Consumers	Limited. Primarily government officials, military	Enormous nos. in principle: local, regional and private
'Boundedness'	Relatively bounded because of nature of superpowers	Less bounded. Non-state actors patient. However, new groups and new methods of attack
Information	Too little. Dominated by secret sources	Too much. Broader range of sources. Secrets still matter.
Interaction with target	Relatively little	Great deal. Assymetric threat.
Form of intel.	Answer for puzzles. Best estimate and speculation on answers to mysteries	Sensemaking for complexities in addition
Primacy of intel.	Important, not primary. Deterrence not intelligence-rich.	Primary. Prevention dependent on intelligence

Source: Based on Gregory F. Treverton, *Intelligence for an Age of Terror* (Cambridge University Press: Cambridge, Mass., 2009), p. 22.

7

OBSERVATIONS ON THE DERIVATION AND USE OF CW-RELATED INFORMATION

The derivation and use of information to assess possible CW activities and programmes present a compelling, if somewhat obscure, history. Key analyses of a given target are necessarily opaque or classified in order to protect intelligence and law enforcement sources and methods.[472] Other factors that promote secrecy include a desire to conceal incompetence and plagiarism, political sensitivity, and procedural and bureaucratic pressures (including inertia).[473] The academic literature is sometimes overly generalized in that there is little or no specific case information or the analyses are too far removed from operational or other primary information that is typically accessible to government employees, defence contractors and some international civil servants only. Thus, a gap frequently exists between the operational requirements of government (e.g., for law enforcement, intelligence or other reasons-of-state) and the interests of academic researchers (e.g. political scientists and laboratory personnel). In the case of IR theory, the academic literature can focus on the development and modeling of theoretical approaches to understanding a process as the goal.[474]

There are also those whose writings are meant to promote political and national agendas or which reflect various prejudices which are not readily apparent. Facts may be deliberately mixed with misinformation, something that has not infrequently occurred with newspaper articles.

A useful operating principle is to assume that one does not know what one thinks he or she knows unless those more directly involved have sufficiently convinced him or her. And then the 'fact' should only be accepted provisionally. Some facts are essentially known, while others should be viewed as working hypotheses. Political expediency, political affiliation and the taking of actions for reasons-of-state should not be confused with attempts to understand the 'facts' or the 'truth' as such.

The factors and processes underlying this topic and the actors and the various related institutional behaviours cannot be disentangled readily. In addition, the arms control verification field has undergone several generational shifts which can be linked to the state of international relations (e.g., the 'classical' European balance-of-power period, the Cold War phases, the rise and

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[472] E.g. see redactions in *Report of the Defense Science Board: Summer Study on Chemical Warfare* (Office of the Under Secretary of Defense for Research and Engineering: Washington, DC, Jan. 1981) Proceedings of meeting held on 3–15 Aug. 1980; San Diego, California (declassified).

[473] Garrett and Hart (note 108), 'Bibliography,' pp. 238–240.

[474] Garrett and Hart (note 108), 'Bibliography', pp. 238–240.

maturation of arms control and disarmament regimes, the information age, the biotechnology century, and non-state actor threat age).

The derivation and use of information for CW assessments is thus affected by the scientific and political context of period, although many of the underlying principles remain the same. Expertise was developed and maintained with different threats in mind. In some instances, institutional mechanisms exist to maintain this expertise or the historical record of it. In other cases, the expertise has resided with a limited number of national experts who have since moved on, retired or passed away. While some of the underlying principles of these analyses remain constant, the specifics driving the creation of the various documentation have changed. This is partly driven by changes in science and technology and partly because the particulars of what activity the actors targeted are engaged in inevitably changes.

Every field of inquiry possesses its own literature and individuals and institutions who are acknowledged as leading authorities. Every expert is generally able to discern whether someone is 'in' the field or from outside based on the terminology and sources used.

Analytical methods evolve, partly in order to take into account S&T developments (e.g., of overhead imagery and the exchange of data over the internet). It also reflects changing understandings of the nature of information that is considered to be 'sensitive' and how it can or should be protected. The contemporary understanding of data mining with its emphasis on computer searchable data streams naturally differs from the manner in which information was acquired between World War I and World War II.

Sampling and analysis for CW agents and their possible degradation products have been fundamentally transformed by scientific developments (e.g. through the development of portable GC/MS detectors) and the possibilities for physical access to the territories and facilities where such samples might be taken have generally expanded. The latter is partly thanks to the establishment of international arms control and disarmament regimes that allow for the taking of such samples under certain circumstances and, given the frequency and scale of international travel, the possibilities for surreptitious sampling have also expanded.[475] Nevertheless, some underlying principles can be usefully contrasted and analysed in the three areas of focus in the methodology.

[475] In 2013 there was much discussion on the serreptitious taking of samples from Syria by several states, including, apparently France, the UK and the United States. On 25 Apr. 2013, the White House sent an open letter to the US Congress which stated 'Our intelligence community does assess with varying degrees of confidence that the Syrian regime has used chemical weapons on a small scale in Syria, specifically the chemical agent sarin. This assessment is based in part on physiological samples'. Letter by Miguel E. Rodriguez (Director, Office of Legislative Affairs, White House) to Senator Carl Levin copied to Senator John McCain, 25 Apr. 2013.

8

ANALYSIS OF COMPETING HYPOTHESES

Heuer originated the concept of ACH while working at the CIA in 1978-1986.[476] His fundamental work in this area—at least in the public domain—is *Psychology of Intelligence Analysis* (1999).[477] He states that ACH is distinctive from 'conventional intuitive analysis' in three major respects:

> 1. '*Analysis starts with a full set of alternative possibilities, rather than with a most likely alternative for which the analyst seeks confirmation. This ensures that alternative hypotheses receive equal treatment and a fair shake*';
>
> 2. '*Analysis identifies and emphasizes the few items of evidence or assumptions that have the greatest diagnostic value in judging the relative likelihood of the alternative hypotheses. In conventional intuitive analysis, the fact that key evidence may also be consistent with alternative hypotheses is rarely considered explicitly and often ignored';* and
>
> 3. '*Analysis of competing hypotheses involves seeking evidence to refute hypotheses. The most probable hypothesis is usually the one with the least evidence against it, not the one with the most evidence for it. Conventional analysis generally entails looking for evidence to confirm a favored hypothesis*'.[478]

Variations of ACH are used as a training aid to help heighten intelligence analysts' awareness of cognitive biases. Some defence contractor personnel focus solely on developing ACH methodologies.[479] However, the sample hypotheses described in the literature often appear to be either rather straightforward thought experiments or attempts to quantify and automate data collection and analysis.[480] There appears to be a gap in the open literature on how ACH might be applied to strategic studies, weapon systems, or dual-purpose technology.

Some work has been carried out in the military strategic context (e.g., on deception). The UK Defence Intelligence Staff has developed a structured version of ACH.[481] Frank J. Stech and Christopher Elsaesser have modified the

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[476] Wheaton and Chido (note 4), p. 12.

[477] Heuer, Jr. (note 427).

[478] Heuer, Jr. (note 427), p. 108.

[479] Personal communication with Department of State official.

[480] E.g., Simon Pope and Audun Jøsang, *Analysis of Competing Hypotheses using Subjective Logic (ACH-SL)*, briefing slides, DSTC, CRC for Enterprise Distributed Ssytems Technology, General Purpose South, University of Queensland, Brisbane, Australia, 13–16 June 2005.

[481] Goodman and Omand (note 416).

ACH to develop a business process and semi-automated tools to detect deception which they test against how this SAT might have been used in the lead up to the Battle of Midway.[482] Simon Pope and Audun Jøsang have modified ACH using a semi-automated system based on the mathematics of subjective logic which they term ACH-SL.[483] Wheaton and Chido propose, through SACH, the generation of sub-hypotheses and the introduction and development of automation as a means to evaluate the resulting decision-trees. A variation of ACH could help to address the difficulty of practical future policy application of the methodology with regard to chemical weapons-related activity.

ACH involves a reiterative 8-step process or cycle. The 8-steps call for continuous reassessment and improvement of assessments based on new information and the results of repeated testing of hypotheses. They are:

1. **Hypothesis generation.** Identify the possible hypotheses to be considered.

2. **List evidence and arguments.**

3. **Prepare a matrix.** Hypotheses are to be placed at the top of the matrix with evidence listed vertically. The 'diagnosticity of the evidence and arguments should be analyzed in order to identify the items most useful in determining the relative likelihood of the hypotheses.

4. **Refine the matrix.** Reconsider the hypotheses and delete evidence and arguments that have no diagnostic value.

5. **Tentative conclusions.** Draw tentative conclusions about the relative likelihood of each hypotheses. Attempt to disprove the hypotheses, rather than to prove them.

6. **Reevaluate weight of critical evidence.** Analyze how sensitive the conclusions are to a few critical items of evidence. Consider the consequences if the evidence supportng the analysis is incorrect, misleading or subject to different interpretation.

7. **Report conclusions.** Discuss the likelihood of all hypotheses, not just the most likely one or the one that was 'accepted'.

8. **Identify milestones for future observation.** These milestones may indicate events that take a different course than expected. Collection of additional information can also suggest other possibilities for future.[484]

Wheaton and Chido identify two main strengths of ACH. First, the methodology creates an audit or evidence trail that reveals the analytic process and the evidence upon which it is based. Managers of intelligence units can therefore more easily evaluate 'after-action reviews' to determine where the results were correct as part of process validation. Second, ACH compels analysts to consider alternate explanations or hypotheses systematically, thereby

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[482] Frank J. Stech and Christopher Elsaesser, *Midway Revisited: Detecting Deception by Analysis of Competing Hypotheses*, performing organization report no. 04-0813, unclassified (The MITRE Corporation: McLean, Virginia, 11 Nov. 2004).

[483] Pope and Jøsang (note 480).

[484] Phrasing based, with slight modifications, on Heuer, Jr. (note 427), p. 97; and Wheaton and Chido (note 4), pp. 12–13.

minimizing or making explicit intuitive assumptions. Wheaton and Chido also identify two weaknesses of ACH. First, it depends on the validity of the 'evidence'. Unreliable evidence or disinformation can undermine seemingly 'scientific' processes and conclusions. Second, carrying out ACH in the absence of an automated process or mechanism can be highly time consuming given the large numbers of hypotheses and amount of evidence analysts are actually faced with in their daily routines.[485]

Any system pre-supposes the existence of patterns, order or relationships where none may exist. An assumption that objective facts can be discovered and understood may also exist. Alternatively, one could view efforts to achieve a better understanding as an iterative process (Bayesian). In philosophy and elsewhere, observers also sometimes speak of the risks posed by 'determined' or 'over-determined' outcomes. Any application of a methodology carries this risk and retrospective analyses unavoidably introduce distortions. For example, after-the-fact awareness often shapes 'received wisdom' at that moment, rather than the received wisdom at the time events were predicted or were actually occurring. Some analysts and officials therefore argue that if an event or understanding was not documented at the time it occurred, the event did not occur or the understanding did not exist.[486]

Cognitive traps may occur due to: (*a*) the effect of underlying views, (*b*) a failure of imagination, (*c*) a role of religion, (*d*) the role of philosophical and political views, (*e*) 'cherry picking' of evidence and (*f*) deception measures implemented by the target of analysis. It is therefore useful to test a variation of ACH using multiple hypotheses and sub-hypotheses for a specific type of analytical problem: the evaluation of CW programmes and activities. Because sub-hypotheses are introduced in the present study, this essentially meets the definitional requirements of Wheaton and Chido for SACH. The methodology used in this study is therefore labeled SACH-CW. In other words, in cases where the estimate is reasonably 'clear', the complexity of the hypothesis can be increased with an eventual view towards supporting strategic analysis. In cases where the estimate is not sufficiently clear, further information must be sought—preferably information which is 'diagnostic'.

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[485] Wheaton and Chido (note 4), p. 13.

[486] This point has been raised in the context of the preparation of oral histories of UN inspections in Iraq where contemporary recollections do not necessarily coincide with the documentation. Personal communication with UNODA official.

9

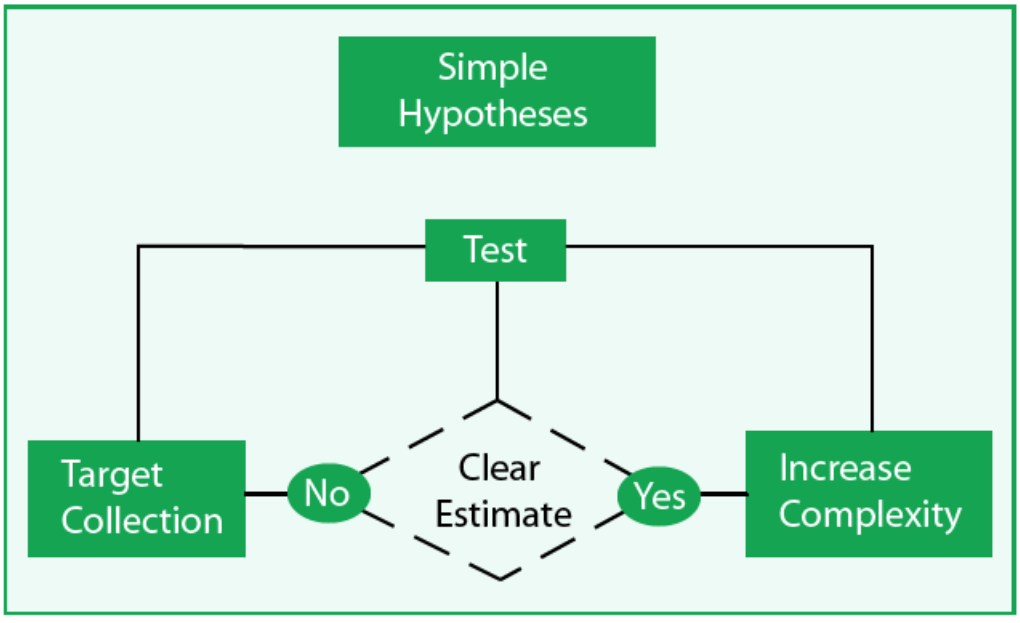
DEFINING CW-FOCUSED STRUCTRUED ANALYSIS OF COMPETING HYPOTHESES

This section attempts to define an operationally meaningful ACH methodology specific to chemical warfare. This formulation of ACH is tested against three case studies. Each case study consists of a narrative that is informed by a structured table of topics. While matrices and hypotheses are offered, the structured table of topics will be done to help focus and structure the narrative, as well as to make it more apparent to the reader. It is not possible to transform a complicated and wide-ranging set of information into a matrix without narrative. While automation and quantification present interesting analytical problems, the author is of the view that focused qualitative analysis can better inform operational requirements of arms control verification, intelligence analysis and broader policy. It is hoped that the study will elucidate the degree to which a SACH-CW is applicable or practical in these areas.

9.1. CW Matrices, Decisionmaking Process and Indicators

Wheaton and Chido offer a basic ACH matrix and a SACH flowchart. In cases where clear estimates are possible, the competing hypotheses can be made more complex (i.e., more structured).

Figure 9.1 Structured Analysis of Competing Hypotheses (SACH) process.[487]



[487] Wheaton and Chido (note 4), p. 15.

Traditionally, indicators for offensive and defensive CBW were developed with state military programmes in mind. As mentioned previously, much of the work on offensive and defensive indicators for biological warfare programmes has been done by Milton Leitenberg (see Table 9.1). The 1993 US OTA report reviews CBRN and ballistic missile indicators.[488] Many are are also broadly applicable as potential chemical warfare programme indicators. The principal acquisition steps of chemical weapons identified by the OTA report are: (*a*) acquire equipment, material and expertise, (*b*) initiate pilot-scale production of agent, (*c*) purchase or domestic production of munition componenets, (*d*) munition filling, (*e*) establish storage and associated infrastructure, (*f*) undertake the acquisition of chemical defence capabilities (e.g., detection, decontamination equipment), (*g*) undertake the development of military doctrine and training programmes.[489]

Intelligence and arms control verification analysts should be cognizant of the relevance of developments in science and technology to such models. The dichotomies identified by Leitenberg in 1996 (see Table 9.1), for example, have become less relevant due to changes in science and technology, research and industry practice and an increased focus on non-state actor threats. With respect to the distinction between BW and non-BW 'facilities, security, and equipment', all information used by civilian life sciences facilities today is generally considered proprietary (i.e., it is not public). Also aerosol test chambers are now common to such facilities (not only to defence-related facilities). Furthermore, the security and sophistication of software and hardware systems at civilian facilities can actually be higher than those at defence-related facilities. In some respects, defence and non-defence facilities are converging in terms of their design, operating protocols and capabilities, partly as a consequence of international efforts to promote and integrate safety and security measures for chemicals and biological substances.

[488] US Congress, Office of Technology Assessment (note 12). See also Frisina, M. E., 'The Offensive-defensive Fistinction in Military Biological Research', *Hastings Center Report*, vol. 20, no. 3 (May/June 1990), pp. 19–22; and Roger Roffey, 'Biological Weapons and Potential Indicators of Offensive Biological Weapon Activities', *SIPRI Yearbook 2004: Armaments, Disarmament and International Security* (Oxford University Press: Oxford, 2004), pp. 557–571.

[489] Based on US Congress, Office of Technology Assessment (note 12), p. 19.

Table 9.1 Overview of offensive vs. defensive BW indicators.

Categories:
Funding and personnel
Facility design, equipment and security
Technical considerations
Safety
Process flow

Funding and personnel

BW facility	**Legitimate facility**
1. Military funding	1. Private enterprise or non-military
2. High salary	2. Salary within normal limits
3. Funding exceeds product/research output	3. Average or underfunded for expected output
4. Scientist/technician ratio high	4. Average ratio
5. Limited ethnic diversity[490]	5. Integrated work staff
6. Elite workforce/trained abroad[491]	6. Domestically trained workforce
7. Multi-lingual competency	7. Limited linguistic capabilities
8. High ratio of military to civilian	8. Military personnel unlikely

Facilities, security, and equipment

BW facility	**Legitimate facility**
1.Access control: high walls, guard towers, motion detectors, video cameras, elite security force, badges and security clearance procedures	1. Avg. security (badges and little else)
2. Transport provided	2. Public or private transport
3. Quarantine facilities onsite	3. No quarantine
4. Travel to other countries restricted (readily available to some)	4. Unrestricted travel to other countries
5. Refrigerated bunkers, secure area	5. Cold rooms in facility
6. Advanced software, external database access, ADP security, high foreign access	6. Open information (except proprietary)
7. Static aerosol test chambers	7. No aerosol test chambers
8. Military with weapons expertise	8. No military with weapons expertise
9. Rail or heavy trucking required for filling facility	9. Only light truck transportation

Technical considerations

BW facility	**Legitimate facility**
1. Pathogenic or toxic strains	1. Non-pathogenic or non-toxic strains
2. Test aimed at killing animals	2 Test aimed at minimizing animal mortality
3. Facilities for large animals such as monkeys and primates	3. Facilities for smaller animals, specific inbred strains
4. Negative air flow	4. Positive air flow
5. No commercial products	5. Commercial products
6. Weapons-filling equipment	6. Bottle-filling equipment

[490] Applicable for some states.
[491] Applicable for some states.

Safety

BW facility	**Legitimate facility**
1. Physical barriers to prevent animal-to-animal and animal-to-human transmission	1. Physical barriers designed animal to animal and human to animal transmission
2. HEPA filters present, exhaust	2. HEPA filters possible, intake
3. Dedicated biosafety personnel	3. May or may not be present
4. Infectious and toxic agent trained medical staff	4. Dedicated highly trained medical staff less likely
5. Decontamination equipment and showers	5. Not needed on a large scale
6. Large capacity pass through autoclaves	6. Small bench top autoclaves
7. Dedicated waste treatment	7. Waste treatment integrated with local system
8. Specialized sterilization of waste	8. May or may not exist
9. Test animals sterilized before final disposal	9. Animals may not need to be sterilized before final disposal

Process flow

BW facility	**Legitimate facility**
1. Raw material consumption does not equal output	1. Raw material consumption relates to output
2. Large volume fermenters (greater than 500 litres), cell cultures (thousands of culture flasks/roller bottles), embryonated eggs (hundreds, or thousands)	2. Large- and small-scale fermentation but cell culture and eggs in smaller volume
3. Air pressure gradients keep microbes out of vessel	3. Air pressure gradients keep contaminants within vessel
4. Finished product—wet stored at low temperature in sealed (often double packaging) containers—not readily identifiable	4. Labelled by product, batch no., date, etc.
5. Milling equipment operated in biohazard protective suits	5. Milling equipment is not operated in biohazard areas
6. Storage—low temperature, high security, bunkers with biocontainment	6. Storage in temperature controlled environment, clean warehouse conditions
7. Munitions—special filling buildings and/or explosives handling facilities	7. Non-issue

Source: Reproduced with slight modifications from Milton Leitenberg, 'Biological Weapons Arms Control', *Contemporary Security Policy*, vol. 17, no. 1 (Apr. 1996), pp. 57-58.

The main hypotheses for an ACH application to CW and their matrices are given in the following section. The indicators have been selected with the following criteria in mind. First, they must be fundamental to the analysis of potential CW activities or programmes. Second, they should be limited in number. Third, they should be sufficiently broad so as to permit a meaningful analytical narrative for *any* case study (historical, contemporary or future; technical or political). Fifth, the indicators should provide sufficient structure to allow one to identify and organize key data from large amounts of information in order to produce meaningful, policy-relevant analyses. Doing so might also assist in the consideration of Heuer's step 6 (reevaluate weight of critical evidence) and step 8 (identify milestones for future observation).

Each matrix is based on a major hypothesis (i.e., the production and stockpiling of chemical weapons). However, the supporting analysis should—in view of the great volume of information—be largely qualitative. The selection of key questions necessary to address each main hypothesis must also be kept within reasonable limits so as not to lose analytical focus. For example, Jervis observes that while the number of [intelligence-relevant] questions that can be posed are 'theoretically limitless', it is nevertheless 'often possible to find a relatively small number of crucial ones, which, if answered differently, would most alter one's understanding of the situation and the predictions one would make'.[492] He also argues that feedback from policymakers would assist in the selection of the most relevant questions.[493] The same may also be said of those responsible for carrying out any weapon-related verification measures. In addition, Jervis concluded that the estimates by US intelligence on the pre-Iranian Revolution political status did not provide a range of interpretations. He therefore recommends that estimates provide evidence for and against alternate conclusions or assessments as part of normal practice.[494]

Consideration of computer automation of ACH will also be avoided. Although such automation is possible, it is a complication that deserves separate treatment in order to assess its feasiblity for CW. Automation may also reflect, to an extent, a US bias in wishing to seek a technical solution to what is in fact rather a matter of how to assess political and ideological motivation and the significance of human behaviour.[495]

It is also perhaps notable that organizational security procedures have been developed to the point which disallow certain types of individual initiative that are common to organizations that have fewer or less extensive procedures (e.g., in small or medium power states). Those involved in CW evaluations in various states are undoubtedly constrained by institutional procedures and expectations. These can include: the parameters of what constitutes an 'acceptable' estimate, and understandings of what constitutes 'sensitive'

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[492] Jervis (note 399), p. 48.

[493] Jervis (note 399), p. 48.

[494] Jervis (note 399), p. 48.

[495] Living with ambiguity and attempting to resolve it within the chemical warfare context deserves attention and will be considered further in the conclusions. Diarmaid MacCulloch relates how a Moscow priest said that the difference between how people in the West and the Orthodox East react to a problem is that, in the West, people look for a solution, while the Orthodox are more inclined to live with the problem. This remark was made within a religious and cultural context. Diarmaid MacCulloch, *A History of Christianity: the First Three Thousand Years* (Allen Lane: London, 2009), p. 509. It has also been often observed that the United States, in particular, approaches policy challenges and security threats by devoting large resources to their 'solution'. The author suspects that this may, in part, be related to a 'law suit culture' which demands and expects that all precautions and measures be taken in order to try to achieve absolute security (i.e. to protect the environment and population).

In 2011 the US DHS was engaged in the trial testing of the Future Attribute Screening Technology (FAST) programme (formerly known as Project Hostile Intent) which consists of a suite that includes infrared cameras and pressure pads designed to detect discomfort (such as fidgeting, increased heart rate, facial blushing and pupil dialation) consistent with those who might be contemplating an illegal act. Nick Allen, 'US Crime Predicting Technology Tests Draw Minority Report Comparisons', *Telegraph*, 11 Oct. 2011, <http://www.telegraph.co.uk/news/worldnews/northamerica/usa/8818716/US-crime-predicting-technology-tests-draw-Minority-Report-comparisons.html>, (accessed 18 July 2013).

information. Sensitive information may be so considered for organizational reasons, rather than for being inherently sensitive as such. A view that a given piece of information is sensitive may also reflect the fact that the individual is largely (or only) familiar with the closed literature on the topic. Thus, all but the most prosaic information can be viewed as 'sensitive'. The leadership of an organization may wish to limit information dissemination and, therefore, imposes a broad understanding of the term sensitive in order to limit autonomous or otherwise unapproved actions by the lower echelons. To do otherwise, may introduce undesirable ambiguity because individuals would be provided greater latitude resulting in unpredictable situations that affect the institution's operational integrity or the state's policymaking process.

A major methodological question is how one approaches defining and elucidating a method for the derivation and use of information in order to assess CW activities and programmes. In the case of ACH, this entails developing: (*a*) an audit trail, (*b*) insight into how to structure and populate a CW-specific series of matrices and (*c*) a policy relevant procedure for refining the analytical output.

The analysis should also attempt to pose questions systematically so as to yield different conclusions that must be further tested and refined iteratively (i.e., to weigh and assess competing hypotheses and sub-hypotheses). Whether the information provided is representative and the criteria by which this is determined should be considered.

ACH methodology may also be applied according to three 'philosophical' approaches during the testing phase (steps 6 and 7): 1. all information is interpreted in the most positive manner (i.e., that the activity of the target of analysis is non-prohibited under the CWC), 2. ambiguous and non-commital wherever possible and 3. a worst case scenario interpretation. Each should result in a distinct analytical outcome. The differences (or lack thereof) should form part of the analysis. Approaching the analysis in this manner by a single author helps to serve the function of multiple hypotheses generated by several individuals or groups.

The focus should be on the analytical process, rather than, for example, on the broader political and organizational matters that define consumer–producer relations in the field of intelligence reporting or the capacity and procedures of states to support arms control verification. The principal focus should be on the qualitative analysis in the main text with possible supplemental (including quantitative) annexes.

10

OPERATIONALISING A CW-FOCUSED ACH: ORGANISATION OF ANALYSIS OF CASE STUDIES

CWC-defined violation scenarios are considered for each of the three case studies: (*a*) the production of chemical weapons or (*b*) the stockpiling of chemical weapons. Adhering to CWC-defined violations focuses the analysis and make it more relevant to contemporary and future arms control verification, intelligence methodology and strategic and defence analysis. The CWC also prohibits the development, use, and transfer of chemical weapons. However, as previously noted, the development and use of chemical weapons will only be considered insofar as it relates to the production or stockpiling of such weapons (e.g., as part of analysis of intent). This is done in order to narrow the focus. Stockpiling is more susceptible to detection than laboratory-scale research and scale-up of CW production. Stockpiling is thus less susceptible to politicized legal hair splitting arguments as compared to small-scale development and production. The transfer of chemical weapons deserves separate analysis within the framework of current oversight and control of chemical transfers. Therefore transfers of chemical weapons or their possible precursors will also not be considered except somewhat tangentially.

The ACH methodology can also be used to test a 'situational logic' that can then be checked for internal consistency and set against other situational logic-defined scenarios.

Situational logic is the most common analytic strategy used by intelligence analysts.[496] It means that a given scenario should be understood according to 'the terms of its unique logic, rather than as one example of a broad class of comparable events'.[497] The scenario should be internally consistent and function as a 'plausible narrative'. The analyst may then 'work backwards to explain the origins or causes of the current situation or forward to estimate the future outcome'.[498] Situational logic focuses on elucidating cause-effect relations and means-ends relations. In doing so, the analyst 'identifies the goals being pursued and explains' why the actor believes 'certain means will achieve those goals'.[499]

Heuer identifies two principal weaknesses to this analytic strategy: (*a*) understanding the mental and bureacratic processes of other actors can be extremely difficult, and (*b*) the strategy can fail to take advantage of the theoretical knowledge derived from the study of similar phenomena in other states and for other periods.[500]

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[496] Heuer, Jr. (note 427), p. 32.
[497] Heuer, Jr. (note 427), p. 32.
[498] Heuer, Jr. (note 427), p. 33.
[499] Heuer, Jr. (note 427), p. 33.
[500] Heuer, Jr. (note 427), p. 33.

Step 1. Identify the Possible Hypotheses to be Considered

As previously noted, the two main hypotheses considered in the case studies are: (*a*) the production of chemical weapons and (*b*) the stockpiling of chemical weapons. As part of defining the problem, the CWC's definition of a chemical weapon is employed.[501]

Main hypothesis 1.
Has the target of analysis *produced* chemical weapons?
Main hypothesis 2.
Has the target of analysis *stockpiled* chemical weapons?

It is not necessary for ACH to be conducted by groups or using dedicated software. To the extent that group activity in developing the technique is desirable, this study may be seen as an initial assessment that can be subjected to peer review and other forms of evaluation or validation. This application may also serve as a starting point for further iterations of the hypotheses and matrices by others.

Heuer and Pherson believe that the technique is 'well-suited for addressing questions about technical issues in the chemical, biological, radiological, and nuclear arena'.[502]

Step 2. Make a List of Significant Evidence and Arguments For and Against Each Hypothesis

The principal requirement under this step is to provide basic background on chemical-weapon related activities for each of the case studies. This information is provided according to the following structure (Table 10.1).

[501] Namely, the convention defines such weapons as the following together or separately: (a) toxic chemicals and their precursors, except where intended for purposes not prohibited under this Convention, as long as the types and quantities are consistent with such purposes; (b) munitions and devices, specifically designed to cause death or other harm through the toxic properties of those toxic chemicals specified in subparagraph (a), which would be released as a result of the employment of such munitions and devices; (c) any equipment specifically designed for use directly in connection with the employment of munitions and devices specified in subparagraph (b). CWC, Article II, para. 1.

[502] Heuer Jr. and Pherson (note 5), p. 161.

Table 10.1 Structure of Background Narrative to Case Studies.

Political factors
Definition of violation
Intent
Doctrine
Consistent with types and quanties?
Threat perception
Apparent
Actual
Demand side factors
Supply side factors
Technical factors
Assimilation
Capability
Technological stages
Verification measures
Onsite
Nearsite
Offsite

Source: Author compilation.

Weapons acquisition and assimiliation are determined by the dynamics of push-pull factors. Thus, a variety of supply and demand factors determine the acquisition and integration of chemical weapons into training, doctrine and logistics.[503] The process of assimilation of new technology into weapon systems is often slow and characterized by special interest advocacy, military disfavour and moral or ethical repugnance.[504] A military must adapt its operating procedure and adjust its structure to accommodate a new weapon system or technology.[505] This adaptation process imposes an 'opportunity cost' in that the adoption of a given weapon system or technology inhibits the adaptation or adaptability of other weapon systems and associated technology.[506] Julian P. Perry Robinson argues that so long as a weapon system is not fully assimilated, 'its status is determined by supply side factors' and its final acceptance therefore remains uncertain.[507] The public language of military strategy and defence analysis can also influence the negotiations of arms control and disarmament agreements and their implementation.[508]

[503] Most of the literature on demand-supply side factors is from the nuclear (and possibly conventional) weapons field. The terminology is similar to, but distinct from, push-pull factor analysis.

[504] Julian P. Perry Robinson phrases it as 'special-interest advocacy, military disfavour and moral obloquy'. Robinson (note 41), p. 117.

[505] Robinson (note 41), p. 117.

[506] Robinson (note 41), p. 117.

[507] Robinson (note 41), p. 120.

[508] Robinson (note 41), p. 120.

Two key points for analysis of assessing a CW programme are whether the opponent has a no-first use policy, and whether there is active CW assimilation or active CW dis-assimilation.[509] Momentum for or against assimilation of a given weapon system can also be affected by the political, legal and defence and security aspects associated with the consideration of weapons free zones (e.g., chemical or nuclear). If weapons modernization, for example, is pursued in order to strengthen one's negotiating position on a disarmament agreement, then a certain de facto momentum towards assimilation (and longer-term acceptance) of the weapon system may result.[510] Prior to the finalization of the CWC, the Reagan Administration pursued a CW modernization programme in the 1980s partly through the development of binary systems. Conversely, demonstrating a willingness to retain weapon systems, or to modernize or stockpile them can arguably prompt negotiating states to conclude negotiations sooner.[511]

Heuer, citing Alexander George, identifies the following pitfalls which may be encountered when attempting to create a full set of hypotheses: (*a*) 'satisficing', (*b*) incrementalism, (*c*) consensus, (*d*) reasoning by analogy, and (*e*) relying on sets of principles or maxims.[512]

Satisficing occurs when an analyst selects the first available option that seems 'good enough', rather than examining all possible alternatives in order to try to determine which is 'best'. The reasons for this are similar to those that produce confirmation bias. Incrementalism refers to an analyst's focus on 'a narrow range of alternatives that represent marginal change' rather than completely reassessing one's mental approach and opinion. Consensus refers to the tendency by analysts to reach conclusions they believe will garner agreement or support within the institution or government. This reflects a basic unwillingness to contradict accepted or 'received wisdom'. Reasoning by analogy can be a useful technique so long as one understands its purpose and underlying assumptions. However, reasoning by analogy should be avoided if it consists of selecting an alternative 'that appears most likely to avoid some previous error or to duplicate a previous success'. Finally, any set of principles that dictates whether alternatives are 'bad' or 'good' can itself be misleading.

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[509] Robinson (note 41), p. 122.

[510] See Julian P. Perry Robinson, 'An Historical Context for European Chemical-Weapon-Free Zone Concepts, with an Account of Current European Chemical-Warfare Forces', pp. 1–29 in Ed. Ralf Trapp, *Chemical Weapon Free Zones?,* SIPRI Chemical & Biological Warfare Studies no. 7 (Oxford University Press: Oxford, 1987, reprinted 1988).

[511] The Reagan Administration's deployment of Pershing II nuclear missiles to Europe arguably helped to facilitate the subsequent agreement by the Soviet Union and the United States on the 1987 Intermediate-Range Nuclear Forces (INF) Treaty.

[512] Alexander George, *Presidential Decisionmaking in Foreign Policy: the Effective Use of Information and Advice* (Westview Press: Boulder, Colorado, 1980), chap. 2. Cited in Heuer, Jr. (note 427), p. 43.

Step 3. Prepare matrix with hypotheses

Heuer considers evidence to be 'diagnostic' when it affects one's judgement of the 'relative likelihood' of the hypotheses identified in step 1.[513] He attempts to illustrate the concept, which is often cited in the intelligence field, by using the medical analogy of a patient with a fever. There are many reasons for a high temperature and the temperature reading is not especially useful for medical diagnostic purposes in the absence of further context.[514] In the field of intelligence or information analysis, Heuer considers a factor to have high 'diagnosticity' if it is somehow uniquely revealing or if it brings special understanding to the problem. Information that tends to support prevailing views or assessments is not highly 'diagnostic' unless it yields further (preferably unusual) understanding.

Bayesian analysis is also dependent on the concept of diagnosticity. A simplified quantitative application of diagnosticity using Bayesian logic is provided by Omand.[515] A target country is periodically evaluated for whether its rocket programme is for civil and/or military purposes. Based on existing evidence, the analysis concludes that there is a 20 per cent likelihood that current testing is military. The question arises as to whether the most recent test is civilian or military. The telemetry of the most recent test is encrypted with a system used by the military. If all civilian tests are so encrypted, the knowledge that the most recent test was encrypted with such a military system adds nothing in terms of diagnosticity to the analysis. To repeat, the information that the telemetry was encrypted with a code used by the military has no diagnostic value. Therefore, with all other factors remaining the same, the estimate must remain the same (i.e., there is an 80 per cent chance the test was civilian).

However, if no previous civilian tests had used encrypted telemetry (whether the encryption used is known to be employed by the military is a related, but distinct issue), then this fact does have diagnostic value. Thus, with all other relevant factors remaining the same, the likelihood that the most recent test was civilian must be lowered (conversely the likelihood that the test was military must be raised).

Startling or unusual information does not necessarily have diagnostic value and could distort an assessment (or its reading by the consumer) because of its unexpectedness or novelty. Well-known publicly available information, by contrast, may have high diagnosticity, but its implications are underappreciated because the information is 'common knowledge'. The concept of diagnosticity will be a major focus of analytical narrative and has parallels to Daniel Kahneman's analysis of 'heuristics' (i.e., 'rules of thumb' to identify and explicate cognitive biases), including for the avoidance of WYSIATI and hindsight bias.

The matrices for the stockpiling and use of chemical weapons are provided below. The responses to each hypothesis are: consistent (C), inconsistent (I) or not applicable (N/A). This labeling is meant to provide an

513 Heuer, Jr. (note 427), p. 102.

514 On the parallel between medical and intelligence diagnostics, see Marrin (note 19), pp. 111–123; and Heuer Jr. and Pherson (note 5), p. 42.

515 Omand (note 13), pp. 155–156.

overview of 'all the significant components' of the analytical problem.[516] The format of this particular ACH matrix is based on one provided by Heuer.[517]

The number of questions posed in each matrix should, in my view, meet the following criteria: (*a*) be of key or fundamental importance to addressing the hypotheses, (*b*) be as few in number as possible and (*c*) serve as 'hooks' with which essentially all the important questions can be discussed in the analytical narrative.

It is also important to inquire whether the order in which the hypotheses are dealt with can affect the reader's opinion of their relative validity. Will a reader, for example, be more attracted to the first hypothesis and least receptive to the last hypothesis when looking at the matrix (or after reading through the analysis in a yes, no, ambiguous/maybe order)? Some brain science research suggests that humans are inclined to accept an initial presentation or characterization of 'facts' over those subsequently presented even when they are explicitly told of this physiologically-based, statistically significant tendency.

Matrix Production/Stockpiling

Question: Has the target (i.e., state or non-state actor) stockpiled chemical weapons?

Hypotheses:
H1 No production/stockpiling of chemical weapons [C=18, I=8, N/A=10]
H2 Yes production/stockpiling of chemical weapons [C=18, I=17, N/A=1]

	H1	H2
IR1. Does target have CW technical capacity (e.g. military, medical)?		
E.1 General publications aimed at domestic audience (yes)	I	C
E.2 General publications aimed at domestic audience (no)	C	I
E.3 Civil defence against CW policy documentation (yes)	N/A	C
E.4 Civil defence against CW policy documentation (no)	C	I
E.5 Civil defence against CW technical guidance (yes)	N/A	C
E.6 Civil defence against CW technical guidance (no)	C	I
Qualitative working assessment: SUMMARIZE		
IR2. Is CW mentioned in military doctrine?		
E.1 Defence against CW in civil defence context (yes)	N/A	C
E.2 Defence against CW in civil defence context (no)	C	I
E.3 Defence against CW for military personnel (yes)	N/A	C
E.4 Defence against CW for military personnel (no)	C	I
E.5 Civilian prophylaxis and/or countermeasures (yes)	N/A	C
E.6 Civilian prophylaxis and/or countermeasures (no)	C	I
E.7 Military prophylaxis and/or countermeasures (yes)	N/A	C
E.8 Military prophylaxis and/or countermeasures (no)	C	I
Qualitative working assessment: SUMMARIZE		
IR3. Statements and similar communications		
E.1 Has leadership discussed CW matters? (yes)	N/A	C
E.2 Has leadership discussed CW matters? (no)	C	I
Qualitative working assessment: SUMMARIZE		

[516] Heuer, Jr. (note 427), p. 100.
[517] Heuer, Jr. (note 427), figure 15, p. 101.

IR4. Weight of evidence of integration of CW into military doctrine?		
E.1 Publications indicate integration of CW (yes)	I	C
E.2 Publications indicate integration of CW (no)	C	I
E.3 Arms control policy statements against CW (yes)	C	I
E.4 Arms control policy statements for CW (yes)*	I	C
Qualitative working assessment: SUMMARIZE		
IR5. Interest in CW activities of others?		
E.1 Discussion of CW threats posed by others (yes)	N/A	C
E.2 Discussion of CW threats posed by others (no)	C	N/A
Qualitative working assessment: SUMMARIZE		
IR6. Evidence of CW production?		
E.1 Laboratory scale synthesis (extraction) of CW agents (yes)	N/A	C
E.2 Laboratory scale synthesis (extraction) of CW agents (no)	C	I
E.3 CW production facility indicators (yes)	I	C
E.4 CW production facility indicators (no)	C	I
E.5 CW stockpiling indicators (yes)**	I	C
E.6 CW stockpiling indicators (no)	C	I
E.7 Documentation of production (yes)	I	C
E.8 Documentation of production (no)	C	I
E.9 Documentation of stockpiling (yes)**	I	C
E.10 Documentation of stockpiling (no)	C	I
E.11 Availability of CW production material/equipment (yes)	N/A	C
E.12 Availability of CW production material/equipment (no)	C	I
E.13 Availability of CW munition (yes)	I	C
E.14 Availability of CW munition (no)	C	I
Qualitative working assessment: SUMMARIZE		

Qualitative summary:
Weight of data integrity and consistency difficulties (key dichotomies)? Re: production, planning, documentation.

Source: Author's adaptation of Heuer's ACH matrix. C=consistent, I=inconsistent and N/A=not applicable, IR=information request, E=evidence. *E.g., Some parties to the 1925 Geneva Protocol reserved the right to use CW if such weapons were first used against them. **The question is not a non sequitor in the sense that, for e.g., overhead imagery might be available that suggests such stockpiling.

People and groups will naturally fill in such a table differently. However, the rationale for why it was done so should be evident, including to those who disagree.

The evidence and sub-evidence chains can (and almost certainly have) been developed using ACH programmes. This is appropriate when massive amounts of data are being systematically collated and evaluated by multiple analysts or working groups. Such an approach lends itself to quantitative analysis.

For qualitative or strategic analysis, a simplified version of the ACH tables is preferable. To promote qualitative, including strategic, analysis the evidence chains should be limited in range and scope. The evidence chains should also be balanced and sufficiently focused. For in-depth, highly detailed

quantitative data analysis, special computer programmes should probably be employed that show multiple chains of evidence and their interlinkages.[518]

A further point of possible analysis is whether different personality types are statistically more inclined to place C's and I's that reveal patterns. A symmetry exists in the question pairings listed above. For example:

E.1 General publications aimed at domestic audience (yes)	I	C
E.2 General publications aimed at domestic audience (no)	C	I

An apparent asymmetry that may reflect the point of view of an analyst is evident in the following:

E.1 Laboratory scale synthesis of CW agents (yes)	N/A	C
E.2 Laboratory scale synthesis of CW agents (no)	C	I

In a general sense, laboratory-scale synthesis of CW being marked N/A for H1 (No stockpiling of chemical weapons) can perhaps be a matter of opinion. Some analysts might argue that N/A should read 'I'. How one views this particular point depends on whether one accepts that states may legitimately develop and test CW agents at the laboratory-scale. Such work is allowed under the CWC today and would generally be understood to constitute part of a 'defence CW programme'.[519] In a pre-CWC international security environment (e.g., during the inter-World War period), any laboratory scale synthesis of CW agent would probably be judged as an indicator that is consistent with the production and stockpiling of chemical weapons by a state. There is an increased emphasis on non-state actor threats in the current international security environment. Also chemical warfare is prohibited by international law under any circumstances. In view of these two factors, synthesis of CW at the laboratory scale can be viewed as fairly non-threatening or even routine (if done by states). One can therefore argue that the evidence chain E.1 is—to varying degrees—'delinked' from the consideration of H1 and H2 in the context of the current international security environment.[520]

Analysts will also probably disagree on the optimal content and phrasing of information requests and evidence lines. For example, addressing the question of CW 'production' can become somewhat confused when one considers the actual indicators and related information. Such indicators and information may suggest or relate to small-scale laboratory production, or large-scale production or a standby production capacity. Analysts might also disagree on specific information regarding materials, technology and know-how that can be used for both peaceful purposes and to support offensive CW activity and programmes.

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[518] See Pherson Associates, <www.pherson.org>, (accessed 26 May 2013); and Palo Alto Research Center, '$ACH_{2.0.5}$ Download Page', <www2.parc.com/istl/projects/ach/ach.html>, (accessed 26 May 2013).

[519] The parties may produce Schedule 1 chemicals for research, medical, pharmaceutical or protective purposes at a so-called single small-scale facility. CW agents may also be produced at 'other facilities' subject to certain restrictions. CWC, Verification Annex, Part VI, paras. 8–12.

[520] A similar delinking can be argued for E.1 under IR5 (interest in CW activities of others). Such an interest need not necessarily support H2 as is currently indicated in the Matrix.

This can result in disputes over whether N/A should appear in the following pairing:

E.11 Availability of CW production material/equipment (yes) N/A C
E.12 Availability of CW production material/equipment (no) C I

Somewhat more prosaically, analysts might also not agree on the use of term 'indicator' in the evidence line: 'CW stockpiling indicators' could be singular or plural. An individual's results should be contrasted against and supplemented with the results from other individuals or groups as part of an ongoing process of revision. Results can then be transformed into a form suitable for quantitative and qualitative analyses respectively.

Toxicological modeling is a large and growing activity. It is possible that research and development can be carried out in the absence of chemical experimentation.

By attempting to create a hybrid ACH combined with structured argumentation, the potential criticism that ACH is overly mechanistic to properly reflect the variety and complexity of human thought and activity can hopefully be addressed usefully.

The above matrix has been filled according to the view of the author. Each information request section is discussed individually. Information gaps are normal to such an exercise. The methodology can be applied using software that 'drills down' to extreme detail which is continuously updated by multiple individuals and groups. For a single author to use a programme-based approach would effectively become a 'self-conversation', although the datasets would evolve over months or years as additional datapoints are loaded in and the analyst's views change. An emphasis on the accumulation of data points would transform the nature of the study towards more of a technical operational manual, rather than one of qualitative strategic analysis. The objective is to review an ACH methodology according to a particular set of information requirements and evidence chains in a manner that:

(*a*) permits the reader to grasp the reasoning behind how the table has been developed, and

(*b*) facilitates strategic qualitative analysis with a view towards developing a strategic application of ACH specific to CW.

An 'answer' to the main hypotheses is desirable. However, the method, at a minimum, facilitates achieving progressively better understanding through progressive iterations of the matrix.

The use of such matrices thus allow others to review briefly the thinking of the analyst and the data points employed.

It may be desirable to develop matrices that contain questions where 'N/A' responses are minimized or eliminated. The correlation of 'N/A' with one or the other main hypothesis should be noted. In this case, all instances of 'N/A' are associated with H1 *and* the response to the information request is affirmative (e.g., 'Civil defence against CW policy documentation (yes)' is given an 'N/A' response) (see above matrix).

Further gradation of assessments is permitted through the use of 'CC' to denote 'highly consistent', or 'I++' to denote 'very highly inconsistent'. Such markings are not employed in this study for the sake of simplicity.

A binary yes-no answer *versus* a N/A answer to the evidence chain may be insufficient to reflect an analyst's understanding. Alternatively, the analyst's understanding to the effect that the answer to the evidence chain does have a binary yes-no response can be disputed by others.

Cumulative Preliminary Score

> The cumulative generic score for H1 is: C=18, I=8, N/A=10
> The cumulative generic score for H2 is: C=18, I=17, N/A=1

These scores are the result of *generic* responses. They are not specific to any particular case study.

A single analyst can run time series analysis of cumulative scores. Alternatively, multiple analysts can run aggregate or compare cumulative scores based on a single data set at one time. Such operations will not be performed for the following reasons: the author does not have access to multiple data sets, the author is not collaborating with others in this study, and such a quantitative (including through the use of specialized software) detracts from the broader qualitative strategic application objective.

The type and number of questions selected, as well as the best estimate of the analyst, affect the scores. In this case, the likelihood of H1 and H2 are similar except in two respects. First, the N/A category for H1 is 10 times greater than that for H2. Second, the I category for H1 is just under half that of H2.

IR1. Does Target Have CW Technical Capability (e.g., Military, Medical)?

> The sub-information request generic score for H1 is: C=3, I=1, N/A=2
> The sub-information request generic score for H2 is: C=3, I=3, N/A=0

The scores are roughly comparable. The main reason for the difference or the lack of correspondence between the H1 and H2 scores is, in my view, that the existence of civil defence policy documentation and the existence of civil defence technical guidance are not applicable to the hypothesis that no CW stockpiling is occurring. Policy hawks or those who support worst-case scenario modeling will probably disagree with this position *a priori*. Using such a matrix would highlight such a distinction that supports a broader analysis or the application of matrices to specific cases. It is also possible that analysts apply worst-case scenario modeling to perceived rivals, while not doing so in the case of friends or allies (actual or apparent).

IR2. Is CW Mentioned in Military Doctrine?

> The sub-information request generic score for H1 is: C=4, I=0, N/A=4
> The sub-information request generic score for H2 is: C=4, I=4, N/A=0

The responses for the two hypotheses are mirror images (i.e., consistent *versus* inconsistent) with the exception of the 'N/A' reponses under H1. The reasons for the choice of N/A include a need to distinguish between 'defensive' *versus* 'offensive' CW-related activities. Broadly speaking, this asymmetry in matrix responses reflects the fact that states can undertake programmes to protect

civilians and military personnel against CW and yet not plan to employ such weapons themselves. States that intend to use CBW are generally understood to wish to protect themselves against such weapons (e.g., through vaccination programmes, stockpiling of prophylactics and treatments).

IR3. Statements and Similar Communications

The sub-information request generic score for H1 is: C=1, I=0, N/A=1
The sub-information request generic score for H2 is: C=1, I=1, N/A=0

Discussion of possible patterns is not warranted in view of the fact that there are only two evidence chains under this information request (sub-evidence chains are possible). The definition of 'leadership' is open to dispute, including at the operational level. The manner and extent to which the leadership 'discusses' (e.g., signals, indicates, consults) is also open to dispute.

IR4. Weight of Evidence of Integration of CW into Military Doctrine?

The sub-information request generic score for H1 is: C=2, I=2, N/A=0
The sub-information request generic score for H2 is: C=2, I=2, N/A=0

The evidence chains are symmetric. However, the total number of evidence chains is too limited to permit meaningful tentative conclusions (the 'n' is too small). Analysts would almost certainly dispute the terms 'indicate' and, in some instances, whether a given arms control policy statement is 'for' or 'against' CW.

IR5. Interest in CW Activities of Others?

The sub-information request generic score for H1 is: C=1, I=0, N/A=1
The sub-information request generic score for H2 is: C=1, I=0, N/A=1

The evidence chains are limited (n=2) and generic. The term 'discussion' can be disputed. For example, should a single sentence in one policy statement be sufficient to allow for meaningful analysis or meaningful conclusions to be drawn? There is also a risk that aggregated matrix figures for 'C', 'I' and 'N/A' obscure the fact that such a mention has merited its inclusion (or exclusion). On the other hand, a review of the operative matrix combined with focused quantitative analysis 'structured argument' should make such shortcomings apparent to those wishing to discover the underlying logic of the analysis (perhaps with a view to confirm or to modify it).

IR6. Evidence of CW Production?

The sub-information request generic score for H1 is: C=7, I=5, N/A=2
The sub-information request generic score for H2 is: C=7, I=7, N/A=0

As with the previous evidence chains, definitions and understandings of terms can be disputed. This includes the point at which 'laboratory-scale synthesis' becomes non-laboratory scale. Also the nature and type of production facility indicators in the general sense can be disputed (e.g., how many indicators should

there be, how representative is the list of indicators). Once one deals with actual cases of such indicators, the scope for differences of understanding generally expands. Perhaps the other main term that could be disputed is 'availability' (e.g., of production material and/or equipment). Where and how should the production material and/or equipment be made available to support strategic CW stockpiling, for example.

Table 10.2 Overview of generic scores for H1 and H2

	H1	H2
Cumulative	C=18, I=8, N/A=10	C=18, I=17, N/A=1
IR1	C=3, I=1, N/A=2	C=3, I=3, N/A=0
IR2	C=4, I=0, N/A=4	C=4, I=4, N/A=0
IR3	C=1, I=0, N/A=1	C=1, I=1, N/A=0
IR4	C=2, I=2, N/A=0	C=2, I=2, N/A=0
IR5	C=1, I=0, N/A=1	C=1, I=0, N/A=1
IR6	C=7, I=5, N/A=2	C=7, I=7, N/A=0

Source: Author compilation.

Step 4. Refine the Matrix

Consideration of the case studies should focus on themes and periods. For example, the analytic outcome for the Soviet CW programme in the 1920s is, a priori, distinctive from that of the 1980s. A situational logic (or awareness) for the production/stockpiling (respectively) is distinct according to the period.

For the Soviet Union, the question of stockpiling of chemical weapons will be based on the following question: Did the Soviet Union possess sufficient chemical weapon stockpiles during the early period of World War II to engage in strategic and tactical chemical warfare?

The analytical focus for the second case study are allegations of the retention of chemical weapons by Iraq during the UNSCOM and UNMOVIC period and how these allegations were understood or characterized to support the case for the United States to invade the country in April 2003. The focus is on analytical methodology of an ACH for CW, rather than developing an exhaustive review of available information.

With respect to non-state actor threats, the alleged stockpiling and use hypotheses is applied to the alleged production of VX at a pharmaceutical plant in Sudan in 1998 (on behalf of non-state actors). The Department of State dissented from the US NIE that concluded that such activity was occurring. However, the US Government subsequently implicitly admitted being in error partly because it unfroze the assets of the plant's Saudi owner. The owner hired a lawyer who subcontracted a semi-privatised sampling and analysis exercise in which Western chemical defence laboratories did the analysis. This story offers important insight into how sampling and analysis might be structured and utilised within a broader context of preferred policy decisions and outcomes and is relevant to the question of proving responsibility for CW use in Syria.

More generally, there are a variety of indications that some al Qaeda affiliates wish to acquire, develop or use chemical weapons. Some former Iraqi chemical munitions have been modified by insurgents as improvised chemical

(i.e., chlorine) weapon devices.[521] There are also indications that chemical warfare experiments have been carried out in Afghanistan. Much of the analysis regarding non-state actors necessarily focuses on statements of intent and ideology of, for the purpose of this study, Islamist extremists. An attempt is made to determine how an ACH methodology of the type developed here can help to inform analysis of future non-state actor threats.

Step 5. Draw Tentative Conclusions About the Relative Likelihood of Each Hypothesis

Under this step, a 'picture' emerges of the target of analysis. A key question is whether information is sufficient to permit accurate or otherwise useful analysis. Heuer cites research conducted by experimental psychologists that suggests:

> (*a*) *'Once an experienced analyst has the minimum information necessary to make an informed judgement, obtaining additional information generally does not improve the accuracy of his or her estimates. Additional information does, however, lead the analyst to become more confident in the judgement, to the point of over-confidence'* and
>
> (*b*) *'Experienced analysts have an imperfect understanding of what information they actually use in making judgements. They are unaware of the extent to which their judgements are determined by a few dominant factors, rather than by the systematic integration of all available information. Analysts actually use much less of the available information than they think they do'*.[522]

Heuer also identifies four examples of when new information might affect an analyst's judgement: (*a*) additional detail about variables already in the analysis, (*b*) identification of additional variables, (*c*) information concerning the value attributed to the variables already in the analysis and (*d*) information concerning which variables are most important and how they relate to each other.[523]

Finally, analysis may be data-driven or concept-driven. Under data-driven analysis, it may be assumed that the analytical model is correct and that the analyst properly applies the model. In such cases, the accuracy of the analysis depends on the completeness of the data. The analysis of the combat readiness of military units is a typical example of such a data-driven approach.[524] Conceptual-driven analyses, by contrast, are structured so as to compensate for a lack of data or information. These analyses must cope with such factors as imperfectly understood relationships among variables, 'known knowns' and 'unknown knowns'. Conceptual-driven analyses often consist of attempts to interpret current (including unexpected) events to one's political leadership. In this case, the accuracy of judgement 'depends almost exclusively upon the accuracy of

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[521] On improvised chlorine devices, see Fred Wehling, 'A Toxic Cloud of Mystery: Lessons from Iraq for Deterring CBRN Terrorism', pp. 273–298 in Wenger and Wilner (note 290).

[522] Heuer, Jr. (note 427), p. 52.

[523] Heuer, Jr. (note 427), pp. 57–58.

[524] Heuer, Jr. (note 427), p. 59.

mental model'.[525] The technique of 'mirroring' elements of one's own state's activity onto the activity of another state (or non-state actor) may also be employed. If so, this can naturally lead to false (or otherwise misleading) results.

The 'mosaic theory of analysis' should also be mentioned. It states that pieces of information are collected and assembled to reveal a mosaic (like pieces of a jigsaw puzzle). This theory, which is common among large technical intelligence collection systems (e.g., SIGNIT), suggests that the accuracy of an analysis is a function of systematic collection and the storage of information in order to generate 'the picture'. Heuer cautions, however, that cognitive psychology research indicates that analysts do not operate in this manner, and that the most challenging analytical tasks cannot be based on the mosaic theory because they typically—and perhaps unavoidably—form a picture before the analyst selects the pieces to fit it.[526] Heuer observes that 'accurate estimates depend at least as much on the mental model used in forming the picture as upon the number of pieces of the puzzle that have been collected'.[527] In other words, the mental model is more important than volume of data *per se*.

Step 6. Analyse Sensitivity of Conclusions

Perhaps reflecting a great power perspective, Heuer notes that major intelligence failures are usually a failure of analysis, rather than a failure of collection.[528] Small or medium powers, however, must focus or prioritize their data collection and analysis. This is because they have fewer resources and, perhaps, little to no interest in a 'total information' acquisition and management strategy as, for example, China and the United States appear to have adopted.

Heuer suggests several techniques to allow the analyst to achieve different perspectives: (*a*) thinking backwards, (*b*) the 'crystal ball', (*c*) role playing and (*d*) playing 'devil's advocate' (or, in the Catholic tradition, the advocatus diaboli).[529] In thinking backwards, the analyst assumes an unexpected development and then tries to explain how one can interpret available information in a manner that predicts the unexpected event. The crystal ball mechanism involves imagining that a perfectly reliable piece of information demonstrates that an analyst's assumption is incorrect. The analyst must then develop the situational logic underlying this scenario in order to uncover flaws in the analysis. Role playing involves deliberately taking another *persona* (e.g. 'red-teaming' as part of war games). Finally, playing devil's advocate essentially entails contradicting received wisdom, point-by-point.

These 'rules-of-thumb' are, I believe, a major reason for the gap between, respectively, arms control verification and intelligence practitioner literature and the more academic theoretical literature. Those in academia tend to view such rules as not conducive to raising intelligence methodology, in particular, to the

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[525] Heuer, Jr. (note 427), pp. 60–61.

[526] Heuer, Jr. (note 427), p. 62.

[527] Heuer, Jr. (note 427), p. 62.

[528] Heuer, Jr. (note 427), p. 65.

[529] Heuer, Jr. (note 427), pp. 71–73. The Catholic Church pits two advocates against each other to inform decisions on canonization: advocatus Dei (God's advocate) *versus* advocatus diaboli (the Devil's advocate). Properly framed, a comparative study between ACH and the experience of canonization by the Catholic Church could be useful.

level of a theory of strategic analysis. Arms control verification theory, by contrast, is more firmly grounded in the social sciences, including IR theory.

ACH requires the analyst to 'explicitly identify all reasonable alternatives and have them compete against each other for the analyst's favor, rather than evaluating their plausibility one at a time'.[530] It seeks to avoid the situation whereby an analyst intuitively selects the seemingly most likely answer and then seeks information to support it.[531] ACH is therefore a form of dialectic (or counter-factual argument technique) whereby contradictory claims are systematically tested against each other resulting in a more accurate or sophisticated (i.e., deeper) understanding.

In general, the posing and testing of propositions can be done by induction, reasoning by analogy and/or deduction. The ancient Greeks generally favoured deduction.[532] Counter-factual argumentation is a longstanding technique in philosophy dating at least to Socrates and is reflected in the works of Plato and Aristotle in order to reconcile opposing statements.[533] Two fundamental laws of logic underpinning any dialectic can be noted: Aristotle's *Law of Contradiction*, and the *Law of the Excluded Middle*. The law of contradiction may be formulated as: 'It is impossible for anything at the same time to be and not to be', or 'One side of a contradiction must be false'.[534] The law of the excluded middle may be formulated as: 'There cannot be an intermediate between two contradictories', or 'One side of a contradiction must be true'.[535] In addition, the law of contradiction may be understood to pertain to existent objects only. This is because objects may also possess contradictory attributes in one's mind (which, in turn, vary according to individual).[536] In the 19th century, Hegel juxtaposed a thesis againt an anti-thesis in order to achieve a synthesis through sublation (*Aufhebung*). The resulting synthesis then becomes the next thesis in an iterative, open-ended process. In Hegel's system, the synthesis is meant to combine the best elements of the thesis and anti-thesis. In effect, one achieves a series of progressively more fundamental, or 'higher' truths and deeper insight.[537]

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[530] Heuer, Jr. (note 427), p. 95.

[531] Heuer, Jr. (note 427), p. 95.

[532] Morris Kline, *Mathematics: the Loss of Certainty* (Oxford University Press: Oxford, 1980), p. 21.

[533] The extent to which Heuer's method of dialectic contradiction owes its antecedents to classical Western philosophy (including, perhaps, Marx and Engels' *Dialectic Materialism*) should be further considered as part of a separate, philosophical enquiry.

[534] Anders Wedberg, *A History of Philosophy: Antiquity and the Middle Ages,* vol. 1 (Clarendon Press: Oxford, 1982), p. 127. See also W. D. Ross (transl.), *Metaphysics*, *Book IV*, cols. 1011b23-1011b29, pp. 1597–1598 in Ed. Jonathan Barnes, *The Complete Works of Aristotle*, The Revised Oxford Translation, vol. 2 (Princeton University Press: Princeton, New Jersey, 1984).

[535] Wedberg (note 534), p. 127. Aristotle refers several times to the Law of the Excluded Middle. See J. L. Ackrill (transl.), *De Interpretatione*, cols. 18a28-19b4, pp. 28–32; in Ed. Jonathan Barnes, *The Complete Works of Aristotle*, The Revised Oxford Translation, vol. 1 (Princeton University Press: Princeton, New Jersey, 1984).

[536] Categorical distinctions (e.g., of existence and being) have been considered extensively by those in the fields of inter alia logic, mathematics, philosophy and science. To treat this topic systematically is beyond the scope of this study.

[537] Hegel viewed history in terms of processes undergoing progressive development, rather than as being necessarily cyclical or static. He also believed that human thought could

It is worth noting that Croce's principal criticism of Hegel's philosophy of history is that it confuses *opposition* and *distinction*.[538] Croce admitted that some concepts could be usefully contrasted as opposites (e.g., 'good' *versus* 'bad', 'positive freedom' *versus* 'negative freedom'). However, some, like Croce, have argued that the consideration of historical trends or motivations are better characterized in terms of their differences, rather than being subjected to a possibly misguided process of Hegelian dialectic juxtaposition.

Perhaps the more fundamental points are: (*a*) the definition of categories, (*b*) the extent to which they can be compared and contrasted (e.g., comparing 'like' categories with 'like' categories), and (*c*) whether a deeper understanding can be achieved through a Hegelian-type synthesis. For example, the British Middle Eastern news correspondent, historian and social commentator Robert Fisk has objected to discussions on Iraq's internal security being divided according to: the Kurds, the Sunni and Shia partly on the grounds that the latter two categories are by religion. Fisk has expressed concern that Western media reporting that emphasizes these three distinctions has facilitated or promoted sectarian violence. A counter argument to the comparison of 'like' with 'like' is to maintain that this three-way categorization in the case of Iraq is appropriate if it is based on identifying the principal *distinctions* of those groups finding themselves in disagreement or conflict.

Some of the social sciences literature on the definition and contrasting of categories is based on philosophy, while other literature is almost entirely quantitative. Every such field has its own specialized terminology and standard mode of application by the respective practitioners.

Some form of counter-factual analysis and argumentation, such as that proposed by Heuer from a mainly cognitive psychological perspective, has probably existed in many historical and social contexts throughout much of history (wherever sufficiently politically 'sophisticated' and self-aware societies exist). Security and intelligence communities consider Heuer's ACH as having continued operational relevance to the present day.

Finally, it may not be entirely out-of-place for intelligence practitioners to acquire at least a passing familiarity with Marxist dialectic historical literature if only to improve one's concentration (through the reading of dense prose) and to introduce distinctive (perhaps 'alien') thought patterns and perspectives (e.g., within various government circles).

Step 7. Report Conclusions

The analysis will discuss the possible correctness of all hypotheses. It will also consider how the meaning of 'likely' should or could be understood in an ACH in the CW context.

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progressively develop and not remain fundamentally static in its essentials over time. A key question in this regard is whether human nature and understanding of society remains essentially unchanged. See Georg Wilhelm Friedrich Hegel, *The Philosophy of History* (Dover Publications, Inc.: New York City, 1956).

538 The Oxford Professor of philosophy Robin George Collingwood described Croce as Hegel's 'most serious and systematic' critic in his influential, posthumously published: *The Idea of History*. Robin G. Collingwood, *The Idea of History* (Galaxy Book: New York City, 1964), p. 118. Seventh reprint of 1946 edition by Oxford University Press.

Step 8. Identify Milestones

The analysis identifies and describes why selected 'milestones' or key indicators are important indicators of unexpected developments. It is possible that milestones identification processes in this context overlap with difficulties associated with the identification and implementation of milestones in organization theory and practice (e.g., KPIs in UN-type organizations or EU structures).

To reiterate, the advantages to ACH include prompting or allowing analysts: (*a*) to create a complete set of alternate hypotheses, (*b*) to refute (or at least undermine) hypotheses, (*c*) to manage evidence for ongoing analysis, (*d*) to present conclusions in a manner that shows how they were reached, (*e*) to better identify indicators that can be evaluated in order to better determine the direction of events (e.g., assessment of ongoing weapon programmes) and (*f*) to create (and improve) an audit trail of how the analysis was carried out.[539] Inter-office or inter-agency collaboration is facilitated, particularly if software is used.[540]

The potential drawbacks of the technique are: (*a*) assumptions or logical deductions are omitted or are not apparent from the matrices, (*b*) insufficient attention is given to 'less likely' hypotheses, (*c*) the existence (perhaps secret) or introduction of 'definitive evidence' is not done justice by assigning it 'high credibility' in the ACH terminology, (*d*) the evidence and arguments are not representative of the overall analytical problem, and (*e*) a problem of 'diminishing returns' exists after a certain amount of evidence has been accumulated because, beyond this point, any given additional item of information that is 'inconsistent' with the hypothesis carries less weight (in economic terms: 'diminishing marginal returns').[541]

10.1. Summary of Application

This study integrates arms control CW verification literature into a variation of ACH developed by the author. This is done partly in order to set the stage for argument mapping in order to facilitate more general qualitative analysis on the role of CW assessments in the arms control, and security and defence fields.

It is hypothesized that the application of a hybrid, qualitative and CW-focused formulation of ACH directed to arms control verification and intelligence techniques will yield sufficient operational-level dichotomies that can then be used to inform a strategic analysis of neoliberal institutionalism and realist IR theoretical models. By employing a variation of established training methodologies for intelligence purposes, such distinctions (operational-level dichotomies) can help to explain and further develop these schools modeling of WMD deterrence theory, both in a traditional Cold War state-to-state context and a contemporary non-state actor context. In so doing, the gap between intelligence art and academic IR theory can be partially reconciled.

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[539] Heuer Jr. and Pherson (note 5), pp. 161–162.

[540] Heuer Jr. and Pherson (note 5), p. 162.

[541] Heuer Jr. and Pherson (note 5), pp. 167–168.

ACH is an appropriate analytical technique for inter alia: (*a*) assessing the possibility of deception, (*b*) challenging one's mental model and (*c*) managing conflicting mental models or opinions.[542] ACH should be used in cases where it is difficult to decide between alternate explanations, where one requires a systematic approach to help uncover unsuspected outcomes, in cases where it is useful to leave behind an 'audit trail' that indicates how evidence was understood and employed in order to permit other analysts to reach alternate conclusions, and where a 'robust flow of data' must be absorbed and evaluated.[543] Once again, Heuer and Pherson note that ACH is 'well-suited for addressing questions about technical issues in the chemical, biological, radiological, and nuclear arena'.[544]

[542] Heuer Jr. and Pherson (note 5), pp. 36–37.
[543] Heuer Jr. and Pherson (note 5), pp. 160–161.
[544] Heuer Jr. and Pherson (note 5), p. 161.

PART II

CHEMICAL WARFARE AGENTS

11

CHEMICAL WARFARE AGENTS: BACKGROUND AND ATTRIBUTION

According to one estimate approximately 30 main traditional CW formulations exist, including lewisite, sarin, soman, tabun, VX and sulphur mustard.[545] There are three main types of lewisite, three main types of nitrogen mustard and at least nine major types of sulphur mustard (see below). Furthermore, the chemical composition of any given CW agent varies according to whether thickeners, freezing point depressants or stabilizers have been added. At least 120000 compounds are covered in the CWC's Annex on Chemicals; they include standard CW agents, their precursors, known decomposition products, and related compounds.[546] These chemicals are nevertheless a sub-set of toxic chemicals and numerous biological substances, including proteins and so-called toxic industrial chemicals (TICs). The widespread use of chlorine and phosgene during World War I may, today, also be viewed more as an employment of TICs for hostile purposes rather than CW agents as a method of warfare.

Only the blister agent sulphur mustard, and two organophosphorus agents sarin and VX will be considered in any detail.[547] These three are the standard agents of 20th century state military programmes. Following a general introduction to sampling and analysis, the discussion focuses on GC/MS, the so-called 'gold standard' of field detection systems.[548] The principal degradation products and metabolites of these three CW agents will be considered within the context of GC/MS procedures. The overall analysis will be primarily political, but informed by these technical factors. The purpose is to provide a general

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[545] Shigeyuki Hanaoka, 'Analysis of Chemical Warfare Agents and Their Related Compounds', p. 69 in Eds. Osamu Suzuki and Kanako Watanabe, *Drugs and Poisons in Humans: a Handbook of Practical Analysis* (Springer Verlag: Berlin, 2005). See also CWC, Annex on Chemicals.

[546] Shigeyuki Hanaoka, 'Analysis of Chemical Warfare Agents and Their Related Compounds', p. 69 in Suzuki and Watanabe (note 545). The number of chemical compounds subject to routine declaration and verification is based on the OPCW Handbook on Chemicals. The 2009 edition of this Handbook lists approximately 7261 chemical names (some of which refer to the same chemical and therefore have identical CAS numbers). However, the CWC's Annex on Chemicals covers classes of chemicals, as does the Harmonized Commodity Description and Coding System (Harmonized System, HS). As such the number of chemicals covered under routine declaration and verification under the CWC is substantially greater. The HS nomenclature forms an important basis for strategic trade controls over chemicals transfers and can be used (depending on the number of digits specified) to denote a specific chemical or class of chemical, as well as to indicate the country of origin.

[547] There are numerous organonphosphorus nerve agents, including Chinese VX. On the distinction between Soviet V-agent and VX, see below.

[548] Frank Settle (ed.), *Handbook of Instrumental Techniques for Analytical Chemistry* (Prentice Hall PTR: Upper Saddle River, New Jersey, 1997).

review of the nature and type of toxic chemicals and their precursors, how they have been used as a method of warfare and their peaceful applications for scientific research and by the chemical industry.

Chemical warfare agents can be categorized according to their principal physiological effects. A standard classification of agents is: (*a*) vesicants, (*b*) blood agents, (*c*) choking agents, (*d*) incapacitants, (*e*) organophosphorus nerve agents, (*f*) tear gas and (*g*) vomiting agents.

Increased attention has also been devoted to the control and oversight of TICs as a result of the current increased focus on potential threats posed by non-state actors. TICs can be defined as having a LCt_{50} of less than 100 000 mg-min/m^3 and being produced in amounts of over 30 tonnes annually at any given facility.[549] This definition exemplifies a 'types and quantities' concept that complements part of the CWC's definition of a chemical weapon.[550] This definition also appears to be partly based on CWC declaration threshholds concerning certain discrete organic chemicals that may contain the elements phosphorus, sulphur or fluorine (DOC/PSFs).[551] It should also be noted that not all DOC/PSFs are highly toxic.

Vesicants cause skin blisters and can severely damage the eyes, throat, and lungs. Life-threatening infections in the trachea and lungs can result. Lewisite (L), nitrogen mustards (HN-1, HN-2, HN-3), sulphur mustard (H, HD), and phosgene oxime (CX) are blister agents. Their primary purpose is to cause mass casualties requiring intensive, long-term treatment, rather than death. Those exposed may also suffer from long-term health problems.[552]

Blood agents, such as arsine (SA), cyanogen chloride (CK), and hydrogen cyanide (AC), inhibit cytochrome oxidase, an enzyme necessary to permit oxygen to be transferred from the blood to the body's tissue and, in the case of significant exposure (mainly a function of time and concentration), rapidly become fatal.[553]

Choking agents, such as chlorine, diphosgene (DP) and phosgene (CG), interfere with breathing. Phosgene and diphosgene interfere with transfer of oxygen via the lung's alveoli sacks. Symptoms of phosgene poisoning do not become apparent for up to several hours. In addition, the chances for survival are a function of physical exertion. The more a victim exerts himself physically

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549 Yin Sun and Kwok Y. Ong, *Detection Technologies for Chemical Warfare Agents and Toxic Vapors* (CRC Press: Boca Raton, Florida, 2005), p. 9.

550 The CWC defines a chemical weapon to include inter alia 'Toxic chemicals and their precursors, except where intended for purposes not prohibited under this Convention, as long as the types and quantities are consistent with such purposes'. CWC, article II, para. 1(a).

551 The production of DOCs above 200 tonnes annually must be declared to the OPCW, while the production of above 30 tonnes annually must be declared to the OPCW. The processing, consumption, import or export of DOCs or DOC/PSFs need not be declared to the OPCW under the CWC's routine declaration and verification system. CWC, Verification Annex, Part IX, para. 1.

552 Ed. Kouki Inai, *Atlas of Mustard Gas Injuries: Building Bridges Between Iran and Japan through the Relief of Victims Exposed to Mustard Gas* ([no publisher]: [no location] 2012). Distributed at 3rd CWC Review Conference, The Hague.

553 John Eldridge (ed.), *Jane's Nuclear, Biological and Chemical Defence 2005–2006*, 18th edtn. (Jane's Information Group Ltd.: Coulsdon, UK, 2005), p. 69.

following exposure, the more likely death will result. Complete rest and oxygen treatment are recommended.[554]

Incapacitating agents are designed to induce physical disability or mental disorientation. LSD (a form of lysergic acid) and BZ (3-quinuclidinyl benzilate) are two examples.[555] The United States investigated the potential military uses of LSD.[556] It also weaponized BZ, which can cause constipation, headaches, hallucinations, and a slowing of mental thought processes.

The principal nerve agents, sarin (GB), cyclosarin (GF), soman (GD), tabun (GA) and V-agents, are all organophosphorus compounds that inhibit an enzyme responsible for breaking down acetylcholine, a neurotransmitter. Nerve agents may be inhaled or absorbed through the skin. Symptoms include drooling, dilated pinhead pupils, headache, involuntary defecation, and a runny nose. Death is caused by cardiac arrest or respiratory failure.[557]

Tear gases, such as chloroacetephenone (CN) and O-chlorobenzalmalonitrile (CS), cause irritation of the skin and uncontrolled tearing. Although they are designed to be used as non-lethal, riot control agents, their employment can result in death or injuries if improperly used at high doses, enclosed areas or for extended periods.[558]

Although vomiting agents, such as Adamsite (DM), diphenylchloroarsine (DA), and diphenylcyanoarsine (DC), have been used for riot control purposes, they are now generally considered to be too toxic for this purpose.[559] These agents are now considered unsuitable for use as CW against an opponent using modern protective equipment.[560] Some choking or irritating compounds, such as chloropicrin and diphosgene, have been used for rodent control.[561]

Finally, it should be noted that while all CW agents can be viewed as ‘obsolete’, their use persists and states should continue to take steps ensure adequate preparedness and response capacities are available.

11.1. CW Agent Synthesis

Any attempt to list agents and munitions and associated technologies risks devolving into an open-ended exercise. Another difficulty is how to describe the characteristics of chemical weapons (known and possible) in a manner that permits meaningful and well-defined activities for control, verification or oversight purposes (e.g., arms control verification, customs or intelligence).

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[554] Eldridge (note 553), pp. 69–70.

[555] Eldridge (note 553), p. 70.

[556] Ketchum (note 134), pp. 53–68.

[557] Eldridge (note 553), pp. 70–71.

[558] Eldridge (note 553), pp. 72–73.

[559] Eldridge (note 553), p. 73.

[560] The OPCW SAB has concluded that Adamsite should not be used as an RCA. Following entry-into-force of the CWC some States Parties declared the agent as either an RCA or a CW agent.

[561] E.g., one OSOAViaKhim publication covers improvement of soil, diseases and pests in agriculture, chemical warfare agents and methods and means of aerial and ground CW attack and defence. It prescribes the use of chloropicrin to kill gophers. Enyukov (note 204), p. 189. Vials of chloropricin were also hung on the inside of safe doors to deter thiefs. Josh Berry, ‘WWI-era Chemical Weapon Found in Benton, Ar.’, OzarksFIRST.com, 24 May 2013, <http://arkansasmatters.com/fulltext?nxd_id=666572>, (accessed 26 May 2013).

Those involved in oversight and control should ideally possess some understanding of production techniques of chemical weapons and the development and use of chemicals for peaceful purposes. A great deal of the literature on the prevention of chemical warfare concerns sulphur mustard and a limited number of 'standard' organophosphorus nerve agents that were weaponized as part of prior state programmes.[562]

Sulphur mustard is a simple (i.e., short, and aliphatic—or straight chain) compound that is relatively easy to produce using precursors that are widely used in the chemical industry (e.g., thiodiglycol and hydrogen chloride (HCl)).[563] Production of the principal organophosphorus nerve agents does not traditionally require complex equipment. However, working with the highly reactive fluorine compounds (in the case of sarin) and the distillation and other purification steps associated with nerve agent production can be complex and potentially dangerous to the health and safety of those involved in their production.[564] Furthermore, repeated low-level exposure to cyclosarin (GF), for example, induces heightened sensitivity and, therefore, workers incur an increased risk for serious injury or death. It can also be argued that a technical progression from the G-agents to the V-agents may be required as part of an expertise 'development curve'.[565]

Two special characteristics of soman should also be noted. One is that soman has the additional effect that, within minutes, it will permanently deactivate AChE and oxime therapy therefore becomes ineffective. Second, pinacolyl alcohol ($C_6H_{14}O$, IUPAC name: 3, 3-dimethylbutan-2-ol, CAS no. 464-07-3) is necessary for the production of soman and appears not to be used by the chemical industry at the present time.[566] Thus the presence of pinacolyl alcohol stocks is a potential indicator of CW activity and, as such, is subject to being 'red flagged' by those involved in implementing strategic trade controls.

Differences in technical challenges are to be expected with the production of CW agents at the laboratory level as compared to large-scale or industrial production.[567] Chemical reactions, such a precipitation of sulphur impurities from an initial batch of agent may be seemingly impossible to induce even though the 'procedure' was followed correctly. It has been occasionally observed

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[562] Lundin (note 97).

[563] Achieving highly pure (highly distilled) sulphur mustard may nevertheless pose a challenge to some, including for non-state actors.

[564] Accidents have occurred in large, technically advanced prior state programmes among production workers and human test volunteers. In 1953 the British military serviceman volunteer Ronald Maddison died when 200 mg of liquid sarin were deliberately poured onto his uniform. In 1968 sheep alongt the border of the Dugway Proving Ground were killed by an accidental release of VX as part of an open-air testing exercise. Garrett and Hart (note 108), 'Skull Valley Incident', pp. 191–192.

[565] On largescale VX production difficulties at Muscle Shoals, Alabama, see Ferguson, Hylton and Mumma (note 233) vol. I, pp. 6–8.

[566] The auther cannot exclude current or future peaceful uses for this compound. Its presence has long been pointed to in chemical arms control verification discussions as a strong indicator of a CW programme. A 1993 OTA report stated unambiguously that this alcohol has no commercial uses. US Congress Office of Technology Assessment (note 12), p. 30.

[567] See Ferguson, Hylton and Mumma (note 233) vol. I, pp. 6–8.

that chemistry, especially at the laboratory level, can resemble cooking in that the souflé may refuse to rise, even if the recipe has been carefully followed.

Finally, consideration should also be given to chemical nomenclature. As chemical compounds were being discovered and analysed—the pace of discovery began to accelerate starting mainly in the 18th and 19th centuries—the underlying theory of atoms was underdeveloped or absent. Chemists also had to determine the basic chemical properties of elements and compounds such as boiling and freezing temperatures and weight. Chemists often gave names to chemicals on the basis of how they appeared, smelled or tasted. Thus the compound that later became known as arsenic trichloride ($AsCl_3$), a potential precursor of various arsenic chemical warfare agents such as Lewisite, was formerly commonly known as 'butter of arsenic'.[568] Nor was it necessarily clear whether a chemical was an element or a compound. There are numerous synonyms for chemical compounds within and across languages. Some are out-of-date. However, some older terminology may nevertheless be used in different contexts. For example, customs bodies sometimes translate or retranslate chemical terms resulting in the use of older terminology or misspellings.[569]

11.2. Organophosphorus Nerve Agents

Organophosphorus nerve agents are the most toxic and studied class of chemical warfare agents. They can be divided according to G-class agents (soman, sarin and tabun) and the V-agents (VX and V-gas). The Soviet Union developed another group of nerve agents collectively known as novichoks ('newcomers').[570] China also tested a variant (VS, or 'Chinese VX') which are today among the compounds used by some CWC States Parties to evaluate and improve sampling and analysis protocols.[571] There are several thousand organophosphate compounds of moderate concern from the standpoint of their ability to cause serious acute (as opposed to chronic) toxicity effects in humans.[572] Many of the physico-chemical effects of G- and V-agents are similar to those found among organophosphate pesticides. For example, work by Gosh and his associates after World War II on the development of the pesticide amiton prompted further work by the UK and United States to develop VX as a chemical warfare agent. Some such pesticides are not approved for use because of their high toxicity. The protein acetylcholinesterase can be inhibited by

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[568] Arsenious chloride ('butter of arsenic') was discovered by Carl Wilhelm Scheele in 1775. 'Arsenic', <http://mysite.du.edu/~jcalvert/phys/arsenic.htm>, (accessed 10 Feb. 2013).

[569] Examples of this were considered at: SIPRI and Vinca Institute, *Chemical Production Classification and Recognition: Foundation Course and Customs Table Top Exercise on Chemical Transfers in the Western Balkans, Course and Background Material*; Vinca Institute, Serbia; 24–18 Nov. 2008.

[570] For an account by a scientist who participated, see Vil Mirzayanov, *Vyzov* [The Call] ("Dom Pechati" Publisher: Kazan', 2002); and Vil S. Mirzyanov, *State Secrets: An Insider's Chronicle of the Russian Chemical Weapons Program* (Outskirts Press: Denver, Col., Jan. 2009).

[571] Some of this work has been carried out within the framework of the OPCW SAB programmes of work.

[572] Toxicity numbers should always be considered both in terms of acute and chronic toxicity. See Annexe C for a list of common TICs.

organophosphorus nerve agents at its esterasic site or on both the esterasic and anionic sites.[573]

The interaction of various acetylcholine receptors, such as muscarinic acetycholine receptors, have been studied partly within the context of understanding the effect of pesticides and related compounds that could potentially be used as CWAs. Amiton, for example, was originally developed in the 1950s by Drs Ranajit Ghosh and J. F. Newman for use as a pesticide but its use today for this purpose has been essentially ended.[574]

A key structural difference between, on the one hand, the organophosphorus nerve agents sarin, soman, V-gas and VX and, on the other hand, organophosphorus pesticides is that the former have a phosphorus-methyl group (P-CH_3). This bond, which is partly responsible for human toxicity effect, is strong and tends to remain intact in the agents' various degradation products. Thus, the existence of this bond in a known degradation product of the above-mentioned CW agents is a potential indication that the chemical was manufactured for non-peaceful purposes.

There are numerous possible production routes to produce G- and V-agents, particularly if one includes the alternate production routes for key or major precursors. Several synthesis routes for both classes of agents involve the use of methylphosphonic dichloride (DC) (sometimes called 'dichlor' for short) which, although highly corrosive, is relatively easy to ship and store in appropriate containers.[575] A key production step occurs during the fluorination of DC, colloquially referred to as the 'di-di mixture' (which has no apparent peaceful uses).[576]

The organophosphate tabun (N,N-dimethylphosphoramidocyanidate, $C_5H_{11}N_2O_2P$, CAS no. 77-81-6) is manufactured using readily accessible precursors, including ethanol hydroxide (EtOH), phosphorus trichloride ($POCl_3$) and sodium cyanide (NaCN). Tabun was synthesized in 1936 by Gerhard Schrader as part of pesticide research. It has been observed that tabun is one of the simpler organophosphorus nerve agent to manufacture partly because it does not possess the somewhat challenging to synthesize phosphorus-alkyl group bond.[577]

11.3. Vesicating Agents

Of the vesicating or blister agents developed for military use, only sulphur mustard arguably retains potential military utility in case of a decision by a state that wishes to pursue a chemical warfare programme that includes such agents.

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[573] Eds. Satu M. Somani and James A. Romano, *Chemical Warfare Agents: Toxicity at Low Levels* (CRC Press: Boca Raton, Florida, 2001).

[574] R. Ghosh and J. F. Newman, 'A New Group of Organophosphorus Pesticides', *Chemistry and Industry* (29 Jan. 1955), p. 11.

[575] Jonathon B. Tucker, *War of Nerves*: *Chemical Warfare from World War I to Al-Qaeda* (Pantheon Books: New York, 2006).

[576] Personal communication, Sep. 2013.

[577] As opposed to sarin. US Congress Office of Technology Assessment (note 12), p. 26.

11.3.1. Lewisite

Lewisite consists of a group of three chlorovinyl arsine compounds ($C_2H_2AsCl_3$—Lewisite-1, $C_4H_4AsCl_3$—Lewisite-2 and $C_6H_6AsCl_3$—Lewisite-3). It was first prepared for use as a CW agent during World War I by the US chemist Dr Winford Lee Lewis based on a thesis by Julius Arthur Nieuwland using the reaction of arsenic trichloride with acetylene.[578] Its development occurred too late to allow it to be used during World War I. A shipment of Lewisite from the United States was in route to Europe when the war ended.[579] Germany, Japan and the Soviet Union developed and stockpiled the agent, partly in order to mix with sulphur mustard in order to lower sulphur mustard's freezing temperature.[580]

The principal method for preparing Lewisite is still to react acetylene (C_2H_2) with arsenic trichloride ($AsCl_3$) in the presence of an appropriate catalyst.[581] Lewisite-1 is the principal yield. The secondary and tertiary lewisites are of less interest (e.g., Lewisite-2 displays a reduced blistering effect). The military utility of Lewisite was lessened by the discovery of a fairly effective treatment for arsenic poisoning called British Anti-Lewisite, BAL (2,3-dimercaptopropanol). BAL is a chelating agent and has been used to treat metal poisoning more generally (chelants are organic compounds which sequester metal ions and thus render the metal compound essentially unreactive to an organism's metabolic processes). Mixtures of Lewisite and sulphur mustard continue to be recovered in chemical weapons abandoned by Japan in China during World War II.[582]

11.3.2. Mustards

The manufacture of mustard agents (i.e., sulphur and nitrogen) requires chlorinating agents (i.e., they require a chemical compound that can act as a chlorine donor). Common chlorinating agents include $SOCl_2$ (thionyl chloride), PCl_3 (phosphorus trichloride), and PCl_5 (phosphorus pentachloride).

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[578] Classes of organic compounds include: alcohols (-OH, hydroxyl), and ethers (RO, alkoxyl).

[579] SIPRI (note 98), p. 62.

[580] Garrett and Hart (note 108), 'Freezing-point Depressant', pp. 80–81.

[581] In chemistry, catalysts have generally been metals or metal compounds. However, the use of enzymes is increasingly common in the further development of industrial chemical processes.

[582] On the status of destruction of Japanese ACW in China, see John Hart and Peter Clevestig, 'Reducing Threats from Chemical and Biological Material', *SIPRI Yearbook 2013: Armaments, Disarmament and International Security* (Oxford University Press: Oxford, 2013), p. 375; and 'Note by the Director-General, Overall Progress with Respect to the Destruction of the Chemical Weapons Abandoned by Japan in the People's Republic of China', OPCW document EC-73/DG.11, 11 July 2013, <http://www.opcw.org/documents-reports/executive-council/seventy-third-session/>, (accessed 24 July 2013).

11.3.3. Nitrogen Mustard

There are three forms of nitrogen mustard (HN1, HN2 and HN3). Interest in these compounds declined following World War II partly because CW planners realized the difficulty in developing a stabilizer that would allow them to be stored for longer-periods. In its free base form, nitrogen mustard solutions gradually become transformed into a piperazine salt and therefore lose their value as chemical warfare agents. Piperazine compounds, which bear a chemical resemblance to piperdine found in some black peppers, are today used in the manufacture of some pharmaceuticals, plastics and resins.

Triethanolamine (TEA) is a possible precursor of nitrogen mustard and, for this reason, is listed in Schedule 3 of the CWC's Annex of Chemicals. TEA is an organic compound with a range of commercial uses. For example, it acts as a weak base and can therefore be used as a pH balancer for body care products such as skin lotions and moisturizers.

TEA is also capable of forming complex compounds with other materials in solution (i.e., it is a 'complexing agent'). Such characteristics are desirable as part of broader attempts to design and control intermediate chemical processes. This typically includes making functional chemical groups susceptible to a desired reaction or sequestering them so that they are not reacted (i.e., chemically transformed prematurely) and can be made reactive at a later stage.

11.3.4. Sulphur Mustard

There are at least three main production routes for HD.[583] The sulphur atom can be substituted with carbon-sulphur or oxygen-carbon-sulphur chains (e.g., sesqui-mustard (HT)). The choice of production route is informed by the suitability and availability of the chlorinating agent. Some, such as the Levenstein method, yield higher levels of sulphur impurities. Such sulphur mustard therefore tends to degrade faster. For example, a longstanding challenge for the storage of munitions or containers filled with sulphur mustard is that any hydrolysis yields some hydrogen chloride (HCl), a widely used industrial acid. HCl reacts with metal and gives off the inflammable gas hydrogen which has often resulted in a buildup of pressure (potentially explosive) within munition bodies or bulk storage containers. For this reason, munitions were often not fully filled to capacity with sulphur mustard and a great deal of effort was devoted by researchers into investigating stabilizers and thickeners which, among other things, slowed or inhibited chemical reactions with metal. Bulk storage containers were also routinely opened at storage sites to allow for off gassing.

The chlorinating agent of greatest interest in the production of sulphur mustard is thionyl chloride ($SOCl_2$).[584] The production route using TDG is the most attractive for several reasons, including the fact that it yields the highest purity agent. Other chlorinating agents that have been used include phosphorus trichloride (PCl_3) (the Meyer Process), chlorination by HCl in concentrated solution and chlorination by gaseous HCl. In order to increase sulphur mustard's persistence and to lower its freezing temperature, various admixtures such as

583 Lundin (note 97), pp. 4–6.
584 Lundin (note 97).

synthetic resins which are resistant to standard decontaminating agents and adhere to equipment and clothing 'like glue' have been developed.

11.4. Chemical Warfare Agents in the CWC Annex on Chemicals

The CWC prohibits all toxic chemicals and their precursors except for non-prohibited purposes.[585] The CWC's routine declaration and verification regime is based on chemicals listed in the convention's Annex on Chemicals. This Annex consists of three 'schedules of chemicals' (schedule 1, schedule 2 and schedule 3). The convention also contains guidelines for the routine declaration and verification of certain discrete organic chemicals that may contain phosphorus, sulphur or fluorine (DOC/PSFs) (DOC/PSFs are not listed in the schedules).

The CWC negotiations on how to define chemicals and regulate them, including their production and use by the chemical industry, were long and complex. The negotiators initially considered whether and how to categorize militarily significant chemicals as 'super-toxic chemicals', 'other lethal chemicals', or 'other harmful chemicals'.[586] Discussions initially focused on a chemical's toxicity and included efforts to defined 'militarily significant' quantities of chemical agents and their deviation ranges, effective dosages, ratios of agent weight to body weight, median lethal dose (inhalation) and median lethal dose (subcutaneous).[587] This resulted in detailed discussions on the methodologies used in toxicity studies and how differences in assumptions, test animals and control parameters affect results. CWC negotiators finally decided that efforts to reconcile the toxicity of a chemical with its potential use as a chemical warfare agent and its peaceful applications by the research community and the chemical industry were impractical.

The negotiators instead decided to list chemicals in schedules not according to toxicity per se, but in terms of the threat they pose to the object and purpose of the treaty and the extent to which they have peaceful applications. Thus Schedule 1 chemicals are deemed to pose a 'high' risk to the CWC with few, if any, peaceful applications. Schedule 2 chemicals pose a 'significant' risk and Schedule 3 chemicals pose 'some' and have wider peaceful applications. The inclusion of DOC/PSFs in the treaty's routine declaration and verification regime (as opposed to all toxic chemicals and their precursors being subject to verification through, for e.g., a challenge inspection) was done in order to help ensure that the treaty's depth and scope are not overly restricted. In other words, the DOC/PSF verification regime helps to promote confidence among the parties to the CWC that the treaty is being fully and effectively implemented.

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[585] CWC, article II, para. 1.

[586] E.g., 'Report of the Committee on Disarmament to the United Nations General Assembly', Committee on Disarmament document CD/421, 1 Sep. 1983, p. 66.

[587] This understanding was based on consultations held in March 1982 among 32 experts from 25 states. These experts unanimously agreed to recommend a standardized operating procedure for acute subcutaneous toxicity and acute inhalation toxicity determinants. 'Annex on Chemicals, Introductory Note by the Chairman of Working Group 4', Conference on Disarmament document CW/Group4/3, revision 3, undated, pp 18–22. Partly based on John Hart, 'The Treatment of Perfluorisobutylene under the Chemical Weapons Convention', *ASA Newsletter*, no. 88 (28 Feb. 2002), pp. 1, 20–23.

The OPCW continues to implement a range of activities to consult on and harmonize implementation practice, including how to ensure that chemical industry declarations are correct and complete and the further harmonization of data collection and declaration methodologies, as well as determining the most appropriate frequency of inspection and site selection procedures for onsite inspection.

Table 11.1 Selected Schedule 1 Chemicals

Trivial name	CAS no.
Organophosphorus nerve agents	
Sarin	107-44-8
Soman	96-64-0
Tabun	77-81-6
VX	50782-69-9
V-gas	not provided
Vesicants	
Lewisite 1	541-25-3
Lewisite 2	40334-69-8
Lewisite 3	40334-70-1
Nitrogen mustard (HN1)	538-07-8
Nitrogen mustard (HN2)	51-75-2
Nitrogen mustard (HN3)	555-77-1
Sesquimustard	3563-36-8
Sulphur mustard (2-chloroethylchloromethylsulphide)	2625-76-5

Source: Author compilation.

Table 11.2 Selected Schedule 2 Chemicals

Trivial name	CAS no.
Amiton	78-53-5
PFIB	382-21-8
BZ	6581-06-2

Source: Author compilation.

Table 11.3 Selected Schedule 3 Chemicals

Trivial name	CAS no.
Chlorpicrin	76-06-2
Cyanogen chloride	506-77-4
Hydrogen cyanide	74-90-8
Phosgene	75-44-5

Source: Author compilation.

11.5. Incapacitants

Incapacitants are meant to debilitate without causing permanent injury or death. Agents developed as part of traditional state chemical warfare programmes include BZ and LSD.[588] This includes the filling of BZ into munitions and field and laboratory human trials. Some argue that a distinction should be made between incapacitants and RCAs. This is partly because the former are meant to cause a person to become docile, mentally incapacitated or to fall asleep. RCAs generally cause severe short term pain or irritation and are meant to compel those targetted to leave a given area immediately. Because toxicity is a function of dosage, as well as the fact that incapacitants and RCAs can be misused (e.g., in poorly ventilated enclosed environment), a range of ethical, legal, military and police doctrine and training issues arise.[589] Also, as with any programme involving the development and use of chemicals for peacekeeping, counter-terrorism, riot control and the like, there are continuing concerns that such activities may serve as standby capacity to break out of the CWC or effetively undermine the treaty norms through the routine development and use of such agents for ostensibly peaceful purposes (i.e., not as a 'method of warfare').

11.6. Dual-purpose Chemicals

In addition to the above-cited definition,[590] TICs have been further sub-divided according to high, medium and low hazard indices.[591] Examples of such chemicals include bleach solutions,[592] cyanogen chloride, hydrogen cyanide and phosgene. TICs have usually been considered in terms of their potential threat to health and safety and the environment, especially within the chemical industry context. Some toxic compounds have also been considered in terms of the toxic fumes created on the battlefield when electronic components and various plastics, solvents and fuels burn during combat. For example, perfluorisobutylene (PFIB) is a TIC of concern because PTFE (i.e. Teflon™) has a wide variety of commercial and military applications given its lubricity and chemical inertness.

In the 1950s the Imperial Chemical Industries (ICI) found that employees at at facilities that were heat treating PTFE were suffering adverse pulmonary effects.[593] The industry standard for particulate testing was generally at the parts per million level, rather than the parts per billion level. As ICI was unable to determine the cause of the illnesses, it approached Porton Down (the UK's chemical defence establishment) whose experts then determined the cause and

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[588] E.g., in 1964 the US Army conducted BZ field trials (code-named 'Project Dork') on soldiers at Dugway Proving Ground in Utah. Ketchum (note 134), pp. 141–152.

[589] Crowley (note 49).

[590] Sun and Ong (note 549), p. 9.

[591] Hazard Index (HI) = toxicity x state [i.e. gas or liquid] x distribution x producers.

[592] A common form is 'chlorine bleach' which consists of a solution of about 5 per cent sodium hypochlorite (NaOCl).

[593] For more recent research on the pulmonary effects of PFIB, see Hemei Wang, Rigao Ding, Jinxiu Ruan, Benli Yuan, Xiaohong Sun, Xiancheng Zhang, Shouzhong Yu and Wensheng Qu, 'Perfluoroisobutylene-induced Acute Lung Injury and Mortality are Heralded by Neutrophil Sequestration and Accumulation', *Journal of Occupational Health*, vol. 43 (2001), pp. 331–338.

also discovered that standard activated charcoal-based filters were unable to capture PFIB.[594] Given the respirator technology at the time, this finding had security and defence implications. Today, however, PFIB remains an industrial health hazard that can be readily managed. PTFE is still produced in the millions of tonnes per annum.[595] PTFE has also been used in the manufacture of military vehicles, including tanks, armored personnel carriers and aircraft.

With the increased international focus on threats posed by non-state actors TICs have been brought increasingly into the mainstream of threat perceptions and risk analysis. The incorporation of TICs into non-state actor threat analyses and, in view of Parcelsus' injunction that 'the dose makes the toxicity', the number of potentially hazardous chemicals that can be misused to cause physical harm or psychological or economic damage are today practically open-ended. A list of some commercially available TICs is provided in Annexe C.

11.6.1. Chloripicrin

Chloropicrin (CCl_3NO_2) was used as a lachrymator during World War I.[596] The dye industry sometimes uses it. The chemical can also be used for the production of some insecticides.[597]

11.6.2. Hydrogen Cyanide

Hydrogen cyanide (HCN) is a toxic chemical with wide applications in the chemical industry that was also field-tested as a potential chemical warfare agent by a number of states, including Germany and the Soviet Union.[598] Although the HCN toxicity is high,[599] its vapour pressure is also high[600] and a part of the HCN will be destroyed when explosively disseminated (HCN is also fairly flammable).[601] It therefore proved extremely difficult for military establishments to obtain the necessary field concentration. Allegations of use of cyanide compounds, including HCN, should therefore be evaluated in this light.

Two major methods for the production of HCN by the chemical industry are the Andrussov Process (which consists of oxidizing a mixture of ammonia and methane with air using platinum as a catalyst) and the Degussa process which was developed by Degussa AG as a method for the detoxification of cyanide using hydrogen peroxide. This process has been applied to treat mining tailings. (A common method for the extraction of gold has involved cyanide

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[594] Personal communication, Sep. 2013.

[595] Personal communication, Sep. 2013.

[596] SIPRI (note 98), p. 47.

[597] An OSOAVIAKhim publication covering the improvement of soil, diseases and pests in agriculture prescribes the use of chloropicrin to kill gophers. Enyukov (note 204), p. 189.

[598] E.g., see Walter Hirsch, *Soviet BW and CW Capabilities ("The Hirsch Report")* (declassified) (US Army Chemical Intelligence Branch: Washington, D.C., 15 May 1951).

[599] E.g., about 3200 mg/m^3 is sufficient to kill a human within one minute.

[600] 620 mm Hg at 20 degrees Celsius.

[601] The US National Fire Protection Association has given HCN a flammability rating of 4 ('severe fire hazard'). US Department of Labor, Occupational Safety & Health Administration, 'Occupational safety and helath guideline for hydrogen cyanide', <http://www.cdc.gov/niosh/docs/81-123/pdfs/0333.pdf>, (accessed 16 June 2013).

leaching in which a cyanide solution is used to dissolve gold from host rocks for later precipitation. This has resulted in widespread environmental contamination in gold mining areas.)

Chlorine can be reacted with sodium cyanide (NaCN) or HCN to produce chlorine cyanide (ClCN). Chlorine cyanide is the key raw material for cyanuric acid—also known as cyanuric chloride ($Cl_3C_3N_3$)—an important intermediate for the production of dyes, pesticides and detergents. Manufacturing processes are also continuing to be developed to meet major chemical industry demands for acrylonitrile (C_3H_3N). It is used in the manufacture of acrylic fibres, various nylons and some types of synthetic rubber. HCN is produced as a byproduct in the production of acrylonitrile in a process that involves the use of ammonia as an oxidizing agent of propylene (also called propene).

Whether the CWC's routine verification regime on the chemical industry captures HCN is partly dependent on how the term 'captive use' is understood and applied. HCN is typically used at the site where it is produced. Sometimes it is eliminated through in-line processes (i.e., the chemical is not removed from the production line process but is consumed within it). In other instances, HCN is stored in temporarily in 'day tanks'. The chemical industry trends and facility design should be periodically considered in connection with specific information on the intent of those involved in the manufacture, transport and consumption of acrylonitrile and cyanuric chloride.[602]

11.6.3. PFIB

Perfluoroisobutylene (PFIB) is produced as a common by-product, in tens of thousands of tonne quantities, in the fluoropolymer industry, including the production of 1,1,1,3,3,3-hexafluoro-2-propanol (HFP) and tetrafluoroethylene (TFE) and processes involving the pyrolysis of polytetrafluoroethene (PTFE), more commonly known by its trade name Teflon™. As an unwanted by-product with apparently no known commercial uses above one tonne, it is generally eliminated through scrubbing or thermal treatment. PFIB is at least two orders of magnitude more toxic than phosgene. PFIB can cause pulmonary edema and those affected must then be treated for 'polymer fume fever'.[603] It can also act as a 'mask breaker' in one of two ways. Since PFIB is dipolar it cannot be absorbed by carbon. Second PFIB readily hydrolyzes to hydrogen fluoride (HF, an acid) in the presence of moisture or water (i.e., human breath).[604] PFIB's toxicity and effect are similar to those of phosgene and, like phosgene, no treatment for exposure is currently available with the exception of complete avoidance of physical activity and breathing pure oxygen or air with enriched oxygen.[605] It is unclear whether the compound has ever actually been weaponized and incorporated into an offensive CW programme.[606]

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[602] Hart (note 587), pp. 1, 20–23.

[603] The literature on polymer fume fever is extensive. An early reference is D. Kenwin Harris, 'Polymer-fume Fever', *Lancet* (1 Dec. 1951), pp. 1008–1011.

[604] J. Bovenkamp, 'The Development of Penetrant Protective Carbon (PPC)', *ASA Newsletter* (12 Apr. 1996).

[605] PFIB is at least two orders of magnitude more toxic than phosgene.

[606] Hart (note 587), pp. 1, 20–23. See also C. M. Erasmus, 'Perfluoroisobutylene (PFIB)', *BC 2000*, vol. 1, no. 3 (Nov. 1992), p. 8. Protechnick Laboratories (PTY) Ltd. Newsletter.

11.6.4. Phosgene

Phosgene ($COCl_2$) is an important industrial chemical which was also used as a choking agent during World War I. The onset of symptoms are delayed by up to three hours or more. The more the victim exerts himself, the more likely he is to die or suffer permanent injury. Perhaps the most notable industrial accident occurred in Bhopal, India in 1984 when phosgene was reacted with methyl amine ($MeNH_2$) to yield methyl isocyanate (MIC). MIC, in turn, was an intermediate in the manufacture of the insecticide carbaryl (1-naphthyl methylcarbamate, $C_{12}H_{11}NO_2$). The accident, which some maintain, was the result of industrial sabotage, caused over 3800 deaths with approximately 11000 disabilities.[607] The treatment is complete rest and application of oxygen. Phosgene (CG) has periodically caused injury or deaths when shipments or storage containers are ruptured. The chemical industry produces phosgene by reacting chlorine with carbon monoxide (CO_2) in the presence of a carbon catalyst at relatively low temperature (approximately 125 degrees celsius) and pressure (of several atmospheres).

The key industrial objective involving phosgene is to obtain isocyanates (both di- and poly-) for use in the manufacture of polyurethanes and, to a lesser extent, aromatic[608] polycarbonates and various polymerisation processes. To an extent isocyanates can be produced using dimethyl carbonate (DMC, $(MeO)(CO)_2$), rather than phosgene. However, chemical processes involving the use of phosgene tend to be more economical than those involving the use of DMC.

11.6.5. Other Industrial Chemicals and Their Applications

Plastic additives for polychlorinated biphenyls (PCBs) and various plastics products are major end-uses for some chemicals appearing in Schedule 3 of the CWC's Annex on Chemicals. Small amounts of highly-pure phosphorus trichloride and phosphorus oxychloride are essential for the production of high-tech electronics products, including integrated circuit boards.

Acetone (CH_3COCH_3) is a common chemical having wide industrial applications as a feedstock, solvent and drying agent. Its use during the preparation of some chemical warfare agents is standard and even necessary. It is used as a solvent for some sample preparations and by some who have attempted to process ricin from castor beans.

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607 Jackson B. Browning, *Union Carbide: Disaster at Bhopal* (1993), <http://www.bhopal.com/~/media/Files/Bhopal/browning.pdf>, (accessed 16 June 2013).

608 Aromatic compounds are a large class of organic compounds that possess five or more carbon atoms that are joined in a ring. Aliphatic compounds, by contrast, are a large class of organic compounds that possess straight or branched chains in the arrangements of their carbon atoms. Aliphatic compounds include alkanes, alkenes and alkynes. There are important distinctions in the behaviour of functional groups within aromatic and aliphatic compounds, respectively.

Table 11.4 Selected chemical production processes with potential CW applications

Production process	CW agents	Typical commercial products
Chlorination	sulphur-mustard, nitrogen mustard, lewisite, sarin, VX	insecticides, herbicides polymers, dyes, pharmaceuticals, solvents
Fluorination	sarin, soman	polymers, solvents, pharmaceuticals, insecticides, herbicides, refrigerants gases, anasthetics
Esterification	sarin, tabun, 3-Quinuclidinyl Benzilate (BZ)	insecticides, solvents, flavouring, pharmaceuticals
Phosphorylation	tabun, sarin, VX	insecticides, flame retardants, oil additives
Alkylation	sarin, soman, VX	flame retardants, oil additives, petrochemicals

Source: Robert J. Mathews, 'Other chemical production facilities inspections'. Presentation at 'Open Forum: the Chemical Weapons Convention—recent experience and future prospects', OPCW Technical Secretariat, 9 Apr. 2008, The Hague. I thank Dr Mathews for permission to cite this table.

11.6.6. Summary

It is important for analysts to have basic familiarity with standard and non-standard CBW agents and their traditional and possible future role in peaceful base research and applications. Such a consideration is an open-ended exercise which must be focused or appropriately linked to various verification-related analyses. It is also important to understand the theory and practice of CWC declaration and verification requirements. At the operational level there can be (and has been) legitimate scope for understanding among the States Parties on whether and how a given activity is declarable and the manner in which the declaration can or should be verified by inspectors. The States Parties should also continue to consider how S&T developments might improve the possibilities for more focused and effective verification, and where such developments might tend to undermine existing implementation practice.[609]

11.7. Sampling and Analysis

Sampling and analysis is an important component to multilateral arms control verification. In principle, the findings (if properly carried out) are distinct from other types of verification processes in that the results cannot be disputed (e.g., as opposed to witness statements).

[609] An informal TS survey pointed to 3 main challenges for the CWC verification regime: (*a*) continued support by the member states, (*b*) constraints inherent in the CWC's Verification Annex and (*c*) a need for the verification methodologies not to remain static. OPCW, 'Summary of the Third Meeting of the Scientific Advisory Board Temporary Working Group on Verification', OPCW document SAB-21/WP.6, 9 Apr. 2014, para. 3.1, p. 5.

The implementation of a chain-of-custody is the key to proper sampling and analysis and the subsequent verification of the existence or use of chemical warfare agents. Such a chain entails documenting, in a verifiable manner, who took a sample, how it was taken, stored and transported, in whose custody the sample was held prior to the analysis, how the sample was analysed and how the results were presented. Any results should be reproducible, although it is possible that a limited sample size may not yield sufficient material for further testing. Sampling and analysis protocols provide context to CBW allegations evaluations, including the question of degree of uncertainty the possible role of politicization of analysis and cognitive biases.

OPCW analytical database include: (*a*) a discussion of whether unscheduled chemicals should be included and the extent to which they should be included; (*b*) developing an appropriate list of degradation products and, possibly, industrial intermediates; and (*c*) the inclusion and extent of inclusion of homologues.[610] The database is divided into four analytical techniques each of which consists of a set of chemicals and analytical data that may be used with one of four approved analytical methods. The four techniques are: (*a*) Infrared (IR), (*b*) Mass spectrometry (MS), (*c*) Nuclear Magnetic Resonance (NMR), and (d) Gas Chromatography (GC). The addition of spectra to the database must undergo both technical and political approval. The technical approval is given by an informal validation group (mainly composed of members from the Scientific Advisory Board),[611] while the Conference of States Parties must ultimately approve the changes upon the advice and recommendation of the Executive Council and the Director General.

Because the analytical results of the OPCW might be disputed, the sample size should ideally be sufficiently large to permit the organization to conduct the analysis at least twice. This permits a second round of testing in case the results of the first round are disputed. This implies that two OPCW approved laboratories should have at least 2 sets of samples, a standby laboratory should have at least one set of samples and the Inspected State Party (ISP) should retain at least one set of samples.

NATO, the UN and the OPCW continue to develop and test internationally recognized, peer-reviewed sampling and analysis procedures and techniques. These efforts are supported by national research and test facilities such as VERIFIN.[612]

A number of effective international sampling and analysis protocols currently exist. Some states have developed such protocols for mainly national purposes. States have also developed protocols to support the negotiation and implementation of the CWC. For example, VERIFIN was established to help support the development and validation of CW sampling and analysis protocols to support the CWC. The OPCW conducts annual proficiency tests in order to give approval that a given facility can become an OPCW Designated Laboratory. Such laboratories must be capable of performing off-site analysis of chemical

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610 Homologues may be defined as organic compounds having open-chain carbon atoms (i.e., aliphatic compounds) that differ only by the addition of a $-CH_2$ group.

611 The Validation Group is responsible to the SAB. Many of the members of the Validation Group also serve on the SAB.

612 Ed. Markku Mesilaakso, *Chemical Weapons Convention Chemicals Analysis: Sample Collection, Preparation and Analytical Methods* (John Wiley & Sons Ltd.: Chichester, 2005).

samples collected by OPCW inspectors in order to help determine whether a violation of the CWC has occurred, including the possible production or use of CW. The proficiency tests are open to all interested laboratories in the Member States. As of March 2013, there were 22 OPCW Designated Laboratories from 17 member states of which four facilities were suspended pending improvement on tests or delisting.[613] The OPCW has also considered protocols for analyzing so-called mixed samples consisting of both chemical and biological substances.[614]

Internationally-agreed standards for sampling and analysis carry greater weight (if proper and implemented in a sufficiently transparent manner) than national ones. An international inspection team's sampling and analysis procedures, particularly if they indicate that the inspected party has carried out prohibited CW activity, must avoid being politicized (actual and in appearance).

The authorization of an investigation of alleged CW use in Syria by the UN Secretary-General in 2013 highlights the continuing relevance of sampling and analysis for CW arms control verification. It would be useful to review the mandates and actions of relevant actors, as well as their priorities and capacities. It is also important to develop authoritative information, including with regard to the apparent clandestine sampling and analysis of physiological samples. By July 2013 France, Russia, the UK and the USA issued public statements to the effect that believe chemical weapons had been used in Syria. France, the UK and the USA reportedly provided the UN with 'a trove of evidence, including multiple blood, tissue and soil samples' that the USA maintains 'proves that Syrian troops used' sarin 'on the battlefield'.[615]

In the case of sarin use allegations (e.g., in Syria), the following points are worth bearing in mind. Some weapon types are less suited to sarin dispersal, including grenades and explosive dissemination devices (which carry an attendant risk that too much of the agent will be consumed in the explosion). Unitary and multi-component bombs (including sub-munitions), as well as spray devices therefore are more suitable.

Physiological samples may consist of blood, hair, tissue, or urine. One hydrolysis or decomposition product of sarin (including in blood) is isopropyl methylphosphonate (IMPA). A victim of sarin exposure would have depressed levels of acetylcholinesterase. IMPA is also detectable from urine using mass spectrometry. Any degradation products in urine would not be evident immediately following exposure and such products should be extracted within approximately 1 week. Unreacted (non-protein-bound) sarin may also be detectable in all tissue samples using GC/MS techniques.[616]

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613 'Note by the Director-General, Status of Laboratories for the Analysis of Authentic Samples', OPCW document S/1084/2013, 21 Mar. 2013, p. 2, <http://www.opcw.org/index.php?eID=dam_frontend_push&docID=16221>, (accessed 25 May 2013).

614 On 2007 NATO mixed sample exercise, see *Spiez Laboratory Annual Report 2007* (Federal Office for Civil Protection: Spiez, Switzerland, 2008), pp. 26–27.

615 Colum Lynch and Joby Warrick, 'In Syrian Chemical Weapons Claim, Criticism About Lack of Transparency', *Washington Post*, 20 June 2013, <http://www.washingtonpost.com/world/national-security/in-syrian-chemical-weapons-claim-criticism-about-lack-of-transparency/2013/06/20/fa799e6e-d925-11e2-a016-92547bf094cc_story.html>, (accessed 27 July 2014).

616 Carla EAM Degenhardt, Kees Pleijsier, Marcel J. van der Schans, Jan P. Langenberg, Kerry E. Preston, Maria I. Solano, V. L. Maggio, John R. Barr, 'Improvements of the Fluoride

The case of Syria highlights the importance of the chain-of-custody of the samples, including those taken by national intelligence. The fact that the activity was carried out in a war zone is also important. The Syria case underlines both strengths and weaknesses associated with international norms against the possession and use of CW. Some of the difficulties associated with multilateral arms control include how to effectively extend the state-based prohibitions to the actions and interests (both suspected or known) of non-state actors. This is especially true for cases where non-state actors are operating in ungoverned spaces with the possible support of one or more states.

11.8. Concepts, Principles and Procedures

Any review of sampling and analysis principles and procedures risks creating long lists. Those responsible for the evaluation of possible chemical warfare-related activity should nevertheless possess at least a passing familiarity with the basic procedures. This should include acquiring a general appreciation of the scientific and technical principles for sampling and analysis, the principal steps associated with the sampling and analysis for at least one major blister agent (sulphur mustard) and a persistent and non-persistent organophosphorus nerve agent (e.g., sarin and VX) and a familiarity with the challenges posed by non-traditional agents or hallucinogens (e.g., TICs, glycolates and proteins).

Samples may be taken from air, soil or water. Each requires a specific set of techniques to extract and prepare for analysis.

The updated UN Secretary General's technical guidelines and procedures outlines the principal areas in which laboratories should have expertise in chemistry, microbiology and toxicology including:

(*a*) identification, in all types of sample, of known chemical warfare agents, as well as their impurities and their degradation productions (and evaluation of quantities);
(*b*) identification and elucidation, in all the types of sample, of the structure of toxic agents, including those present in trace quantities (and evaluation of quantities);
(*c*) identification and characterization, in different kinds of samples, including clinical and environmental samples, of biological warfare agents (bacteria, viruses, others) and/or toxins;
(*d*) identification and characterization, in different kinds of samples, including clinical and environmental samples, of biological agents (bacteria, viruses, others) and/or toxins;
(*e*) evaluation of the effects of biological warfare agents and toxins, including epidemiological and ecological modeling;
(*f*) pathological and biochemical examination of organs and tissue taken from victims of CBT weapons, and where possible identification of the agent concerned;

Reactivation Method for the Verification of Nerve Agent Exposure', *Journal of Analytical Toxicology*, vol. 28 (July/Aug. 2004), pp. 364–371.

(*g*) expertise in investigation and diagnosis of animal or plant diseases, which may include toxicology, pathology, microbiology, and epidemiology; and
(*h*) examination and evaluation of munitions, munition components, and other military delivery devices, including all their technical specifications, [and] analysis of explosives.[617]

The UN Secretary General's procedures for sample collection, handling, storage, transport and analysis are:

(*a*) neat agent, munitions, remnants of munitions, other military delivery devices;
(*b*) NBC clothing and respirator canisters;
(*c*) environmental samples;
(*d*) food and drinking water;
(*e*) biomedical samples from human or animal source; and
(*f*) any affected crops and other vegetation.[618]

The CWC states: 'If the inspection team collects through, inter alia, identification of any impurities or other substances during laboratory analysis of samples taken, any information in the course of its investigation that might serve to identify the origin of any chemical weapons used, that information shall be included in the report'.[619]

As previously mentioned, ideally, the sample size needs to be big enough to permit the body conducting the analysis to do so at least twice. This means that a portion of the sample should be placed into storage in case the initial analysis is challenged.

11.8.1. Summary

Sampling and analysis protocols are important. All chemical and biological agent detection systems have trade-offs, including size *versus* specificity and detection limits. Thus field detection systems tend to have higher (i.e., worse) detection limits, more false positive and negative readings and less specificity for reliably detecting the target agent. Older laboratory techniques (such as culturing) can take longer. One should also be aware of possible reasons for false and negative and positive readings. Biomedical samples (e.g., blood and urine) are major areas of focus, including in the context of the conflict in Syria. Environmental sampling was arguably more important in the case of Syria. Finally, it should be noted that epidemiology, medical case histories, statistical analysis of health treatment and the like are also important.

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617 'Appendix V, List of diagnostic and analytical laboratory specializations', <http://www.un.org/disarmament/WMD/Secretary-General_Mechanism/appendicies/V/>, (accessed 2 Jan. 2011).

618 'Appendix VII, Procedures for sample collection, handling, storage, transport, and analysis', <http://www.un.org/disarmament/WMD/Secretary-General_Mechanism/appendicies/VII/>, (accessed 2 Jan. 2011).

619 CWC, Verification Annex, Part XI, para. 26.

11.9. Equipment

The OPCW has a standard equipment 'suite' for in-field sampling and analysis of chemical warfare agents and their possible degradation products. In principle the DOC/PSF category covers all organic compounds except polymers and hydrocarbons under the routine verification system (i.e., those cases where allegations of non-compliance with the CWC have not been made).[620]

The OPCW standard in-field configuration consists of approximately 20 items, can be packed in a space occupying approximately 3 cubic meters and weighs approximately 1 tonne.[621]

OPCW inspection equipment includes the following. CALID-3 detection paper that changes colour in the presence of G agents (orange), V agents (dark green) and sulphur mustard (bright red). The OPCW also uses ORI-217 chemical detection kit. This is a tube based system that is used to draw air samples for several minutes. When ready for analysis the second end is broken. The OPCW also uses CAMs (an IMS unit) which measures ion mobility and uses computer-based algorithms to identify the presence of a range of chemical agents.[622] Finally the OPCW uses the handheld AP2C flame spectrometry detector system which detects the presence of sulphur- and phosphorus-based chemicals for both liquid and air samples.[623] The AP2C flame spectrometry detector system detects colour changes which is suitable for use on the battlefield. The detector contains hydrogen gas stored in palladium.[624]

OPCW inspectors use a protective ensemble with level 8 offering the maximum protection. OPCW inspectors fill out a special form to help ensure chain-of-custody. Information on the form include: an identifying number of the sample, whether the sample is authentic or a blank sample code, the type of sample, the weather conditions, whether and how the sample is split, a description of the circumstances under which the sample was taken, and the dates and times for analysis.[625] Sample preparation may include some or all of the following steps: 1. add buffers, 2. derivitization, 3. solubility using various solvent, and 4. specific procedures according to type of agent (e.g., the lewisites). The OPCW takes 8 fractions of the sample. One is passed to the inspected State Party (2 for in-country analysis and 5 splits for off-site analysis).[626]

The OPCW Central Analytical Database (OCAD), updated in 2013, does not include all degradation products of 'standard' CW agents.[627]

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[620] OPCW briefing at sampling and analysis demonstration exercise, 22 Aug. 2012, The Hague.

[621] OPCW briefing at sampling and analysis demonstration exercise, 22 Aug. 2012, The Hague.

[622] The algorithm compares the time-of-flight and only works if it has been validated. Sulphur mustard and organophosphorus nerve agent ions have opposite polarity.

[623] This system entails rubbing an absorbent pad on a surface of the sample point. The pad is then heated and the suspected CW agent desorbed.

[624] Some parties to the CWC object to OPCW inspection equipment that contains a radioactive source.

[625] OPCW briefing at sampling and analysis demonstration exercise, 22 Aug. 2012, The Hague.

[626] OPCW briefing at sampling and analysis demonstration exercise, 22 Aug. 2012, The Hague.

[627] One State Party in particular has blocked their inclusion for unclear reasons.

The OPCW requires two complementary methods for confirming the detection of a CW agent or known-CW degradation product. Preferably one of these methods should be spectrometric.

11.10. Verification Results: Political and Technical Requirements

Analysts should check if proper sampling and analysis has been carried out. Were those involved technically competent? What was the procedure by which the technical findings were assessed and used to inform policy? Were there pre-existing (and validated) sampling and analysis protocols before the need arose to employ them? Was there an existing mechanism to evaluate the legal and political implications of the technical findings (including consideration of possible false positives and false negatives)? What role did political considerations, including preferred outcomes, play in the final assessment?

The taking of samples from humans has periodically been considered in a CBW context. During World War II the US Office of the Surgeon General (at the suggestion of the War Research Service and with the approval of the Secretary of War) took blood samples from some POWs to determine whether they had been immunized against potential biological warfare agents.[628] Cold War Allied operatives may also have arranged for Soviet military personnel to become involved in bar brawls after which they would be offered a hankerchief to wipe their bloody noses. The handerchiefs could then be tested to determine if they had been immunized or otherwise exposed to pathogens of interest.[629]

The taking of biological samples from living or deceased humans or animals has been periodically considered within the CBW arms control and disarmament context, including under the UN Secretary-General's CBW investigation mechanism. This was also considered by CWC negotiators and is discussed largely at the margins by some of the parties involved on sampling and analysis discussions. Some attention is also currently devoted to the development and validation of procedures for forensics analysis to support criminal investigation to possible acts of bioterrorism.[630]

Finally, the UN Secretary-General's technical guidelines and associated procedures for the investigation of alleged chemical and/or biological (CBW) use should be further considered in the light of the experience in Syria. Such an assessment could be structured according to:

(*a*) information basis and pre-assessment (including formulation of inspection mandate),
(*b*) sample activity,
(*c*) interviewing,
(*d*) analysis and
(*e*) communication of findings.

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[628] *Activities of the United States in the Field of Biological Warfare: a Report to the Secretary of War by George W. Merck, Special Consultant on Biological Warfare* (the 'Merck Report'), p. 18. Entry 488, Box 182, US National Archives and Records Administration, Washington, DC. Declassified 2007.

[629] Personal communication with CBW academic.

[630] Kurt B. Nolte, Marc Fischer, Sarah Reagan and Ruth Lynfield, 'Guidelines to Implement Medical Examiner/Coroner-Based Surveillance for Fatal Infectious Diseases and Bioterrorism', *American Journal of Forensic Medical Pathology*, vol. 31, no. 4 (Dec. 2010), pp. 308–312 .

It should also systematically consider how investigations of alleged use have been structured and compare it against the experience in Syria. Relevant recent activity, such as the results of the OPCW SAB working groups on convergence and sampling and analysis, should be evaluated.

The UN Secretary-General's technical guidelines could also be contrasted and compared against the OPCW Inspection Manual (which contains at least 10 SOPs for the investigation of alleged use), as well as associated OPCW Work Instructions (WIs) that inter alia outline procedures for decontamination, security, logistics, health & safety and the like. Past efforts to develop and test SOPs for the investigation of alleged CW use could be presented (e.g., by Soviet specialists in support of the UN during the Iran-Iraq War). The UN may be better positioned to provide logistics and political coverage, while the OPCW operates within the parameters of equal rights and responsibilities among the states parties (including with respect to the provision of logistics and security to the inspection team). The objective would be a further improvement of international capacity to respond authoritatively to allegations of alleged CBW use.

PART III

CASE STUDIES

12

A LARGE STATE PROGRAMME: THE CASE OF THE SOVIET UNION

Heuer's 8 steps are presented in the context of a large state programme: the Soviet Union. Background is provided which is structured according to Table 10.1 as part of Step 2 (also reproduced below as Table 12.2). This is a hybrid, argument-mapping CW application.

12.1. Introduction

The Soviet CW programme originated in Russia's World War I programme. The Czarist government secured the services of chemists, such as Vladimir Nikolaiyevich Ipatiev, to assist with the development of respirators and the redirection of the country's nascent chemical industry towards CW production.[631] Russian planners had to identify the required chemicals and expertise and arrange for the relevant infrastructure. Artillery unit supply chains were employed to move, store and use the CW.[632]

Although Russia employed chlorine, chloropicrin and phosgene, its CW capabilities were underdeveloped as compared to those of Germany. As noted previously, according to casualty figures provided by Gilchrist, Russia suffered more deaths from CW than any of the other belligerents: 56000, while France had the second highest number with 8000.[633] Russia also suffered from underdeveloped production capacity, often poor gas discipline and sub-optimal integration of these weapons in its military doctrine.

The Soviet Chemical Service was founded on the basis of decree no. 220 issued by the Revolutionary Military Council of the Republic on 13 November 1918.[634] On 15 August 1925 the Military-Chemical Directorate (part of the Red Army supply command) was formed under the leadership of Yakov M. Fishman.[635]

CW was also used during Russia's Civil War. British forces employed the irritant adamsite and Red Army units were authorized to use chlorine in 1921 against partisans hiding in forests near the city of Tambov. Pozdnyakov, a Soviet

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631 See Ipatieff (note 158). On Soviet respirators, see, for e.g., A. Melik-Kasparov, *Karmannaya Knizhka Voiskovogo Artillerista* [Pocket Handbook of Troop Artillery Personnel], 4th edtn. (State Military Publishers: Moscow, 1931), pp. 390–393; and S. V. Aginsky and V. L. Zelensky, *Kratkaya Tekhnologiya Sredstv Protivokhimicheskoi Zashchity* [Short Technology of the Means of Chemical Defence] (State Military Publishers: Moscow, 1933).

632 Orlov (note 222), pp. 26–27.

633 All World War I casualty statistics should be treated with caution. See Gilchrist (note 103), p. 7; and Chapter 1 of this volume.

634 Kochubina and Lebedevsky (note 191), p. 5.

635 Kochubina and Lebedevsky (note 191), p. 11.

officer, was told by a participant in the attack that Red Army units had used 'chemical shells' to 'destroy' rebels in the Caucasus mountains.[636] In the 1930s Soviet aircraft sprayed sulphur mustard onto Basmatch tribesmen (Pozdnyakov was told this by the commander of the operation).[637] Lev Borisovich Kamenev[638] and Lev Davidovich Trotsky[639] also reportedly sanctioned the use of 'chemical shells and balloons' against rebel Soviet naval units at the Kronstadt Fortress in 1921 (the fortress guarded the approaches to St. Petersburg). However, the island fell before the plan could be implemented.[640]

In 1923, the Soviet government reportedly received information from abroad on chemical weapon development in 'capitalist' countries which prompted the Revolutionary Military Council of the Republic to establish the Interdepartmental Advisory Council on Chemical Methods of War.[641] In 1924, this body became the Chemical Committee and was attached to the Revolutionary Military Council of the Republic.[642]

Fishman was perhaps the most important organizer and promoter of the Soviet CW programme in those areas where policy and technical expertise intersected. He did this partly, as previously noted, by helping to found and support OSOAVIAKhim, a volunteer society that sought to promote the development and application of chemistry for agriculture and industry and to prepare the country against possible CW attack.[643] The society achieved the latter objective partly by organizing CW contamination avoidance drills and instructing Soviet citizens in decontamination procedures. Fishman was also a Soviet military attaché to Berlin in the 1920s and traveled to Europe for discussions on CW-related matters with German and Italian officials and specialists until he was purged (but not killed).[644] Soviet embassies were tasked to collect CW-related information from Britain, France, Germany, Japan, Poland,

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636 V. Pozdnyakov, 'The Chemical Arm', p. 385 in Basil H. Liddell-Hart (ed.), *The Red Army: The Red Army—1918 to 1945, the Soviet Army—1946 to the Present* (Harcourt, Brace and Company: New York City, 1956).

637 V. Pozdnyakov, 'The Chemical Arm', p. 385 in Basil H. Liddell-Hart *The Red Army* (note 636).

638 Kamenev was Chairman of the Council of Peoples' Commissars, as well as the Politburo during Lenin's final convalescence.

639 Trotsky held various positions and headed the RKKA. It was he who gave the order to attack the fortress.

640 V. Pozdnyakov, 'The Chemical Arm', pp. 384–385 in Basil H. Liddell-Hart, *The Red Army* (note 636).

641 Orlov (note 222), p. 32.

642 Orlov (note 222), p. 32.

643 See L. P. Borisov, 'OSOAVIAKhim, Pages of History: 1927–1941', *Voprosy Istorii* [Issues of History] (1965), pp. 45–60 (in Russian) accessed via EastView at <http//dlib.eastview.com>; Enyukov (note 204); and Yakob Fishman, *Khimiya v Nardonom Khozyaistve i Oborone* [Chemistry in the Peoples' Economy and Defence] (State Military Publisher: Moscow, 1924).

644 Lev A. Fedorov, *Khimicheskoe Vooruzhenie—Voina s Sobstvennym Narodom: Tragichesky Rossiisky Opit* [Chemical Armament—War Against One's Own People: the Tragic Russian Experience], vol. 1 (Moscow: Feb. 2009), pp. 69 & 76–78. An official history of Shikhany states that prior to being named head of the RKKA Military Chemical Directorate, Fishman 'worked for a long time as assistant Soviet military attaché in Germany, and then Chairman of the Defence Commissariat of the USSR. Alimov (note 128), p. 7.

Romania, Sweden and the United States.[645] Some of this information is almost certainly reflected in Soviet journals such as *War and Technology* (see Table 12.1).[646]

Table 12.1 Soviet Military Journals

Journal	Publisher
Armeisky Sbornik [Army Collection]	State Military Publisher (?)
Artilleriisky Zhurnal [Artillery Journal]	State Military Publisher
Boets-Okhotnik [Warrior-Hunter]	State Military Publisher
Krasnaya Konitsa [Red Cavalryman]	State Miltary Publisher
Krasnoarmeets i Krasnoflotets [Red Army Man and Red Navy Sailor]	State Military Publisher
Kul'trabota v RKKA (Krasno-armeisky klub) [Cultural Work in the Worker-Peasant Red Army (Red Army Club)]	State Military Publisher
Mekhanizatsiya i Motorizatsiya RKKA [Mechanization and Motorization of the Worker-Peasant Red Army]	State Military Publisher
Sovietskoe Voennoe Obozrenie [Soviet Military Observer]	
Sovietsky Voin [Soviet Warrior]	Ministry of Defence
Tekhnika i Vooruzhenie [Technology and Armaments]	State Military Publisher
Tyl i Snabzhenie Sovetskikh Vooruzhenikh Sil [Rear and Supply of Soviet Armed Forces]***	State Military Publisher (?)
Vestnik Vozdushnogo Flota [Bulletin of the Air Force]	State Military Publisher
Vestnik Protivodushnoi Oboroni [Bulletin of Air Defence]	State Military Publisher
Voina i Revolyutsiya [War and Revolution]	State Military Publisher
Voenno-Khimichesky Byulleten' [Military-Chemical Bulletin]*	Red Army Chemical Directorate
Voenno-Istorichesky Zhurnal [Military-Historical Journal]	Ministry of Defence
Voenno-Meditsinsky Zhurnal [Military-Medical Journal]	Ministry of Defence
Voennaya Mysl' [Military Thought]**	Ministry of Defence
Voenny Vestnik [Military Bulletin]	State Military Publisher
Voenny Khozyaistvo [Military Economy]	State Military Publisher (?)
Voenny Zarubezhnik [Foreign Military Man]	State Military Publisher
Voennie Znaniya [Military Knowledge]	Ministry of Defence

Source: Author compilation. While none of the publications examined by the author had restriction markings, these journals were probably not available to the general public. They are aimed at non-technical and semi-technical military personnel (as opposed to, for e.g., laboratory researchers carrying out base research on CW production-related work). *See *Voenno-Khimichesky Byulletin'*, vol. 4, no. 15 (Fifth Directorate of the Worker-Peasant Red Army (Chemical Directorate): Moscow, 1940). **According to one source (a Western book), there are at least two versions of this journal. One is in general circulation, while the other is restricted to senior officers (e.g., to the ranking members of the General Staff). ***Later called *Tyl Vooruzhenikh Sil* [Rear Services of the Armed Forces] and then *Tyl Vooruzhenkikh Sil Rossiiskoi Federatsii* [Rear Services of the Armed Forces of the Russian Federation].

12.1.1. Information Sources

Although a large literature exists on the Soviet CW programme, much of it is speculative or incomplete. A comprehensive treatment of the actors, policies and

645 Lev A. Fedorov, vol. 1 (note 644), pp. 56–61.

646 'Voenno-khimicheskoe Delo, k Voprosu o "Zapreshchenii Khimicheskoi Voiny"' [Military-chemical Matters, Towards the Question of the Prohibition of Chemical Warfare], *Voina I Tekhnika* [War and Technology], no. 1 (1928), pp. 58–62. This article summarizes CW activities in other countries, largely on the basis of information published in a 1927 French journal *Chemical Industry*. While the provenance of this article is not certain, Soviet embassies routinely collected such literature.

activities based on Soviet and Russian archival material is still lacking, including in terms of the scope, level of detail and authoritativeness.

Dr Lev Aleksandrovich Fedorov's 2009 and 2011 studies nevertheless fill much of this gap.[647] Fedorov was a chemist in the Soviet chemical defence establishment and is currently the President of the Union for Chemical Safety in Moscow. The 2009 study is a fundamental work, rich in detail and many of the 1057 references are documents from the Russian state archives, while the 2011 work has 773 references that are similar in nature.

The first volume of the 2009 study describes the origins of the Soviet CW programme, including the development of the chemical industry and expertise to support it. The second volume provides an overview of the research and extent of the Soviet CW infrastructure. The final volume focuses on more contemporary issues, including the legacy of the programme for human health and environmental safety. Fedorov does not disguise his distaste for many of the individuals who developed the CW programme or the military and political leadership behind them, including their contribution to the poor working conditions for munitions workers and support of human testing. The 2009 study is disjointed partly because of periodic digressions and the insertion of extended quotations and lists. However, these extended quotations are useful in the absence of direct access to the original sources.[648]

Soviet military literature was placed in libraries of military training facilities and academies. The security services would also circulate reports on international scientific, technical and political activities deemed relevant. The KGB and its predecessors had onsite representatives to oversee facility security and maintain checks on the political reliability of personnel. They presumably were also aware of and perhaps acted as the conduit for intelligence summaries being transferred into the facility. Other libraries and archives of relevance include the present-day Russian State Military Archive (located in Moscow, Bauman Region), and the archives of the Soviet Communist Party Central Committee.[649]

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[647] Lev A. Fedorov, *Khimicheskoe Vooruzhenie* (note 644); and Lev A. Fedorov, *Khimishekoe Razoruzhenie Po-Russky: Dokumental'ny Roman* [Chemical Disarmament Russian-Style: a Documentary Novel] (New Literary Review: Moscow, 2011).

[648] Some of the text describing the 2009 study is based on: John Hart, 'The Soviet Chemical Weapon Programme' (Litteratur), *Kungl. Krigsvetenskapsakademiens Handlinger och Tidskrift* [Royal Swedish Academy of War Sciences Proceedings and Journal] no. 3 (July-Oct. 2010) (in English), pp. 180–183 [Review of Lev A. Fedorov's *Khimicheskoe Vooruzhenie—Voina s Sobstvennym Narodnom: Tragichesky Rossiisky Opyt* [Chemical Armament—War Against One's Own People: the Tragic Russian Experience] (Moscow: Feb. 2009, self published)].

[649] Upon taking control of the Soviet Union following the failed coup attempt against Mikhail Gorbachev, Russian President Boris Yeltsin placed the military historian Dmitri Volkogonov in charge of the Soviet Central Committee archives. Volkogonov is mainly known for his biographies of each Soviet leader which had a profound affect on the views of many Russians towards Soviet history. For example, he described the notations made by Lenin and Stalin on the margins of documentation with disparaging remarks or ordering executions and his own reactions and mental reassessment process as he read them. Volkogonov also characterized Chernyenko as the quintessential and natural end result of the mediocrity that plagued the Soviet leadership in the final years. The English-language editions of the biographies are shortened. It should also be noted that some academic historians have disparaged Volkogonov's research and his ability as an historian more generally.

The professional literature includes a range of journals. *Voenny Mysl'* [Military Thought], still published, consists of dense, jargon-filled articles authored by fairly high-ranking military officers on military planning and doctrine. Although more technocractic, the articles are somewhat comparable to those of the collected lectures of Soviet Marshal Kliment Voroshilov on military doctrine.[650] With possible rare exceptions, the articles do not provide useful or usable information on the Soviet CW threat perceptions or CW capabilities.

Raymond L. Garthoff, a longtime eminent and perceptive student of Soviet (and Russian) military strategy, observed in the 1950s that much of the Soviet military press was not marked restricted and, although its actual distribution may have been limited (e.g., *Military Thought* was meant to be circulated to Soviet officers), they were obtainable and texts dealing with matters of substance were generally less suffused with Soviet-communist political correctness.[651]

I have a similar reaction with respect to inter-World War Soviet journals. Their language is generally focused on substance, and the political rhetoric is largely relegated to the front matter. Other professional literature (having varying degrees of politicization) includes *Voenny Istorichesky Vestnik* [Military Historical Bulletin], *Voprosy Istorii* [Questions of History][652] *Voennie Znaniya* [Military Knowledge], and the *D. I. Mendeleev All-Union Chemical Society Journal*. If one knows the names of chemists and military officers, one can find biographical information on them in such journals.

Technical literature of greater interest includes the *Russian Chemical Review*, *Voina i Tekhnika* [War and Technology], and *Voina i Revolyutsiya* [War and Revolution]. Any publication by a chemist from certain institutions, such as GosNIIOKhT (State Scientific Research Institute of Organic Chemistry and Technology) has, one can assume, been routinely flagged by various non-Soviet defence and security establishments. *Voina i Revolyutsiya* was, at least in the mid-1930s, an official publication of the Organ of the Central Council of OSOAviaKhim.[653] *Voenny Vestnik* was a Soviet military-political weekly journal that was first published in 1920.

Voina i Tekhnika, first published in 1919, appears to have been issued as both a single general journal and as occasional specialized supplements. These specialised supplements include: *Voennoe Khozyaistvo* [Military Economy], *Vozdushny Flot* [Air Force], *Mekhanichesky Transport* [Mechanized Transport], *Voenno-Nauchnaya Zhizn'* [Military-Scientific Life], *Svyaz' Krasnoi Armii* [Red

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650 See Ed. Ghulam Dastagir Wardak, *The Voroshilov Lectures: Materials from the Soviet General Staff Academy,* vols. 1–3 (National Defense University Press: Washington, DC, 1989, 1990, 1992).

651 See Raymond L. Garthoff, *Soviet Strategy in the Nuclear Age* (Greenwood Press Publishers: Westport, Conn., 1974), 'Source Materials on Soviet Strategy: a Bibliographic and Interpretive Guide', pp. 253–274. This book is a facsimile reprint of the original 1958 printing by the Frederick A. Praeger, Inc. edition. It should be noted that Garthoff does not mention in this work several important Soviet publications, including, most notably, *War and Technology*.

652 This can also be translated as *Problems of History*.

653 Only one issue of *Voina i Revolyutsiya* examined by the author appears to have been explicitly affiliated with OSOAviaKhim: *Voina i Revolyutsiya*, no. 1 (Jan.–Feb. 1936). Despite being issue number 1, this particular issue also states that the journal was published starting in 1924. OSOAviakhim nevertheless appears to have been founded under this name in 1927. See Borisov (note 643), pp. 45–60.

Army Communications], and *Voenno-Khimicheskoe Delo* [Military-Chemical Affairs]. In the general issues, CW-related articles in the 1920s-1930s appear not to consist of more than about 5 per cent of the total.[654]

In a typical issue of *Voina i Tekhnika*, a general threat assessment of international chemical industry is provided.[655] A series of special *Military-Chemical Matters* issues of *Voina i Tekhnika* from the 1920s contain little, if any, political or Communist Party rhetoric characteristic of other journals and books, such as *Voenny Mysl'* [Military Thought].[656] Typical topics covered in *Military-Chemical Matters* include listings of patents, general overviews of the state of chemical detection and protection, and smoke operations; and the organization of various CW military establishments.

The sources of information for the articles in *Military-Chemical Matters* are often provided. However, the articles are not, as a rule, properly referenced. Citations from international book publications are provided. Sometimes a paragraph states that information is based on a 'survey of literature'. A hint that some information is derived from intelligence can sometimes be inferred (if the reader is inclined to think in these terms). Much of the information likely originated from a systematic review of publications, as well as information obtained by Soviet embassies.[657]

Military-Chemical Matters also provides an international chronology of events of CW relevance, including speeches by Amos Fries and activities of the US Chemical Warfare Association.[658] The issues looked at by the author were written in a sober, factual manner. The journal also reviewed US publications such as the *Army and Navy Journal* and *Military Chemist*. The chronicle section also notes international trade association meetings and academic congresses of chemists. The issues also included a review of recent Soviet and international publications, such as Dr Gertrud Woker's *Der Kommende Giftgaskrieg* (Kultur und Zeitfragen: Leipzig, 1925).[659] The journal also published extracts from Haldane's *Callinicus* and Rudolf Hanslian's works and Edward Bright Vedder's *Medical Aspects of Chemical Warfare* (Baltimore, 1925).[660]

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654 This is a rather subjective view of the author based on an incomplete review of approximately 100 journal issues.

655 *Voina i Tekhnika* [War and Technology], no. 8 (1927), p. 69.

656 The only issues of *Military-Chemical Matters* that the author could locate were from this period.

657 Admittedly a subjective view by the author.

658 Chemical Warfare Association members included: C. H. Herty of the Synthetic Organic Chemical Manufacturers' Association, W. P. Bancroft of Cornell University, C. L. Parsons of the American Chemical Society, and C. L. Reese of Du Pont Co. Anonymous, 'Khronika: za Rubezhom' [International Chronicle], *Voina i Tekhnika, Voenno-Khimicheskoe Delo* [War and Technology, Military-Chemical Matters], nos. 263–264 (Jan.–Feb. 1926), p. 40.

659 Anonymous, 'Kritika i Bibliographfiya' [Criticism and Bibliography], *Voina i Tekhnika, Voenno-Khimicheskoe Delo* [War and Technology, Military-Chemical Matters], nos. 263–264 (Jan.–Feb. 1926), p. 46.

660 Vedder (b. 1878, d. 1952) was a US physician and scientist who served as the chief of medical research in the US Chemical Warfare Service (CWS). Garrett and Hart (note 108), pp. 223–224.

A. A. Goryainov reviewed the use of chloropicrin against plant pests.[661] Another problem identified in 1926 was to find a suitable decontaminating compound against this compound.[662] The Soviets also noted that Edgewood Arsenal, on 1 May 1926, opened an exhibit of its CW-related achievements in which US chemical industry, scientists and government officials participated. The notation is a single paragraph with no explicit threat perception discussion.[663] *Voina i Tekknika* also reviewed the price of arsenic in the United States, the production of paints in the United States, the exports of iodine from Chile (the UK is the top recipient at 401043 kg, while Italy is in last place at 13836 kg), and the production capacity of sulphur in Italy.[664]

Regarding the organization of CW military establishments, one issue of *Voenno-Khimicheskoe Delo* states, citing Amos Fries, that the Italian CW programme was established in the early 1920s and that it is structured after that of the US Chemical Warfare Service.[665] In 1926 E. P. Banchik reviews the US field organization for treating CW casualties.[666] This article appears to paraphrase unreferenced US materials. For example translations of several terms are reproduced in the original (English). It is possible that the source is a single US publication or was synthesized from multiple booklets and possibly informed by discussions. To make a further determination, one would have to compare the lists of treatments and equipment against the presumed original documentary source, as well as the specific distances for collection points of gas casualties (i.e., 1.5-3 versts [1.4-3.2 km] behind front lines). If this specific detail could be linked to a US document that was restricted at the time, it would illustrate Soviet intelligence collection capabilities. However, such an analysis would not be a particularly worthwhile use of time because the substance of the article is basic and the question is of historical curiosity. So much time has elapsed that uncovering any meaningful or historically interesting information would be unlikely. Nevertheless, by describing the steps that one might undertake to determine Soviet information capabilities, one can obtain a better appreciation of some of the relevant Soviet thought processes involved in intelligence

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661 A. A. Goryainov, 'Khlorpikrin v Bor'be s Vreditel'yami Khleba i Rastenii' [Chloropicrin in the Struggle against Bread and Plant Pests], *Voina i Tekhnika, Voenno-Khimicheskoe Delo* [War and Technology, Military-Chemical Matters], nos. 275–276 (Mar.–Apr. 1926), pp. 38–48.

662 V. Nekrasov, 'O Reaktsiyakh na Khlorpikrin', *Voina i Tekhnika, Voenno-Khimicheskoe Delo* [War and Technology, Military-Chemical Matters], nos. 275–276 (Mar.–Apr. 1926), pp. 32–33.

663 Anonymous, 'Za Rubezhom, I. Voenno-Khimicheskoe Delo, Voenn-Khimicheskaya Vystavka v Ezhdvudskom Arsenale' [Abroad, I. Military-Chemical Matters, Military Chemical Exhibit at Edgewood Arsenal], *Voina i Tekhnika, Voenno-Khimicheskoe Delo* [War and Technology, Military-Chemical Matters], nos. 290–291 (May–June 1926), p. 48.

664 Anonymous, 'Za Rubezhom [Abroad], *Voina i Tekhnika, Voenno-Khimicheskoe Delo* [War and Technology, Military-Chemical Matters], nos. 290–291 (May–June 1926), pp. 51–54. Iodine compounds were developed starting in World War I as lachrymators, including: iodoacetone, ethyl iodoacetate, and benzyl iodide. SIPRI (note 98), pp. 42–43. Such research continued intermittently after World War II as well.

665 Khronika: za Rubezhom (note 658), p. 40.

666 E. P. Banchik, 'Polevaya Organizatsiya "Otdela Lecheniya Gazootravlennikh" v Armii S.-A. Soedinennikh Shtatov' [Field Organization of the "Gas Treatment Unit" in the US Army], *Voina i Tekhnika, Voenno-Khimeskoe Delo* [War and Technology, Military-Chemical Matters], nos. 263–264 (Jan.–Feb. 1926), pp. 13–17.

assessments such processes may possess contemporary relevance vis-à-vis Russia.

Table 12.2 Soviet Inter-World War Field CW Response Requirements

Purpose: for removal and neutralization of sulphur mustard.
Prophylactics
Gas-proof tents
Extra blankets
Kerosene
Chlorinated lime
Sodium bicarbonate
Purpose: first aid with lewisite burns
Prophylactics
Tubes containing hydrates of iron oxide
Sodium hydroxide
Purpose: treatment of thermal burns
Prophylactics
Morphine
Picric acid
Wine spirits
Cotton gauze
Olive oil
Purpose: Mustard and other CW burns
Prophylactics
Dichloramine T.*
Calcium hypochlorite
Purpose: For breathing irritating poisonous fumes
Prophylactics
Ammonium chloride dissolved in alcohol
Chloroform
Ether

Source: E. P. Banchik, 'Polevaya Organizatsiya "Otdela Lecheniya Gazootravlennikh" v Armii S.-A. Soedinennikh Shtatov' [Field Organization of the "Gas Treatment Unit" in the US Army], *Voina i Tekhnika, Voenno-Khimeskoe Delo* [War and Technology, Military-Chemical Matters], nos. 263-264 (Jan.-Feb. 1926), p. 14. *I do not know what the 't' stands for.

Often equipment and patents are reviewed (most of the patents looked at by the author are German). Other topics include: the development and testing of equipment to measure breathing resistance associated with various respirators, microscopic comparison of activated charcoal and studies on the diffusion of war gases from various materials (clothing, rubber, concrete, etc.). In another case, a project for a mobile smoke and CW exposure chamber for 50 people for training purposes constructed in a special rail car is reviewed.[667] Other articles consider developments in filter design and testing. Still others analyse CW agents, such as

[667] A. Zhukoborsky and N. Duriitsky, 'Podvizhnaya Okurivatel'naya Kamera' [Mobile Smoke Chamber], *Voina i Tekhnika, Voenno-Khimicheskoe Delo* [War and Technology, Military-Chemical Matters], nos. 263–264 (Jan.–Feb. 1926), pp. 25–26.

lewisite.[668] Brief summaries of other states' CW programmes are also provided. There is a particular focus on Amos Fries whose influential 1921 book on chemical warfare was often cited in by Soviet military chemists in their own textbooks.[669] Articles in the 1920s and 1930s were also still focused on trying to learn the lessons of CW use during World War I. Frequently, this information reads like a basic summary of Prentiss' seminal 1937 study *Chemicals in War*, such as summaries of World War I casualties and the CW programmes of other states.[670] Such books were also examined by Soviet specialists in what generally appear to be non-copyrighted Soviet translations published by the Soviet State Military Publishers.[671]

12.2. Framing the Hypotheses

The main hypotheses are: Has the target of analysis *stockpiled* chemical weapons (yes or no)?

To allow for more meaningful analysis, the scope and focus should be more narrowly defined. As noted in Chapter 9, the question of production/stockpiling of chemical weapons is meant to inform the broader strategic question: *Did the Soviet Union possess sufficient chemical weapon stockpiles during the early period (i.e., prior to the Battle of Stalingrad) of World War II to engage in strategic chemical warfare?*

Related broader questions include why the German Army appears not to have captured large stocks of CW or CW production facilities, and was the Soviet Union capable of engaging in chemical warfare? If it was capable, what factors constrained the USSR from employing such weapons?

The analytical problem must be broken down (i.e., decomposed) into more readily analyzable parts in order to facilitate 'visualization'.[672] The logic of the information provided should be apparent. A strategic analysis can then, in principle, be developed on the basis of extrapolation (unchanging forces), projection (changing forces) and predictions (changing and new forces) with the objective being to develop a strategic theoretical application of ACH as it relates to chemical weapons.[673]

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[668] Lewisite is named for Winfred Lewis. The compound was discovered in 1904, but became more widely known under this name and as a CW agent in 1918. P. E. [only initials provided], 'Otravlenie Lyuizitom' [Lewisite Contamination], *Voina i Tekhnika, Voenno-Khimicheskoe Delo* [War and Technology, Military-Chemical Matters], nos. 290–291 (May–June 1926), pp. 36–42. This article may paraphrase Vedder's *Medical Aspects of Chemical Warfare* (1925).

[669] Fries and West (note 117). As head of the US CWS and public lobbyist for maintaining a chemical warfare programme, Fries had a higher profile than West in Soviet writings. On Fries' successful efforts to lobby the chemical industry and the Congress to prevent the army from shutting down the CWS following the end of World War I, see Frederick J. Brown, *Chemical Warfare: a Study in Restraints* (Princeton University Press: Princeton, 1968,) pp. 74–92.

[670] Prentiss (note 100).

[671] Intellectual property protection laws were sometimes criticized as capitalist or bourgeoisie means of keeping down the working classes, and undesirable or irrelevant to Soviet communist system.

[672] Heuer Jr. and Pherson (note 5), p. 41.

[673] Clark (note 29), pp. 204–205. It should be noted that Clark employs these three terms (extrapolation, projection and prediction) in terms of 'target-centric' intelligence analysis, not ACH. The distinction, however, is relevant in order to faciliate consideration of how

Strategic intelligence assessments from the post-World War II into the Cold War period are presented in Chapter 15 in order to facilitate consideration of the longer-term implications of the strategic CW stockpiling question that may, in turn, have continued relevance, including in terms of arms control verification and intelligence analysis. This discussion may also inform consideration of neoliberal institutionalism and realist models of IR theory.

Step 1. Identify the Possible Hypotheses to be Considered

The possible hypotheses are:

1. Yes (the Soviet Union did possess the means to engage in strategic chemical warfare until the tide of the war turned in its favour at the Battle of Stalingrad (Aug. 1942-Feb. 1943)), or
2. No (the Soviet Union did not possess the means to engage in strategic chemical warfare to the period ending at the Battle of Stalingrad (Aug. 1942-Feb. 1943)).

Engaging in strategic chemical warfare is understood to entail the systematic and widespread use of such weapons in the hundreds or thousands of tonnes—both along front lines and deep strikes against lines of communication and supply and troop concentration areas in order to implement Soviet strategic objectives. Incidental exposure to CW agent—as occurred when German soldiers were exposed to sulphur mustard at a bridge incident in the 1939 Polish campaign, the so-called Jaslo incident in Galicia[674]—or ad hoc/'one-off' employment of CW, would not rise to the level of strategic chemical warfare. A general employment of CW for strategic purposes would not go unnoticed and would probably not be subject to dispute. A limited number of instances of CW use for strategic purposes could be (and is) more ambiguous due to a lack of authoritative evidence and the passage of time. A proposition that may appear to be self-evident can nevertheless be formulated as a hypothesis and challenged using counter-factual test methods.

Step 2. Make a List of Significant Evidence and Arguments For and Against Each Hypothesis

The background for the significant evidence and arguments for and against each hypothesis must be provided for the main question. This background is structured according to Table 10.1 (reproduced here as Table 12.3).

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operational, counter-factual techniques can facilitate a higher level and broader strategic analysis.

674 SIPRI (note 98), pp. 153–155; and Hermann Ochsner, *History of German Chemical Warfare in World War II* (Historical Office: Office Chief of Chemical Corps), pp. 16–17. US Chemical Corps Historical Studies, study no. 2. Declassified.

Table 12.3 Structure of Background Narrative to Case Studies.

Political factors
Definition of violation
Intent
Doctrine
Consistent with types and quanties?
Threat perception
Apparent
Actual
Demand side factors
Supply side factors
Technical factors
Assimilation
Capability
Technological stages
Verification measures
Onsite
Nearsite
Offsite

Source: Author compilation.

Sufficient background for each hypothesis must be provided. The background should also be structured with a limited number of headers, have internal cohesion and be sufficiently broad to allow for a meaningful narrative that permits the reader to readily ascertain the connection between the logic of the argument and the evidence (or lack thereof). To do so, allows for further refinement of the analytical technique and modification of the conclusions as new insight and information become available.

The background is structured according to political and technical factors. The *political factors* considered are: (*a*) the definition of a CWC-defined violation, (*b*) intent, (*c*) threat perception (apparent and actual), (*d*) demand side factors and (*e*) supply side factors. The *technical factors* considered are: (*a*) CW assimilation and (*b*) 'verification measures' (mainly derived from the arms control paradigm). These political and technical factors were developed by the author. However, it should be noted that supply and demand side factors are part of the standard nuclear arms control and disarmament literature.[675] Also variations of integration and assimilation of weapons systems into military doctrine and training have long been considered by analysts in various contexts.[676]

[675] For a recent summary of IR-based explanations for the low number of nuclear weapons states, see Jacques E. C. Hymans, 'The Study of Nuclear Proliferation and Nonproliferation', pp. 13–37 in Eds. William C. Potter and Gaukhar Mukhatzhanova, *Forecasting Nuclear Proliferation in the 21st Century: the Role of Theory*, vol. 1 (Stanford Security Studies: Stanford, Cal., 2010).

[676] E.g., Robinson (note 41), pp. 112–123; Jean Pascal Zanders, 'Putting the Horse Before the Cart: Some Thoughts on Controlling Unconventional Arms in the Middle East', *Studia Diplomatica*, vol. 51, nos. 3–4 (1998), pp. 40–42; and Arnett (note 41).

12.3. Political Factors

CWC-defined violations are employed to serve as an agreed standard in the analysis (as well as for the other two case studies). This is despite the fact that geopolitical circumstances, including security perceptions and the existence and implementation practice of legal regimes, have changed over time. Although the CWC did not exist at this time, its provisions provide a contemporary and relevant standard by which to define and understand CW-related activity in both a 20th and 21st century arms control context, and a general security and defence intelligence analysis context.

With respect to the *stockpiling* of chemical weapons for a large state programme, such as that of the Soviet Union, this may be understood to mean that the state has undertaken to produce and store multiple tonne amounts of munitions (filled and unfilled) as part of its military logistics system (as opposed to, for e.g., sabotage or assassination programmes by security services).[677] It may also be understood to mean that the target of analysis has taken steps to ensure standby production capacity to meet its doctrinal requirements, including field filling stations for the replenishment of aged (i.e., degraded) chemical fill or empty 'obsoleted' munitions.[678] A government implementing a large, traditional state programme which wished to maintain the option of engaging in chemical warfare would, prior to the end of the Cold War, view chemical warfare mainly in terms of state-to-state conflict for both tactical and strategic operations. Sabotage operations using chemical agents have also been a concern of states, though this aspect is generally less visible (at least in public).[679]

A traditional large state-run programme that has not stockpiled CW would occur where any work with CW agents remains largely confined to the laboratory for protective and evaluation purposes. The 'footprint' of such activity would be much smaller and more dependent on systematic evaluation of scientific and technical publications, including the issuance of patents or certificates of invention.[680] Such factors could be analyzed and presented in terms of the understanding of 'types and quantities' phrasing that informs whether activity involving toxic chemicals and their precursors are permitted under the CWC.[681]

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677 'Militarily-significant' amounts of CW agent was generally understood by CWC negotiators to be 100 tonnes or more, while significant quantities for non-state actor (terrorists) can be understood to be kilograms or grams of CW agent. On the latter point, see Ron G. Manley, 'Chemical Weapons and Efforts to Prevent Their Use', slide 14. Presented at SIPRI and Vinca Institute (note 569).

678 Unlike many biological fills, chemical fills can, depending on purity and stability, be stored in viable form for at least ten years (or, sometimes, decades). 'Obsoleted' (as opposed to 'obsolete') is normal usage (i.e., jargon) in some circles.

679 *Soviet Capabilities for Clandestine Attack Against the US with Weapons of Mass Destruction and the Vulnerability of the US to Such Attack (mid-1951 to mid-1952)*, NIE-31 (note 217).

680 See John A. Martens, *Secret Patenting in the USSR and Russia* (Deep North Press: Santa Fe, New Mexico, 2010).

681 CWC, article II, para. 1.

Overhead imagery (notwithstanding periodic airspace overflights) did not become generally available to the Cold War superpowers until the 1960s.[682] Without such imagery, literature reviews and individual discussions probably took on greater importance for those involved in developing threat assessments and related analyses.

A large traditional state CW programme that wished to *use* such weapons would likely do so in a state-to-state armed conflict where reports from the field by opposing military forces would tend to confirm such use to even non-specialists or onlookers. It is possible that sabotage or not-for-attribution ad hoc use could occur (perhaps for evaluation of response purposes or to induce social disturbance). However, traditional state programmes were mainly concerned with state opponents and would have viewed the non- or 'less than fully attributable' CW use scenarios as peripheral to their strategic and defence planning.[683] The context of any given case study would have to inform the analysis of such factors.

Western states have devoted much effort in attempting to discern meaning from Soviet doctrinal and politico-military literature. Accusations of CBW activity may be understood by others as an indication of CBW intentions by the first party (i.e., accusing others of an activity is carried out in order to justify one's own activity).[684] Soviet military doctrine was (and remains) a rather arcane sub-topic in which analysts study the various Soviet field regulations manuals and other published training material, searching for changes in phrasing or emphasis. Major questions with respect to CW include a desire to determine the capacity of a state to defend against CW and to employ such weapons in battle, as well as indications (implicit or explicit) as to whether the state intends to use CW in offensive or defensive operations or has a 'no first use' (i.e., retaliatory only) CW use policy. The Soviet Union acceded to the 1925 Geneva Protocol on 15 April 1928 with the reservation that it did not consider itself to be bound by the agreement if engaged in armed conflict with states that had not joined the Protocol or against states that did not respect the object and purpose of the Protocol.[685]

Key military doctrinal figures in the inter-war period include Yakov Fishman, Mikhael Vasilyevich Frunze,[686] Mikhael Nikolayevich Tukhachevsky,

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[682] The UK and the United States conducted short penetration overflights of the territory of the Soviet Union in the years immediately following the end of World War II. See Lennart Andersson, *Bortom Horisontom: Svensk Flygspaning mot Sovjetunionen 1946-1952* [Beyond the Horizon: Swedish Aerial Reconnaissance against the Soviet Union] (Stenbom: Stockholm, 2002).

[683] A CIA release of clandestine WMD attack scenarios is mainly concerned with nuclear weapons. *Soviet Capabilities for Clandestine Attack Against the US with Weapons of Mass Destruction and the Vulnerability of the US to Such Attack (mid-1951 to mid-1952)*, NIE-31 (note 217).

[684] Garthoff has observed: 'Vociferous accusations that the United States is planning and conducting bacteriological-warfare research and has used germs in North Korea may be an indication of the fact that the USSR itself is preparing for bacteriological warfare'. Raymond L. Garthoff, *How Russia Makes War: Soviet Military Doctrine* (George Allen & Unwin Ltd.: London, 1954), p. 319.

[685] *The Problem of Chemical and Biological Warfare, CBW and the Law of War*, vol. 3 (note 251), pp. 157 & 164.

[686] For an autobiographical summary (doc. 5) and extract of Frunze's service record (doc. 6), see Eds. Colonel P. M. Kirillov and Major A. F. Metel'kin, *M. V. Frunze Na Fronte*

Leon Trotsky and Kliment Efremovich Voroshilov.[687] Tukhachevsky was to become Marshal of the Soviet Union before being killed in a purge in 1937. He is associated with promoting the theory of 'deep operations' to destroy the enemy's logistics and other support infrastructure. For most military establishments, CW has usually played a rather esoteric (i.e., non-central) role that was not very well regarded by command structures or particularly well reflected in the broader military preparations and training.[688]

The Soviet military strategist Suleiman compared the rear military supply and support services for World War I and inter-World War periods.[689] Much of his work touches on distances of supply routes (including the status and role played by railways), organization of the supply responsibilities, and organization of animal and human health support services, including field laboratories (e.g., by the Red Army during the Russian Civil War).[690] He reviews the structure of the Russian Army rear organization and supply in 1914-1918[691] and for the Red Army during the Russian Civil War.[692] This includes summaries of the organization of chemical warfare services during World War I.[693] A 1931 Soviet artillery field handbook aimed at mid-level commanders gives no indication of the possible existence of Soviet CW munitions or that Soviet doctrine envisions the employment under any circumstances of such weapons (whether smoke,

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Grazhdanskoi Voiny: Sbornik Dokumentov [M. V. Frunze on the Civil War Front: Collected Documents] (Military Publisher of the Peoples' Commissariat of the Defence of the Union of Soviet Socialist Republics: Moscow, 1941), pp. 38–43. Selected documents of the *Central Archive of the Red Army*. Frunze wrote the autobiographical summary in 1921 while commander of Red Army forces in the Ukraine and Crimea, and while simultaneously holding the position of fully-empowered Peoples' Commissar of Military and Naval Matters of the Russian Soviet Federated Socialist Republic (attached to the Council of Peoples' Commissars of the Ukrainian Soviet Socialist Republic). Soviet authorities perhaps felt the operational art reflected in the volume was relevant for the war with Germany.

687 See A. Golubev, *M. V. Frunze o Kharaktere Budushchei Voini* [M. V. Frunze on the Character of Future War], (State Military Publisher: Moscow, 1931); Wardak (note 650); A. Svechin, *Strategiya* [Strategy] (Voenny Vestnik: Moscow, 1927); and Sally W. Stoecker, *Forging Stalin's Army: Marshal Tukhachevsky and the Politics of Military Innovation* (Westview Press: Boulder, Colorado, 1998). For a comprehensive study of the Soviet military-industrial complex, including the role of chemical weapon preparedness, see Nikolai S. Simonov, *Voenno-Promyshlenny Kompleks SSSR v 1920-1950-e gody: Tempy Ekonomicheskogo Rosta, Struktura, Organizatsiya Proizvodstva i Upravlenie* [The Military-Industrial Complex of the USSR in the 1920s-1950s: Rates of Economic Growth, Structure, Organization of Production and Direction] (ROSSPEN Publisher: Moscow, 1996).

688 On the structure of offensive and defensive infantry operations doctrine, see A. Lignau, *Pekhota: Opyt Issledovaniya Ustroistva i Boevogo Primeneniya v Usloviyakh Manevrennoi Voiny* [Infantry: Experience of Research Devices and Combat Application During Mobile War Conditions], Second Edtn. (corrected and supplemented) (Voenny Vestnik: Krasnaya Presnya Publisher, Stolyarny (?), Moscow (?), 1927), pp. 95, 360–374, 461–473.

689 N. Suleiman, *Tyl i Snabzhenie Deistvyushchei Armii* [The Rear and Supply of a Mobile Army], part 2, *Front i Armiya* [The Front and the Army], (State Publisher, Military Literature Department: Moscow, Leningrad, 1927).

690 Suleiman, part 2 (note 689).

691 Suleiman, part 2 (note 689), pp. 79–167.

692 Suleiman, part 2 (note 689), pp. 168–206.

693 Suleiman, part 2 (note 689), pp. 360–361.

flame or lethal agents). The handbook does, however, describe some Soviet protective equipment, and detection and decontamination procedures.[694]

CW seems to have also been generally absent from the pronouncements of the top political leadership. A notable exception in the context of the present case study was a speech by Stalin at the 15th Congress of the Communist Party of the Soviet Union, held on 2-19 December 1927, when he spoke at length about the need for Soviet military preparedness, and the lack of relevance of arms control and disarmament work then being conducted in Geneva. He noted that 'the position as regards *war chemicals* is illustrated' by the well-known statement of the head of the US CWS (see discussion below).[695]

The timing of Stalin's speech might be explained by the fact that the Soviet Union participated in the Preparatory Commission for the League of Nations' Disarmament Conference for the first time that year (the Soviets had not participated in the first three sessions of the commission prior to this time).[696] (The work, carried out in Geneva under the auspices of the League of Nations, has parallels with contemporary arms control and disarmament discussions. For example, a sub-committee to the Preparatory Commission on Disarmament in Geneva was tasked in 1926 to consider the possibility that chemical industry could be converted to produce chemical warfare agents.[697] The sub-committee concluded that 'chemical factories, especially dyeworks and factories connected therewith, can be very quickly adapted' to CW manufacture, that 'it is impossible to prevent or hinder the manufacture' of CW and that 'there is no technical means of preventing chemical warfare'.[698]) It should perhaps also be noted that Stalin was kept apprised of Italo—Soviet cooperation on CW which occurred in the early 1930s.[699]

Any CW stockpiles developed for strategic use in state-to-state conflict would have to be at least in the hundreds of tonnes. One planning assumption for a single military engagement (e.g., to cover one's flanks for in an advance to impede an enemy's offense with sulphur mustard) would be 100-200 tonnes.[700]

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694 A. Melik-Kasparov (note 631), pp. 385–396.

695 Josef V. Stalin, 'The Fifteenth Congress of the Communist Party of the Soviet Union', 2–19 Dec. 1927, in Stalin, J. V., [Works], vol. 10 (Foreign Language Publishers: Moscow, 1954); and Khronos: Universal History on the Internet (in Russian), 'Joseph Stalin', <http://www.hrono.ru/libris/stalin/10-13.html>, (accessed 16 June 2013).

696 Jean Pascal Zanders, *Dynamics of Chemical Armament: Towards a Theory of Proliferation*, doctoral thesis (Free University of Brussels: Feb. 1996), p. 261.

697 For a description of the work of the League of Nations on control over and prohibition of chemical warfare by a Secretariat official, see De Madariaga (note 120), pp. 158–164.

698 Liddell-Hart (note 119), pp. 80–81.

699 A 1934 technical mission headed by Fishman was received by Mussolini at a reception in which a toast was raised to future cooperation in this area. Italy and the Soviet Union agreed a 19-point programme of cooperation that included the exchange of samples of the irritant and 'mask breaker' diphenylchloroarsine (100 kg), and the blister agent sulphur mustard (350 kg). The two sides discussed how to lower the freezing temperature of sulphur mustard, to produce higher-purity sulphur mustard and methods of rubber (including synthetic) production. Stalin was kept apprised of these Italian-Soviet contacts. See Yakov Fishman, *Preliminary Final Report on the Trip to Italy by the Military-Chemical Mission*, dated 11 Aug. 1934, and other material, Russian State Military Archive, collection 31, special file 7, folder 38, pp. 77–84; and special file 8, folder 299, pp. 81–87. Quoted in Lev A. Fedorov, *Khimicheskoe Vooruzhenie*, vol. 1 (note 644), p. 77.

700 The latter numbers were discussed at the CD during the CWC negotiations.

12.3.1. Threat Perceptions

There is little basis, at least in the published literature, for assessing the Soviet perception of CW threats and CW security requirements.[701] Reasons for this include: (*a*) the fact that many non-Soviet/Russian analyses reflect the language constraints of the authors, (*b*) most of the Russian-language material is not available and that which is is fragmentary, and (*c*) Russian-language material that is more broadly accessible internationally often contains political or propagandistic 'spin' that describes Soviet intentions and reactions to international pressure and provocations (actual or perceived).[702]

It has therefore been difficult for outsiders to obtain a good sense of what the Soviet technical experts and political leadership actually thought regarding CW threats and Soviet CW security requirements.[703] Soviet military doctrine and preparedness literature often consists of a combination of hagiography, obscurantist Marxist-Leninist theory, and a lack of substantive or otherwise operationally-relevant detail. Some overarching principles may be provided.[704] Quoting a Soviet translation of Fries, a Russian CW history has Fries saying that chemical weapons would be the decisive factor in any future war.[705]

While overarching principles or statements of political or strategic military planning may be stated, they offer little (if any) insight into military capabilities or operationally-relevant detail (e.g., structure, personnel, training, type of equipment). Nevertheless, as previously noted, Western states have devoted much effort in attempting to glean meaning from Soviet doctrinal and politico-military literature.

One may posit that a number of actors were influential to the Soviet understanding of CW threats at different levels (e.g., at the technical, training, strategic and political levels). These actors can be identified according to the positions held, statements issued and work carried out. At the broader military strategic and political levels they do (or should) include the statements and work of Tukhachevsky, Trotsky and Frunze. As far as the author can determine, only one Soviet leader, Stalin, made a notable reference in a public speech concerning CW threats to the Soviet Union.

As previously noted, at the 15th Congress of the Communist Party of the Soviet Union, held on 2-19 December 1927, Stalin spoke at length about the need for Soviet military preparedness, the lack of relevance of arms control and disarmament work then being conducted in Geneva. He said that it was the policy of capitalist states to embark on 'new imperialist wars'.

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[701] Soviet threat perceptions in the CBW area (and arms control more broadly) are provided by Gordon S. Barrass, *The Great Cold War: A Journey Through the Hall of Mirrors* (Stanford Security Studies: Stanford, California, 2009).

[702] E.g. M. Yu. Raginsky, S. Ya. Rozenblit and L. N. Smirnov, *Bakteriologicheskaya Voina—Prestupnoe Orudie Imperialisticheskoi Agressii* [Bacteriological Warfare – the Criminal Weapon of Imperial Aggression] (Academy of Sciences of the USSR Press: Moscow, 1950).

[703] 'Soviet CW security requirements' are understood to include the Soviet policy towards achieving necessary national CW capabilities, including offensive.

[704] See Golubev (note 687).

[705] Kochubina and Lebedevsky (note 191), p. 9. The authors cite a 1924 Soviet translation of Fries and West's book *Chemical Warfare*, p. 412.

He also stated that the friendship pacts between capitalist states and the 'Locarno System' and 'spirit of Locarno' were essentially a process of aligning forces for 'future military collisions'. In support of these points, Stalin stated that 'from 1913 to 1927 *the numerical strength* of the armies of France, Britain, Italy, the United States and Japan increased from 1,888,000 to 2,262,000 men: in the same period the *military budgets* of the same countries grew from 2,345 million gold rubles to 3,948 million; in the period from 1923 to 1927, the number of *aircraft in commission* in these five countrie rose from 2,655 to 4,340; the *cruiser* tonnage of these five powers rose from 724,000 tons in 1922 to 864,000 tons in 1926; the position as regards *war chemicals* is illustrated by the well-known statement of General Fries, Chief of the United States Chemical Warfare Service: "One chemical air-bomb of 560 kilograms charged with Lewisite can make ten blocks of New York uninhabitable, and 100 tons of Lewisite dropped from 50 aeroplanes can make the whole of New York uninhabitable, at least for a week"'.[706]

Stalin's final quotation is somewhat reminiscent of US Secretary of Defense William Cohen's 1997 appearance on ABC News' *This Week* programme where he held up a five pound bag of flour and stated that this amount of dried *Bacillus anthracis* spores would be sufficient to kill half the population of Washington, DC.[707] Similar hyperbole, which discounts delivery-to-target difficulties, was evident in the post-World War I discussion on the nature of science and technology in possible future conflict (see Chapter 2 on inter-war consideration of the nature of future conflict).

Finally, Stalin added:

> '*Lastly, by the fact that nationalised industry is based on the working class, which is the leader in all our development, thanks to which it is able more easily to develop technology in general, and the productivity of labour in particular, and to apply rationalisation to production and management, with the support of the broad masses of the working class, which is not and cannot be the case under the capitalist system of industry. All this is proved beyond doubt by the rapid growth of our technology during the past two years and the rapid development of new branches of industry (machines, machine-tools, turbines, automobiles and aircraft, chemicals, etc.)*'.[708]

The timing of Stalin's speech might be explained by the fact that the Soviet Union participated in the Preparatory Commission for the League of Nations' Disarmament Conference for the first time that year (as previously noted the Soviets had not participated in the first three sessions of the

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[706] Joseph V. Stalin, 'The Fifteenth Congress of the Communist Party of the Soviet Union', 2–19 Dec. 1927, p. 287 in Joseph V. Stalin, [Works] (note 695).

[707] The interview does not appear to be included in the ABC Internet site archive for *This Week*. See 'Interview with William Cohen', ABC This Week, 16 Nov. 1997, transcript no. 97111604-j12, transcribed by the Federal Document Clearing House, Inc. (American Broadcasting Company: New York City, 1997) cited in Audrey Kurth Cronin, *Terrorist Motivations for Chemical and Biological Weapons Use: Placing the Threat in Context*, report no. RL31831 (Congressional Research Service: Washington, DC, 28 Mar. 2003), note 18, p. 5.

[708] Joseph V. Stalin, 'The Fifteenth Congress of the Communist Party of the Soviet Union', 2–19 Dec. 1927, pp. 309–310 in Joseph V. Stalin, [Works] (note 695).

commission prior to this time).[709] Mention of chemical weapons is generally absent from military preparedness literature and top-level political and policy pronouncements (as opposed to, for example, discussion of aerial threats in the inter-war period). The fact that an individual (Amos Fries) was mentioned in high-level political speech is also notable. It would be interesting (if possible) to clarify the planning and consultations that went into Stalin's speech.

Much of the history of CW threat perceptions and motivations may be irretrievable, even to Russian scholars who might be granted unrestricted access to all the relevant extant archives. This is partly because not all decisions taken by a bureaucracy are written down. Also, the Soviet Union is more generally known to have 'air brushed' some of its archives to remove political non-persons or modify narratives towards those deemed more politically acceptable. One can postulate that important functions in how the Soviet CW military complex operated included: personal and professional relations, perceived (and actual) political reliability and perceived (and actual) political influence. It has often been observed that careers in the Soviet Union (and now Russia) are to a significant extent based on personal affiliations to a patron, such as someone in the leadership of a 'power ministry'. In the Soviet (now Russian) military, personnel in the same graduating class often assist each other in their careers.[710] Those who fail to obtain promotions together with the rest of the graduating class may be compelled to retire at that time.

Distinctions probably also existed between civilian and military cadres. More narrowly focused, technical experts also probably played roles distinct from civilian and military leadership and lower-level management. Literature aimed at technical experts seems to ignore or downplay the finer points of political deviation (Left Socialism, Trotskyite, Cosmopolitanism, etc.) of the moment, especially during Stalin's regime. Military personnel, to varying degree, may have been somewhat insulated during some periods of Soviet history from civilian leadership purges and the effects of purges on society in general. Members of the CW establishment were, however, purged and sometimes executed. Perhaps the most notable CW officer and technical expert who was purged (but not executed) was the first head of the Red Army Military Chemical Directorate, Jakov Fishman. The Communist Party also took steps to ensure that, through the early 1920s, experiments were carried out on the basis of collective decisionmaking until Lev Trotsky restored a version of traditional chain-of-command and military discipline in the ranks with, over time, more politically reliable Soviet officers (rather than Czarist officers who had been impressed into the Red Army to fight in the Civil War).[711] A number of chemists and other technical experts who were swept up in the Great Terror, served their time not in the regular Gulag, but in Sharashky [plural].[712] Perhaps the most notable

[709] Zanders (note 696), p. 261.

[710] This not infrequently also occurs in other states.

[711] See Stoecker (note 687).

[712] Sharaskhy were special facilities where scientists and technical specialists served their prison sentences working on scientific projects, including the development of chemical weapons. Some Sharashky were laboratories established within a prison complex. Other inmates were placed in regular research facilities and worked alongside non-prisoners. However, outside normal working hours, they were confined. Garrett and Hart (note 108), p. 188.

Sharashka [singular] was GosNIIOKhT. The research institute still exists and is headquartered in Moscow.[713]

Part of the Soviet military literature was classified, such as the technical specifications for the manufacture of chemical munitions. It is not possible to determine what percentage of the Soviet military literature was (or is) classified.[714] Even a researcher with full access to the relevant archives may find this question problematic to clarify (e.g., if important paperwork is not digitized). However, it is reasonable to assume that some of the unclassified literature was not meant to be circulated outside the country.[715] In these cases, the Soviet authorities may have been less concerned with placing restriction markings on such publications. For example, the publications listed in Table 12.2 do not have restriction markings. It is also possible that part of the military literature (politically or technically) parallels a type of literature that is currently produced by the Chinese state media (Xinhua News Agency) called 'internal reference' (*neican*). This literature is not necessarily based on intelligence information. However, it is meant to provide clearly articulated analyses of political developments to the senior political leadership that is unadulturated by Party 'spin'.[716]

The Soviet leadership could probably generally distinguish between Party rhetoric and actual political interests and processes. Living in such a society caused many Soviet citizens' attenae for the detection and interpretation of politically-slanted reporting to become highly-developed. However, the Archer Able 83 Nato exercise which the Soviet leadership appears to have understood to be a cover for a Western nuclear attack (a simulated Defcon 1 alert with full-scale field exercises) suggests this was not necessarily always the case. The Soviet intelligence services appear to have issued reporting that coincided with what they believed the political leadership wished to hear (some of which was influenced by Soviet communist ideology).[717] The threat reporting was

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[713] Vil S. Mirzyanov, *State Secrets: An Insider's Chronicle of the Russian Chemical Weapons Program* (note 570), pp. 79 & 225.

[714] Martens provides estimates on Soviet patents and certificates of invention that have been declassified and the scale of those that might remain closed. Martens (note 680).

[715] *Military Thought* was, for at least a time, specifically limited to Soviet officers. Raymond L. Garthoff, *Soviet Strategy in the Nuclear Age* (note 651), p. 253. Facsimile reprint of original 1958 printing by Frederick A. Praeger, Inc. edition. This restriction appears to me to be somewhat unusual for Soviet military periodicals. Rather the restrictions during the Soviet Union were more a function of de facto distribution and access to relevant library holdings. A related factor is reflected by a Soviet saying that a Soviet citizen is either in the 'inner zone' (i.e, in prison) or 'outer zone' (i.e., not under arrest or inprisoned). At least one version of *Military Thought* is available at libraries in various countries, including the SIPRI library (there appear to be two views on whether the journal has been produced in two versions—one being classified).

[716] Anonymous, 'China's Secret Media: Chinese Whispers', *The Economist*, vol. 395 no. 8687 (19–25 June 2010), pp. 51–52.

[717] See National Security Archive (George Washington University), *The 1983 War Scare: "The Last Paroxysm" of the Cold War Part I*, Briefing Book no. 426, 16 May 2013, <http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB426/>; National Security Archive (George Washington University), *The 1983 War Scare: "The Last Paroxysm" of the Cold War Part II*, Briefing book no. 427, <http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB427/>; and National Security Archive (George Washington University), *The 1983 War Scare: "The Last Paroxysm" of the Cold War Part III*, Briefing book no. 428, <http://www.gwu.edu/~nsarchiv

believable in the case of Archer Able perhaps because it supported a particular 'preferred narrative' of the Soviet Communist Party in the minds of the leadership.[718]

External perceptions of Soviet CW activity should also be noted. One type of Soviet review of international military publications is broadly similar to 'The Foreign Military Press' section of *The Coast Artillery Review*.[719] The Soviet reviews examined by the author are more detailed and less based on publications per se but also include summaries of speeches (e.g., by CWS officers) and assessments of CW patents. It must also be stated that, although it dealt with CW issues, including citation of Fishman on Soviet CW strategy, *The Coast Artillery Journal* was not focused on CW per se. Contributing authors to this journal did have access to *Voina i Revolutsiya*.[720] The Swedish journal *Effektivt Försvar: Fritt Militärt Forum* [Effective Defence: the Free Military Forum] contains similar articles, but with a somewhat broader geo-political focus.[721]

Referring to Fishman's *Military Chemistry*, Alden H. Waitt of the US CWS summarizes Soviet CW military doctrine as follows.[722] First air attacks should be carried out against troop concentrations in bivouc areas and rail stations. Fishman recommends the use of chemical air bombs combined with high explosives and incendiaries. For attacking troop columns, Fishman recommends the use of aerial sprayers filled with lewisite or sulphur mustard. He also recommends the use of persistent agents (e.g., sulphur mustard) against troop concentrations within forested areas rather than fragmentation bombs. Enemy units on the attack should be constricted and slowed by zones contaminated by sulphur mustard, especially in along probable main routes and river crossings.[723] Waitt also states that Soviet chemical defence is based on six tasks (four of which are for tactical protection): discover the enemy's intention; select the proper positions most suited to chemical defence; prevent the enemy

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NSAEBB/NSAEBB428/>. (all accessed 24 July 2013).

[718] Further insight into Soviet decisionmaking regarding chemical weapons threat assessments and their role in arms control policy formation are located in the Vitalii Leonidovich Kataev collection at the Hoover Institution (Stanford University). See <http://www.oac.cdlib.org /findaid/ark:/13030/kt900039p6/?query=kataev>, (accessed 4 Aug. 2013); and Jamie Doward, 'How a War Game Brought the World to the Brink of Nuclear Disaster', *Guardian*, 2 Nov. 2013, <http://www.theguardian.com/uk-news/2013/nov/02/nato-war-game-nuclear-disaster>, (accessed 3 Nov. 2013).

[719] Alexander L. P. Johnson, 'The Foreign Military Press', *The Coast Artillery Journal*, no. 4, vol. 78 (July-Aug. 1935), pp. 313–16.

[720] Alexander L. P. Johnson, 'The Foreign Military Press: USSR – Voyna i Revolutsiya – January-February 1935, Military Developments of 1934 in Japan, Germany, and Poland. By A. Petrov', *The Coast Artillery Journal*, vol. 78, no. 4 (July-Aug. 1935), p. 316.

[721] E.g. Lars-Erik Tammelin, 'Biologiska Stridsmedel: Vapenteknikens "Dark Horse"' [Biological Warfare Agents: Weapon Technology "Dark Horse"], *Effektivt Försvar: Fritt Militärt Forum* [Effective Defence: Free Military Forum], no. 6 (1962), pp. 255–57.

[722] Waitt gives the bibliographic information of Fishman's publication as: '*Military Chemistry*, A Guide to Commanding Personnel of the Red Army. Moscow, 1930.' Quoted in Alden H. Waitt, 'Chemical Security: Part I, Methods of Chemical Attack and Chemical Intelligence', *The Coast Artillery Journal*, vol. 78, no. 4 (July-Aug. 1935), reference 2, p. 270.

[723] Waitt gives a general overview of when and how CW can be employed with advantage. He is somewhat unclear as to how much of this discussion consists of Fishman's recommendations. By page 272, Waitt's discussion slides into British doctrine. Alden H. Waitt (note 722), p. 271.

CW attack through active defensive measures that include artillery fire; notify troops of CW threats; employ protective equipment; and maintain degassing equipment.[724]

12.3.2. Demand and Supply Side Factors

Demand and supply side factors are not considered in detail for this case study. In the post-World War I and post-Civil War periods, the Soviets were engaged in a broad-based effort to modernize their economy and related technical expertise. In addition to a general wish by the Soviet leadership to at least reach all around parity with the leading military powers, perhaps the most useful avenue for analysis on demand and supply factors as they pertained to CW in the inter-World War period are the motivations, priorities and results achieved by those actors and institutions involved in volunteer societies such as OSOAVIAKHIM. These volunteer society activities represent a systematic attempt to align the objectives of developing a civilian chemical industry with the military requirements for expertise and CW production capacity. Such societies were also a means for mobilizing and harnessing mass political support, as well as improving civilian technical capacity and their ability to contribute to dual-purpose civilian-military industrial enterprises (including as a standby workforce). A key question here is the extent to which such capacity was a driver or a byproduct of military programmes (i.e., are there cause-effect relations or analytically suggestive correlations).

12.4. Technical Factors

With respect to technical factors, most of the discussion would have to focus on assimilation of CW into the state's economic, military, and technological infrastructure.[725] Verification measures in the contemporary arms control and disarmament context would not be applicable except, perhaps, for those falling under the headings of 'off-site' or 'near-site' measures. Sampling and analysis protocols for potential CW agents and their degradation products would also largely be inapplicable for the period, partly because field-based chemical warfare detection systems were rare and not very capable.[726] It is reasonable to suppose that, at a minimum, the Soviets sought to match major Western military

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[724] Alden H. Waitt (note 722), p. 272.

[725] See L. F. Fokin, *Obzor Khimishskoi Promyshlennosti v Rossii* [Survey of the Chemical Industry in Russia], part I (Scientific Chemico-Technical Publisher: Petrograd, 1920); L. F. Fokin, *Obzor Khimisheskoi Promyshlennosti v Rossii: Promezhutochnie Produkty Krasochnogo i Khimiko-Farmatsevticheskogo Proizvodstva* [Survey of the Chemical Industry in Russia: Intermediate Products of Dyes and Chemico-Pharmacological Production], part I, second edtn. (Scientific Chemico-Technical Publisher: Petrograd, 1921); *Ryssland: Officiell Rapport av Engelska Fackföreningsdelegationen till Ryssland och Kaukasus i November och December 1924* [Russia: Official Report of an English Factfinding Delegation to Russia and the Caucusus in November and December 1924], authorized translation (Frams Förlag: Stockholm, 1925), pp. 74–94 [on industrial developments] and pp. 124–131 [on the Red Army].

[726] On the taking of blood samples from Axis POWs during World War II, see *Activities of the United States in the Field of Biological Warfare: a Report to the Secretary of War by George W. Merck, Special Consultant on Biological Warfare* (the 'Merck Report') (note 628), p. 18.

capabilities, including on the chemical side. The US CWS started designing a CW analysis field laboratory in 1929 that was later standardized as the M1 Field Laboratory in 1936.[727] The Soviet Union possessed CW exposure tent systems (for military personnel training) and railway car-based CW analytical and decontamination support equipment.[728]

Assimilation in the chemical weapons programme or activity context is understood to include the capability of the target of analysis to acquire the expertise associated with the development, production, storage and use of CW. Following the Russian Revolution, the Soviets undertook a largescale and wide-ranging series of measures to industrialize their society (e.g., through 'chemicalization') and to modernize its military.[729] This included the establishment of societies such as OSOAVIAKhim.

If a state or non-state actor does not possess the capacity to technically support a chemical weapons programme, it may instead forgo such activity or seek to enter into joint development programmes or to simply import the weapons. In the 1920s the Soviet Union undertook to ameliorate its CW capability shortcomings by entering into a secret cooperative arrangement with Germany under the terms of the 1922 Treaty of Rapallo. Germany assisted with the construction and scale up of the Soviet (now Russia's) principal CW field test and development facility at Shikhany located on the lower Volga River (see Chapter 2).[730]

Step 3. Prepare Matrices with Hypotheses

A matrix should be prepared which has 'diagnostic' value (i.e., it provides insight and understanding that either confirms or counters the prevailing wisdom).

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[727] Smart (note 210), p. 5.

[728] Zhukoborsky and Duriitsky (note 667), pp. 25–26.

[729] Sarah White observes that '"Chemicalization" is a portmanteau word used by the Soviets to mean the widespread development of the chemical industry, by increasing its production and the number of its products, and by widening their use in other fields of the national economy, particularly in agriculture'. pp. Sarah White, *Guide to Science and Technology in the USSR: a Reference Guide to Science and Technology in the Soviet Union* (Francis Hodgson, Ltd.: Guernsey, UK, 1971), chap. 11, pp. 144–145.

[730] The Soviet Union permitted Germany to circumvent Treaty of Versailles restrictions on military training and research and development in various fields. On German-Soviet cooperation at Shikhany, see Alimov (note 128), pp. 11–19. See also Carsten (note 221), pp. 217–244.

Matrix Stockpiling

Question: Has the target (i.e., state or non-state actor) stockpiled chemical weapons?

Hypotheses:
H1 No stockpiling of chemical weapons [C=3, I=5, N/A=10]
H2 Yes stockpiling of chemical weapons [C=15, I=3, N/A=0]

	H1	H2
IR1. Does target have CW technical capacity (e.g. military, medical)?		
E.1 General publications aimed at domestic audience (**yes**)	I	C
E.2 ~~General publications aimed at domestic audience (no)~~	-	-
E.3 Civil defence against CW policy documentation (**yes**)	N/A	C
E.4 ~~Civil defence against CW policy documentation (no)~~	-	-
E.5 Civil defence against CW technical guidance (**yes**)	N/A	C
E.6 ~~Civil defence against CW technical guidance (no)~~	-	-
IR2. Is CW mentioned in military doctrine?		
E.1 Defence against CW in civil defence context (**yes**)	N/A	C
E.2 ~~Defence against CW in civil defence context (no)~~	-	-
E.3 Defence against CW for military personnel (**yes**)	N/A	C
E.4 ~~Defence against CW for military personnel (no)~~	-	-
E.5 Civilian prophylaxis and/or countermeasures (**yes**)	N/A	C
E.6 ~~Civilian prophylaxis and/or countermeasures (no)~~	-	-
E.7 Military prophylaxis and/or countermeasures (**yes**)	N/A	C
E.8 ~~Military prophylaxis and/or countermeasures (no)~~	-	-
IR3. Statements and similar communications		
E.1 Has leadership discussed CW matters? (**yes**)	N/A	C
E.2 ~~Has leadership discussed CW matters? (no)~~	-	-
IR4. Weight of evidence of integration of CW into military doctrine?		
E.1 ~~Publications indicate integration of CW (yes)~~	-	-
E.2 Publications indicate integration of CW (**no**)	C	I
E.3 Arms control policy statements against CW (**yes**)	C	I
E.4 ~~Arms control policy statements for CW (yes)*~~	-	-
IR5. Interest in CW activities of others?		
E.1 Discussion of CW threats posed by others (yes)	N/A	C
E.2 ~~Discussion of CW threats posed by others (no)~~	-	-
IR6. Evidence of CW production?		
E.1 Laboratory scale synthesis of CW agents (**yes**)	N/A	C
E.2 ~~Laboratory scale synthesis of CW agents (no)~~	-	-
E.3 CW production facility indicators (**yes**)	I	C
E.4 ~~CW production facility indicators (no)~~	-	-
E.5 ~~CW stockpiling indicators (yes)**~~	-	-
E.6 CW stockpiling indicators (**no**)	C	I
E.7 Documentation of production (**yes**)	I	C
E.8 ~~Documentation of production (no)~~	-	-
E.9 Documentation of stockpiling (**yes**)**	I	C
E.10 ~~Documentation of stockpiling (no)~~	-	-
E.11 Availability of CW production material/equipment (**yes**)	N/A	C
E.12 ~~Availability of CW production material/equipment (no)~~	-	-
E.13 Availability of CW munition (yes)	I	C
E.14 ~~Availability of CW munition (no)~~	-	-

Source: Author's adaptation of Heuer's ACH matrix. C=consistent, I=inconsistent and N/A=not applicable, IR=information request, E=evidence. *E.g., Some parties to the 1925 Geneva Protocol reserved the right to use CW if such weapons were first used against them. **The question is not a non-sequitor in the sense that, for e.g., overhead imagery might be available that suggests such stockpiling.

The cumulative scores for the hypotheses are:
H1: C=3, I=5, N/A=10
H2: C=15, I=3, N/A=0

The aggregate consistent score for H2 is 5 times greater than for H1. H1 has a N/A score that is 10 times higher than that for H2.

Several points should be considered. One is the distinction between a trend and a pattern. Such trends or patterns may be reflected in the cumulative scores, or the scores for a particular information request. Another point is the concept of 'significance'. Qualitatively speaking, significance means that the data pattern is not caused by chance. Finally, a broader pattern may emerge in the cumulative scores for each hypothesis. This can have the effect of obscuring operational facets or subtleties in cases where a binary yes-no assessment is made. Alternatively, the cumulative scores for each hypothesis may, given sufficient data points (or a sufficiently high 'n'), point to an underlying (including counter-factual or counter-intuitive) tentative conclusion.[731]

Information should be assessed according to that available to interested parties in the inter-World War period, during World War II and the post-World War II period. This is a distinct exercise from a cumulative, all-source, all-period hindsight evaluation.

IR1. Does Target Have CW Technical Capability (e.g., Military, Medical)?

The sub-generic score for H1 is: C=0, I=1, N/A=2
The sub-generic score for H2 is: C=3, I=0, N/A=0

At its face, the hypothesis for stockpiling (H2) is favoured.

It was evident to CW specialists of the major military powers in the inter-World War period that starting no later than the early 1920s, all were engaged in CW threat evaluation and, at a minimum, in the small-scale production and testing of agents. This was done partly in the context of assessing the implications of World War I for future warfare. The Soviet Union possessed a CW technical capacity for evaluation and protective purposes. Its ability to engage in offensive CW warfare in the first half of World War II is less certain and subject to dispute.

IR2. Is CW Mentioned in Military Doctrine?

The sub-generic score for H1 is: C=0, I=0, N/A=4
The sub-generic score for H2 is: C=4, I=0, N/A=0

At its face, the hypothesis for stockpiling (H2) is favoured.

Offensive use of CW is discussed in terms of the planning of other states. CW is sometimes meant to include flame and smoke operations. Otherwise,

[731] These points are undoubtedly very familiar to professional statisticians and others according to different terminology and criteria. The manner in which these points have been formulated have been intuitive and qualitative from the perspective of the author. Mathematics has been avoided for the sake of focusing on qualitative, including counter-factual, analysis.

mention of lethal CW agents or Soviet military capability for using such weapons is eschewed.

IR3. Statements and Similar Communications

The sub-generic score for H1 is: C=0, I=0, N/A=1
The sub-generic score for H2 is: C=1, I=0, N/A=0

At its face, the hypothesis for stockpiling (H2) is favoured.

Stalin addressed CW threats at the XVth Party Congress. Periodic, but less frequent and prominent, military leadership pronouncements on CW threats were issued.

IR4. Weight of Evidence of Integration of CW into Military Doctrine?

The sub-generic score for H1 is: C=2, I=0, N/A=0
The sub-generic score for H2 is: C=0, I=2, N/A=0

At its face, the hypothesis for stockpiling (H1) is favoured.

Soviet representatives generally gave pro-peace statements and anti-Capitalist as war mongers statements. Soviet delegations delivered pro-peace and pro-disarmament statements to the League of Nations. Stalin addressed disarmament in favourable, but skeptical, terms at the XVth Party Congress.

IR5. Interest in CW Activities of Others?

The sub-generic score for H1 is: C=0, I=0, N/A=1
The sub-generic score for H2 is: C=1, I=0, N/A=0

At its face, the hypothesis for stockpiling (H1) is favoured.

Such discussion is clearly evident in the inter-World War Soviet military journals.

IR6. Evidence of CW Production?

The sub-generic score for H1 is: C=1, I=4, N/A=2
The sub-generic score for H2 is: C=6, I=1, N/A=0

At its face, the hypothesis for stockpiling (H2) is favoured.

The Soviet Union synthesized laboratory scale World War I-type CW agents. Germany (and perhaps others) were aware of the Soviet CW field test facility since they supported its construction and the two countries ran joint tests there within the framework of the 1922 Treaty of Rapallo. Fedorov's archival research demonsrates that the Soviet Union produced CW in the thousands of tonnes range starting in the inter-World War II period. Some documentation was captured by Germany during World War II.[732] Most of the Soviet literature (e.g.,

[732] E.g., Hirsch reviews Soviet munitions based on manuals and other literature. Hirsch (note 598).

memoirs) mention flame and smoke operations.[733] Soviet sources have consistently avoided discussing possible employment lethal CW agents by Soviet forces, including their weaponization and stockpiling.[734]

Step 4. Refine the Matrix

Analysts have long debated why CW were not employed on the Eastern front during World War II. A standard explanation is that the use of CW by Germany (even the employment of the then novel soman and tabun) would have slowed its advance against the Soviet Union and complicated its logistics requirements. As Germany retreated, it faced diminishing resources and a progressive loss of air superiority to the Allied forces. It has also been postulated that Hitler was opposed to the use of CW in general because of his temporary loss of vision after being exposed to sulphur mustard during World War I. Recently, Dr Thomas Weber of the University of Aberdeen states that a series of previously unpublished letters from 1943 contradict this claim and that the reason for Hitler's hospitalization in 1918 was 'hysterical amblyopia'.[735] The question of why CW was not employed by Germany was given greater urgency at the end of the war when the UK and United States uncovered German stocks of the then (generally unknown to them) soman and tabun.[736] One cannot also exclude the non-use by Germany of nerve agents due to an assumption by Hitler that the Allies possessed them as well.

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[733] E.g., Grigory A. Zhukov, *Vospominaniya Voennogo Khimika* [Recollections of a Military Chemist] (Military Publishers: Moscow, 1991).

[734] The ambiguity as to whether the Soviet army was prepared to use toxic chemicals to injure or kill (as opposed to engaging in smoke or flame operations) is maintained by A. Lignau in his treatment of offensive chemical operations by the Red Army. On 'military-chemical matters' (*voenno-khimicheskoe gelo*) during attack, see Lignau (note 688), pp. 461–473. Even examples of chemical munitions cited in Soviet publications are non-Soviet. See, for e.g., M. M. Voreisha, *Boevie Pripasy Voiskovoi Artilerii* [Ammunition of the Troop Artillery] (State Military Publisher: Moscow, 1932), pp. 14–16.

[735] Tom Kelly, 'British Mustard Gas Attack Didn't Blind Hitler: His Invented Trenches Myth Concealed Bout of Mental Illness', *Daily Mail*, 21 Oct. 2011, <http://www.dailymail.co.uk/news/article-2051829/Mental-illness-Hitler-blind-British-mustard-gas-attack.html>, (accessed 22 July 2013).

[736] There is some uncertainty as to whether scientists at Porton Down or the Soviet Union (e.g., GosNIIOKhT and, in particular, Professor Martin I. Kabachnik, knew or suspected that Germany was weaponizing organophosphorus nerve agents. Germany stopped publishing scientific articles concerning soman and tabun following Schrader's employer informing the German government of the possible military significance of work on pesticides. Some evidence suggests that the Soviet Union produced organophosphorus nerve agents during World War II. An unclassified 1963 US NIE, for e.g., states: 'There is good evidence that a tabun-like compound was synthesized in the USSR during World War II while the Germans were developing tabn (GA) itself'. *Soviet Capabilities and Intentions with Respect to Chemical Warfare*, NIE report 11-10-63, 27 Dec. 1963, p. 3.

As previously noted, Reginald V. Jones observed that one of the British failures in scientific intelligence during World War II was its inability to uncover and appreciate Germany's organophosphorus nerve agent programme. Jones (note 430).

A Soviet explanation for why Germany did not use CW against it is:

'How can we explain that fascist Germany, which was thoroughly prepared for the use of chemical weapons, did not start chemical warfare against the Soviet Union?

1. The main and basic reason is that the Soviet people were ready to repel the chemical attack of the enemy. The Soviet army and the population of the threatened belt had adequate means of protection. In such a situation, the use of chemical warfare weapons was not worthwhile and could not be successful.

2. During the first period of the war, when Hitler's troops had a certain technical advantage, and they succeeded in occupying a part of the territory of the USSR, there was no necessity to use such an extreme method of war as poison gases.

3. The fear of mutual annihilation played a restraining role. It is timely in this context to remind one of the declaration of the Soviet government, warning Germany of the consequences of such a step, i. e., the use of chemical warfare weapons.[737] *The declaration of the USSR was supported by our military allies—the USA and England.*

4. The above-mentioned Geneva Protocol also had a restraining influence upon the unleashing of chemical warfare.

5. Finally, Hitler's troops could not use poison gases in the second half of the war, when the Soviet army evicted them from the territory of the USSR and continued to hit the foe on its own territory. The use of war gases was excluded in such conditions, for the German population was already enough angered by the burdens of war unleashed by Hitler's clique, and could have risen against its own army'.[738]

The World War II junior chemical officer Grigory Andreevich Zhukov stated, perhaps displaying preferred hindsight, that there were two main reasons

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737 Winston Churchill and Franklin Roosevelt did issue such a warning. Any possible Soviet warning to Germany is less certain, at least based on the standard English language literature. For background on the warning and associated intelligence from a British perspective, see Francis Harry Hinsley, C. F. G. Ransom, R. C. Knight and E. E. Thomas, *British Intelligence in the Second World War: Its Influence on Strategy and Operations*, vol. 2 (Her Majesty's Stationary Office: London, 1981), pp. 116–122 and 674–676.

738 L. F. Supron, 'The Toxicology, Clinical Aspects, and Therapy of Affections Caused by War Gases', chap. 4, p. 171 in L. F. Supron and F. P. Zverev (Professor A. P. Mukhin as series editor), *Medical and Civil Defense in Total War* (Israel Program for Scientific Translations: Jerusalem, 1961). Anonymous English-language translation of L. F. Supron and F. P. Zverev (under the editorial direction of Professor A. P. Mukhin), *Meditsinskoe Obespechenie Naseleniya v Usloviyakh Primeneniya Sredstv Massovogo Porazheniya* [Medical Provision for the Population under Weapons of Mass Destruction Use] (State Publisher of the Belorussian Soviet Social Republic, Scientific-Technical Literature Editing: Minsk, 1959). The Russian language version of the title differs from that given by the translators. Furthermore, the spine of the book reads: *Medical and Civil Defense in Total War*.

Germany did not employ CW: the reliability of Soviet chemical protection and fear of retaliation.[739]

The question of whether the Soviet Union was *capable* of employing CW during World War II and, if so, why it did not choose to do so at least perhaps to slow down the initial German advance remains open to debate. The main technical basis for this discussion in the West is almost certainly the Hirsch Report, which was prepared by a Wehrmacht chemical officer for the United States following the war. One view is perhaps best summarized by Pozdnyakov, a former Soviet chemical officer, in a study edited and published by Liddell-Hart in 1956. Pozdnyakov summarizes his view that when the war started in 1941 'the Soviet Army had modern chemical weapons and means of defence. Supplies were normal'.[740]

Herman Oschner categorically states that the Soviet Union not only did not employ CW but that Germany was surprised they did not capture CW stockpiles. He states in a now declassified report he prepared for the US military following the war:

> '*Surprisingly enough, the Russians even did not use gas in 1941 in defense of their excellently prepared field fortifications within their rear defense lines….We never discovered what caused the Russians consistently to desist from the use of gas….The author [Oschner] does not believe that they did not possess sufficient quantities even though we found gas nowhere, because the Russians achieved marvelous feats in clearing their country of anything that might have been of any use to us. Thus it is possible that they removed their stockpiles of chemical warfare agents (which presumably, and in common with other states, they did not store near the borders)…*'.[741]

Zanders also argues the more sceptical position—that the Soviet Union was not capable of engaging in chemical warfare during Germany's advance into the country. In particular, he notes: (*a*) the purges in the 1930s reduced the technical capacity of the Red Army to engage in chemical warfare, (*b*) the Red Army was greatly expanded in the 1930s which generated training and logistical challenges (*c*) the massive losses (some 3.35 million men captured by the Germans in 1941) were too destablizing to permit chemical warfare, (*d*) the disruption of relocating military industries to the Urals, and (*e*) no clear indication of offensive CW in Soviet military doctrine manuals.[742]

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[739] Zhukov (note 733), p. 5.

[740] V. Pozdnyakov, 'The Chemical Arm', p. 393 in Liddell-Hart, *The Red Army* (note 636).

[741] Ochsner (note 741), p. 20.

[742] Zanders states: 'The Soviet counterattacks in front of Moscow in December 1941 halted the German advance. However, it was only after the war industry relocated to the east began increasing weapons production that the Red Army was able to mount counteroffensives. From an assimilation point of view, only then did it succeed in finding a high level of accordance between people, equipment and theory to execute the principles of manoeuvre. However, by that time CW had all but disappeared from the field manuals'. Zanders (note 696), pp. 306–09. A point for further consideration is to clarify whether and how the numerous manuals aimed at various ranks and for various purposes related to the overarching military doctrine. In other words, what sort of Soviet training material could or should fall under the term 'field manual'? The different types of doctrinal materials would include small-unit pamphlets, chemical

Zanders summarizes:

> '*Contrary to the traditional presentations, the Second World War thus emerges as a major breakpoint in the development of the Soviet offensive chemical doctrine. Charting the limited information on Soviet CBW preparations during the interbellum on the political and military tracks of the assimilation model points to the Red Army's general unpreparedness for offensive or defensive chemical operations as a consequence of the failure to reconcile military and political imperatives at any particular moment. The Soviets introduced chemical weapons into their military doctrine as instruments of high-technology warfare. It was an area, but not the only one, in which they lagged badly. Trotsky, who strongly advocated a Soviet CW posture, saw it as a means to offset the capitalist states' technological superiority in his defensive doctrine. Later it became a cornerstone in offensive doctrinal theory and was merged predominantly with another high-technological development, the aeroplane. Thus, during the late 1920s, when doctrine and politics appeared closest, the lack of a sufficiently developed industrial base precluded the arming of the nascent Red Army with the required equipment. Offensive CW disappeared from the mainstream military doctrine with Stalin's purges in the late thirties. When during the Second World War the Red Army became able to mount its own offensives, it had essentially achieved technological parity and was capable of producing equipment in greater quantities than the enemy. Offensive chemical weapons were then no longer necessary to achieve that parity'*.[743]

Grigory Andreevich Zhukov's memoirs give a sense of the wartime training of chemical troops whose duties included the detection of and protection against CW attack and responsibility and support for smoke and flame operations (including Molotov cocktails for use against German armour).[744] Zhukov (not to be confused with Georgy Konstantinovich Zhukov, the General Chief-of-Staff during World War II) carefully avoids stating or implying that the USSR produced or contemplated the use of CW.

Ochsner's view is consistent with Zander's argument. For example, he states that although the Soviet CW defensive equipment (e.g., respirators, filters, protective suits, boots and gloves) was 'good', the Soviets were unable to 'fully equip' their forces following their initial heavy losses in 1941.[745] Ochsner also notes that the Soviets had ample white phosphosphorus munitions which German forces found to be troublesome.[746]

More recent research by Paul Maddrell using British archival sources led him to conclude that during World War II Germany only captured 'quite a narrow range of gas-filled weapons' (mainly aerial bombs) and that German intelligence obtained 'useful information' on CW that did not fall into their

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sargeant training, technical specialist training, role of CW in tactical and strategic engagements, and higher-level policy doctrinal guidance and analysis.

[743] Zanders (note 696), p. 310.

[744] Zhukov (note 733).

[745] Ochsner (note 674), p. 27

[746] Ochsner (note 674), p. 33.

hands.[747] Maddrell states that Germany captured more than 12 types of CW bombs and 6 types of CW spray devices.[748] Germany conducted field trials on cyanide compounds (hydrogen cyanide and cyanogen chloride) during the war at Munsterlager (the present-day site of Germany's OCW destruction programme and not to be confused with the city of Münster) based on information obtained on Soviet CW capabilities.[749]

It should also be re-emphasized that the Soviet understanding of chemical units was not confined to traditional chemical warfare agents, but included the use of smokes, obscurants and flame throwers.[750] These units also had responsibility for supplying Molotov cocktails. A further source of confusion regarding the possible use of traditional chemical warfare agents (including sulphur mustard) is a distinction made between defensive chemical equipment (the provision of respirators, decontamination units and field agent detection kits, for example) and weaponized lethal (e.g., nerve agents) or debilitating (e.g., sulphur mustard) CW agents.[751]

Fedorov, as previously mentioned, a former Soviet military chemist who writes on environmental issues connected to the former Soviet CW programme, provides lists of munition type and quantities of agent to be produced prior to and during World War II in his fundamental 2009 history of the Soviet programme. His principal archival source appears to be the Russian State Military Archive. What is generally lacking from such data, however, is whether and to what extent the production targets were actually met. Fedorov provides locations of pre-World War II CW stocks, including 121 artillery storage sites where CW was stored prior to the war (see Table 12.4). There is nevertheless ambiguity between production capacities and 5-year plan goals *versus* actual production.[752] Much of the Soviet Union's World War II CW production appears to have consisted of sulphur mustard and lewisite (mainly air bombs, artillery shells and mines). The cumulative tonnage for these agents for 1941-45 is over 2 million tonnes (which almost certainly includes the weight of the munition bodies).[753] Finally, it should be noted that tables 12.5 and 12.6 are not consistent with each other.

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747 Maddrell (note 129), p. 24.

748 Maddrell (note 129), p. 24.

749 Bernd Appler, 'The Production of Chemical Warfare Agents by the Third Reich, 1933-45', p. 100 in Stock and Lohs (note 138). See also Hirsch (note 598).

750 Zhukov (note 733), p. 44. For a history of US activity in this area, see Mountcastle (note 199).

751 For a summary of these and related points, see V. Pozdnyakov, 'The Chemical Arm', pp. 384–394 in Liddell-Hart, *The Red Army* (note 636).

752 Haber provides average World War I British chemical plant production performance as a percentage of the theoretical maximum for four chemicals: (*a*) bleaching powder (input material) to chloropicrin (end use), performance: 81%; (*b*) chlorine (input material) to phosgene (end use), performance: 63%; (*c*) alcohol (92% C_2H_5OH) to ethylene (end use), performance: 48%; and (*d*) sulphur and chlorine (input material) to sulphur chloride (end use), performance: 95%. Haber (note 106), p. 154. In addition to such difficulties, questions that arise with regard to the Soviet pre-WW II CW production targets include whether the quality control, facility personnel expertise and supply chains were comparable to those of other states.

753 Partial Soviet CW production figures for the 1930s are provided in Fedorov, L. A., *Khimicheskoe Vooruzhenie*, vol. 1 (note 644), p. 101. By comparison, Russia declared the possession of 40 000 agent tonnes of CW stored at 7 sites (all west of the Urals) to the OPCW following the entry into force of the convention in 1997. Tracy Keith, who carried out an extensive archival search on behalf of the OPCW PrepCom which was later published by the

Table 12.4 Soviet Military-Chemical Storage Sites (1918–1945)

Berdsk (Novosibirsk oblast')
Chita-II
Gatchinia (Leningrad oblast')
Gorny (Saratov oblast')
Il'ino (Nizhegorsk oblast')
Irkutsk-Batareinaya
Kambarka (Udmurt Republic)
Khabarovsk-Krasnaya River
Knorring (Primorsk krai)
Lesnaya (Chitinskaya oblast')
Moscow-Ochakovo
Novocherkassk (Rostov oblast')
Omsk
Pes'yanka (Altai krai)
Redva (Sverdlovsk oblast')
Rostov-Yaroslavsky (Yaroslavl oblast')
Rzhanitsa (Bryansk oblast')
Shikhany (Saratov oblast')
Sungach (Primorsk krai)
Svobodny (Amursk oblast')
Tver'
Vozdvizhensky (Primorsk krai)

Source: Lev A. Fedorov, *Khimicheskoe Vooruzhenie—Voina s Sobstvennym Narodom: Tragicheskii Rossiiskii Opyt* [Chemical Armaments—War Against One's Own People: the Tragic Russian Experience], vol. 3 (self-published: Moscow, Feb. 2009), pp. 287–88.

Table 12.5. Production of Chemical Warfare Agents in the Soviet Union during World War II (thousands of tonnes).

CW agent	Years					Total	
	1941	1942	1943	1944	1945	[output;	%]
Sulphur mustard	14.4	26.7	22.6	10.3	2.8	[76.8;	62.6]
Lewisite	2.2	6.1	8.5	2.9	0.5	[20.2;	16.5]
Hydrogen cyanide (HCN) (aka 'Prussic acid')	1.5	2.7	2.8	2.4	1.7	[11.1;	9.1]
Phosgene	0.6	1.7	2.7	2.6	0.7	[8.3;	6.8]
Adamsite	1.0	1.8	2.5	0.8	--	[6.1;	5.0]
Total	**19.7**	**39.0**	**39.1**	**19.0**	**5.7**	**122.5**	100

Source: V. Ryabukhin, *Voenno-Khimichekoe Proizvodstvo v Gody Otechestvennoi Voiny i v Poslevoenny Period* [Chemical Warfare Production during the Great Patriotic War and the Post-War Period] (USSR Gosplan: 1948) p. not provided. Cited in Fedorov, Lev A., *Khimishekoe Razoruzhenie Po-Russky: Dokumental'ny Roman* [Chemical Disarmament Russian-Style: a Documentary Novel] (New Literary Review: Moscow, 2011), p. 25.

Bonn International Center for Conversion (BICC), estimated that 150 000 tonnes of CW agent were produced by all of the belligerants in World War II. If so, the 2 million tonne figure could represent agent tonnes. States began to provide CW weight estimates to agent fill only during the negotiations and subsequent implementation of the CWC so as to circulate the lowest possible numbers. The ratio of declared munitions to agent tonnes to the OPCW following the CWC's entry-into-force is approximately 8.7 million rounds versus 76 000 agent tonnes. See OPCW, 'Demilitarisation', <http://www.opcw.org/our-work/demilitarisation/>, (accessed 3 Nov. 2013).

Table 12.6. Output in the USSR of Chemical Munitions Filled with Persistent Agents during World War II.

Munition type	Formulation	Output (thousands of items)					
		1941	1942	1943	1944	1945	**Total**
Air Chemical Bombs							
KhAB-500	sulphur mustard-Lewisite	2.35	18.8	23.8	7.0	--	**52.0**
KhAB-200	sulphur mustard	--	10.5	27.3	16.4	0.06	**54.3**
KhAB-200	sulphur mustard-Lewisite	4.7	3.5	--	--	--	**8.2**
KhAB-100	sulphur mustard-Lewisite	1.6	22.1	71.2	27.0	1.1	**123.0**
KhAB-25	sulphur mustard-Lewisite	31.1	44.0	4.0	1.5	--	**80.6**
Chemical Artillery Shells							
AKhS-76	sulphur mustard	--	62.0	629.3	6.9	--	**698.2**
AKhS-122 UD	sulphur mustard	30.0	197.5	182.2	102.5	1.0	**513.2**
DD	viscous Lewisite	54.3	7.5	46.0	--	--	**107.8**
UD	sulphur mustard-Lewisite	--	--	--	4.5	--	**4.5**
DD	vis. sulphur mustard-Lew.	--	--	--	20.4	2.7	**23.1**
AKhS-152 UD	sulphur mustard	0.6	50.7	78.5	9.0	--	**138.8**
DD	viscous Lewisite	--	21.2	37.9	--	--	**59.1**
UD	sulphur mustard-Lewisite	--	--	--	5.0	--	**5.0**
DD	vis. sulphur mustard-Lew.	--	--	--	8.8	--	**8.8**
Chemical Mines							
M-82	sulphur mustard	--	0.7	195.0	718.3	--	**914.0**
M-82	sulphur mustard-Lewisite	0.3	18.1	547.7	907.9	35.0	**1509**
M-107	sulphur mustard-Lewisite	--	2.0	--	--	--	**2.0**
M-120	sulphur mustard-Lewisite	--	--	82.0	93.0	--	**175.0**
Chemical Multi-Rail Rocket Launchers [also known as Multiple Rocket Launchers or Katyusha Rocket Launchers]							
11MKh-13	sulphur mustard-Lewisite	--	48.2	35.2	13.6	--	**97.0**
Total		**125.0**	**506.8**	**1960.1**	**1941.8**	**39.9**	**4573.6**

Source: Cited in Lev A. Fedorov, *Khimishekoe Razoruzhenie Po-Russky: Dokumental'ny Roman* [Chemical Disarmament Russian-Style: a Documentary Novel] (New Literary Review: Moscow, 2011), p. 26. [no documentary source provided by Fedorov]. AKhS=artillery chemical shell, DD=proximity fuze, KhAB=chemical air bomb, M=mine, MKh=chemical mine, UD=impact fuze. 'Vis.' = viscous.

The Soviet Union did, in fact, consider the possibility that CW would be used and took measures to defend against such weapons.[754] Fedorov estimates that the Soviet Union produced during the inte-World War period between 10000 and 20000 tonnes of CW which was stored, in principle, at more than 200 facilities.[755] At the end of World War II, Soviet forces discovered on the territory of Germany and set aside for destruction 393,436 chemical shells of various calibres, 149,485 chemical air bombs, 33,0802 smoke rounds and rockets, and 6854 tonnes of CW in various bulk storage containers.[756]

[754] Zhukov (note 733).

[755] Lev A. Fedorov, *Khimishekoe Razoruzhenie* (note 647), p. 27.

[756] Central Archive of the Ministry of Defence, collection [fond] 233, inventory [opis'] 2311, folder [delo] 32, pp. 309–339. Cited in Kochubina and Lebedevsky (note 191), p. 25.

Finally, according to a bilingual English-Russian language Russian Federation MOD armaments publication, the Soviet Union ended the production of the following agents as follows: sarin (1982), soman (1987), VX [almost certainly 'V-agent'—an isomer of VX] (1986), sulphur mustard (1957), Lewisite (1946), phosgene (1946), and hydrogen cyanide (1946).[757] It can perhaps be safely assumed that the data for this resides with the Russian MOD. It is also possible that it is reflected in Russia's initial (or subsequent annual) declarations to the OPCW. If so, then its publication in this volume may not have been considered to be problematic. The decision to publish may also reflect historical interest and may not have been considered in terms of a more skeptical national security perception.

It would be useful to compare Fedorov's information for these years against a 1951 declassified report prepared by the Austrian chemist and German Army officer Walther Hirsch for the United States following the war.[758] The Hirsch Report was perhaps the main source of substantive information in this area for the NATO allies during the early years of the Cold War.

Another source of data on the Soviet Union's CW stockpiles at the start of the war (at least for the southern sector) is the type and quantity of munitions dumped by retreating Soviet forces into the Black Sea. Some survey work has been carried out in the context of ongoing concern over the possible human health effects of dumped munitions that could shed light on this.[759] Ukraine has a service which periodically deals with the recovery of old munitions, including from former battlefields.[760] Information in these areas should be sufficiently diagnostic to substantially revise and improve the matrix.[761]

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[757] Ed. Nikolay Spassky, *The XXI Century Encyclopedia: Russia's Arms and Technologies, Ordnance and Munitions*, vol. 12 ('Arms and Technologies' Publishing House: Moscow, 2006), 'Chemical Ordnance', p. 440.

[758] Hirsch (note 598).

[759] Sub-bottom profiling for obstacles, including shipwrecks and munitions, may be carried out as part of the pipeline survey for the oil pipeline project South Stream. A similar exercise was previously conducted in connection with the Nord Stream oil pipeline project in the Baltic Sea. See, for e.g., Nord Stream, *Nord Stream Espoo Report: Key Issue Paper, Munitions: Conventional and Chemical* (Feb. 2009), available at <https://www.nord-stream.com/press-info/library/?category=4&q=&type=3&per_page=10&sort_documents=-title_en>, (accessed 18 July 2013).

[760] Ukraine periodically recovers old or otherwise dangerous munitions, including from former battlefields. Information on such activity is, in principle, available at <http://www.mns.gov.ua/>, (accessed 18 July 2013). On a 2004 recovery of WW I-era chlorine-filled artillery shells in the Ukraine, see Richard Guthrie, John Hart and Frida Kuhlau, 'Chemical and Biological Warfare Developments and Arms Control', *SIPRI Yearbook 2005: Armaments, Disarmament and International Secrity* (Oxford University Press: Oxford, 2005), p. 615.

[761] However, for a single author to do so in a single study is not feasible. Some editorial and similar changes have been made to the matrix during the drafting of this manuscript. The overall purpose is to allow others to understand the analytical logic carried according to a hybrid ACH-structured argument structure that supports broader qualitiative analysis. Data point-based statistical analysis should be carried using specialized software and by multiple analysts or groups.

Step 5. Draw Tentative Conclusions About the Relative Likelihood of Each Hypothesis

A key question is whether information is sufficient to permit accurate or otherwise useful analysis. Another important point is whether one should lean towards the 'worst case scenario' or remain passive until positive proof or strong evidence points to one hypothesis being correct over the other(s).

There are at least three interpretations: yes, no and ambiguous. An ambiguous case could be that the Red Army was not prepared for chemical warfare, but that large stockpiles of CW were nevertheless produced and available in locations beyond European border areas, including west of the Urals. If CW had been located in border areas, information to this effect probably would have been provided by German military personnel to the Western Allies following the end of the war. The question then hinges on how effectively the Soviets could have removed or disposed of CW stocks (including CW agent stored in bulk) before they could fall into German hands. An indication of this could, for example, be provided by surveys of dumped munitions in the Black Sea.[762] Given the territorial size of the Soviet Union, it would also be useful to consider the extent to which German forces possessed 'situational awareness' of the materials and equipment located in their zones of nominal control and operation. The zone of operation was extremely large and, in many respects, in a continual state of partial chaos.

The tentative conclusion drawn is that it is not possible to choose definitively between the two hypotheses. To do so would require remaining 'agnostic' until proven otherwise, or to take a 'worst case' (and active) scenario approach.

Step 6. Analyze Sensitivity of Conclusions

Critical items of evidence may also serve as the 'milestones'. The conclusion is that either hypothesis may be correct. 'Thinking backwards', the 'crystal ball', 'role playing' and playing 'devil's advocate' do not appear to be relevant to this case.

The critical items of evidence include: the Hirsch and Ochnser reports, and stockpile numbers from Soviet archives.

This case study is a hindsight analysis exercise. Key sources of information were partly based on the memory of World War II participants. This is true in the cases of Hirsch and Oschner who were writing their assessments for US military intelligence. If the Soviets were planning to engage in chemical warfare, many of their officials may have been reticent in advertising this in public.

Definite conclusions are not possible. This probably, therefore, reflects sufficient sensitivity to the critical items of evidence considered. The overall balance of items of evidence is too uncertain.

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[762] The Baltic and White Seas, and sections of the Pacific Ocean could be similarly considered. On recent efforts to remediate explosive remnants of war in the Crimea, including dumped munitions and old munitions at the Kerch fortress, see Niels Poul Petersen and Maria Brandstetter, 'Crimea's Past Catches Up with Its Present—Protecting People from Explosive Remnants of War', *OECD Magazine*, no. 1 (2010), pp. 20–23.

Step 7. Report Conclusions

The two main narrative interpretations are those summarized Pozdynakov and Zanders. A third possibility is that CW stocks were produced in quantity but did not, with the exception of the odd items, fall into German hands. Paul Maddrell's research is consistent with the second and third possibilities.

Step 8. Identify Milestones

The following milestones (also known as and understood to be indicators here) would clarify further consideration of the two hypotheses.

The extent to which statements of opinion or purported fact by contemporaries should be accepted.

The further availability of archival material from all relevant archives concerning Soviet CW planning would be helpful. In particular information that clarifies possible gaps between declared production (including targets) and actual production, whether the CW agent was filled into munitions and where they were stored (e.g., in the theatre of operations). Archival information that further clarifies the priority given to evacuating CW to rear areas or disposing of them by burning, land burial or dumping would also be useful.

The potential relevance of information in the memoirs of Soviet chemical officers prior to and during World War II.

Information that clarifies possible confusion over chemical capacity and intentions that derives from an older understanding that chemical troops were also responsible for the deployment of smokes and obscurants and flame operations.

The further availability of contemporary information on old munitions recovery and surveys.

Further clarification on the understanding of the terms 'tactical' and 'strategic' in the inter-war Soviet understanding in particular would be useful.

The extent to which the analysis of the hypothesis should be data driven *versus* concept driven based on inter alia the above milestones (indicators).

Through the use of ACH today, one can conclude that the Soviet Union did possess a strategic CW stockpile during World War II. Prior to and during World War II, however, the information did not exist outside the Soviet Union to permit the application of ACH to reach a meaningful conclusion.

ACH applications during the Cold War, the Cold War transition and the post-Cold War periods would yield distinct results with regard to any state CW programme. Nevertheless, a cold war intelligence mentality persists (please see below).

13

A MEDIUM STATE PROGRAMME: THE CASE OF IRAQI CW IN THE LEAD-UP TO THE 2003 US-LED INVASION

Heuer's 8 steps are presented in the context of a medium state programme: Iraq. Background is structured according to Table 10.1 as part of Step 2 (also reproduced below as Table 13.1). This is a hybrid, argument-mapping CW application.

13.1. Introduction

A greater political context existed with respect to whether Iraq possessed CW, maintained a CW programme or was developing CW in 2002-2003. During the 1980-1988 Iran-Iraq War, Iraq employed CW against Iran and its own Kurdish population.[763] Following the 1990-1991 Persian Gulf War, the UN Security Council adopted resolution 687 (1991), which required Iraq to *inter alia* end its CW programme and to verifiably destroy its CW. The resolution also established UNSCOM to verify the destruction and dismantlement of the non-nuclear prohibited weapons and associated programmes (i.e., CBW and missiles having a range greater than 150 km).[764]

International surprise and concern grew as the scale and scope of Iraq's NBC and ballistic missile programmes, especially the extent of its nuclear enrichment activity, became evident.[765] The principal CW agents produced by Iraq were cyclosarin, sarin, sulphur mustard, and tabun. UNSCOM inspectors left Iraq in late 1998, as a consequence of a dispute partly based on whether

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[763] Although allegations have been made that Iran used CW against Iraq, they have not been conclusively proven. By contrast, investigative teams sent to the region during the war by the UN secretary-general conclusively proved Iraqi use of CW. Iran is a party to the CWC and has declared a past production capability, but did not declare a CW stockpile. See Joost R. Hilterman, *A Poisonous Affair: America, Iraq, and the Gassing of Halabja* (Cambridge University Press: Cambridge, Mass., 2007).

[764] The IAEA was given primary responsibility for overseeing the nuclear weapon disarmament of the country. The CD was still negotiating the CWC at this time. The missile range limit probably was set with Israel and, perhaps, the Riyadh, in mind. According to one former UNSCOM official, the number was circulated by the US Department of State as part of the planning process.

[765] So-called natural uranium consists of 2 main isotopes in the following proportions: U-238 (99.2 per cent) and U-235 (0.72 per cent). U-238 possesses 3 more neutrons than U-235. Of the two isotopes, only a an amount of uranium where the percentage of U-235 has been enriched to 'weapons grade' (generally understood to be 80 per cent or higher) can sustain a fission reaction. The process of enrichment is costly, time consuming and has traditionally had a large intelligence 'footprint' associated with it (mainly because of the power requirements and centrifuge arrays—if centrifuge enrichment is being used). Power reactors generally require an enrichment level of 5-10 per cent. The isotopic ratios of natural uranium when mined vary slightly according to geographic origin.

UNSCOM inspectors should be allowed full access to so-called presidential sites. In December 1999 UNSCOM was replaced by the UNMOVIC which conducted its first inspections of Iraq on 27 November 2002. UNMOVIC's mandate was partly informed by UN Security Council resolution 1441 (2002), which deplored Iraq's failure to fully disclose all aspects of its prohibited programmes, including with respect to CW.

In describing the nature of Iraqi cooperation with UNMOVIC inspectors, the body's Executive Chairman Hans Blix drew a distinction between *substance* and *process*.[766] Blix headed UNMOVIC from 1 March 2000 until 30 June 2003.[767] While Iraq did provide immediate access to all requested sites, its active and full cooperation was questioned. The main unresolved CW issue was the nature and extent of Iraq's VX programme. Iraq maintained that it had never weaponized VX and had produced only limited, pilot plant-scale quantities of the agent. UNSCOM disputed this claim. Another major unresolved CW issue was the failure by Iraq to account for approximately 6500 munitions filled with about 1000 tonnes of chemical agent. The US-led coalition forces that entered Iraq in March 2003 did not recover any stockpiled chemical munitions. However, they did recover and dispose of non-stockpiled chemical and conventional munitions. To be more precise, the recovery of non-stockpiled chemical munitions consisted of the odd leftover weapon and was not indicative of a programme by the former regime to retain a stock of such weapons.

The CW disposal operations were reported to the OPCW in consultation with the UK and the post-Saddam Hussein government of Iraq.[768] Iraq joined the CWC in 2009 and declared that it possessed five former CW production facilities and CW at the former Muthanna State Establishment (this establishment has two bunkers: one containing substantially destroyed CW munitions along with some precursor chemicals, and one containing potentially contaminated waste material from the destruction process. Both were sealed by UNSCOM).[769] No weapons were placed in the bunkers that were, at the time, deemed to be too dangerous to store. For example, salts from hydrolysis were placed inside. The contents of the bunkers are now in the public domain.[770]

UNMOVIC's mandate was ended on 29 June 2007 when the UN Security Council adoped Resolution 1762 (2007).

As of 2013 there have been periodic consultations between OPCW officials and mainly Iraqi, UK and US officials on how best to deal with what

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[766] Blix (note 337), p. 139. Blix gives Elbaradei credit for making this observation. Blix was the Executive Chairman of the United Nations Monitoring, Verification and Inspection Commission from March 2000-June 2003.

[767] UN, 'UNMOVIC: Basic Facts', <http://www.unmovic.org/>, (accessed 9 Aug. 2013).

[768] Iran publicly objected to the OPCW as to whether this was done accordance with the provisions of the CWC. Iran's objection was at least a partial reflection of broader political tensions between it and the UK and the US (e.g., on nuclear activities within the framework of Iran's NPT commitments).

[769] John Hart and Peter Clevestig, 'Reducing Security Threats from Chemical and Biological Materials', *SIPRI Yearbook 2010: Armaments, Disarmament and International Security* (Oxford University Press: Oxford, 2010), p. 412.

[770] Iraqi National Monitoring Directorate, 'The Past Iraqi CW Program', unclassified slides presented at British Defence Science and Technology Laboratory-sponsored conference, 13th International Chemical Weapons Demilitarisation Conference, Prague, 24-27 May 2010.

remains at the Muthanna facility.[771] A major concern has been the physical safety of OPCW inspectors due to the continued uncertain security situation in the country. The OPCW has conducted at least one overflight of the location.[772]

13.1.1. Information Sources

The literature on Iraq's pursuit of NBC weapons and longer-range ballistic missiles is extensive (see Table 4.2).[773] This case study concerns the international understanding of the status of the Iraqi CW programme and activity just prior to the 2003 invasion.

Following its occupation of Iraq in 2003, the United States transferred to its territory at least 48,000 boxes of documents and 'hundreds of hours of recorded conversations' including 'many' by Saddam Hussein.[774] Most of the UNSCOM/UNMOVIC material remains essentially sealed for up to 60 years.[775]

Iraqi oil sales were initially prohibited. However, they were later permitted under the Oil-for-Food (OFF) Programme and Iraq conducted largescale oil smuggling in parallel.[776] Implementation of this programme generated further information and consultation at the UN and elsewhere

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[771] Duelfer, a career CIA employee, UNSCOM Deputy Executive Chairman and ISG head, desribes one of the bunkers in question as follows: The facility contains 'dozens of buildings and bunkers, many of them built by German construction companies. At the height of the [1980–88] Iran-Iraq War, it was churning out mustard blister agent and sarin nerve agent around the clock. . . . UNSCOM, using the facilities at hand . . . destroyed 28,000 munitions, 480,000 liters of agent, 1.8 million liters of liquid chemical precursors, and a million kilograms of solid precursor chemicals. Some containers and munitions were too volatile to attempt to destroy. They were gingerly placed in a huge bunker that reminded me of the Great Pyramid at Giza. I visited the storage bunker once before it was finally, and permanently, sealed. Outfitted in full protective gear, breathing air from scubalike tanks, and carrying a chemical detector that progressively blinked warnings of the lethal environmental, the Dutch team chief, Cees Wolterbeck, and I examined the interior with its leaking sarin rounds, barrels with toxic agents, and assorted contaminated equipment. It was a dark, lethal junkyard'. Duelfer (note 26), pp. 96–97. It should be noted that UNSCOM CW technical experts do not agree with this characterization.

[772] John Hart, 'Reducing Security Threats from Chemical and Biological Materials', *SIPRI Yearbook 2012: Armaments, Disarmament and International Security* (Oxford University Press: Oxford, 2012), p. 400.

[773] E.g. Peter Dunn, *Chemical Aspects of the Gulf War: 1984-1987, Investigations by the United Nations* (DSTO: Maribyrnong: Australia, 1987); and Hal Brands and David Palkki, 'Saddam, Israel, and the Bomb: Nuclear Alarmism Justified?', *International Security*, vol. 36, no. 1 (summer 2011), pp. 133–166.

[774] US House of Representatives, *The Iraqi Documents: a Glimpse into the Regime of Saddam Hussein*, Hearing Before the Subcommittee on Oversight and Investigations of the Committee on International Relations, 109th Congress, second session, serial no. 109-184 (US Government Printing Office: Washington, DC, 6 Apr. 2006), p. 1. The focus of the hearings was on the thinking of the Iraqi leadership and the fate of POWs. NBC weapon programmes and delivery systems were not the focus of these hearings.

[775] Some controlled access is permitted in principle, including to the permanent members of the UN Security Council.

[776] See UN, 'Office of the Iraq Programme', Oil-for-Food, <http://www.un.org/Depts/oip/background/index.html>, (accessed 1 Aug. 2013); and Independent Inquiry Committee into the United Nations Oil-For-Food Programme ('Volcker Committee'), *Management of the Oil-For-Food Programme*, 4 vols. (United Nations: New York, 7 Sep. 2005), <http://www.iic-offp.org/>, (accessed 1 Aug. 2013).

regarding the intentions, activities and weapons holdings of Iraq. Although a UN ongoing monitoring and verification (OMV) regime had no time limit, it is less clear how realistic this mechanism was in the minds of the drafters of UNSC Resolution 687 (1991). For example, could OMV, which was established by UN Security Council Resolution 715 (1991), be implemented until (or after) Hussein lost power years or decades later?[777]

The verification approach taken by UNSCOM, partly based on IAEA practice, was a material balance approach. In other words, UNSCOM attempted to estimate the types and quantities of CW precursors and related equipment and material that was imported, how much CW Iraq produced domestically and how much CW was expended during the 1980-1988 Iran-Iraq War. Further deductions were made based on verified Iraqi destruction of CW holdings. These figures were continuously refined through data obtained by inspections, from information received by various (mainly Western) companies and information received from (mainly Western) national intelligence services. Iraq also produced a series of Full, Final and Complete Declarations (FFCD), which at least one European technical expert seconded to UNSCOM would informally refer to as Full, Final and Complete Fairy Tales.[778]

13.2. Framing the Hypotheses

The main hypotheses are: Has the target of analysis *stockpiled* chemical weapons (yes or no)?

To allow for a more meaningful analysis, the scope and focus should be more narrowly defined. As noted in Chapter 10, the question of production/stockpiling of chemical weapons is meant to inform the broader strategic question: *Did Iraq maintain a production capability and was it secretly retaining CW stocks?*

This case study mainly considers a series of intelligence assessments, with a focus on the international understanding of Iraqi CW intentions and capabilities in the lead-up to the April 2003 invasion and the post-invasion intelligence assessments.

Related broader questions include whether and how Iraq might have decided to maintain a CW programme over the medium- to longer-term.

Step 1. Identify the Possible Hypotheses to be Considered

The possible hypotheses are:

1. Yes (Iraq did possess a CW stockpile in the lead-up to the April 2003 US invasion); or
2. No (Iraq did not possess a CW stockpile in the lead-up to the April 2003 US invastion).

A ‘stockpile’ is understood to be a militarily-significant quantity of CW suitable for tactical or strategic use in inter-state conflict. Related questions—including development work, standby capacity and intent—are considered only

[777] UN Security Council Resolution 687 (1991), paras. 10 & 12.

[778] Personal communication.

in as much as they contribute directly to the consideration of the two main hypotheses.

Step 2. Make a List of Significant Evidence and Arguments For and Against Each Hypothesis

The background for the significant evidence and arguments for and against each hypothesis must be provided for the main question. This background is structured according to Table 10.1 (reproduced here as Table 13.1).

Table 13.1 Structure of Background Narrative to Case Studies.

Political factors
Definition of violation
Intent
Doctrine
Consistent with types and quanties?
Threat perception
Apparent
Actual
Demand side factors
Supply side factors
Technical factors
Assimilation
Capability
Technological stages
Verification measures
Onsite
Nearsite
Offsite

Source: Author compilation.

Sufficient background for each hypothesis must be provided. The background should also be structured with a limited number of headers, have internal cohesion and be sufficiently broad to allow for a meaningful narrative that permits the reader to readily ascertain the connection between the logic of the argument and the evidence (or lack thereof). To do so, allows for further refinement of the analytical technique and modifications of the conclusions as new insight and information become available.

The background is structured according to political and technical factors. The *political factors* considered are: (*a*) the definition of a CWC-defined violation, (*b*) intent, (*c*) threat perception (apparent and actual), (*d*) demand side factors and (*e*) supply side factors. The *technical factors* considered are: (*a*) CW assimilation and (*b*) 'verification measures' (mainly derived from the arms control paradigm). These political and technical factors were developed by the author. However, it should be noted that supply and demand side factors are part of the standard nuclear arms control and disarmament literature. Also variations of integration and assimilation of weapons systems into military doctrine and training have long been considered by analysts in various contexts.

13.3. Political Factors

The international inspection and verification regime of Iraq date to the 1980-1988 Iran-Iraq War during which Iraq used CW against Iran.[779] The fact that Iraq was able to acquire much of its know-how and material base for its NBC and ballistic missile programmes from abroad prompted a number of mainly Western governments to consider ways to strengthen and harmonize their strategic trade control procedures and practice. Iraqi use of CW in the war was confirmed by the UN in 1984.[780] The Australia Group, whose participants seek to ensure that material, technology and know-how is not misused for CBW purposes, held its first annual meeting in 1985.[781]

Following the UN-sanctioned ejection of Iraqi forces from Kuwait in the 1990-1991 Persian Gulf War, the UN imposed a verification and inspection regime on the country to ensure that Iraq disarmed and eliminated its associated programmes and infrastructure for NBC weapons and longer range missiles. The broader regional and international political tensions, however, remained. Despite the OFF programme activity, the willingness of the UN Security Council to maintain OMV remained in some doubt by the time George W. Bush entered office in 2001, partly because of a progressive worsening of humanitarian effects of the international sanctions in the country.

The two main narratives on Iraqi NBC weapon and ballistic missile capabilities, intentions and holdings in the lead up to the April 2003 invasion were:

1. the carefully-phrased, technocratic reports and statements of UNSCOM (then UNMOVIC), and
2. statements informed by national intelligence that were issued mainly by the George W. Bush Administration and its allies (or politically sympathetic partners), including policy analysts and political commentators.

These narratives generally failed to coincide in terms of philosophical approach, conclusions and policy prescriptions. A major reason for this was the multilateral, consensus-driven nature of the international UN-type bodies (despite the coercive disarmament structure put in place by UN Security Council Resolution 687 (1991)). The characterizations made by multilateral bodies often contrasted distinctly against political statements made by the US Administration. The latter generally presumed that Saddam Hussein was recalcitrant on his international commitments and was, common sense would indicate, pursuing such weapons (or at least would do so once the international pressure and focused attention were reduced). This debate was expressed in terms of what various intelligence information showed, suggested or demonstrated. The public could not know the full details because intelligence sources and methods had to

[779] The possible use by Iran of CW has not been publicly proven. By contrast, UN Secretary-General investigation teams did demonstrate the use of CW by Iraq.

[780] See Dunn (note 773). Dunn was one of the initial inspectors sent to the region by the UN Secretary-General to investigate CW use claims.

[781] AG guidelines are incorporated into EC regulation 1331/2000 (revised) which forms a legal basis of the EU munitions control lists. The regulation is typically revised annually to reflect routine legal developments within, for e.g., various treaty regimes.

be protected. Public reporting by UNSCOM and UNMOVIC was also more general than the closed briefings these bodies gave to members of the UN Security Council and individual member states. In short, the political decisionmaking for going to war was shaped by inconsistent narratives of what arms control verification information and intelligence analyses showed (or did not show), respectively. This dichotomy can, it is hypothesized, offer theoretical methodological lessons when considering neoliberal institutionalism and realist IR theory.

It should also be noted that a violation of UN Security Council Resolution 687 (1991) (and the subsequent resolutions that supported the work of UNSCOM and UNMOVIC) does not necessarily coincide with what might be considered a violation of the 1993 CWC (which entered into force in 1997). In particular, the technical understanding of a violation by those implementing the coercive and verified disarming of Iraq may not be the same as the understanding of a violation of the CWC in which the member states of the treaty are understood to have equal rights and obligations unless clear evidence exists that a member state is obfuscating on its fundamental treaty commitments.[782] For example, would UNSCOM inspectors have been willing to accept laboratory-scale synthesis by Iraq of novel CW agents for prophylactic, protective, threat evaluation and other CWC-permitted purposes? Moreover, regardless of the technical understanding by UNSCOM and UNMOVIC of permitted and non-permitted CW-related work, a larger political question would remain: Would the UN Security Council members accept an Iraq under Saddam Hussein that openly pursued defensive CBW programmes and activity?

If the answer to the last question is no, then consideration of 'types and quantities' criterion of this analytical framework loses relevance (and is perhaps irrelevant). Similarly, any mention of CW in doctrine would be highly suspect as an indicator of a violation in the post-Persian Gulf War international security climate as this related to Iraq.

Had Hussein been more politically astute, he could have acceded to the CWC once the treaty was opened for signature in January 1993. However, the US and others did not wish Iraq to do so until it had fully complied with UN Security Council Resolution 687 (1991).[783]

There is some reason to suppose that Iraq followed Soviet military doctrine on chemical weapon matters.[784] If true, this could be a natural corollary

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[782] A non-fundamental ('technical') treaty violation, by contrast, would be the submission of an annual report to the OPCW several days late.

[783] It has been reported that the main reason the US successfully organized the ouster of former OPCW Director-General Ambassador José Bustani of Brazil was that he was attempting to reach out to Iraq to join the CWC through informal diplomatic channels. Marlise Simons, 'To Ousted Boss, Arms Watchdog Was Seen as an Obstacle in Iraq', *New York Times*, 13 Oct. 2013, <www.nytimes.com/2013/10/14/world/to-ousted-boss-arms-watchdog-was-seen-as-an-obstacle-in-iraq.html>, (accessed 3 Nov. 2013).

[784] Richard L. Russell, 'Iraq's Chemical Weapons Legacy: What Others Might Learn from Saddam', *Middle East Journal*, vol. 59, no. 2 (Spring 2005), pp. 194–195. For intelligence analysis, all sources are considered worth noting and can serve as a basis for further consideration to support the purpose of the analysis. For academic analysis, by contrast, the focus on sources has traditionally been based on peer-reviewed publications with a view towards contributing further such articles. Newspapers and unsourced speculation on blogs, by contrast, are to be treated with caution and possibly avoided.

of Iraqi acquisitions of Soviet (then Russian) arms and similarities between Baathist Party leadership practice and that of the Soviet Union (especially during the leadership of Joseph Stalin).[785]

13.3.1. Threat Perceptions

Iraq perceived Iran and Israel as security threats and regional rivals (both in terms of Iraqi pronouncements and internal consultations). Starting with the 1980-1988 Iran-Iraq War, Iraq almost certainly considered the extent to which Iran was capable of defending against and employing CW.[786] Iraq also viewed Israel as a country that it should be able to either more effectively attack or to deter.[787]

UNMOVIC identified the following factors as shaping Iraq's WMD programmes: (*a*) the Iran-Iraq War, and (*b*) the 1990 occupation of Kuwait. Iraq appears to have viewed chemical weapons as a means to counteract Iran's numerical superiority in manpower and to blunt Iran's debilitating human wave attacks.[788] UNMOVIC concluded that Iraq's occupation of Kuwait prompted an emphasis by the Iraqi leadership on the production and weaponization of WMD to prepare for the then imminent Persian Gulf War.[789]

UNMOVIC also cited an anonymous letter written by a senior Iraqi official to Saddam Hussein as possibly forming a basis for Iraq's rationale for pursuing WMD. This letter states:

'If our country were to obtain and develop chemical and biological weapons, this would be considered the best weapon of deterrence against the enemy in the field.

The principle of "deterrence" is the best means of defence against the Zionist entity, and in this respect we suggest the following:

a. To continue to develop the types of chemical weapons with an attempt to manufacture the most dangerous of these types in large quantities.

b. To secure long-range means, "Missile carrying chemical heads" for reciprocal threat.

To prepare special storage areas for chemical weapons in the Southern area of the region, and these areas must [be] within the range of the effectiveness of the current available missiles, and other means to reach the Zionist active targets in order to secure the surprise "thunder strike", in using and accomplishing the quick reaction to deter the enemy'. [790]

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[785] Saddam Hussein was purportedly an admirer of Stalin.

[786] Iran declared a former CW production capabity when it joined the CWC in 1997 prior to the treaty's entry-into-force.

[787] UNMOVIC, *Unresolved Disarmament Issues: Iraq's Proscribed Weapons Programmes* (UNMOVIC: New York, 6 Mar. 2003), p. 5, <http://www.un.org/depts/unmovic/new/documents/cluster_document.pdf>, (accessed 9 Aug. 2013).

[788] UNMOVIC (note 787), p. 6.

[789] UNMOVIC (note 787), p. 7.

[790] UNMOVIC (note 787), p. 5.

13.3.2. Demand and Supply Side Factors

Some Western-based companies traded extensively with Iraq during the Iran-Iraq War in dual-purpose materials, technology, equipment and know-how that Iraq then used to develop its NBC weapon and ballistic missile programmes. Iraq established supply chains for the importation of pesticides and pesticide precursors to support its CW R&D and production capability. The Dutch businessman Frans van Anraat is currently serving a 17-year prison sentence for his role in selling chemical precursors to Iraq during the 1980s.[791]

Iraqi demand generally drove supply. This is indicated perhaps most clearly by the inflated (even by comparison to other inflated prices paid by other states seeking to circumvent strategic trade controls at the time) prices Iraq was prepared to pay. The fact that money was no obstacle to weapons acquisition and development is also reflected by the fact that Iraq pursued multiple uranium enrichment options, instead of pursuing only one.[792]

13.4. Technical Factors

Iraq experienced persistent difficulties in the scale-up and stockpiling of CW. It had difficulty storing nerve agents in a reasonably stable form and, during the Iran-Iraq War, typically manufactured its nerve agents and filled them into munitions just prior to employment (e.g., by filling them at al Muthanna just prior to shipment for use in the field). It should be noted, however, that Iraq was perceptibly moving towards binary nerve agent munition configurations in order to overcome the stability/storage problem.[793]

UNSCOM officials informally concluded that the country had manufactured 2-4 tonnes of poor quality VX. Since the removal of Saddam Hussein, it has since become evident that the various institutions involved in NBC weapons and ballistic missile programmes had to deal with numerous resource shortages and institutional inefficiencies, including those associated with an underlying fear by personnel for their physical safety and that of their relatives. Other inefficiencies were a consequence of secrecy, interaction with security services and fear of losing one's career at the hands of higher-level officials (including by Saddam Hussein). CBW programme personnel therefore avoided issuing unfavourable progress reports which were, in fact, not infrequently highly optimistic.[794]

UNSCOM and UNMOVIC developed extensive onsite, near-site and off-sited verification measures, including as part of OMV. The principal focus of this case study is examining the international CW arms control verification assessment of Iraq and various—mainly US—intelligence CW assessments of

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[791] Anna Wetter, *Enforcing European Union Law on Exports of Dual-Use Goods* (Oxford University Press: Oxford, 2009), pp. 122–125.

[792] For an account of how freely funds were expended by Iraqi officials for weapons development and procurement, see Khidir Hamza and Jeff Stein, *Saddam's Bombmaker: the Daring Escape of the Man Who Built Iraq's Secret Weapon* (Touchstone: New York City, 2000).

[793] Personal comunication with former UNSCOM official, Aug. 2013.

[794] Such factors may have implications for organization theory and rational actor theory, respectively.

Iraq, as well as how they were understood at the time and were used to support broader strategic security and international policy objectives.

Step 3. Prepare Matrices with Hypotheses

Matrix. Stockpiling

Question: Has the target (i.e., state or non-state actor) stockpiled chemical weapons?

Hypotheses:
H1 No stockpiling of chemical weapons [C=2, I=6, N/A=6]
H2 Yes stockpiling of chemical weapons [C=12, I=2, N/A=0]

	H1	H2
IR1. Does target have CW technical capacity (e.g. military, medical)?		
E.1 ~~General publications aimed at domestic audience- (yes)~~	-	-
E.2 General publications aimed at domestic audience (**no**)	C	I
E.3 ~~Civil defence against CW policy documentation (yes)~~	-	-
E.4 ~~Civil defence against CW policy documentation (no)~~	-	-
E.5 ~~Civil defence against CW technical guidance (yes)~~	-	-
E.6 ~~Civil defence against CW technical guidance (no)~~	-	-
IR2. Is CW mentioned in military doctrine?		
E.1 ~~Defence against CW in civil defence context (yes)~~	-	-
E.2 ~~Defence against CW in civil defence context (no)~~	-	-
E.3 Defence against CW for military personnel (**yes**)	N/A	C
E.4 ~~Defence against CW for military personnel (no)~~	-	-
E.5 ~~Civilian prophylaxis and/or countermeasures (yes)~~	-	-
E.6 ~~Civilian prophylaxis and/or countermeasures (no)~~	-	-
E.7 Military prophylaxis and/or countermeasures (**yes**)	N/A	C
E.8 ~~Military prophylaxis and/or countermeasures (no)~~	-	-
IR3. Statements and similar communications		
E.1 Has leadership discussed CW matters? (**yes**)	N/A	C
E.2 ~~Has leadership discussed CW matters? (no)~~	-	-
IR4. Weight of evidence of integration of CW into military doctrine?		
E.1 ~~Publications indicate integration of CW (yes)~~	-	-
E.2 ~~Publications indicate integration of CW (no)~~	-	-
E.3 Arms control policy statements against CW (**yes**)	C	I
E.4 Arms control policy statements for CW (**yes**)*	I	C
IR5. Interest in CW activities of others?		
E.1 Discussion of CW threats posed by others (**yes**)	N/A	C
E.2 ~~Discussion of CW threats posed by others (no)~~	-	-
IR6. Evidence of CW production?		
E.1 Laboratory scale synthesis of CW agents (**yes**)	N/A	C
E.2 ~~Laboratory scale synthesis of CW agents (no)~~	-	-
E.3 CW production facility indicators (**yes**)	I	C
E.4 ~~CW production facility indicators (no)~~	-	-
E.5 CW stockpiling indicators (**yes**)**	I	C
E.6 ~~CW stockpiling indicators (no)~~	-	-
E.7 Documentation of production (**yes**)	I	C
E.8 ~~Documentation of production (no)~~	-	-
E.9 Documentation of stockpiling (**yes**)**	I	C
E.10 ~~Documentation of stockpiling (no)~~	-	-
E.11 Availability of CW production material/equipment (**yes)**	N/A	C

E.12 ~~Availability of CW production material/equipment (no)~~	-	-
E.13 Availability of CW munition (**yes**)	I	C
E.14 ~~Availability of CW munition (no)~~	-	-

Source: Author's adaptation of Heuer's ACH matrix. C=consistent, I=inconsistent and N/A=not applicable, IR=information request, E=evidence. *E.g., Some parties to the 1925 Geneva Protocol reserved the right to use CW if such weapons were first used against them. **The question is not a non-sequitor in the sense that, for e.g., overhead imagery might be available that suggests such stockpiling.

The cumulative scores for the hypotheses are:
H1: C=2, I=6, N/A=6
H2: C=12, I=2, N/A=0

This case study reflects significant information gaps in the matrix questions. When both 'yes' and 'no' pairings in the evidence chain are struck through, this indicates the information is unavailable or uncertain to this author.

The cumulative scoring shows that Iraq did stockpile CW in general. However, the evidence chain must be considered in much greater detail for the time period in the lead-in to the 2003 invasion. In broad terms, this should be done by comparing and contrasting the international verification and inspection results as they were understood in 2002-2003 with those of national (mainly US) intelligence assessments.

Particular attention should be devoted to possible dichotomies between technical analyses and how their results were presented and used in public at the broader political and policy levels. Such dichotomies should help to elucidate the interests and actions of actors and institutions in the broader international peace and security context.

The information considered according to the structure of this matrix is incomplete and not necessarily representative. The manner in which the questions are posed and considered, however, should be useful on its own terms (regardless of the conclusions or understanding reached (provisional or otherwise)).

IR1. Does Target have CW Technical Capability (e.g., Military, Medical)?

The sub-score for H1 is: C=1, I=0, N/A=0
The sub-score for H2 is: C=0, I=0, N/A=0

Only one evidence chain is answered (or answerable) here. The author is not aware of any CW publications aimed at the Iraqi public at large. Without a positive counter-example, it is impossible to make this assertion with full confidence.

Such publications aimed at an Iraqi audience would have presumably drawn sustained and heavy public criticism from Iran. The UN may have considered the matter further at the request of the Iranian delegation (e.g., at the UN General Assembly).

The lack of such literature, one can assume, reflects such factors as an unwillingness to attract further international approbium for potentially implying (or inviting criticism) that Iraq expected such weapons to be used, or that the use of such weapons might not be unusual or otherwise out-of-the-ordinary.

Technical and policy documentation and guidance against CW may have been recovered following the US-led occupation of Iraq. This is a point for further inquiry and analysis.

Perhaps the main traditional method for assessing CW technical capabilities of a target of analysis is by reviewing all of its scientific publications according to keyword lists. Such reviews, which were extensively carried out prior to and during World War II, would tend to reveal locations and names of facilities where research of interest is being conducted, possible patterns of research or research personnel, and the nature of such research.

IR2. Is CW Mentioned in Military Doctrine?

The sub-score for H1 is: C=0, I=0, N/A=2
The sub-score for H2 is: C=2, I=0, N/A=0

Two evidence chain pairings are ignored: defence against CW in a civil defence context, and civilian prophylaxis and/or countermeasures. This is because the author is unaware of any significant information in these two areas.

Saddam Hussein maintained extensive recordings of his meetings, including an insistence that his military commanders expose his own troops to CW prior to their use against Iran in order to gain confidence that Iraqi forces could function sufficiently well in a CW contaminated environment.[795] The UNSCOM/UNMOVIC archives reportedly contain almost 460 metres of paper files and 1 terabyte of electronic data.[796]

IR3. Statements and Similar Communications

The sub-score for H1 is: C=0, I=0, N/A=1
The sub-score for H2 is: C=1, I=0, N/A=0

The United States and other states reportedly attempted to install surveillance equipment, including for communications intercepts, through UNSCOM inspection and verification activity.[797] The United States acquired large quantities of Iraqi archives, including recordings by Saddam Hussein.[798] Following the April 2003 occupation of Iraq it became clear that Saddam Hussein and other leaders discussed CW matters. This is partly reflected in the

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[795] Personal communication with researcher who reviewed part of Saddam Hussein's personal papers in the US, June 2013. On the nature of Iraqi Government papers captured by the US, see, for e.g., Brands and Palkki (note 773), pp. 133–166; and National Security Archive (George Washington University), *Saddam Hussein Talks to the FBI: Twenty Interviews and Five Conversations with "High Value Detainee #1" in 2004*, National Security Archive Briefing Book no. 279, <http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB279/index.htm>, (accessed 12 Aug. 2013).

[796] Nicholas Kulish, 'End Looms for Iraq Arms Inspection Unit', *New York Times*, 18 June 2007, <http://www.nytimes.com/2007/06/18/world/middleeast/18weapons.html?_r=0>, (accessed 25 July 2013).

[797] On the role of NTM and national espionage activity carried out in parallel with IAEA and UNSCOM verification and inspection activity, see Chapter 1 of this volume.

[798] E.g., Brands and Palkki (note 773), pp. 133–166; and National Security Archive (George Washington University), *Saddam Hussein Talks to the FBI* (note 795).

materials used to prosecute 'Chemical Ali', the commander responsible for the Halabja CW attacks against Iraq's Kurdish population in 1988.

IR4. Weight of Evidence of Integration of CW into Military Doctrine?

The sub-score for H1 is: C=1, I=1, N/A=0
The sub-score for H2 is: C=1, I=1, N/A=0

One evidence chain pairing is omitted: publications that indicate integration of CW.

In the arms control context, Iraq acceded to the 1925 Geneva Protocol in 1931 with reservations.[799] It joined the CWC in 2009. In international arms control fora, Iraq generally maintained positions similar to those of other Middle Eastern and Arab states. This was to maintain an ambiguous position on formally renouncing CBW until such time as Israel should agree to join all WMD arms control regimes, including the NPT, as part of a process for achieving a WMD Free Middle East. Much of the discussion on achieving a Middle East WMD Free Zone initiative, on the surface, is over whether there should be direct negotiations or preconditions. Israel usually indicates that direct negotiations are desirable, while Iran is opposed to talks with 'the Zionist entity'. There are similar differences of position regarding whether talks should proceed with or without preconditions. It is unclear to what extent the positions are 'real' or merely reflect the fact that one or more states simply oppose negotiations are the present time. Israel has indicated that the broader regional tensions and differences must be addressed prior to reaching accommodation and common understanding on NBC weapons and ballistic missiles arms control.[800]

IR5. Interest in CW Activities of Others?

The sub-score for H1 is: C=0, I=0, N/A=1
The sub-score for H2 is: C=1, I=0, N/A=0

During the Iran-Iraq War, Iraq considered CW threats posed by Iran. Iraq engaged in a systematic effort to acquire NBC and ballistic missile expertise.[801]

IR6. Evidence of CW Production?

The sub-score for H1 is: C=0, I=5, N/A=2
The sub-score for H2 is: C=7, I=0, N/A=0

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[799] *The Problem of Chemical and Biological Warfare: CBW and the Law of War*, vol. 3 (note 251), p. 158.

[800] E.g., 'Israel, Statement by Mr Eyal Propper, Director [of] Arms Control Policy Department, Ministry of Foreign Affairs at the Seventeenth Session of the Conference of the States of the States Parties', OPCW document C-17/NAT.15, 27 Nov. 2012.

[801] E.g., the Iraqi engineer Khidir Hamza describes how he purchased books on S&T in bulk at Foyle's bookshop in London which the Iraqi embassy then shipped back to the country. Hamza and Stein (note 792).

The evidence chains here reflect the results of the verification and inspections carried out by UNSCOM and then UNMOVIC. Further detail and context was developed by the Iraq Survey Group (ISG) and other activity carried out as part of the post-April 2003 occupation of Iraq.

The understanding by technical and political actors of these evidence chains are the focus of addressing H1 and H2 in this case study.

Step 4. Refine the Matrix

Two main narratives are compared and contrasted with a view to determine ways to refine the matrix: the findings of UNSCOM and UNMOVIC on the one hand, and various national (mainly US intelligence assessments and policy statements) on the other hand. The findings of UNMOVIC (and by implication UNSCOM) enjoyed the support of some analysts and governments, including among French and German officials. The United States issued reports and statements, including on BW, derived from a source controlled by Germany code-named Curveball, as well as a 2002 NIE. This NIE was produced in two versions: the longer classified one, and a shorter public one. Fingar has observed that it was human nature for some in the US Government to read the shorter, public version rather than the full classified version.[802] A September 2002 British intelligence assessment maintained that Iraq was capable of deploying some WMD within 45 minutes of an order to use them (this phrasing was later much criticized as politically-motivated 'sexed up' intelligence).[803] This report, which was later shown to be false, could be viewed as being more consistent with tactical, rather than strategic, use.[804] The Iraqi civil engineer defector Adnan al-Haideri also provided CBW information prior to the 2003 invasion. He maintained that he had personally supervised the construction of chemical and biological weapon-related facilites at some 20 sites, including the Baghdad General Hospital.[805]

The matrix provided in Step 3 reflects information from multiple periods, including the post-2003 invasion 'intelligence failure' investigations.[806] This case study is thus a hindsight analysis. If it were ongoing or future-oriented, different matrices would be developed as new information and analyses came to light and were incorporated.

ACH computer programmes could be employed to help keep track of large data streams with associated evidence chains, as well as for multiple research groups working simultaneously on the problem.[807] A qualitiative-focused summarizing approach is taken using the matrix developed for this

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[802] Fingar (note 25), p. 104.

[803] *Iraq's Weapons of Mass Destruction: the Assessment of the British Government* (The Stationary Office: London, 24 Sep. 2002), <http://news.bbc.co.uk/nol/shared/spl/hi/middle_east/02/uk_dossier_on_iraq/pdf/iraqdossier.pdf>, (accessed 9 Aug. 2013). The term 'sexed up' appears to originate from an anonymous UK official. There was much speculation that Tony Blair's Director of Communications was at least partly responsible for the insertion of the '45 minutes' text.

[804] I am grateful to one of the anonymous reviewers for drawing my attention to this point.

[805] Paul Todd, Jonathan Bloch and Patrick Fitzgerald, *Spies, Lies and the War on Terror* (Zed Books: London, 2009). p. 57.

[806] The extent to which intelligence services, including those in the US, were wrong is debatable. This partly depends on the parameters of the analysis.

[807] On longitudinal studies framing, see Prunckun (note 380), p. 24.

study. This approach is also more appropriate for supporting higher-level strategic analysis by a single analyst or author.

UN-sanctioned Verification and Inspection Regime of Iraq Following the 1990-1991 Persian Gulf War

As previously mentioned, UNSCOM was established by UN Security Council Resolution 687 (1991) and operated from 1991 to 1999 when it was replaced by UNMOVIC under the terms of UN Security Council Resolution 1284 (1999). This development reflected the fact that UNSCOM was effectively barred from carrying out in-country inspections and many of the UN member states wished the body to be structured more closely to standard UN-type organizations (e.g., in terms of recruitment and management structure and practice). In the words of a former diplomat, UNMOVIC was more bureaucratic and was meant to provide a bit of 'law and order' to the process.[808]

The modalities of the inspection regime were based on an exchange of letters between Iraq and the UN which was finalised on 18 May 1991. This included provision for the unrestricted freedom of movment of inspectors, the right of inspectors to examine and copy records, the right to take samples for in- or out-of-country analysis, and the right to conduct interviews. UNSCOM's executive office was located at the UN Secretariat in New York City. UNSCOM also maintained a regional office in Baghdad which served as its base of operations for inspection activities and the extensive ongoing monitoring activity of Iraq.

UNSCOM's activity in Iraq was curtailed in 1998 over a series of disputes concerning access to so-called presidential sites. UN Secretary-General Kofi Annan then attempted to resolve this issue by concluding a bilateral memorandum of understanding in March 1998.[809] This MOU is viewed by some as 'the thin edge of the wedge' that helped to undermine UNSCOM's support and hastened its exit from Iraq.

UNSCOM developed procedures to compartmentalize information partly in order to help ensure that the site selection for inspection was kept secret until the last possible moment. UNSCOM also received information from governments, including from intelligence services, as well as information on Iraq's procurement activities that originated from banks and business firms.[810]

A number of prominent scientists, such as Dr Rihab Taha ('Dr Germ'), had received training outside Iraq. Partly as a result the British Foreign Office recently began implementing an academic technology approval scheme (ATAS) in which students from outside the EU who wish to undertake postgraduate study in some natural sciences fields for more than 6 months are vetted.[811]

UNSCOM operated in Iraq over a period of more than 8 years, while UNMOVIC's presence in the country was limited to 3 1/2 months. It should also

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[808] Personal communication, Apr. 2014.

[809] 'Letter dated 25 February 1998 from the Secretary-General addressed to the President of the Security Council', UN document S/1998/166, 27 Mar. 1998.

[810] E.g., Duelfer (note 26).

[811] Foreign and Commonwealth Office, 'Academic Technology Approval Scheme (ATAS)', <http://www.fco.gov.uk/en/about-us/what-we-do/services-we-deliver/atas/>, (accessed 1 Aug. 2013).

be noted that UNMOVIC's reporting referred to below was the result of UNMOVIC's evaluations of the UNSCOM reports, often by staff members who continued on in the new organization, and was not based upon independent inspection activities.[812]

With the exception of information from governments regarding two notable occasions during the summer 1991—both exclusively related to the Iraqi nuclear weapons programme—no 'significant intelligence' or information regarding CBW or longer-range missiles was received from governments.[813] Thus, according to a former UNSCOM official, the work of the inspectors is the sole reason for the success of UNSCOM which was to account fully for Iraq's prohibited items and to verify their destruction.[814]

The information and material generated from these and other activities is massive and pose severe information management burdens. As previously mentioned, the UNSCOM/UNMOVIC archives reportedly contain almost 460 metres of paper files and 1 terabyte of electronic data.[815] The UNSCOM and UNMOVIC files have been transferred to the custody of the UN's Archive and Records Management Section in the Department of Management where they will remain sealed separately from the other UN archival material for 30-60 years starting from 1 March 2008.[816] Despite the oral histories, much of the understanding will be lost.[817]

UNMOVIC's Findings

The final unresolved verification issues were contained in an UNMOVIC report ('the Cluster Report') that Blix presented to the UN Security Council in March 2003.[818] This report summarizes each weapon type as a separate 'cluster'. The chemical cluster is divided according to: (*a*) tabun, (*b*) sarin and cyclosarin, (*c*) sulphur mustard, (*d*) VX, (*e*) chemical process equipment, (*f*) soman, (*g*) BZ analogues (psychoactive compounds).[819]

VX stabilizer was found in the field in a large area and depth (this indicated more than gramme level production of VX).[820]

UNMOVIC found a crate of unfilled 122 mm CW warheads and further warheads were subsequently found by both Iraqis and UNMOVIC inspectors.[821]

UNMOVIC concluded that, from the mid-1970s to 1990, more than 200 international suppliers had provided 'major critical technology, equipment, items

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[812] Personal communication with former UNSCOM official, Nov. 2009.

[813] Personal communication with former UNSCOM official, Nov. 2009.

[814] Personal communication with former UNSCOM official, Nov. 2009.

[815] Kulish (note 796).

[816] UN, 'Secretary-General's Bulletin, Records and Archives of the United Nations Monitoring, Verification and Inspection Commission, UN document ST/SGB/2009/12, 1 Aug. 2009.

[817] Oral history-based studies include Jean E. Krasno and James S. Sutterlin, *The United Nations and Iraq: Defanging the Viper* (Praeger: Westport, Conn., 2003).

[818] UNMOVIC (note 787).

[819] UNMOVIC (note 787), pp. 67–94.

[820] UNMOVIC (note 787), p. 84.

[821] Blix (note 337), pp. 117–118. Colin Powell gives the warhead size as 122 mm in his February 2003 presentation to the UN Security Council. Blix does not mention the calibre.

and materials that were directly used by Iraq' for CBW and missile programmes and that approximately 80 international bank branches were involved in the delivery of associated items and material.[822] Some international actors participated knowingly, while others were unaware of the intended purpose of the transaction. Iraq's procurement became more sophisticated over time. UNMOVIC also concluded that more 2000 engineers, managers, scientists and technicians were directly involved in Iraq's CBW and missile programmes.[823]

Of the NBC weapon types, Iraq first worked on CW when the Iraqi Chemical Corps in 1971 began operating a laboratory-scale facility for agent synthesis. During the 1980-88 Iran-Iraq War CW precursors were imported through the State Establishment for Pesticide Production (SEPP). Iraq declared having produced 3850 tonnes of sarin, sulphur mustard, tabun, VX in 1981-91.[824] The first indication of military interest in biological agents was reportedly expressed by the head of Iraq's CW programme in 1983; by 1985, the causative agents for anthrax and botulinum toxin had been selected as prospective BW agents.[825] UNMOVIC concluded that the acquisition of equipment, technology and material was 'critical' to Iraq's CBW programme, that procurement verification was important to uncovering concealment efforts, that the introduction of export licensing 'significantly slowed' and 'limited' Iraq's procurement activity prior to 1991 and that Iraq demonstrated an ability to circumvent trade restrictions by changing its procurement techniques.[826]

National Intelligence Assessments and Their Application for Policymaking

Various intelligence assessments on Iraqi CW capabilities and holdings were carried out with some urgency starting in the 1980-1988 Iran-Iraq War. Major contributions to these assessments were provided by various states including Germany, Israel, the UK and the United States. Their findings—and the processes by which these assessments were conducted and used to inform and support policy—represented a sort of institutional 'baggage' having potential political implications in terms of the legitimacy and authority of the institutions and their findings and the various preferred policy outcomes of the UN member states during the review, assessment and debates in the lead up to the 2003 invasion of Iraq.

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[822] 'United Nations Monitoring, Verification and Inspection Commission, note by the Secretary-General, Summary of the Compendium of Iraq's Proscribed Weapons Programmes in the Chemical, Biological and Missile Areas', UN document S/2005/420, 21 June 2006, para. 93, p. 30.

[823] United Nations Monitoring, Verification and Inspection Commission, note by the Secretary-General (note 822), para. 83, p. 28.

[824] UNMOVIC, 'Annex, Overview of the Chemical Weapon Programme of Iraq', UN document S/2006/342, para. 11, p. 8.

[825] UNMOVIC, 'Appendix, Biological Weapons Programme of Iraq (extracted from the compendium summary)', UN document S/2005/545, 2005, para. 4, p. 6.

[826] UNMOVIC, 'Annex, Iraq's Procurement for Its Weapons of Mass Destruction Programmes', UN document S/2005/742, 2005, paras. 33–6, p. 17.

US Assessment of the Role of CW in the Iran-Iraq War

Recently partially declassified US Government intelligence assessments are reviewed.

A 1988 CIA assessment released in October 2012 states:

> *'Recent fighting in northwestern Iraq has underscored the regular, recurring use of chemical weapons to [?] the Iran-War war and suggests that such activity will continue to increase. Chemical attacks on either country's major cities are unlikely under current circumstances, but the risk is growing that smaller population centers might be attacked with chemical weapons. If such attacks failed to evoke international sanctions, the chance of chemical strikes on larger cities would increase significantly. [blacked out text probably consisting of 1-3 words] The Iraqis have the largest stockpile of chemical weapons in the region, including mustard and nerve agents that can be delivered by air or artillery strikes. [blacked out text probably consisting of about 5 lines.]'.*[827]

Under 'battlefield use increasing' the assesment continues:

> *'Baghdad and Tehran apparently believe chemical weapons are tactically useful and effective. The increasing availabilty of chemical munitions and experience in their use are likely to encourage both sides to employ chemicals more frequently and on a wider scale.' [blacked out word, followed by blacked out paragraph of perhaps 10 lines]*.[828]

Under 'prospects for a chemical war in the cities', the assessment continues:

> *'Neither side is likely to initiate a chemical war of the cities in the near term. There is no evidence that either Iran or Iraq has developed chemical warheads for Scud missiles, but that possibility cannot be ruled out. Baghdad's success in developing chemical bombs and artillery shells suggests it could produce a crude chemical warhead for its Scuds, and Tehran might have obtained foreign assistance in producing chemical warheads for its surface-to-surface missiles. Each side has the capability to conduct chemical airstrikes against major cities [black out text of perhaps one or two words] A strategic breakthrough by Iran in the ground war would be the scenario most likely to drive Iraq to chemical attacks on Iran's major cities. Such attacks might provoke Iran to retaliate in kind against Baghdada or Ka[?]rkuk [read: Kirkuk], but Tehran probably would refrain from doing so initially—hoping for widespread international condemnation of, and possible sanctions against, Iraq [blacked out text consisting perhaps of one to two words]*

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827 National Intelligence Daily, DCI, Special Analysis 'Iran-Iraq: the Chemical Warfare Issue', 5 Apr. 1988 (declassfied). Available at The National Security Archive (George Washington University), Ed. Malcolm Byrne, *US-Iran: Lessons from an Earlier War*, National Security Archive Briefing Book no. 364, 12 Oct. 2012, document 7, <http://www.gwu.edu/~nsarchiv/news/20121012/>, (accessed 15 Oct. 2012).

828 National Intelligence Daily (note 827).

> *Iraq probably would use chemical weapons in a battle for a major Iraqi city such as Al Basrah or As Sulaymanlyah [spelling?] if Baghdad believed Iranian forces were on the verge of taking control. Unless residents were evacuated or fled, large numbers of civilians could become victims of chemical agents. [blacked out text of perhaps one to two words] In the near term, civilian chemical casualties probably will rise as a result of the gradual increase in the frequency and intensity of chemical attacks on smaller cities close to major battles or military targets' [blacked out text consisting of perhaps four to five words].* [829]

The CIA analysis (at least the part that is declassified) does not make a determination on whether Iran has used chemical weapons or intends to use such weapons.

US Intelligence Assessment in the Lead-up to the April 2003 Invasion

In September 2002 the US produced a NIE on Iraq's 'weapons of mass destruction' which later proved to contain inaccuracies, as well as underlying shortcomings in terms of the processes by which it was created. The US Senate Intelligence Committee later concluded that the NIE's key judgements were either 'overstated' or were 'not supported' by the underlying intelligence. Arguments in support of the NIE included the fact that Iraq had used chemical weapons (i.e., it had shown a willingness to use at least one of the weapon types) and that the country had been generally obstructionist in its conduct with international arms inspectors.

Curveball

Curveball was the code name for an Iraqi national (Rafid Ahmed Alwan al-Janabi, also known as Ahmed Hassan Mohammed) who defected to Germany in 1999. He described to the Bundesnachrichtendienst (BND) mainly biological weapons work he said that Iraq was conducting. The BND shared this information with the United States, mainly through the DIA. Following the 2003 invasion of Iraq, it soon became clear to those both within and outside governments that Curveball was the principal source[830] of information for the mobile production units for biological warfare agents in Colin Powell's February 2003 presentation to the UN Security Council on Iraq's prohibited weapons programmes and related activity (see below).

Although the focus of Curveball's information was on biological weapons, the intelligence assessment procedures are also relevant to chemical weapons. This is partly because of the fact that many of the biological and chemical weapon development, acquisition and stockpiling pathways are similar or overlap.

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[829] National Intelligence Daily (note 827).

[830] According to some sources, Curveball was the sole source for the BW trailers. Others cite 3 sources for the BW trailers. It cannot be excluded there were additional sources. Another question is how to confirm what sources fed into a particular assessment. The fact that other sources in support for the same conclusion exist in the system should be noted.

The existence of the mobile production units was perhaps the most compelling single item of evidence in Powell's presentation to support attacking Iraq. However, doubts about his reliability by the BND and others were not properly communicated in the US evaluation and decisionmaking process in the lead-in to the attack. Also there were perhaps at least three sources for the mobile BW lab sources. According to Drogin, these sources were: Curveball, an MI6 informant codenamed Red River and Mohammed Harith (aka al-Assaf) (an Iraqi intelligence major who was introduced to US military intelligence by Ahmed Chalabi).[831] The major was also apparently a source for *Vanity Fair* articles.[832] In February 2002 the Iraqi National Congress and Chalabi helped to arrange a meeting between the major and US military intelligence officials. He stated that he had personally conceived the idea of developing mobile BW production facilities.[833] However, given Chalabi's political ambitions, any sources connected to or associated with him have generally been considered to be suspect.

It is unclear if or when the BND monitored Curveball's Internet habits. Doing so might have revealed a checking of UNSCOM and UNMOVIC reports and statements. The BND reportedly closed the Curveball file in September 2001 (not because of the attacks on the United States).[834]

Nature of Curveball's Information

Curveball also said that he spoke often with Taha, the Iraqi microbiologist known as 'Dr Germ' who obtained her doctorate from the University of Birmingham.[835] Curveball at first focused on describing plans for mobile BW production facilities.[836] He told of a system consisting of 3 commercial trailer trucks: the first section comprised 1-2 fermenters, the second section was where mixing occurred, and the third was for storage or preparation of the slurries for filling into munitions.[837] At one point, Curveball stated that he helped to design and test these trailers.[838] He alleged that a facility at Djerf al Nadaf (southeast of Baghdad) was a docking/filling station for these trailers.[839] This raised the question of whether Iraq would employ a functioning grain and seed facility as a 'docking station'.

Curveball was aware of the temperature ranges for fermenters (which must be cooled, especially if operated in the heat of Iraqi weather).[840] Curveball also displayed a familiarity with the names of many of the Iraqi scientists and

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[831] Bob Drogin, *Curveball: Spies, Lies, and the Man Behind Them, the Real Reason America Went to War in Iraq* (Ebury Press: 2007), p. 148.

[832] Drogin (note 831), p. 148.

[833] Drogin (note 831), p. 121.

[834] Drogin (note 831), p. 99.

[835] Drogin (note 831), p. 50. Taha's course of study in the UK helped to prompt the establishment of the ATAS programme.

[836] Drogin (note 831), p. 50.

[837] Drogin (note 831), pp. 51–52.

[838] Drogin (note 831), p. 50.

[839] Drogin (note 831), p. 55.

[840] Drogin (note 831), p. 56.

technicians, many of whom UNSCOM had already determined to possess al-Hakam affiliations (a major BW facility).[841]

During his first period of debriefings, Curveball's accounts reportedly shrank, rather than grew—within intelligence and security circles this is often considered a poor indication of a source's reliability.[842] Information provided by defectors often tends to deteriorate because they are generally dependent on their hosts to provide them the means for livelihood or remaining in the country. As memories fail, the stories typically become more elaborate. For example, Volker Foertisch (a former head of BND counter-intelligence)[843] stated that defectors:

> *'typically fear they lose value. They are very dependent people. So they begin to exaggerate, and tell you what you want to hear. They are totally dependent on the people they're talking to for their future well-being. They want to please their masters. Psychologically, they have to do something to enhance their value. So they begin to stretch the truth'.*[844]

Drogin further describes how intelligence services must guard against their handlers' becoming advocates for their sources or inadvertently interpreting questionable statements from defectors.[845] Intelligence services should guard against blackmailers, provocateurs and swindlers.[846]

The BND channeled Curveball reports to the US via the DIA.[847] This may have been partly because of longstanding tensions between the BND and CIA dating to the Cold War. It was the DIA that gave the source the cover name 'CURVE BALL', and the Germans subsequently adopted it.[848] The DIA also designated him a 'blue source' meaning that Germany did not permit direct access.[849] Germany informed the United States that the source disliked Americans and did not wish to speak to them.[850]

CIA Directorate of Operations (DO) had procedures to validate human sources (i.e., to check if they lie), while CIA Directorate of Intelligence (DI) analysts at the time did not generally focus on human behaviour or psychology.[851] Curveball's blood was checked in May 2000 for anthrax antibodies with negative results.[852]

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841 Drogin (note 831), p. 60.

842 Drogin (note 831), p. 87.

843 For news articles concerning Foertisch, see *Der Spiegel*, <http://www.spiegel.de/thema/volker_foertsch/>, (accessed 9 July 2013).

844 Drogin (note 831), pp. 23–24.

845 Drogin (note 831), p. 24.

846 Drogin (note 831), p. 24.

847 Drogin (note 831), p. 32.

848 Drogin (note 831), p. 34.

849 Drogin (note 831), p. 35.

850 Drogin (note 831), p. 36.

851 Drogin (note 831), p. 136.

852 Drogin (note 831), pp. 70 & 147.

Follow-up on Curveball's Information

In the lead up to the 2003 invasion, UNMOVIC did inspect mobile food testing laboratories.[853] In early 2003 Iraq provided UNMOVIC with a summary of similar truck units used by the government, including refrigerated trucks for drug delivery, field hospitals, mobile labs for disease analysis, and mobile kitchens.[854] In February 2003 UNMOVIC inspected Djerf al Nadaf with negative results.[855] Inspectors found 3 trailers that contained seed processing equipment.[856] Swabs were taken and later tested using RAPID-PCR for *C. botulinum*, *B. anthracis*, *F. tularensis* and *Y. pestis* with negative results.[857] UNMOVIC sometimes found that suspected missiles were actually rotating steel drums for drying corn or poultry sheds.[858]

Following the 2003 occupation of Iraq, the United States established the ISG to search for NBC and longer-range ballistic missiles in the country. Headed first by David Kay and then Charles A. Duelfer, the group operated in 2003-2005 and was composed mostly of US nationals. Its missions were mainly jointly organized by the DOD and the CIA. The total cost of the ISG was said to be approximately 3 billion US dollars.[859]

While the ISG was working (under David Kay) the CIA sent officials to watch Curveball being asked questions by German handlers.[860] Ultimately it was unclear what Curveball did (based on his own statements). He may have obtained some of the details from the Internet (including UNSCOM and UNMOVIC statements and reports).[861] Although he was hired by the Chemical Engineering and Design Center in Iraq, he was apparently fired in 1995 for unspecified sexual offenses.[862]

Two trailers were found and initially suspected of being BW production units. The first was taken by Kurdish security conducting a road check in early April 2003 near Mosul.[863] In May 2003, a US army patrol found a second one in a parking lot outside the gates of the Al Kindi State Company (a missile production facility).[864] The trailer systems also lacked containment elements. The CIA later issued and put onto the Internet a report on the trailers. The CIA characterized them as mobile BW production units. The report was not initially issued in a classified version. Nor was a draft passed to other agencies in the US intelligence community for peer-review (as was the standard practice). This may have reflected partly the view in Weapons, Intelligence, Nonproliferation, and Arms Control (WINPAC) that the trailers were in fact the 'smoking gun' of Iraqi

853 Drogin (note 831), p. 169.
854 Drogin (note 831), p. 181.
855 Drogin (note 831), pp. 167–168 & 170–177.
856 Drogin (note 831), p. 175.
857 Drogin (note 831), p. 176.
858 Drogin (note 831), p. 169.
859 Elbaradei (note 300), p. 80.
860 Drogin (note 831), pp. 247–248.
861 Drogin (note 831), p. 245.
862 Drogin (note 831), p. 240.
863 Drogin (note 831), p. 194.
864 Drogin (note 831), p. 196.

WMD.[865] The trailers were not connected to BW production. The WINPAC group focus on BW reportedly failed to validate Curveball's reliability prior to the 2003 US invasion of Iraq.[866]

2002 US Congressional Testimony

The US Congress also held hearings to consider the status of Iraq's weapon holdings, international disarmament obligations and intentions. For example, in September 2002 Adam B. Schiff (a Democratic Party representative of California) stated:

> '*You also made a point, though, that the intelligence is clear about a lot of what Saddam Hussein is doing; and I do want to express a note disappointment that some of my other colleagues have alluded to with the information that has been shared with Members of Congress. I have attended the classified and non-classified briefings; and many, many of us feel that there was much more information that we should be receiving [regarding Iraq's WMD programmes, intentions and activity]*'.[867]

Secretary of State Colin L. Powell responded:

> *'With respect to the most recent evidence, I don't know that there is a single smoking most-recent gun, although people have been reading stories about the aluminum tubes that shows a continued intention on the part of Saddam Hussein to do it. But there are many other things that may be going on that we don't know about, and we do know the intention still remains. So it is not just what we know, it is what we don't know that may be going on, because there is someone determined to try to develop this kind of capability that we have to keep our eyes on'*.[868]

The aluminum tubing was generally characterized by US Administration officials as supporting the case that Iraq was pursuing a nuclear weapons programme. These tubes had been intercepted by Jordan in 2001. However, they were, in all likelihood, meant to serve as part of 81 mm conventional rockets.

Richard N. Perle—at the time a Resident Scholar at the American Enterprise Institute—stated in his prepared remarks before the House of Representatives:

> *'My own view is that with all that it is simply not possible to devise an inspection regime on territory controlled by Saddam Hussein that can be effective in locating, much less eliminating his weapons of mass destruction. In any case, the inspection regime known as Unmovic doesn't even come close: Its size, organization, management and resources are all inadequate for the daunting task of inspecting a country the size of France*

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[865] The CIA group was, according to Drogin, sometimes referred to as the 'geek squad'.

[866] Drogin (note 831), pp. 64–65 & 130.

[867] *US Policy Toward Iraq: Administration Views*, Hearings before the Committee on International Relations, House of Representatives, 107th Congress, Second Session, serial no. 107-117 (US Government Printing Office: Washington, DC, 19 Sep. 2002), p. 46.

[868] *US Policy Toward Iraq: Administration Views* (note 867), p. 47.

> *against Saddam's determined program of concealment, deception and lying.*
>
> *We know, Mr. Chairman, that Saddam lies about his program to acquire nuclear, chemical and biological weapons. We know he goes to great lengths to conceal his activities. We know that he has used the years during which no inspectors were in Iraq to move everything of interest, with the result that the data base [i.e., information baseline] we once possessed, inadequate though it was, has been destroyed. We know all of this yet I sometimes think there are those at the United Nations who treat the issue not as a matter of life and death, but rather more like an episode of "Where in the World is Carmen San Diego [a US television learning programme for children]", or an Easter egg hunt on a sunny Sunday'*.[869]

In January 2003 Senator Sam Brownback (a Republican Party representative of Kansas) asked Depty Secretary of State Richard L. Armitage:

> '*There is an article in the New York Times today talking about large convoys moving out of Iraq into Syria. And I guess—I am just going to read you this instance—or report. "For instance, the Administration today was still debating the credibility of intelligence about a Christmas time Iraqi truck convoy that some Americans analysts say could have been transporting weapons of mass destruction or scientists to Syria where they would be safely out of the United Nations inspectors' view." Do you have any either further illumination you could give us about what we know about movement of weapons of mass destruction out of Iraq, if you can identify it?'*[870]

Armitage responded:

> '*I would—Senator Brownback, I would say that there has been a debate in the administration, as I know it, in the intelligence communities, about how much we know about other countries perhaps receiving such things as missiles. I do not think—particularly, I do not think we know the definitive [object missing]. I saw the report you referred to, and I have seen other reports, and I cannot give you a level of credibility on other reports as to whether missiles are in other countries. Those countries to whom—who we have approached on this with our suspicions have vehemently denied, but—that is what they have done. So I cannot comment further'*.[871]

Armitage's uncertain and rather ambiguous response almost certainly reflects a desire to say nothing that was factually incorrect. The phrasing of his response might have also reflected uncertainty or lack of knowledge of the

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869 *US Policy Toward Iraq*: *Administration Views* (note 867), p. 9.

870 *The January 27 UNMOVIC and IAEA Reports to the UN Security Council on Inspections in Iraq*, Hearing before the Committee on Foreign Relations, United States Senate, 108th Congress, first session, (US Government Printing Office: Washington, DC, 30 Jan. 2003), p. 34.

871 *The January 27 UNMOVIC and IAEA Reports to the UN Security Council on Inspections in Iraq* (note 870), p. 34.

relevant information, a desire not to reveal intelligence sources and methods, and/or a wish to avoid politically awkward characterizations.

The UK's September 2002 Dossier

The UK's September dossier was heavily cited, including by US officials, to support the case for war. In particular, it was the source for the assertion that Iraq was capable of deploying WMD within 45 minutes. This time estimate is mentioned in four places:

> 1. '*Saddam has used chemical weapons, not only against an enemy state, but against his own people. Intelligence reports make clear that he sees the building of his WMD capability, and the belief overseas that he would use these weapons, as vital to his strategic interests, and in particular his goal of regional domination. And the document discloses that his military planning allows for some of the WMD to be ready within 45 minutes of an order to use them'*.[872]
> 2. '*As a result of the intelligence we judge that Iraq has: ....military plans for the use of chemical and biological weapons, including against its own Shia population. Some of these weapons are deployable within 45 minutes of an order to use them'*.[873]
> 3. '*Iraq's military forces are able to use chemical and biological weapons, with command, control and logistical arrangements in place. The Iraq military are able to deploy these weapons within 45 minutes of a decision to do so'*.[874]
> 4. '*Saddam's willingness to use chemical and biological weapons: intelligence indicates that as part of Iraq's military planning Saddam is willing to use chemical and biological weapons, including against his own Shia population. Intelligence indicates that the Iraqi military are able to deploy chemical or biological weapons within 45 minutes of an order to do so'*.[875]

The time estimate was later discredited as a politically-motivated phrasing inserted by a Blair advisor to help strengthen a sense of urgency among British officials and the public that it was necessary to deal with Iraq by ejecting Saddam Hussein from power using military force.

Powell's 5 February 2003 Presentation to the UN Security Council

On 5 February 2003 US Secretary of State Colin L. Powell argued in a presentation to the UN Security Council that Iraq was continuing to pursue its WMD programmes and activities. His purpose was to provide an arms control

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[872] *Iraq's Weapons of Mass Destruction: the Assessment of the British Government* (note 803), pp. 3–4.

[873] *Iraq's Weapons of Mass Destruction: the Assessment of the British Government* (note 803), p. 5.

[874] *Iraq's Weapons of Mass Destruction: the Assessment of the British Government* (note 803), p. 17.

[875] *Iraq's Weapons of Mass Destruction: the Assessment of the British Government* (note 803), p. 19.

verification-based rationale for the US Administration's argument that Saddam Hussein should be militarily overthrown.

With regard to CW, Powell stated Iraq had never properly accounted for precursors, agents and munitions including: (*a*) 550 sulphur mustard-filled artillery shells, (*b*) 30 000 unfilled munitions, and (*c*) precursor chemicals sufficient to manufacture up to 500 tonnes of CW agents,[876] and (*d*) up to 6500 unaccounted for bombs from the Iran-Iraq War. Powell also observed that Iraq had not admitted to producing four tonnes of VX and still denied weaponizing the agent (in spite of sampling and analysis results suggesting that such weaponization had occurred).[877] Powell accused Iraq of embedding CW capacity in its civilian industry. He also cited May 2002 overhead imagery—referring to a slide in his presentation—that indicated cargo vehicle activity 'accompanied by a decontamination vehicle associated with biological or chemical weapons activity' that was corroborated by a human intelligence source.[878]

In addition to the BW trailer information (subsequently shown to be non-BW related), Powell briefed the Council on recorded conversations of Iraqi officials purportedly discussing and issuing instructions for the removal of evidence of nerve agent possession.[879] Part of the translated transcript states: 'Nerve agents. Stop talking about it. They are listening to us. Don't give any evidence that we have these horrible agents'.[880]

Blix later observed that, as he watched Powell's presentation, the provenance of the tapes should be reviewed by UNMOVIC including who and how they had been provided to the US Government.[881]

Blix also later argued that reasons for the intelligence shortcomings on Iraq included: (*a*) the United States placed too much reliance of information provided by defectors over the information collected and analysed by UNSCOM and UNMOVIC, (*b*) UN inspection reporting tended to be couched in cautious, legalistic language that officials in the US administration tended to 'misread' and to use to support 'preconceived convictions', and (*c*) a feeling of contempt by US Vice President Richard Bruce 'Dick' Cheney and many in the leadership of the DOD for international inspections.[882]

Step 5. Draw Tentative Conclusions About the Relative Likelihood of Each Hypothesis

Because this is a hindsight exercise, the relative likelihood of the 2 main hypotheses (i.e., Iraq possessed a CW stockpile in the lead up to the 2003 invasion—yes or no) can be approached in terms of the intelligence failure analyses. The stockpiling matrix provides a common baseline for the

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[876] Powell did not specify the type of tonne (e.g., metric, long, short).

[877] Transcript of Powell's UN Presentation, 'Part 6: Chemical Weapons', *CNN.com*, posted 5 Feb. 2013, <http://edition.cnn.com/2003/US/02/05/sprj.irq.powell.transcript.06/index.html>, (accessed 13 Aug. 2013).

[878] Transcript of Powell's UN Presentation (note 877).

[879] Blix (note 337), p. 153.

[880] Transcript of Powell's UN Presentation (note 877).

[881] Blix (note 337), pp. 153–154.

[882] Blix (note 337), p. 261.

identification of cognitive biases and ensuring a manageable 'audit trail' in the qualitative argument mapping hybrid application of ACH.

Numerous 'intelligence failure' investigations—much of it touching on intelligence methodology and the avoidance of cognitive biases—have been carried out (see Table 13.2).

The UNMOVIC verification findings were presented in language that focused on statements of fact and degrees of uncertainty associated with unresolved arms control verification issues. Some of these issues were inherently unresolvable and devolved into more philosophical discussions on standards of proof, knowability, and what conclusions could be drawn from ambiguous information or the absence of 'proof'.

The deliberate (as opposed to inadvertent) misinterpretation of intelligence to support politically preferred outcomes cannot be absolutely demonstrated or determined in hindsight.

Table 13.2 Iraqi CBRN Weapons and Ballistic Missiles Pre-2003 Intelligence Investigations.

Inquiry
Australia
-*Report on the Inquiry into Australian Intelligence Agencies* (Flood Report)(Australia, 2004) <http://www.pmc.gov.au/publications/intelligence_inquiry/> (accessed 8 Aug. 2013).
Netherlands
-Davids Commission Report (2010), <http://www.rijksoverheid.nl/documenten-en-publicaties/rapporten/2010/01/12/rapport-commissie-davids.html> (accessed 8 Aug. 2013).
United Kingdom
-Iraq Inquiry ('Chilcot inquiry') <http://www.iraqinquiry.org.uk/> (accessed 8 Aug. 2013).
-*Iraq's Weapons of Mass Destruction: a Net Assessment* (IISS: London, 9 Sep. 2002).
-*Iraq's Weapons of Mass Destruction: the Assessment of the British Government* (24 Sep. 2002) <http://www.archive2.official-documents.co.uk/document/reps/iraq/cover.htm> (accessed 8 Aug. 2013).
-*Review of Intelligence on Weapons of Mass Destruction* (Butler Report) (July 2004) <http://news.bbc.co.uk/nol/shared/bsp/hi/pdfs/14_07_04_butler.pdf> (accessed 8 Aug. 2013).
United States
-*Iraq's Weapons of Mass Destruction Programs* (Oct. 2002) <https://www.cia.gov/library/reports/general-reports-1/iraq_wmd/Iraq_Oct_2002.htm> (accessed 8 Aug. 2013).

Source: Author compilation.

An underlying assumption behind much of the debate regarding the reliability of mainly Western intelligence on Iraq is that the political decision to invade would not have been taken had intelligence assessments more clearly stated that Iraq likely did *not* possess CBRN weapons and ballistic missiles.[883]

The key CW failure of the 2002 NIE was the assessment that Iraq had resumed production of sulphur mustard, cyclosarin, sarin and VX and that the country possessed a CW stockpile totalling 100-500 tonnes.[884] Thomas Fingar summarizes the principal hindsight failures associated with the NIE (see Table 13.3).

[883] Jervis (note 399), pp. 124–125.

[884] Clark (note 29), p. 315.

Table 13.3 Main points from 2002 NIE that ought to have raised 'red flags'.

'We *judge* that Iraq has continued its weapons of mass destruction (WMD) programs'.
'We *lack specific information* on many key aspects of Iraq's WMD programms'.
'We *assess* that Saddam does not yet have nuclear weapons or sufficient material to make any'.
'We *assess* that Baghdad has begun renewed production of mustard, sarin…'.
'Although *we have little specific information* on Iraq's CW stockpile….'.
'*We judge* Iraq has some lethal and incapacitating BW agents….'.
'We have *low confidence in our ability to assess* when Saddam would use WMD'.
Baghdad for now *appears* to be drawing a line short of conducting terrorist attacks with conventional or CBW against the United States….'.
'INR's *alternate view* of Iraq's nuclear program….'.
'The Air Force *view* that Iraq was developing UAVs primarily for its reconnaissance, not for delivery of CBW agents….'.

Source: Thomas Fingar, *Reducing Uncertainty: Intelligence Analysis and National Security* (Stanford Security Studies, Stanford University Press: Stanford, California, 2011), p. 105. Italicized text as provided by Fingar.

> Robert M. Clark faults the 2002 NIE on the following grounds:
> (*a*) poor problem definition,
> (*b*) poor evaluation of sources and evidence,
> (*c*) failure to consider alternate target models,
> (*d*) poor analytic methodogy, and
> (*e*) poor interaction with collectors and customers.[885]

The problem definition was essentially one of fitting all available information into a WMD model often on short notice.[886] Clark argues that the problem definition should have instead included input from economic, military, and political specialists not focused on the WMD model. While the US Air Force raised doubts as to whether the drones/UAV work was meant to deliver biological (and possibly chemical) warfare agents, they were not pursued by the intelligence community further.[887] The air force did not, in fact, concur that the Iraqi drones in question were meant to deliver chemical or biological warfare agents.[888] With respect to poor evaluation in generating the CW component of the NIE, Clark observes:

> '*Analysts relied heavily on imagery showing the presence of "Samarra type" tanker trucks at suspected chemical weapons (CW) facilities. The distinctive trucks had been associated with CW shipments in the 1980s and during the Gulf War. Analysts also believed that they were seeing increased Samarra truck activity at the sites. They apparently did not consider an alternative hypothesis—that the trucks might be used for other purposes, as turned out to be the case. And they failed to recognize that the more frequent[ly] observed activity of the trucks was an artifact*

[885] Clark (note 29), pp. 315–319.
[886] Clark (note 29), pp. 315–316.
[887] Clark (note 29), p. 316.
[888] Blix (note 337), p. 227.

> *of increased imagery collection (122, 125). The trucks were simply observed more often because of more imagery reporting'.*[889]

In addition, a number of CBW human sources were suspect. One was an Iraqi chemist half of whose reporting was 'absurd'.[890] This source was used by US intelligence to conclude that Iraq had stabilized VX.[891] Another human source stated that Iraq was producing sulphur mustard and binary nerve agents. But because he also reported on purported nuclear weapons, ballistic missiles and biological weapons developments, this should have led US intelligence to conclude that this source was not likely to have had access to all these programmes in view Iraqi security compartmentalization.[892]

With respect to the failure by US intelligence to consider alternate target models, Clark emphasizes that alternate purposes of Iraq's UAVs/drones should have been considered, and that, using Occam's razor, analysts should have considered the possibility that the reason why they could not find mobile BW labs was because they did not exist.[893]

Fingar states that the key part of the 2002 NIE (in both classified and unclassified versions) should have read:

> *'We judge that Iraq is reconstituting its WMD capabilities but do not know tthat it has done so and do not know with certainty or specificity how much has been reconstituted or how long it will take to complete the process'.*[894]

With respect to poor analytic methodology, Clark states that US analysts relied excessively on a 'straight line' historical extrapolation of Iraq's WMD programmes and activity.[895]

Finally, with respect to poor interaction with collectors and customers, Clark observes that analysts did not share with collectors the extent to which they relied on particular sources, including the above-mentioned Iraqi chemist.[896] Similarly, the customers not infrequently held the erroneous view that the reporting was based on more reliable sources.[897]

Arguably the corollary to 'the politicization' of national intelligence estimates is the question of whether the arms control verification results of a UN-type body can or should be understood as 'stand alone' findings or are susceptible (appropriately or inappropriately) for being employed as a 'means to an end'. In this regard, Elbaradei recalls his understanding of US Administration views of international verification and inspection activity in the lead-up to the April 2003 invastion.

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889 Clark (note 29), p. 317.
890 Clark (note 29), p. 318.
891 Clark (note 29), p. 318.
892 Clark (note 29), p. 318.
893 Clark (note 29), p. 318.
894 Fingar (note 25), p. 105.
895 Clark (note 29), pp. 318–319.
896 Clark (note 29), p. 319.
897 Clark (note 29), p. 319.

> *'A few weeks later, with negotiations on the resolution still underway, Blix and I were called to a short courtesy meeting at the White House. On our way to meet President Bush, we had our first encounter with Vice President Dick Cheney. It was brief; Cheney was sitting behind his desk. Cheney wasted no time on small talk; he had a direct, simple message to convey. "The US is ready to work with the United Nations inspectors," he told us, "but we are also ready to discredit the inspections in order to disarm Iraq."'*[898]

> *'Having received this warning, we proceeded to our meeting with Bush. Other than Condoleeza Rice and Bush's chief of staff, Blix and I were the only audience. In what was more or less a monologue, Bush got right to the point. He asserted that he was in favor of using inspections to address Iraq's WMD issues, that he would prefer a peaceful resolution of the international concerns about Saddam Hussein's regime. "I'm not a trigger-happy Texas cowboy, with six-guns," he quipped, sliding forward on his armchair, hands on his hips, to show us how a cowboy would pull out his pistols. On the other hand, he countered, if peaceful approaches were unsuccessful, he would not hesitate to lead a "coalition of the willing," using military force.'*[899]

> *'Together with our exchange with Cheney, the encounter told us clearly that the US administration viewed us as bit players in an operation they intended to control'.*[900]

In May 2003 Paul Wolfowitz stated that the attack on Iraq on the basis of WMD possession was done for bureaucratic reasons: 'The truth is that for reasons that have a lot to do with the US government bureaucracy we settle on the one issue that everyone could agree on which was weapons of mass destruction as the core reason [for attacking Iraq]'.[901]

Step 6. Analyze Sensitivity of Conclusions

The critical items of evidence include: (*a*) availability of munitions, (*b*) documentation of production and (*c*) leadership intentions. The sensitivity of the conclusions to these few critical items of evidence can include: (*a*) ensuring that technical means for determining the availability of munitions does not reflect changes in verification methodology (e.g., increased collection or frequency of collection), (*b*) developing indicators that assist in determining whether documentation adequately reflects actual policy, capacities and intentions (e.g., it does not tell the leaderhip what it wishes to hear) and (*c*) actual Iraqi motivations.

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898 Elbaradei (note 300), p. 53.

899 Elbaradei (note 300), p. 53.

900 Elbaradei (note 300), p. 53.

901 US DOD, 'Deputy Secretary Wolfowitz Interview with Sam Tannenhaus, Vanity Fair', 9 May 2003, News Transcript, <http://www.defense.gov/transcripts/transcript.aspx?transcriptid=2594>, (accessed 13 Aug. 2013).

Post-invasion reactions regarding WMD capabilities, holdings and intentions include the following.

General Amir al-Sa'adi speaking into camera of the German television station ZDF as he surrended to coalition forces on 12 April 2003 stated 'We have no weapons of mass destruction, and time will bear me out'.[902]

An Arabic speaking FBI agent, George Piro, interviewed Saddam Hussein. *New York Times* correspondent Tim Weiner says that six days into Hussein's debriefing, Piro asked about the chemical and biological weapons and that Hussein responded: 'We destroyed them. We told you. By God, if I had such weapons, I would have used them in the fight against the United States'.[903]

According to the last UNSCOM chairman, stated that Tariq Aziz told him in private: 'Of course we made biological weapons'.[904] In public, however, Iraqi officials could not say this because such weapons were to be used against 'the Persians and the Jews'.[905]

Step 7. Report Conclusions

The main conclusion is to keep separate the technical aspects of arms control verification and intelligence assessments from the higher-level political and strategic considerations.

Step 8. Identify Milestones

Milestones for future observation include cross-checking established conclusions and understandings against unprocessed archival materials with a view towards identifying cognitive biases, including through the consideration of counter-intuitive, possibly ad hoc nature of Iraqi decisionmaking and implementation practice.

13.5. Implications

Lessons from the US Iraq intelligence failure include the fact that no 'judgement' from prior analyses should be assumed to remain valid, but must be reexamined and revalidated for each subsequent intelligence assessment (including NIEs).[906] 'Zero-based' reviews must also taken into account whether new information has become available and whether it is consistent, corroborates, confirms, etc. the previous information.[907] In particular, does the new information make alternate hypotheses more or less plausible?[908] For example, increased activity at Iraqi CW facilities may reflect an increase of overhead imagery collection.[909] As a

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902 Elbaradei (note 300), p. 5.

903 Weiner (note 350), p. 431.

904 US Public Broadcasting Corporation, 'Interview, Richard Butler', *Frontline*, Oct. 2001, <http://www.pbs.org/wgbh/pages/frontline/shows/gunning/interviews/butler.html>, (accessed 4 Nov. 2013).

905 US Public Broadcasting Corporation (note 904).

906 Fingar (note 25), p. 82.

907 Fingar (note 25), p. 83.

908 Fingar (note 25), p. 83.

909 *Report of the Commission*, p. 125. Cited in Clark (note 29), p. 128.

result of the US assessment on Iraq, George Tenet introduced a requirement that the head of an intelligence agency or designee must affirm the validity of the sources by signing a formal letter.[910]

As a result of the various inquiries into whether Iraq had CBRN weapons or ballistic missiles prior to the 2003 Iraq War, it is now clear that Iraq unilaterally destroyed its CW already starting in 1991 without inviting international inspectors to observe their full destruction (itself a violation). It should also be noted that old CW munitions continued to be recovered in following years, including by the US-led coalition forces that invaded Iraq in 2003. Iraq did, however, attempt to retain as much of its CW infrastructure as possible (it also attempted retain some key items of nuclear weapons and ballistic missile equipment). Iraq was also allowed to retain research facilities and technical experts were not required to change fields.[911]

An inadequate understanding by many Western intelligence analysts of Iraq's chemical infrastructure and the political culture of its government, institutions and people also existed. Mirroring was instead employed (implicitly or explicitly) to fill these and similar gaps.

Hindsight for this case study is irrelevant. The key question is what reasonable inferences could have been drawn from the information available at the time.[912] Worst-case scenario planning combined with a strong political preference or intention to invade Iraq occurred.

The manner in which technical evaluations are understood and incorportated at the higher political and strategic level suggests a dual-dichotomy consisting of multilateral arms control verification being understood, structured and used in a manner that supports and explains aspects of neoliberal institutionalism IR theory, while the manner by which national intelligence is understood, structured and used is focused national security priorities that (in turn) explain and support aspects of realist IR theory. In this manner, a linkage can be elucidated between operational techniques, principles and practice on the one hand and theoretical principles and explanation at the strategic level. Further implications for strategic analysis and IR theory are provided in Chapter 15.

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[910] Fingar (note 25), p. 83.

[911] The Iraq Inquiry ('Chilcot inquiry'), 'Dr Hans Blix transcript', uncorrected, p. 5, <http://www.iraqinquiry.org.uk/media/48849/20100727pm-blix.pdf>, (accessed 18 July 2013).

[912] I am grateful to one of the anonymous reviewers for drawing my attention to this point.

14

CASE STUDY: NON-STATE ACTORS

Heuer's 8 Steps are presented in the context of non-state actor CW threats posed by so-called militant Islamists. Background is provided which is structured according to Table 10.1 as part of Step 2 (also reproduced below as Table 14.1). This is a hybrid, argument-mapping CW application.

14.1. Introduction

This chapter provides context to the CW non-state actor threat with a focus on so-called Islamists. The particular case is the alleged VX production at the al-Shifa pharmaceutical plant in Sudan which the United States destroyed in 1998 with cruise missiles (*Operation Infinite Reach*).

14.1.1. Target of Analysis Definitions

Non-state actors in this case are understood to mean Islamist non-state actors. Islamism has been defined as a 'highly politicized version of Islam which maintains that Islam is in a state of conflict with the West, non-Muslims, and other Muslims who are seen to be insufficiently pious by Islamist ideologues'.[913]

Ibrahim Karawan makes the following distinctions regarding terminology of militants motivated by Islam. He cautions that 'Islamic', 'Islamist' and 'violent groups' are distinct from each other.[914] 'Islamic' groups often focus on individual redemption, while 'Islamist' groups emphasize obtaining political power.[915] Karawan categorizes militant Islamic groups (MIGs) as a subset of Islamists. MIGs seek to 'eradicate existing state structures via a combative insurrectional approach'.[916]

Various 'Islamic arguments' may contradict each other. Karawan believes that such arguments should instead be viewed more in terms of how they are used to reflect tensions inherent to a 'colonial setting' or ethnic conflict.[917] He also argues that MIG violence 'reflects a strong sense of urgency, emergency,

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913 Kunal Mukherjee, 'British Universities and Islamism', *Comparative Strategy*, vol. 30, no. 1 (2011), p. 60.

914 Ibrahim Karawan, 'Militant Islamist Groups (MIGs): Their Motives and Mindsets', p. 53 in Ed. R. Ragaini, *International Seminar on Nuclear War and Planetary Emergencies 29th Session* ('E. Majorana' Centre for Scientific Culture: World Scientific: London, 2003). Conference proceedings; Erice, Italy; 10-15 May 2003.

915 Karawan (note 914), p. 53.

916 Karawan (note 914), p. 53.

917 Karawan (note 914), p. 53.

and immediacy to act in a confrontational manner within a setting marked by cultural, political and economic inequality and marginalization'.[918]

Further distinctions may result from Arab *versus* non-Arab differences or dichotomies, as well as 'AQ central' *versus* 'AQ regional' groupings. Indonesian Islamic variations are generally distinct (localized and regional) from those found in the Arabian Peninsula (e.g., a general absence of Wahhabism and Salafism). Taliban are distinct from al-Qaeda. For example, the British fought black-turbined talib (students) in the 19th century.[919] Pashtun codes of conduct (Pashtunwali) may also vary from some Islamic prescriptions or 'standard' practice. Prescribed codes of hospitality (e.g., the protection of guests—even if they are enemies of the group, family or individual) and blood feuds may originate more from tribal codes of behaviour than from Islam *per se*.

Akbar Ahmed, a former Pakistani political officer to Waziristan and currently a Professor at American University, emphasizes the dichotomy between an urbanized, often Westernized and repressive centre *versus* a periphery characterized by tribal customs as more important to understanding current discussions on Islamic-inspired threats, the Global War on Terror (GWOT), and the like.[920] In his recent book, however, Ahmed fails to address directly whether and how blood feuds or the treatment of women according to tribal codes of conduct should be accommodated or opposed as part of efforts by 'the centre' (and international institutions and process more generally) to engage with 'the periphery' in a respectful and constructive manner. In addition, the dichotomy between 'the centre' and 'the periphery' characterization implies distinctiveness in approaches and understanding to strategies of Jihad—violent and non-violent—according to region (e.g., in Afghanistan, Europe, the Horn of Africa, the Maghreb, the Arabian Peninsula). Jihad, for example, may be understood to be an internal, personal struggle to achieve a better understanding and practice of Islam. In addition, among believers, the term (and concept) of Jihad generally lacks any negative connotation as it often does in Western states. Such distinctions have often been ignored or minimized in the GWOT-conceptualized policy framework of the US Administration of George W. Bush.

Scott Atran approaches the subject of Islamic-inspired violence as an anthropologist with field interview experience. He has also worked with US terrorist analysts and academics (e.g., the noted psychiatrist and former CIA case officer Marc Sageman). To a great extent, Atran views the Jihadi, Islamicist-inspired violence as a function of small-group dynamics of young people who enjoy close and overlapping networks of family, friends, schoolmates, work collegues and sports teammates (usually football/soccer).[921] They tend to possess a mix of attractions and hatreds of Western-dominated culture and norms. As they become older, their impulse towards violence tends to lessen.

Laurent Murawiec views the current Islamic-inspired violence as a phenomenon that shares characteristics with revolutionary, gnostic

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[918] Karawan (note 914), p. 54.

[919] For a fundamental study of the Afghan campaigns, see John William Kaye, *History of the War in Afghanistan*, 2 vols. (Richard Bentley: London, 1851). The study was reissued in 1857 in 3 vols.

[920] Akbar Ahmed, *The Thistle and the Drone: How America's War on Terror Became a Global War on Tribal Islam* (Brookings Institution Press: Washington, DC, 2013).

[921] Atran (note 314), p. 48.

millenarianism that is informed by Western nihilism and exhibits certain Leninist qualities. He argues that this combination of characteristics is discernable in strains of militant Wahhabist and Salafist interpretations of Islam. This implies that the present-day violent Jihadi-inspired terrorism owes some of its background and virulence to 19th and 20th century anarchist movements.[922] Such an outlook encompasses a binary mentality of being 'for' or 'against'/'good' or 'evil', an expectation to subsume personal wishes to those of the communal (i.e., Islam's Ummah) common good—as prescribed by an established orthodoxy, and a desire to eliminate mental resistance or deviation—both in terms of behaviour and thought (e.g., to 'own the souls' and to determine the thought processes and views of all members of the community).[923]

Arthur Koestler, an author and social commentator who witnessed many upheavals of the inter-World War period and knew many of the principals involved, famously left the Communist Party disillusioned. He argued that in becoming a Marxist, one joins an 'intellectually closed system' not unlike orthodox Freudianism or Catholicism. The closed system aims to explain all phenomena and to provide prescriptions for all human needs. Such a system possesses 'elastic defences' to counteract newly-observed facts and deprives its members of their willingness and ability to think critically.[924] He argues that, in closed systems, facts are deprived of value through 'scholastic processing' and objections are invalidated by questioning the psychological motive ostensibly behind them. Koestler's observations in this regard are worth expanding.[925] This

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[922] Laurent Murawiec, *The Mind of Jihad* (Cambridge University Press: Cambridge, Mass., 2008). Murawiec (d. 2009) was a French neoconservative formerly affiliated with the Hudson Institute and the RAND Corporation.

[923] Ali A. Allawi, a former Minister of Defence and Minister of Finance in the post-Saddam Government who then became a senior fellow at Princeton University, cautions that the term ummah is more nuanced than 'a grouping of people' by stating that the Koran refers to Abraham as being an ummah in and of himself. Ali A. Allawi, *The Crisis of Islamic Civilization* (Yale University Press: New Haven, Connect., 2009), p. 12.

[924] Arthur Koestler, *Arrow in the Blue: an Autobiography* (Collins with Hamish Hamilton, Ltd.: London and Glascow, 1952), pp. 230–231.

[925] Koestler states: 'Within the closed system of Freudian thought you cannot, for instance, argue that for certain reasons you doubt the existence of the so-called castration complex. The immediate answer will be that your arguments are rationalisations of an unconscious resistance which betrays that you yourself have such a complex. You are caught in a vicious circle from which there is no logical escape. Similarly, if you are a Marxist and if you claim that Lenin's order to march on Warsaw in 1920 was a mistake, it will be explained to you that you ought not to trust your own judgment because it is distorted by vestiges of your former petit-bourgeois class-consciousness'. He further argues 'The absence of objectivity in debate is many times compensated by its fervour. The disciple receives a thorough indoctrination, and an equally thorough training in the system's particular method of reasoning. As a result of this training, he acquires a technique of argumentation which is mostly superior to that of any opponent from the outside. He is thoroughly acquainted with the great debates of the past between the apostles and the unbelievers; he is acquainted with the history of heresies and schisms; he knows the classic controversies between Jansenites and Jesuits, between Freud and Jung, between Lenin and Kautsky. Thus he recognises at once the type and attitude of his opponent, is able to classify the latter's objections according to familiar categories; knows the questions and answers as though they were the opening variants of a chess game. The trained, "close-minded" theologian, psychoanalyst, or Marxist can at any time make mincemeat of his "open-minded" adversary and thus prove the superiority of his system to the world and to himself. This superiority enables the initiate of the closed system to display a patient tolerance towards the outsider. In discussion with pagans, patients and bourgeois reactionaries, he is calm, paternal and impressive. His

is because while the specifics of the philosophical, religious or political argument may vary, a certain underlying human inclination or behaviour may remain that helps to inform consideration of current non-state actor threats to international peace and security.[926]

Some researchers and observers have argued that Islam arrogates to itself an expansionist exclusivity which presumes that all people will eventually adhere to the religion or must be subjected to secondary citizen (dhimmi) status. The presumption that Islam will eventually become the world's sole religion—along with death to any apostates—implies that Islam is uniquely inclined to a form of exceptionalism and violence.

Bernard Lewis, who enjoyed a certain political prominence as an informal advisor to members of the George W. Bush Administration following the 11 September 2001 attacks, has long considered such concerns which are partly based on his research in Ottoman Empire archives and how the empire interacted with European powers.[927] A somewhat parallel set of discussions have developed regarding the extent to which Islamic societies have been able and willing to adopt and to develop science and technology, and are able to access and to utilise the necessary knowledge base.[928] 'Periodization' of history in traditional Islamic understandings is distinct from Western concepts of modernity, progress and positivist policy prescriptions. In particular, orthodox Islam tends to reject notions of 'progress' in cases where the latter are understood to be 'superior' to various early Islamic societies. In such cases, progress is instead often understood to mean a return to basic Islamic societal, cultural or religious norms.

The positivist, neo-liberal character of the contemporary international system places a set of constraints and expectations on all states that is significantly shaped by economic development theory and practice (e.g., the behaviour and standards of multinational corporations and civil society, and various notions of modernity and progress). Thus a perceived historical-based 'backwardness' of some states or societies may be partly explained by their affinity with or willingness to engage fully in the international system.[929]

There has also been some consideration of whether a form of European Islamic 'exceptionalism' can or should develop in the sense that European

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superiority, his self-assurance, the radiance of his sincere belief, create a peculiar relationship between the *guru* and the pupil, between confessor and penitent, analyst and patient, between the militant Party member and the fascinated sympathiser, the admiring fellow-traveller'. Koestler (note 924), pp. 231–232.

926 E.g., Koestler's observations can usefully be compared (with respect to closed and open system thought processes) to Leopold Weiss' autobiography (*Road to Mecca).* Weiss (b. 1900, d. 1992), an Austro-Hungarian Jew who converted to Islam, was a noted scholar and former Pakistani envoy to the UN. Upon his conversion he changed his name to Mohammad Asad. See Mohammad Asad, *Vägen till Mecka* [Road to Mecca] (Bonniers: Stockholm, 1956).

927 See, for e.g., Bernard Lewis, *What Went Wrong: the Clash Between Islam and Modernity in the Middle East* (HarperCollins: New York City, 2002).

928 In addition to the works of Bernard Lewis, see also Moustapha Safouan, *Why Are the Arabs Not Free?—The Politics of Writing* (Blackwell Publishing: Oxford, 2007); and Timur Kuran, *The Long Divergence: How Islamic Law Held Back the Middle East* (Princeton University Press: Princeton, New Jersey, 2011). Safouan is a Paris-based psychoanalyst whose family orginated from Egypt. His father was a communist. Kuran is a Professor of economics and political science at Duke University.

929 An issue of continuing relevance is reconciling the Islamic prohibition against the earning of interest with how international financial markets operate.

Muslims accept and support societal rights and obligations as a cultural and religious minority in a secularized broader community (e.g., to act as 'good citizens' in a manner whereby they are respectful towards and supportive of broader societal norms and where the broader society reciprocates appropriately).[930]

Regarding the structure and type of al Qaeda actors, Anne Stenersen of FFI has adapted Bruce Hoffman's 'layers' of AQ networks according to: (*a*) AQ central (i.e., Usama bin Ladin and his close circle),[931] (*b*) AQ affiliates (regionally based groups), (*c*) AQ locals and (*d*) AQ sympathizers.[932] It is also worth recalling Cronin's observation that 'Terrorist leaders are all amateur historians: historical irrelevance is the death knell of any [such] group'.[933]

Finally, the difficulty of defining and applying a definition of 'terrorism' should be noted. UN Security Council Resolution 1373 (2001), which forms the basis of the UN Security Council Counter-Terrorism Committee, does not define the term. Nor does UN Security Council Resolution 1540 (2004), which is meant to ensure effective and universal implementation of measures to prevent the proliferation of WMD. In fact, throughout its existence, the UN has been unable to agree a definition of terrorism despite numerous attempts.

The US Code defines 'international terrorism' as:

> *'(1) the term "international terrorism" means activities that—*
> *(A) involve violent acts or acts dangerous to human life that are a violation of the criminal laws of the United States or of any State, or that would be a criminal violation if committed within the jurisdiction of the United States or of any State;*
> *(B) appear to be intended—*
> *(i) to intimidate or coerce a civilian population;*
> *(ii) to influence the policy of a government by intimidation or coercion; or*
> *(iii) to affect the conduct of a government by mass destruction, assassination, or kidnapping; and*
> *(C) occur primarily outside the territorial jurisdiction of the United States, or transcend national boundaries in terms of the means by which they are accomplished, the persons they appear intended to intimidate or coerce, or the locale in which their perpetrators operate or seek asylum'.*[934]

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930 Cédric Baylocq, 'The Autonomisation of the Muslim Brotherhood in Europe: Da'Wa, Mixité and Non-Muslims', pp. 149–168 in Eds. Roel Meijer and Edwin Bakker, *The Muslim Brotherhood in Europe* (Hurst & Co.: London, 2012).

931 Bin Ladin was killed by US special forces on 2 May 2011 at a private home in Abbottabad, Pakistan (code named: *Operation Neptune Spear*). His death has presumably left Ayman al-Zawahiri, an Egyptian-born physician, as the commander of AQ.

932 Stenersen (note 209), p. 2.

933 Audrey Kurth Cronin, *How Terrorism Ends: Understanding the Decline and Demise of Terrorist Campaigns* (Princeton University Press: Princeton, New Jersey, 2009), p. 105.

934 Cornell University Law School, Legal Information Institute, <http://www.law.cornell.edu /uscode/text/18/2331>, (accessed 14 Aug. 2013).

The US Code defines 'domestic terrorism' as:

'(5) the term "domestic terrorism" means activities that—
(A) involve acts dangerous to human life that are a violation of the criminal laws of the United States or of any State;
(B) appear to be intended—
(i) to intimidate or coerce a civilian population;
(ii) to influence the policy of a government by intimidation or coercion; or
(iii) to affect the conduct of a government by mass destruction, assassination, or kidnapping; and
(C) occur primarily within the territorial jurisdiction of the United States'.[935]

Ekaterina Stepanova, of Moscow's Institute of World Economy and International Relations (IMEMO), has defined terrorism as: 'the intentional use or threat to use violence against civilians and non-combatants by a non-state (trans- or sub-national) actor in an asymmetrical confrontation in order to achieve political goals'.[936]

In practice, however, states and analysts can (and do) dispute what constitutes an act of terrorism or whether a particular person or group should be considered to be a terrorist. Some officials, observers and analysts are concerned that the terrorism label not be applied to those holding political grievances as a means to delegitimize them (including internationally). As has been frequently noted, asymmetries in force capabilities sometimes result in individuals and groups resorting to non-standard forms of violence, including suicide attack. However, the legitimacy of underlying grievances should not necessarily be dismissed out-of-hand if the methods of violence employed are illegal, indiscriminate or unethical.

14.1.2. AQ's Reported Interest in Chemical Weapons

A number of allegations have been made regarding Al Qaeda interest in NBC weapons and, if such interest and activity seems reasonably certain to exist, whether and how Islamic strictures may inhibit their use, including whether Muslims may be targeted or inadvertently killed if the primary target is deemed to be legitimate. The indicators on AQ capabilities and intentions regarding CW remain ambiguous.

In 2001 US forces captured documents and computer files that contained information on chemical and biological warfare agents (e.g., a reported 1999 activity authorized by al-Zawahiri and code named 'the Yoghurt Project').[937] There have also been reports of *Yersinia pestis* experiments by Al-Qaeda in the

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[935] Cornell University Law School (note 934).

[936] Ekaterina Stepanova, *Terrorism in Asymmetrical Conflict: Ideological and Structural Aspects*, SIPRI Research Report no. 23 (Oxford University Press: Oxford, 2008), p. 11.

[937] Alan Cullison, 'Inside Al-Qaeda's Hard Drive', *Atlantic Monthly* (1 Sep. 2004), <http://www.theatlantic.com/magazine/archive/2004/09/inside-al-qaeda-s-hard-drive/303428/>, (accessed 18 Aug. 2013).

Islamic Maghreb (AQIM).[938] Concern has been expressed that those responsible for the 2006-2007 improvised chlorine container attacks in Iraq will support anti-Syrian government forces by introducing similar methods.[939] Anwar al-Awlaqi (through an issue of the jihadist, glossy English-language magazine *Inspire*) reportedly stated: 'The use of poisons or chemical and biological weapons against population centres is allowed and strongly recommended due to its great effect on the enemy'.[940]

FFI researchers Hogan and Stenersen analysed discussion topics in one 'well-known dedicated to online training'. Of 764 threads posted on this forum in February 2005–December 2006: 3 per cent dealt with ideology, 5 per cent concerned CBRN weapons, 6 per cent concerned manual collections, 9 per cent concerned field skills, security and organisational matters, 23 per cent conventional weapons/equipment, and 42 per cent dealt with explosives.[941]

In mid-2002 CNN obtained 250 tapes in Afghanistan that were part of a larger library of unknown size (the index system was never recovered to the best of my knowledge).[942] CNN correspondents Henry Schuster and Mike Boettcher categorized the tapes into nine categories:

> 1. non-al Qaeda tapes (mostly from news and combat footage on Chechnya) and tapes created by [violent] groups in Burma, Egypt, Eritrea, Indonesia, Kurdistan and Yemen,
> 2. tapes created for a particular reason (e.g., the demonstration of an SA-7 intended for viewing by Mohammed Atef),
> 3. al-Qaeda training and instruction tapes,
> 4. al-Qaeda documentation of training,
> 5. historical filming (e.g., of a meeting between al-Qaeda and Taliban members in about 1996),
> 6. recordings of Osama bin Laden coverage in international media,
> 7. tapes for distribution to al-Qaeda members and potential sympathizers (e.g., speeches of bin Laden for a limited distribution and 'crusader' type tapes made for a wider audience),
> 8. 'tapes made for specific purposes', and
> 9. tapes on topics on international developments the recorders were interested in.[943]

International media items of interest included 'avid' coverage of the return of the *USS Cole* to the United States for repairs after having been hit in 2000 by

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938 Nicholas Blanford, 'Cache and Carry: Syria's Chemical Stockpile Poses Regional Threat', *Jane's Intelligence Review*, vol. 24, no. 9 (Sep. 2012), p. 50.

939 Blanford (note 938), pp. 49–50. On the chlorine attacks in Iraq, see Fred Wehling, 'A Toxic Cloud of Mystery: Lessons from Iraq for Deterring CBRN Terrorism', pp. 273–298 in Wenger and Wilner (note 290).

940 Blanford (note 938), p. 49.

941 Hanna Rogan and Anne Stenersen, *Jihadism Online: Al-Qaida's Use of the Internet*, report no. 1-08 (FFI: May 2008), unclassified, p. 4.

942 Henry Schuster and Mike Boettcher, 'The al Qaida Tapes—What Have We Learned?', p. 73 in Eds. Lars Nicander and Magnus Ranstorp, *Terrorism in the Information Age—New Frontiers?* (Swedish National Defence College: Stockholm, 2004). Boettcher and Schuster are longserving CNN correspondents.

943 Henry Schuster and Mike Boettcher, 'The al Qaida Tapes—What Have We Learned?', p. 75 in Nicander and Ranstorp (note 942).

suicide bomb attack in a Yemeni harbour, the ship crew's memorial services and any items that appeared to confirm that the United States was unwilling to take casualties (e.g., that confirmed a 'Vietnam syndrome' aversion to taking deaths and casualties).[944] Boettcher and Schuster place the well-known dog gassing tape which occurred in Afghanistan under category 8. They state that the gas was 'most likely by some sort of cyanide compound' and that the experiment was carried out by al-Qaeda's 'weapons chief' Abu Khabab.[945] Boettcher and Schuster state: 'A careful analysis of this tape, which was edited together from experiments that took place on at least two separate occasions, was that it was presented by Abu Khaba to bin Laden and his top lieutenants as an indication of what progress was being made at the Darunta camp with chemical weapons'.[946] The dog displayed hind leg twitching. The actual nature of the experiment remains publicly uncertain. Hydrogen cyanide is sometimes cited as the suspected chemical.

In 2010 the US DNI stated:

> *'Several terrorist groups, particularly al-Qa'da, probably remain interested in chemical, biological, radiological, and nuclear (CBRN) capabilities, but not necessarily in all four of those capabilities. A number of the 33 US Department of State designated foreign terrorist organizations worldwide have previously expressed interest in one or more of these capabilities, mostly focusing on low-level chemicals and toxins. Some terrorist groups see employing (CBRN) materials as a high-impact option for achieving their goals, as even if they do not produce many casualties they would have a psychological impact. We believe some of these terrorists aim to use these agents against Western targets, especially in Iraq and Afghanistan. We continue to be concerned about al-Qai'da's stated intent to conduct uncoventional attacks against the United States. While counterterrorism actions have disrupted al-Qai'da's near-term efforts to develop a sophisticated CBRN attack capability, we judge the group is still intent on its acquisition'*.[947]

Saifullah Paracha one of the 'inner circle' operatives involved in the planning of the 11 September 2001 attacks currently incarcerated at Guantamino was carrying a Casio digital diary when he was captured which contained 'references to military chemical warfare agents'.[948] Paracha, according to US leaked files, also 'discussed obtaining biological or nuclear weapons'.[949]

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[944] Henry Schuster and Mike Boettcher, 'The al Qaida Tapes—What Have We Learned?', pp. 79–80 in Nicander and Ranstorp (note 942).

[945] Henry Schuster and Mike Boettcher, 'The al Qaida Tapes—What Have We Learned?', p. 75 in Nicander and Ranstorp (note 942).

[946] Henry Schuster and Mike Boettcher, 'The al Qaida Tapes—What Have We Learned?', p. 75 in Nicander and Ranstorp (note 942).

[947] *Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, Covering 1 January to 31 December 2010*, pp. 6–7, <https://www.fas.org/irp/threat/wmd-acq2010.pdf>, (accessed 25 July 2013).

[948] Scott Shane and Benjamin Weiser, 'In Dossier, Portrait of Push for Post-9/11 Attacks', *New York Times*, 25 Apr. 2011, <http://www.nytimes.com/2011/04/26/world/guantanamo-files-portrait-of-push-for-post-september-11-attacks.html?_r=1&ref=global-home>, (accessed 23 July 2013).

[949] Shane and Weiser (note 948).

14.1.3. The al-Shifa Case

In August 1998 the US destroyed the al-Shifa pharmaceutical plant in Sudan using cruise missiles in an action codenamed *Operation Infinite Reach* on the grounds that it had produced VX on behalf of AQ.[950] One person was killed (a watchman) and several injured. The facility was owned by a Saudi businessman whose assets were frozen by the United States. The owner then secured legal services who arranged for private sampling and analysis to be carried out. Kroll and Associates was hired (despite pressure from the US Government not become involved). The sampling and analysis study was headed by Dr Thomas D. Tullius who was the Chairman of the Boston University Chemistry Department.[951] The samples were then analysed by three European laboratories with CW-related expertise none of which showed the presence of any CW agent or evidence of principal, known degradation products. Sudan cooperated in the exercise and chain-of-custody and a validated sampling methodology were employed.

The stockpiling matrix-template is used. Although it may be preferable to label the matrix 'production', the covert sampling and analysis that was carried out was done in order to determine the presence of chemical weapons (i.e., the toxic fill—not delivery devices or munition bodies). It is argued that the matrix for determining the presence of CW or their known principal degradation products is justified. In particular, the ACH purpose is to determine whether VX was produced based on sampling and analysis of soil samples taken surreptitiously by agent(s) acting on behalf of the US Government.

14.2. Framing the Hypotheses

The main hypotheses are: Has the target of analysis stockpiled chemical weapons (yes or no)?

To allow for a more meaningful analysis, the scope and focus should be more narrowly defined. As noted in Chapter 10, the question of production/stockpiling of chemical weapons is meant to inform the broader strategic question: *Did an al-Qaeda affiliate produce VX at a facility at al-Shifa in Sudan?*

Since the size of the stockpile will not be the focus of the analysis, the question is more one of confirmation or clarification of CW production (which is stored in some amount and in some form at the production site—even if not weaponized).

Related broader questions include:

(*a*) the nature of AQ affiliated individuals and groups in chemical weapons,

(*b*) whether such weapons are permitted by AQ and (if so) against whom (e.g., non-combatants, religious believers), and

(*c*) the nature of CW-related consultation or cooperation between individuals, groups, private business and state officials and state agencies.

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950 For a critical account of the action, see David Hoile, *Farce Majeure: the Clinton Administration's Sudan Policy, 1993-2000 (*The European-Sudanese Public Affairs Council: London, 2000).

951 Garrett and Hart (note 108), 'Shifa Pharmaceutical Industries Factory, Al-', pp. 188–189.

Step 1. Identify the Possible Hypotheses to be Considered

The possible hypotheses are:

1. Yes (EMPTA was present at the pharmaceutical facility and that this indicates the facility could have produced VX),[952] or
2. No (EMPTA was not present at the pharmaceutical facility).[953]

The results will be presented in terms of broader strategic analysis of continued present-day relevance.

Step 2. Make a List of Significant Evidence and Arguments For and Against Each Hypothesis

The background for the hypotheses is structured according to Table 10.1 (reproduced below as Table 14.1).

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[952] The presence of EMPTA per se does not mean that VX was produced. There are some organophosphorus pesticides that can leave EMPTA. Personal communication, Sep. 2013.

[953] The hypothesis that President Bill Clinton wished to divert attention from a Congressionally-mandated investigation into whether he had had sexual relations with Monica Lewinsky in the Oval Office will not be considered as a hypothesis under this step. It should be noted that Clinton gave video taped testimony concerning this matter on 17 August and that *Operation Infinite Reach* was carried out on 20 August 1998. Christopher Hitchens is among those who suspected a 'wag-the-dog' factor at work. The term refers to 1997 movie by that name which describes the successful efforts of a Hollywood mogul to create the false impression of a war in the Balkans in order to obscure a US President's pecadilloes just prior to an election. The wagging the dog perception is of potential relevance if considered inter alia in a cognitive psychology context of organizational decisionmaking.

Former US Under Secretary of Defense for Policy Walter Slocombe compares the argument that Clinton ordered cruise missile attacks to divert attention from the Monika Lewinsky scandal as being 'up there with the charge that the Jews are responsible for 9-11'. US National Archives, 'Memorandum for the Record (MFR) of an interview with Walter Slocombe of the Department of Defense Conducted by Team 3, 12/19/2003', 9/11 Commission Memorandum of Record, Record Group 148, National Archives Identifier 2610636, unrestricted, p. 4, <http://research.archives.gov/description/2610636>, (accessed 7 Feb. 2013).

The career German diplomat, NATO official and convert to Islam—from Catholicism—Murad W. Hofmann states: 'I saw what State terrorism really means when I visited the ruins of the Shifa Pharmaceutical Plant in the middle of Khartoum, destroyed, out of the blue, by American cruise missiles, without a thread of evidence of the alleged chemical weapons production. A stunning example of ruthless imperialism in the 20th century. Yet the Sudanese take it with a measure of wisdom and humour, blaming Monika [sic] Lewintzky [sic], the Jewish lover of President Clinton, for his need to lash out'. 'Paying my repects to the Mahd**i** (Wad Madani, 10 March 1999)', p. 219 in Murad Wilfried Hofmann, *Journey to Islam: Diary of a German Diplomat 1951-2000* (The Islamic Foundation: Leicester, 2001, reprinted 2002). The diary was first published in 1986. Murad Wilfried Hofmann (b. 1931) was a career German Foreign Ministry official. He was also NATO's Information Director (1983–1987) and Ambassador to Algeria (1987–1990) and Morocco (1990–1994). Leopold Weiss (Muhammad Asad) (1900–1992) wrote in 1985 the introduction to Hofmann's diary which consists of short entries concerning events in Hofmann's life that led him to convert to Islam and which reaffirm his decision to do so.

Table 14.1 Structure of Background Narrative to Case Studies.

Political factors
Definition of violation
Intent
Doctrine
Consistent with types and quanties?
Threat perception
Apparent
Actual
Demand side factors
Supply side factors
Technical factors
Assimilation
Capability
Technological stages
Verification measures
Onsite
Nearsite
Offsite

Source: Author compilation.

Sufficient background for each hypothesis must be provided. The background should also be structured with a limited number of headers, have internal cohesion and be sufficiently broad to allow for a meaningful narrative that permits the reader to readily ascertain the connection between the logic of the argument and the evidence (or lack thereof). To do so, allows for further refinement of the analytical technique and modification of the conclusions as new insight and information become available.

The background is structured according to political and technical factors. The *political factors* considered are: (*a*) the definition of a CWC-defined violation, (*b*) intent, (*c*) threat perception (apparent and actual), (*d*) demand side factors and (*e*) supply side factors. The *technical factors* considered are: (*a*) CW assimilation and (*b*) 'verification measures' (mainly derived from the arms control paradigm). These political and technical factors were developed by the author. However, it should be noted that supply and demand side factors are part of the standard nuclear arms control and disarmament literature.[954] Also variations of integration and assimilation of weapons systems into military doctrine and training have long been considered by analysts in various contexts.

14.3. Political Factors

A CWC-defined violation in this context would entail the production or stockpiling of chemical weapons.[955] To fall under CWC declaration and verification procedures, the state must be a party to the treaty (Sudan joined in

[954] For a recent summary of IR-based explanations for the low number of nuclear weapons states, see Jacques E. C. Hymans, ''The Study of Nuclear Proliferation and Nonproliferation', pp. 13–37 in Potter and Mukhatzhanova (note 675).

[955] For the definition of a chemical weapon, see CWC, Article II, para. 1.

1999). The CWC also excludes any facility that produced CW prior to 1 January 1946 from its definition of a chemical weapons production facility. In the al-Shifa case, a CWC-defined violation falls mostly under 'technical factors'(see 'technical factors' below).

Assessment of intent to acquire, develop or use CW is more problematic than for a traditional evaluation of a state's military programme. Sudan was in the midst of a longterm counter-insurgency campaign with the predominantly animist and Christian south. Islamist militants, including Osama bin Laden and other veterans of the Afghanistan conflict with the Soviet Union, moved to the country and enjoyed good relations with various Sudanese officials. Bin Laden used his family's business connections and money to support road building and other infrastructure projects in Sudan.

The evaluation of intent therefore must encompass the policies and intentions of Sudan's government, and possible divergent actions by elements of the Sudanese Government (e.g., on a more personal basis). Such a consideration must also address the still problematic question of whether al-Qaeda officials are strongly motivated to acquire CBRN weapons, their capacity to do so, and their willingness to use such weapons against Muslims, some non-Muslims, or all non-Muslims. A third set of issues consists of whether those al-Qaeda individuals and groups in Sudan had any interest in CW in particular.

AQ's interest in CBRN weapons has been divided into 3 periods: the Sudan period (1991-1996), the Afghanistan period (1996-2001) and the period starting after the Taliban regime in Afghanistan was toppled in November 2001).[956] In recent years the number of terrorist attacks has fallen, but grown more deadly.[957]

Analysts are also continuing to debate whether and how violent non-state actors innovate and assimilate weapons or modes of attack. Those who support innovation argue that militants' default position is to innovate in order to maximize success.[958] In other words, non-state actors are pro-active. A second school maintains that such groups are generally reactive due to a certain natural conservatism.[959] There may also be a link between degree of centralization and level of innovation. The more centralized the organization, the less innovative or risk prone it may be.[960]

14.3.1. al-Qaeda Doctrine

Much literature has been produced by and about AQ affiliates concerning their ideology and military doctrine. The bulk of the military training and doctrinal literature concerns the use of conventional weapons and explosives. One of the best developed, standard military doctrines of AQ is 'Abd 'Al-Aziz Al-Muqrin's

[956] Stenersen (note 209), p. 6.

[957] Stenersen (note 209), p. 8.

[958] Stenersen (note 209), p. 11.

[959] Stenersen (note 209), p. 11.

[960] Stenersen (note 209), p. 12. Stenersen cites work by Mathew Evangelista that suggests centralized organizations are less innovative.

A Practical Course for Guerilla War.[961] Al-Muqrin headed al-Qaeda in the Arabian Peninsula branch before being killed by Saudi security forces in June 2004. Al-Muqrin does not address suicide attack.[962] He only briefly touches on 'weapons of mass destruction' as part of his 'taxonomy of wars based on military and human factors'.

His taxonomy is: (*a*) conventional wars, (*b*) total wars, (*c*) cold wars and (*d*) unconventional (guerilla) wars.[963] He considers conventional wars to be those conflicts where all weapons except WMD are employed. Total wars are those armed conflicts where: 'unconventional weapons are used (weapons of mass destruction such as biological and nuclear weapons) but this type of war is considered unlikely because it leads to mass destruction, which could spell the end of all mankind'.[964]

Al-Muqrin defines cold wars as 'wars in which there is no direct combat between the two parties'.[965]

Finally, he categorizes guerilla wars as occurring in three phases:

Phase One: Attrition (Strategic Defence),
Phase Two: Relative Strategic Balance (Policy of a Thousand Cuts) and
Phase Three: Military Decision (Final Attack).[966]

Al-Muqrin defines war as 'a state of conflict that erupts between two communities, factions, or states, or between two individuals and, in general terms, between two armed camps with the purpose of achieving political, economic, or ideological gains or for expansionist goals'.[967]

Al-Muqrin defines war objectives as:

> '*1. For the belligerent to destroy the force that is confronting him and to compel that force to submit to him.*
> *2. To eliminate the enemy opposing him and to uproot him.*
> *3. For self-preservation'*.[968]

Al-Muqrin also states that the causes of war can be divided according to just and unjust wars as follows:

> *'Just wars are those wars that a party or peoples deprived of power, who are oppressed and wronged, wage against an oppressive aggressor or a*

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961 *Al-Qa'ida's Doctrine for Insurgency: 'Abd 'Al-Aziz Al-Muqrin's A Practical Course for Guerilla War* (Potomac Books, Inc.: Washington, DC, 2009). Translation and analysis by Norman Cigar.

962 Norman Cigar, 'Overview and Analysis', p. 34 in *Al-Qa'ida's Doctrine for Insurgency: 'Abd 'Al-Aziz Al-Muqrin's A Practical Course for Guerilla War* (note 961).

963 *Al-Qa'ida's Doctrine for Insurgency: 'Abd 'Al-Aziz Al-Muqrin's A Practical Course for Guerilla War* (note 961), pp. 90–91.

964 *Al-Qa'ida's Doctrine for Insurgency: 'Abd 'Al-Aziz Al-Muqrin's A Practical Course for Guerilla War* (note 961), p. 90.

965 *Al-Qa'ida's Doctrine for Insurgency: 'Abd 'Al-Aziz Al-Muqrin's A Practical Course for Guerilla War* (note 961), p. 90.

966 *Al-Qa'ida's Doctrine for Insurgency: 'Abd 'Al-Aziz Al-Muqrin's A Practical Course for Guerilla War* (note 961), p. 94.

967 *Al-Qa'ida's Doctrine for Insurgency: 'Abd 'Al-Aziz Al-Muqrin's A Practical Course for Guerilla War* (note 961), p. 89.

968 *Al-Qa'ida's Doctrine for Insurgency: 'Abd 'Al-Aziz Al-Muqrin's A Practical Course for Guerilla War* (note 961), p. 89.

> *tyrannical ruler. The objective is to end injustice and aggression, and to fight for the sake of God to make shar'ia the law of the land and for the word of God to become supreme. Examples of this kind of war are the wars in the Land of the Two Holy Shrines [Saudi Arabia], Palestine, Afghanistan, Iraq, Chechnya, Kashmir, the Philippines, and others'*.[969]

For Al-Muqrin:

> *'Unjust wars are those wars that unjust powers wage against the dispossessed. The objective is to dominate other belief systems, to replace the prescriptions of religious laws, to seize territory, and to plunder (others') riches'*.[970]

The final objective under this doctrine is to achieve a worldwide caliphate in which all people either accept Islam as the true faith or are killed. It is less clear whether he realistically expected this to be achieved in his (or anyone's) lifetime.

Norman Cigar argues that the Al-Muqrin doctrine is influenced—directly or indirectly—by Clauswitz and Mao. Al-Muqrin's thought is apocalyptic, binary (i.e., good *versus* evil; 'with us' or 'against us') and uncompromising in seeking to achieve victory, regardless of the human and societal costs (e.g., in terms of deaths and upheaval). The technological benefits of 'modernity' are secondary to ethical and religious correctness, and individual and societal moral well-being.

I am not aware of any Sudanese military doctrine that is CW-relevant.

14.3.2. Threat Perceptions

Threat perceptions of a CW non-state actor context are similarly conflated and confused for various reasons, including the mix of state and non-state actors, and as a consequence of the tension and disassociative pressures in the region.[971] The traditional state *versus* state calculation on whether one requires a CW stockpile is probably irrelevant in the case of Sudanese threat perceptions of military threats posed by others.

One possible factor driving demand for CW is a desire to acquire an asymmetric military capability with actual or potential opponents. It is also generally postulated that this threat can be ameliorated—to an extent—through participation in various economic and security arrangements, including through the participation in multilateral arms control treaty regimes. In the case of Sudan, perhaps the African Union could help to play such a role.

Had Sudan been a party to the CWC at the time of the attack, one can speculate whether the United States would have been inhibited from launching the attack. The potential damage to its position inside the arms control regime,

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[969] *Al-Qa'ida's Doctrine for Insurgency: 'Abd 'Al-Aziz Al-Muqrin's A Practical Course for Guerilla War* (note 961), p. 89.

[970] *Al-Qa'ida's Doctrine for Insurgency: 'Abd 'Al-Aziz Al-Muqrin's A Practical Course for Guerilla War* (note 961), p. 89.

[971] It should be noted again that non-state actor in the context of this study is not meant to apply to civil society actors, the chemical industry, or the like. Rather it refers to individuals and groups disposed towards violence to meet perceived political and other objectives through threats and actual indiscriminate violence.

might have led the United States to seek clarification using the CWC's provisions on consultation, clarification and fact-finding.[972] Sudan would have been obligated to engage in a process or dialogue, though this would not necessarily have resulted in the granting of onsite access to inspectors. The conclusions drawn from such an analysis have implications for IR theory, including how one weighs and evaluates neoliberal institutionalism and realism.

14.3.3. Demand and Supply Side Factors

The implementation of so-called supply side measures (in an arms control context) focus on the prevention of the misuse of equipment, technology, know-how and materials through various control and oversight mechanisms, such as through national munitions control lists. Demand and supply side factors may be understood to apply to either non-state actors themselves or the actors, agencies or states with which they cooperate or interact.

14.4. Technical Factors

With regard to the question of weapons (or weapons system assimilation), the al-Shifa case also presents unique difficulties because of the interaction between state and non-state actor interests and activity. Given sufficient willingness, many states would have the technical capability to produce VX using their own resources if they chose to do so. Key questions in this regard include: whether external support is feasible to facilitate the process, and whether the state is able to produce chemical agents in sufficient quantity and purity for longer-term storage.

There are approximately five production routes suitable to produce militarily significant quantities of VX. Distillation of VX on a largescale is extremely difficult. Furthermore, if more than about 1 litre of agent is produced one risks killing people in the surrounding area given the fact that most facilities, including well-equipped university laboratories, lack filtration units in their fume hoods. Larger scale production of VX would have required good handling techniques.[973]

It is also worth recalling the CWC's definition of a CW production facility.[974] The treaty defines a CWPF as having produced CW at any time since 1 January 1946 (the al-Shifa facility appears to have been constructed in 1992-1996). A CWPF may include filling equipment, bulk storage containers (including those that are part of binary or other multi-component CW munitions) and loading devices. A facility is not a CWPF if it produces unspecified byproducts if they do not exceed 3 per cent of the total product and the facility is subject to declaration and inspection under the CWC.[975] The timing of the accession appears to have been prompted by the al-Shifa attack (Sudan joined the

[972] See CWC, Article IX.

[973] Personal communication, Sep. 2013.

[974] CWC, Article II, para. 8.

[975] Sudan deposited its instrument of ratification 30 days prior to this. CWC, Article XXI. In practice, the 3 per cent threshhold probably concerns production of unwanted byproducts in small quantities that might otherwise be declarable, such as BZ, PFIB and nitrogen mustards. CWC negotiators at the CD should be consulted on this matter for clarification.

CWC on 24 May 1999). This is consistent with the fact that Sudanese officials made periodic calls for investigation of the plant site, and allowed representatives of the facility owner to take samples. The question of how the US Government evaluated the facility in terms of its equipment and configuration should also be considered.

It is also worth considering the potential relevance of OPCW inspection and verification procedures as they relate to CW production facilities and facilities that produce toxic chemicals and their precursors for permitted (i.e., peaceful purposes). This includes facilities that produce toxic chemicals for agricultural, industrial and pharmaceutical research. It also includes the evaluation of CW agents listed on Schedule 1 of the CWC's Annex on Chemicals (including novel) for protective purposes. It should also be reiterated that the chemicals listed on Schedule 2 and Schedule 3 of the Annex on Chemicals have legitimate peaceful applications, while those listed on Schedule 1 are today supposed to be used essentially for CW evaluation and protective purposes only.

Written material such as policy documentation, research notebooks and facility process control planning schedules and records of operation would, if available, indicate the nature of any given production (civilian or military) facility.

The above context is lacking in the public analyses of the al-Shifa case and may have been secondary to (or absent from) the internal US Government evaluation and decisionmaking processes.

Step 3. Prepare Matrices with Hypotheses

A matrix should be prepared which has 'diagnostic' value (i.e., it provides insight and understanding that either confirms or counters the prevailing wisdom).

Matrix Stockpiling

Question: Has the target (i.e., state or non-state actor) stockpiled chemical weapons?

Hypotheses:
H1 No stockpiling of chemical weapons [C=, I=, N/A=]
H2 Yes stockpiling of chemical weapons [C=, I=, N/A=]

	H1	H2
IR1. Does target have CW technical capacity (e.g. military, medical)?		
E.1 General publications aimed at domestic audience (**yes**)	I	C
E.2 ~~General publications aimed at domestic audience (no)~~	-	-
E.3 ~~Civil defence against CW policy documentation (yes)~~	-	-
E.4 Civil defence against CW policy documentation (**no**)	C	I
E.5 ~~Civil defence against CW technical guidance (yes)~~	-	-
E.6 Civil defence against CW technical guidance (**no**)	C	I
IR2. Is CW mentioned in military doctrine?		
E.1 ~~Defence against CW in civil defence context (yes)~~	-	-
E.2 Defence against CW in civil defence context (**no**)	C	I
E.3 ~~Defence against CW for military personnel (yes)~~	-	-
E.4 Defence against CW for military personnel (**no**)	C	I
E.5 ~~Civilian prophylaxis and/or countermeasures (yes)~~	-	-
E.6 Civilian prophylaxis and/or countermeasures (**no**)	C	I
E.7 ~~Military prophylaxis and/or countermeasures (yes)~~	-	-
E.8 Military prophylaxis and/or countermeasures (**no**)	C	I
IR3. Statements and similar communications		
E.1 Has leadership discussed CW matters? (**yes**)	N/A	C
E.2 ~~Has leadership discussed CW matters? (no)~~	-	-
IR4. Weight of evidence of integration of CW into military doctrine?		
E.1 ~~Publications indicate integration of CW (yes)~~	-	-
E.2 Publications indicate integration of CW (**no**)	C	I
E.3 Arms control policy statements against CW (yes)	N/A	N/A
E.4 Arms control policy statements for CW (yes)*	N/A	N/A
IR5. Interest in CW activities of others?		
E.1 ~~Discussion of CW threats posed by others (yes)~~	-	-
E.2 Discussion of CW threats posed by others (**no**)	C	N/A
IR6. Evidence of CW production?		
E.1 Laboratory scale synthesis of CW agents (yes)	?	?
E.2 Laboratory scale synthesis of CW agents (no)	?	?
E.3 CW production facility indicators (yes)	?	?
E.4 CW production facility indicators (no)	?	?
E.5 CW stockpiling indicators (yes)**	?	?
E.6 CW stockpiling indicators (no)	?	?
E.7 Documentation of production (yes)	?	?
E.8 Documentation of production (no)	?	?
E.9 ~~Documentation of stockpiling (yes)**~~	-	-
E.10 Documentation of stockpiling (**no**)	C	I
E.11 Availability of CW production material/equipment (**yes**)	N/A	C
E.12 ~~Availability of CW production material/equipment (no)~~	-	-
E.13 Availability of CW munition (yes)	?	?
E.14 Availability of CW munition (no)	?	?

Source: Author's adaptation of Heuer's ACH matrix. C=consistent, I=inconsistent and N/A=not applicable, IR=information request, E=evidence. *E.g., Some parties to the 1925 Geneva Protocol reserved the right to use CW if such weapons were first used against them. **The question is not a non-sequitor in the sense that, for e.g., overhead imagery might be available that suggests such stockpiling.

The cumulative scores are:
H1: C=9, I=1, N/A=4
H2: C=3, I=8, N/A=3

The matrix is not as well-suited for non-state actors as it is for state actors. The law enforcement nature of some of the non-state actor threat indicators can be better reflected through modified information request headings and associated evidence chains.

IR1. Does Target Have CW Technical Capability (e.g., Military, Medical)?

The sub-score for H1 is: C=2, I=1, N/A=0
The sub-score for H2 is: C=1, I=2, N/A=0

None of the evidence chains for this information request appear to be particularly applicable to a non-state actor context. It is not necessary and largely irrelevant for an AQ affiliate to generate CW civil defence policy and technical guidelines.

General publications aimed at the AQ audience such as *Inspire* and various blog sites do mention CW—as an occasional side topic. Threat pronouncements have also been issued for its opponents.

Because the evidence chains are so few and the civil defence questions are largely irrelevant, the numerical results lack meaning.

IR2. Is CW Mentioned in Military Doctrine?

The sub-score for H1 is: C=4, I=0, N/A=0
The sub-score for H2 is: C=0, I=4, N/A=0

The evidence chains are not especially suited (or applicable) to non-state actors. The key irrelevant terms include civil defence, civilian and military prophylaxis, and military personnel.

IR3. Statements and Similar Communications

The sub-score for H1 is: C=1, I=0, N/A=1
The sub-score for H2 is: C=1, I=1, N/A=0

As previously mentioned, there is a general AQ literature reflecting interest and capabilities on CW.

IR4. Weight of Evidence of Integration of CW into Military Doctrine?

The sub-score for H1 is: C=0, I=0, N/A=1
The sub-score for H2 is: C=1, I=0, N/A=0

Communications occur among and by leadership figures (e.g., in the AQ manual), and in a more decentralized space on the Internet.

Evidence chain should be longer (a higher ‘n’) in order to achieve more meaningful sub-numbers.

IR5. Interest in CW Activities of Others?

The sub-score for H1 is: C=0, I=0, N/A=0
The sub-score for H2 is: C=0, I=0, N/A=0

There appears to be no interest in CW activity of others except inasmuch as this might assist AQ affiliates. AQ affiliates are not concerned with such weapons being used against themselves.

IR6. Evidence of CW Production?

The sub-score for H1 is: C=0, I=0, N/A=0
The sub-score for H2 is: C=0, I=0, N/A=0

This IR is the heart of the case study. The evidence chains offer various formulations and aspects of the case study. The author has not particular 'answer' to the evidence chains. Nevertheless, some key questions include the following. If EMPTA was present at the facility, was it produced there and (if not) where did it come from? Also, was VX production at this facility technically feasible? EMPTA is a complex molecule that is not simple to manufacture. Even if this form of alcohol and EMPTA were both present, what was the reaction vessel used? Was a suitable reaction vessel ever identified?

Step 4. Refine the Matrix

The two main narratives are those of the owner of the pharmaceutical facility and the United States, respectively, at the time of the attack.[976] First, the rationale for the attack and the reaction by the owner and Sudan are reviewed.

The reasons and nature of the longstanding tensions between Sudan and the USA should be considered. In 1993 the United States designated Sudan as a state sponsor of terrorism. Osama bin Ladin lived in Sudan prior to his departure to Afghanistan in 1996. Also Sheik Omar Abdel Rahman (aka 'the blind sheik'), one of the perpetrators of the 1993 World Trade Center bombing in New York City, obtained at least one of his US visas in Khartoum.[977] The United States also suspected that Iran and Sudan had facilitated an attempted assassination of Egyptian President Hosni Mubarak while on a visit to Addis Ababa, Ethiopia on

[976] There has been a de facto attenuation, softening and backtracking of the US position, including the unfreezing of the owner's US assets.

[977] Rahman's travel to the USA, including the manner in which his visa applications were handled, are summarized in *Monograph on 9/11 and Terrorist Travel* (National Commission on Terrorist Attacks Upon the United States: Washington, DC, 2004), chap. 3 (Terrorist entry and embedding tactics, 1993 to 2001), pp. 49–52, <http://govinfo.library.unt.edu/911/staff_statements/index.htm>, (accessed 25 July 2013). Collected *New York Times* articles on Rahman are available at 'Omar Abdel Rahman news', <http://topics.nytimes.com/top/reference/timestopics/people/a/omar_abdel_rahman/index.html>, (accessed 25 July 2013).

26 June 1995.[978] Another possible motivating factor for the United States is that gunshots had been directed at US officials in the preceding 3 years.[979]

In 1996 the United Nations Security Council passed resolution 1044 in which it condemned the assassination attempt and called on Sudan to extradite without delay to Ethiopia three suspects located under its jurisdiction or control. On the basis of a March 1996 report by the UN Secretary-General (S/1996/179), the Security Council adopted resolution 1054 which inter alia imposed travel sanctions on Sudan. In August of that year the Security Council decided that states should deny aircraft permission to take off, land in or fly over their territories if the aircraft was registered in Sudan, or owned, leased or operated or substantially owned or controlled by Sudan or Sudanese public authorities.[980] In October 1997 the USA imposed comprehensive economic, trade and financial sanctions on Sudan.[981]

Rationale for the Attack

In 1991 Sudan introduced a visa free travel for Muslims who wished to enter the country.[982] This prompted a movement of former mujahedeen into the country, including 'hundreds of suspected terrorists' and bin Laden.[983]

In March 1995 two of bin Laden's associates followed a US embassy official in Khartoum.[984] In June 1995 Egyptian militants based in Sudan attempted to assassinate Hosni Mubarak.[985] US officials suspected that the then head of Sudan's security services was complicit in the assassination plot.[986] At about the same time, the CIA 'reported indications that Iranian operatives in Sudan were conspiring to attack US officials, although nothing came of that threat'.[987] In August 1994 Sudan turned Carlos the Jackal over to French authorities.[988] In September 1995 Sudan ended the visa free travel for citizens of Arab states.[989]

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978 Abdelkérim Ousman, 'The Potential of Islamist Terrorism in Sub-Saharan Africa', *International Journal of Politics, Culture, and Society*, vol. 18, nos. 1-2 (fall-winter 2004), p. 92.

979 Tim Weiner and James Risen, 'Decision to Strike Factory in Sudan Based Partly on Surmise', *New York Times*, 21 Sep. 1998, <http://theater.nytimes.com/library/world/africa/092198attack-sudan.html>, (accessed 18 Aug. 2013).

980 United Nations Sanctions Secretariat (Department of Public Affairs), *The Experience of the United Nations in Administering Arms Embargoes and Travel Restrictions*, paras. 43–45, pp. 11–12. Paper presented at *Smart Sanctions, the Next Steps: Arms Embargoes and Travel Sanctions*, Second Expert Seminar, Berlin, 3–5 Dec. 2000. Paper revised effective 25 Jan. 2001.

981 Embassy of the United States, Khartoum, Sudan, 'US-Sudan relations', <http://sudan.usembassy.gov/ussudan_relations.html>, (accessed 3 Jan. 2012).

982 Weiner and Risen (note 979).

983 Weiner and Risen (note 979).

984 Weiner and Risen (note 979).

985 Weiner and Risen (note 979).

986 Weiner and Risen (note 979).

987 Weiner and Risen (note 979).

988 Weiner and Risen (note 979).

989 Weiner and Risen (note 979).

In 1996 communication between Sudan and the United States deteriorated.[990] The US shut its embassy in Khartoum in February 1996.[991] On 8 March 1996 CIA and State Department officials reportedly met secretly with a Sudanese official in Washington, DC during which the US officials requested Sudan to turn over the names of over 200 bin Laden associates allowed into the country since 1994, information on Arab and Iranian opponents located in Sudan and the location of three Egyptians who were suspected in the plot to kill Mubarak.[992] In May 1996 Sudan expelled bin Laden from the country at the request of Saudi Arabia and the USA who then returned to Afghanistan.[993]

In February 1997, President Oman al-Bashir reportedly sent President Clinton a letter offering US intelligence and law enforcement officials to enter Sudan and 'to go anywhere and see anything, to help stamp out terrorism'.[994] The US reportedly did not respond to the letter.[995] In early 1998, Sudan made a similar offer to the Federal Bureau of Investigation (FBI), offering the bureau to send a law enforcement unit to Sudan, which the FBI declined to do four months later in June of the same year.[996]

The 'Small Group'

Another set of factors is related to Washington politics. The members of the small group, the key US Administration decisionmakers, included Sandy Berger and Madeleine Albright.[997] Berger and Albright were reportedly 'convinced that Sudan could be making weapons for bin Laden'.[998] One side (known as the 'isolators') wished to isolate Sudan, while the other side wished to engage the country. Susan Rice, who later became assistant secretary of state for African affairs, was also reportedly one of the isolators.[999]

According to one press report, 'Few national security issues in Clinton's presidency were handled with greater secrecy or by a smaller group of people. The administration was determined to avoid leaks, and that meant limiting deliberations to the "small group," the president's innermost circle'.[1000]

Attempts have been made to reconstruct how 'the small group' operated and came to its decision to attack the facility.[1001] It appears that various officials in the US government gave their views to Tim Weiner and James Risen, for example, who developed an 'unusually detailed glimpse at the complexities of making momentous decisions on the basis of shards of information gleaned from telephone intercepts, spies and scientific analysis'.[1002]

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990 Weiner and Risen (note 979).
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1002 Weiner and Risen (note 979).

The small group had several meetings. One was with President Clinton in the Oval Office on 12 August 1998.[1003] At this meeting Chairman of the Joint Chiefs of Staff General Hugh Shelton provided Clinton with a target list at this meeting.[1004] All the participants were reportedly in agreement that al-Shifa was the most suitable target on the list.[1005] Clinton approved the strike on 14 August.[1006]

Following the attack one administration official reportedly stated 'As an American citizen, I am not convinced of the evidence'.[1007]

The US had 'unconfirmed intelligence reports' in about 1996 that indicated that 'terrorists in Sudan were plotting' to kill Anthony Lake.[1008] Berger stated that the evidence for this was 'extremely convincing'.[1009]

One 'senior intelligence official' stated 'I don't have a piece of paper that says, in a wiring diagram', but argued that 'evidence plus inference' indicates that bin Laden was connected to the facility.[1010] In particular, US intelligence officials maintained that they had uncovered financial transactions between bin Laden and Sudan's Military Industrial Corporation.[1011] They also maintained that this corporation was 'overseeing chemical weapons development'.[1012]

One 'senior [US] official' reportedly stated 'Al Shifa was to one degree or another involved in chemical weapons production. I can't tell you whether the VX precursor was produced or stored there. But the plant is tied to Sudan's military-industrial complex, which is tied to bin Laden'.[1013]

Another US official stated 'The decision to target Al Shifa continues a tradition of operating on inadequate intelligence about Sudan'.[1014]

The US Government reportedly did not know who owned the facility at the time of the attack.[1015] The owner was Saudi businessman Saleh Idris, was an advisor to a Saudi bank.[1016]

The CIA believed that Osman Sulayman was the general manager of the facility and that he had been deported from Saudi Arabia in about 1995 because of his suspected ties to bin Laden.[1017]

Evidence in favour of the attack considered by the small group included:

> (*a*) a report from a 'sensitive source' that stated Osama bin Laden has requested 'Sudanese officials' to assist him to 'obtain chemical weapons that could be used against US installations';[1018]

[1003] Weiner and Risen (note 979).
[1004] Weiner and Risen (note 979).
[1005] Weiner and Risen (note 979).
[1006] Weiner and Risen (note 979).
[1007] Weiner and Risen (note 979).
[1008] Weiner and Risen (note 979).
[1009] Weiner and Risen (note 979).
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[1015] Weiner and Risen (note 979).
[1016] Weiner and Risen (note 979).
[1017] Weiner and Risen (note 979).
[1018] Weiner and Risen (note 979).

(*b*) for the preceding 18 months the CIA had been analyzing the facility.[1019]

It had obtained a soil sample from outside the facility which showed the presence of EMPTA.[1020]

CIA director George Tenet told five members of the small group that bin Laden had requested Sudanese leaders approximately three years previously to assist him in the manufacture of 'poison gas' to attack US troops stationed in Saudi Arabia.[1021]

A 'senior [US] intelligence official' was quoted as saying 'Bin Laden directly involved himself with the Sudanese government, trying to get it to test poisonous gases in case they could be tried against US troops in Saudi Arabia'.[1022]

One red flag to the USG regarding Sudan was bin Laden's arrival in Khartoum in 1992. In April 1994 Saudi Arabia stripped him of his citizenship.[1023]

One 'senior [US] administration official' who participated in a small group meeting reportedly stated 'We believed he was deep in a hunt for weapons of mass destruction, including chemical weapons. Was it safe to ignore that evidence? After very careful deliberation, it was decided, on balance, that it would be irresponsible of us not to attack the plant'.[1024]

The context in which the small group operated was one that had developed over several years of 'bitter disagreement within the administration about how to handle Sudan' after the USA had shortlisted the country as a 'state sponsor of terrorism'.[1025]

Walter Slocombe was Under Secretary for Policy at US DoD from September 1994-20 January 2001. His understanding of the pharmaceutical plant strike was that 'there was direct evidence linking the facilities to the VX precursor and whatever one thinks of that evidence, the subsequent evidence is that the plant was in fact controlled by someone linked to UBL'.[1026] In 9/11 Commission testimony Slocombe stated that the Monika Lewinsky scandal had no bearing on the Tomahawk strikes. He relates an NSC planning meeting prior to their recommendation that Operation Desert Fox proceed in which President Clinton entered the room (which was unusual). At the end of the meeting, Clinton said (according to Slocombe) 'well it is no secret that the house is planning to impeach me today. Does anybody think that changes their [sic] decision one way or the other?'.[1027] All responded that the scandal did not.[1028]

[1019] Weiner and Risen (note 979).

[1020] Weiner and Risen (note 979).

[1021] Weiner and Risen (note 979).

[1022] Weiner and Risen (note 979).

[1023] Robert Lacy, *Inside the Kingdom* (Arrow Books: 2010, Croydon), p. 177.

[1024] Weiner and Risen (note 979).

[1025] Weiner and Risen (note 979).

[1026] 'Memorandum for the Record (MFR) of an interview with Walter Slocombe of the Department of Defense Conducted by Team 3, 12/19/2003' (note 953), p. 3.

[1027] 'Memorandum for the Record (MFR) of an interview with Walter Slocombe of the Department of Defense Conducted by Team 3, 12/19/2003' (note 953), p. 3.

[1028] 'Memorandum for the Record (MFR) of an interview with Walter Slocombe of the Department of Defense Conducted by Team 3, 12/19/2003' (note 953), p. 3.

Reaction to the Attack

In 1998 the opposition Ummah party issued a statement that called on specialized UN agencies to check 'all suspicious sites and installations in Sudan, including the Shifa factor, which was attacked by US forces because it was suspected of producing material that could be used to manufacture chemical weapons'.[1029] The party was lead by former Sudanese Prime Minister Sadiq al-Mahdi and was part of the National Democratic Alliance coalition based in Eritrea.

One month after the attack, US officials 'conceded they had no evidence directly linking bin Laden' to the facility.[1030]

US Court Cases

The company and its owner have made at least three attempts to seek legal redress in US courts. The first was a 'takings claim' in the US Court of Federal Claims which was dismissed as 'posing a nonjusticiable political question'.[1031] The second was an administrative claim against the CIA under the US Federal Tort Claims Act (FTCA).[1032] The third claim was dismissed in March 2009 by a Washington, DC circuit court of appeals judicial panel which affirmed the dismissal of a suit against the US Government by El-Shifa Pharmaceutical Industries Company and Salah El Din Ahmed Mohammed Idris.[1033] The circuit court had concluded 'After the CIA denied the claim, plaintiffs filed this action against the United States under the FTCA seeking at least $50 million in damages for the government's alleged negligence and trespass in carrying out the attack. At issue on appeal are two further claims. The plaintiffs also sought declaratory judgments that the statements linking them to "Osama bin Laden, international terrorist organizations and the production of chemical weapons" were false and that the government's refusal to compensate them for the attack violated the law of nations. The district court granted the government's motion to dismiss plaintiff's complaint for lack of subject matter jurisdiction, concluding that sovereign immunity barred all plaintiff's claims. *El-Shifa Pharm Indus. Co. v. United States*, 402 F.Supp.2d 267, 270-73 (D.D.C.2005). The court also noted that the complaint "likely present[ed] a nonjusticiable political question." *Id*. at 276. Plaintiffs filed a motion to alter the judgment with respect to their claims for equitable relief, which the district court denied. *El-Shifa Pharm. Indus. Co. v. United States* No. 01-731 (D.D.C. Mar. 28, 2007).

[1029] Anonymous, 'Sudanese Opposition for UN Probe into "Suspicious Sites"', *BBC Monitoring Newsfile*, 21 Aug. 1998. BBC Monitoring Newsfile translation of MENA news agency (Egypt), (accessed via ProQuest database, Jan. 2012).

[1030] Weiner and Risen (note 979).

[1031] El-Shifa Pharm. Indus. Co. v. United States, 378 F.3d 1346, 1370 (Fed. Cir. 2004) cited in 'DC Circuit Finds Political Questions, Dismisses Sudan Pharmaceutical Plant Bombing Suit Reviewed Work(s)', *The American Journal of International Law*, vol. 103, no. 2 (Apr. 2009), p. 336.

[1032] 28 U.S.C. §1346(b) (2000) in 'DC Circuit Finds Political Questions, Dismisses Sudan Pharmaceutical Plant Bombing Suit Reviewed Work(s)' (note 1031), p. 336.

[1033] El-Shifa Pharm. Indus. Co. v. United States, No. 07-5174 (D.C. Cir. Mar. 27, 2009), cited in 'DC circuit finds political questions, dismisses Sudan pharmaceutical plant bombing suit reviewed work(s)' (note 1031), p. 336.

On appeal, plaintiffs challenge only the dismissal of their claims for equitable relief for defamation and under the law of nations. They restrict their defamation claim to statements about Idris and their law of nations claim to the refusal to pay compensation for the attack'.[1034]

The DC circuit rejected the damages claim stating 'President Clinton, in his capacity of Commander-in-Chief, fired missiles at a target of his choosing pursuant to a military objective he had determined was in the national interest. Under the Constitution, this decision is immune from judicial review.

Although plaintiffs attempt to distance their law of nations and defamation claims from the nonjusticiable question of why the President ordered the missile strike, both claims nonetheless present questions "inextricably intertwined" with the underlying decision to attack the El-Shifa pharmaceutical plant. Plaintiffs' law of nations claim asserts that under customary international law a state must compensate a foreign national for the unjustified destruction of property. Plaintiffs allege the United States violated this principle by failing to compensate them for the destruction of their plant. In passing judgment on this claim, the district court could not avoid becoming arbiter of the President's battlefield actions and would need to determine whether his decision to bomb the plant was justified.

The basic facts of the case as presently understood are summarized by a 2009 United States Court of Appeals for the District of Columbia Circuit decision which chose to 'treat the factual allegations in the complaint as true' because it was asked to review a grant of motion by the US Government to dismiss the case.[1035] One can assume that the basic facts as laid out in this decision do not contradict the fundamentals of what occurred. In August 1998 Osama bin Laden-directed network bombed the US embassies in Kenya and Tanzania. Several days later the United States destroyed the pharmaceutical facility. President Clinton publicly stated that the facility was terrorist 'base of operation' that was 'associated with the bin Laden network'. US Administration officials stated they believed (*a*) bin Laden financed the facility, (*b*) the facility was owned by the Sudan Military Industrial Complex Corporation, (*c*) the facility produced no commercial products, (*d*) the facility was 'involved' in the production of CW.[1036] The US Government stated that a soil sample taken from the facility contained EMPTA. The company and its owner argue that the US was incorrect on each point.[1037]

The US Government's position with respect to the legal proceedings brought on behalf of the owner has been that the case 'presents a nonjusticiable

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[1034] Unpublished opinion ('slip opinion') cited in 'DC Circuit Finds Political Questions, Dismisses Sudan Pharmaceutical Plant Bombing Suit Reviewed Work(s)' (note 1031), pp. 336–337, ref. 9.

[1035] 'United States Court of Appeals for the District of Columbia Circuit: El-Shifa Pharmaceutical Industries Co. V. United States', *International Legal Materials*, vol. 48, no. 4 (2009), pp. 831–840. Case no. 07-5174, identifier code 48 ILM 831 (2009), argued 7 Apr. 2008 and decided 27 Mar. 2009.

[1036] 'United States Court of Appeals for the District of Columbia Circuit: El-Shifa Pharmaceutical Industries Co. V. United States' (note 1035), p. 832.

[1037] 'United States Court of Appeals for the District of Columbia Circuit: El-Shifa Pharmaceutical Industries Co. V. United States' (note 1035), p. 832.

political question'.[1038] The plaintiffs attempted to distance their case from the nonjusticiable question by attempting to base their argument on the law of nations and defamation claims.[1039] However, the circuit court decided the questions raised are 'inextricably intertwined' with the underlying [executive or political] decision to attack the facility.[1040] The law of nations argument is based on customary international law which obliges a state to compensate a foreign national for the 'unjustified destruction of property'.[1041] The circuit court decided that to agree to apply customary international law in this manner would effectively make the court the 'arbiter of the President's battlefield actions' and that it would have to 'determine whether his decision to bomb the plant was justified' and, in particular, whether the plant was a CW facility and, by extension to act as a 'forum for second guessing the merits of [US] foreign policy and national security decisions.[1042]

The company and owner argued:

> *'Administration officials incorrectly stated the claim that Osama bin Laden financed the plant, that the plant was owned by the Sudan Military Industrial Complex Corporation, made no products for commercial use, and was involved in the production of chemical weapons, all justifications given for striking the plant. Even after Administration officials learned that their initial justifications were incorrect, they offered a new false explanation that described Idris (the owner of the plant) as a friend and supporter of terrorists by involvement in money laundering and representing Osama bin Laden's interests in Sudan'*.[1043]

Sampling and Analysis Issues

The focus on refining the matrix should be on sampling and analysis. The samples obtained by the United States that served as a basis of the attack were taken surreptitiously and appear not have been analysed at the US's principal CW analytical facilities—operated by the Army. Rather the sampling and analysis was carried out (and perhaps on behalf of) the CIA.[1044] It is unclear whether internationally validated sampling and analysis protocols were employed (or possible). The United States maintained that its analysis of these samples showed the presence of O-ethyl methylphosphonothioic acid (EMPTA). The

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[1038] 'United States Court of Appeals for the District of Columbia Circuit: El-Shifa Pharmaceutical Industries Co. V. United States' (note 1035), p. 832.

[1039] 'United States Court of Appeals for the District of Columbia Circuit: El-Shifa Pharmaceutical Industries Co. V. United States' (note 1035), p. 833.

[1040] 'United States Court of Appeals for the District of Columbia Circuit: El-Shifa Pharmaceutical Industries Co. V. United States' (note 1035), p. 833.

[1041] 'United States Court of Appeals for the District of Columbia Circuit: El-Shifa Pharmaceutical Industries Co. V. United States' (note 1035), p. 833.

[1042] 'United States Court of Appeals for the District of Columbia Circuit: El-Shifa Pharmaceutical Industries Co. V. United States' (note 1035), p. 833.

[1043] El-Shifa Pharm. Indus. Co. v. United States, 559 F.3d 578, 581 (DC Cir. 2009) cited in 'Introductory Note to the United States Court of Appeals for the District of Columbia Circuit: El-Shifa Pharm. Indus. Co. Et Al. V. United States' (note 1035), p. 829.

[1044] An indication of this is provided in Anonymous, 'Albright and Top Aide Killed Critical Report', *New York Times*, 27 Oct. 1999, p. A14, accessed via ProQuest Historical Databases. A US contractor performed the analysis. Personal communication, Sep. 2013.

analysis arranged by Dr Tullius, however, appears not to support this conclusion. The United States progressively became more equivocal in its statements regarding whether the owner or the facility was engaged in any CW-related activity. Eventually the United States unfroze the owner's assets without admitting guilt or liability. The owner continued to pursue legal proceedings against the United States through at least 2009 (see above).

Chairman of Kroll Consulting for Europe and the Middle East Tommy Helsby observed that Kroll accepted a contract by the owner of Al-Shifa to investigate whether the facility had produced chemical weapons. 'I don't think the US government was very happy about, but as a big US company, we were comfortable with it. A little company could have done it and not worried about the fallout from criticism by the US government, but then their name would not have carried the weight ours did when we submitted our report'.[1045]

It should also be noted that the United States decision was taken in a broader context of political tension between it and the Sudanese government, strong US concern regarding suspected ties between al-Qaeda members (including Osama bin Laden) and Sudanese officials, and possible links between al-Qaeda members and Iraqi officials. A US intelligence community assessment judged the facility to be carrying out CW-activity. However, the Department of State's INR did not agree.[1046] Most of the information about this case comes from media reports. Many (or even all) of the so-called 'small-group' of Clinton Administration advisors appear to have had non-technical and non-scientific backgrounds.

Authoritative public information regarding the role of Kroll and Associates, and Dr Tullius remains insufficient. One can speculate that some of the classified internal US Government archives presumably provide a more or less complete picture of these events and their implications for intelligence analysis. Nevertheless is it also possible that organizational preferences and personality conflicts skew the conclusions of some of this documentation. Even after all relevant documentation is declassified several decades hence, it is probably safe to conclude that some aspects will be lost to history. This is because written records do not fully reflect all discussions and interactions. Conversely, post-action analyses may reflect hindsight biases.

The *New York Times* was quoted as saying that 'the crucial soil sample' was taken not from the facility itself, but approximately 20 meters away from across an access road and that the sampling had been carried out in December 1997—approximately 4 months prior to Saleh Sidris purchased the factory.[1047]

At the UN General Assembly on 30 September 1999 the Sudanese Foreign Minister called for the UN to send a fact-finding mission to the site.[1048]

Prior to the attack the Department of State's Bureau of Intelligence and Research (INR) concluded that the evidence linking al-Shifa to UBL and CW was weak.[1049]

[1045] Anonymous, 'Kroll', *Spears Indices*, Sep. 2008, <http://www.spearswms.com/spears-indices/security-index/546/kroll.thtml>, (accessed 2 June 2013).

[1046] Anonymous, 'Albright and Top Aide Killed Critical Report' (note 1044).

[1047] Anonymous, 'News Chronology', *The CBW Conventions Bulletin*, no. 46 (Dec. 1999), p. 37.

[1048] Anonymous, 'News Chronology' (note 1047), p. 31.

[1049] Anonymous, 'News Chronology' (note 1047), p. 37.

According to one press report, US officials were not certain if the EMPTA was manufactured at the facility, stored there or shipped through the facility.[1050] This report, however, does not include the possibility that the soil sample analysis yielded a false positive result.

Step 5. Draw Tentative Conclusisons About the Relative Likelihood of Each Hypothesis

A key question is whether information is sufficient to permit accurate or otherwise useful ananlysis. Another important point is whether one should lean towards the 'worst case scenario' or remain passive until positive proof or strong evidence points to one hypothesis being correct over the other(s).

This facility was constructed with the assistance of Western firms and onsite technical support staff. At least one of these technical support personnel strongly disagreed that the facility was producing VX or even had the technical capability to produce it. The facility was configured for as a mixing and packaging plant. It would be useful to clarify whether the United States did check with such officials prior to taking the decision to attack. A member of a UN peacekeeping unit in Sudan visited the al-Shifa site and took photos of a medicine box, an amoxonil bottle, as well as the remains of the facility and missiles.[1051]

Step 6. Analyze Sensitvity of Conclusions

Critical items of evidence may also serve as the 'milestones'. The conclusion is that either hypothesis may be correct. 'Thinking backwards', the 'crystal ball', 'role playing' and playing 'devil's advocate' do not appear to be relevant to this case.

Critical items include: Were the samples spiked by parties unknown (if so, how and why)? Also are there Western assumptions of steps a programme might take that are not necessarily applicable to all actors?

Several thought patterns are apparent. Those who opposed the strikes have tended to emphasize the role of validated sampling and analysis protocols. Those who supported the strikes have emphasized the importance of the totality of the information, including from human sources.

Step 7. Report Conclusions

According to Toby Gati, 'Shortly after I left government, the Clinton administration bombed the Al-Shifa pharmaceutical factory in Sudan in 1998. This proved to be a mistake. I had read an independent analysis that showed it was a mistake. This separate analysis was offered to the US government and to the intelligence community, but they refused to take it. They did not want to look

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[1050] Weiner and Risen (note 979).

[1051] Yannick Lemieux, 'The Al-Shifa Pharmaceutical Factory', <http://ptaff.ca/al-shifa/?lang=en_CA>, (accessed 25 July 2013). Blog entry. The author appears to be a Canadian military officer who was posted to Sudan by the UN in 2005.

at it, did not want to analyze it, did not want to have anything to do with it'.[1052] Gati, who was the former US National Security Council (NSC) Senior Director of Russia, Ukraine, and Eurasian Affairs and worked as an Assistant Secretary of State for INR at the Department of State in 1993-1997, may be referring to a report that was sub-contracted by Kroll Associates.[1053]

Milt Bearden, who worked as CIA station chief in Sudan in the mid-1980s, stated 'Look, if you've got intelligence sources that matters to protect, don't worry about it. Bite the bullet, lay the intelligence on the table'. And 'If you've got to move somebody up for safety, do that, but lay it on the table now. Let us see it. This is not going to go away. The doubts are not just lingering, they're growing'.[1054]

The US Department of State Sudan embassy website, as of January 2012, refers to the 1998 attack as follows: 'In August 1998, in the wake of the East Africa Embassy bombings, the US launched cruise missile strikes against Khartoum'.[1055] No further context is provided.

Step 8. Identify Milestones

The further declassification and release of information by Kroll Associates, Sudan and the US Government constitute, in a sense, 'milestones'.

In January 1996 the CIA reportedly formally withdrew over 100 reports on Sudan, many of which dealt with threats against US nationals in Sudan, after concluding that they were based on information provided by a single source who had provided the agency with false information.[1056] This occurred shortly after the US had withdrawn many (perhaps all) of its diplomats and intelligence officials from the country.[1057] This included shutting down the CIA station in Sudan.[1058] According to one press report, 'In late 1995, the CIA realized that a foreign male agent who had warned repeatedly of startling terrorist threats to US diplomats, spies and their children in Khartoum was fabricating information'.[1059] A second CIA source warned in 1995 that Lake was targeted for assassination by 'terrorists based in Sudan'.[1060] Following the report, Lake reportedly moved to the Blair House and then to an undisclosed location for safety.[1061] One Clinton administration official stated that 'The threat to Tony Lake had a chilling effect

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[1052] Elizabeth Rindskopf-Parker, Richard Goldstone, Toby Gati, M. E. 'Spike' Bowman, Douglas Feith and Kevin Whitelaw, 'Intelligence and the Use of Force in the War on Terrorism', *Proceedings of the Annual Meeting (American Society of International Law)*, vol. 98 (31 Mar.-3Apr. 2004), p. 152.

[1053] Elizabeth Rindskopf-Parker, Richard Goldstone, Toby Gati, M. E. 'Spike' Bowman, Douglas Feith and Kevin Whitelaw (note 1052), p. 148.

[1054] Oriana Zill, 'The Controversial US Retaliatory Missile Strikes', PBS Frontline, <http://www.pbs.org/wgbh/pages/frontline/shows/binladen/bombings/retaliation.html>, (accessed 3 Jan. 2012).

[1055] Embassy of the United States, Khartoum, Sudan, 'US-Sudan Relations' (note 981).

[1056] Weiner and Risen (note 979).

[1057] Weiner and Risen (note 979).

[1058] Weiner and Risen (note 979).

[1059] Weiner and Risen (note 979).

[1060] Weiner and Risen (note 979).

[1061] Weiner and Risen (note 979).

on the National Security Council'.[1062] However, the source of the assassination threat was not 'verified or corroborated'.[1063] The possibility that such personal threats may have had on White House deliberations should be noted.

14.5. Implications

One question regarding response strategies to al-Qaeda is whether to modify policy if some individuals act against 'official' al-Qaeda policy. For example, if it is determined that al-Qaeda policy is not to engage in certain types of activities, and a person claiming to be acting on behalf of al-Qaeda does engage in such types of activity anyway.

A differentiation challenge for AQ exists in the sense that external communication and response strategies are not necessarily consistent with those necessary (or perceived to be necessary) to maintain internal ideological coherence.

National Security Advisor Sandy Berger told PBS Frontline 'Well, I believe we had solid knowledge that this facility was associated with chemical weapons'.[1064] The day following the strike he was quoted as saying the facility was 'producing chemical weapons'.[1065]

The US news investigative organization Frontline identified two major problems with the US case. 'First, a test on a soil sample that the administration says proves the plant was involved in chemical weapons production is, according to many experts, inconclusive. The chemical which was found, Empta, is a precursor to create nerve gas. But, experts say, Empta breaks down quickly and can be confused with other less harmful chemicals. Despite repeated tests by others, including lawyers for the plant owner, there have been no independent confirmations of the US government's soil test'.[1066] Frontline went on 'Secondly, the Clinton administration has failed to demonstrate a solid financial link between the plant and bin Laden. They initially claimed that the plant was owned by the Sudanese Military Industrial Corporation, yet the plant had actually been sold to a Saudi millionaire, Saleh Idris, several months before the attack. The private investigative firm of Kroll and Associates has found no solid financial link between bin Laden and Idris'.[1067]

According to one estimate, the facility produced more than half of the country's human and veterinary medicines, including drugs against cholera, malaria and tularemia.[1068] People involved in the construction of the plant included a UK engineer from Hexham, England. He helped to construct and equip the facility and worked there as a technical manager for 4 years and who claimed that the facility did not have the equipment necessary to produce VX. The engineer was subsequently interviewed by UK television that also showed

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[1062] Weiner and Risen (note 979).
[1063] Weiner and Risen (note 979).
[1064] Zill (note 1054).
[1065] Zill (note 1054).
[1066] Zill (note 1054).
[1067] Zill (note 1054).
[1068] Ousman (note 978), p. 96. Ousman does not provide any source for this information.

footage of some of the equipment.[1069] Implications for strategic analysis and IR theory are provided in Chapter 15.

[1069] Sean Gabb, 'International Terrorism and Sudan: a Brief Discussion', The Sudan Foundation (1997), <http://www.sufo.demon.co.uk/fact004htm> (dead link). Ousman (note 978), ref. 128. Gabb, a former director of the Sudan Foundation, is a British libertarian. The website is delinked. His personal website is <http://www.seangabb.co.uk/>, (accessed 25 July 2013). Also personal communication, Sep. 2013.

PART IV

ANALYSIS AND CONCLUSIONS

15

TOWARDS A STRATEGIC THEORETICAL APPLICATION OF ACH IN THE ASSESSMENT OF POTENTIAL CHEMICAL WARFARE ACTIVITIES IN ARMS CONTROL AND INTELLIGENCE STUDIES

This study considers whether the application of a hybrid, qualitative and CW-focused formulation of ACH directed towards arms control verification and intelligence practice can inform a strategic and defence analysis, including with respect to neoliberal institutionalism and realism. As previously mentioned, ACH tends to focus on procedure, process and technique, rather than on achieving a broader understanding of the behaviour of states and policies to maintain and strengthen international peace and security. This reflects a continued gap between intelligence practice and academic theory.[1070]

The case study results are summarized. Then the variation of ACH as developed by this study is considered in terms of the research questions posed earlier:

(*a*) the motivations of actors to pursue CW programmes and activities,

(*b*) the relevance of the present study for strategic and defence studies,

(*c*) ways to integrate ACH into arms control verification, and

(*d*) the identification of major elements of a strategic theoretical application of ACH in arms control verification and intelligence analysis.[1071]

In so doing, the gap between intelligence art and academic theory is narrowed.

15.1. Case Study Results

ACH has been applied to three case studies that demonstrate operational aspects of intelligence analysis and arms control verification. Important linkages to policymaking, including for international peace and security, have been highlighted. All are hindsight analyses having continued analytical—including theoretical—relevance. The explanatory and predictive capacity of this model is tested against three case studies. Major attributes and analytical implications include the following.

1. **Soviet case study**. This is a classical strategic military intelligence analysis application. It is a traditional intelligence 'mystery'[1072] that later helped to inform strategic nuclear force analyses and IR deterrence theory.

[1070] Marrin (note 19).

[1071] See Chapter 1.

[1072] See Table 6.5.

Contemporary relevance for analytical techniques includes the role of cognitive biases, and lessons-learned during the Cold War and post-Cold War periods.

2. **Iraq case study**. This is a 'non-standard' arms control verification case (i.e., multilateral arms control in a non-cooperative environment backed by implicit—sometimes explicit—threat of military force).[1073] It is of historical, and contemporary analytical relevance. It has elements of both an intelligence 'mystery' and 'puzzle'.[1074] It presents two distinct CW assessment processes: a state-based intelligence process that took a mainly worst-case scenario approach (within the context of a broader preferred political policy preference to attack Iraq) *versus* a more legally-nuanced and politically ambiguous scenario assessment process (with a potential attendant risk of the 'lowest common denominator' of acceptable reporting being generated). The former assessment process was driven to an extent by the classical 'cost of failure' and 'no time' factors that are often encountered in intelligence assessments production.[1075]

Fingar observes that while worst-case scenario planning in intelligence estimates is appropriate for military planning purposes, it can be counterproductive when applied to 'nonmilitary issues'.[1076] He cites the 2002 US NIE on Iraq as an example where the worst case scenario approach was counterproductive because the context in which the main question to be addressed was posed ('What do we know about Saddam's WMD capabilities and intentions?') was, in practice, transformed into a military capabilities question due to the political atmosphere of Washington at the time which was one of preparing for war.[1077] Thus, for example, unless the probability that Iraq had chemical weapons was zero, it was difficult for the US intelligence community to minimize or exclude the possibility of their existence or use against US forces.[1078]

3. **Non-state actor case study**. This is a law enforcement target and military intelligence case within the context of what, during the Administration of George W. Bush, became the US-led global war on terror (GWOT) policy context. The case has more the character of an intelligence mystery. As with the Iraq case study, it exhibits the dichotomy between inconsistent and potentially competing—in terms of purpose and narrative—assessments by state intelligence services and multilateral arms control verification assessments, respectively. The national intelligence assessments were perhaps mainly predicated on the assumption that an adversary must be defeated, while the multilateral arms control verification process would have been at least partly informed by a desire by the international legal regime (with support or opposition of some states) to bring a targeted state's behaviour into compliance with international law (after first confirming the non-compliance).

The al-Shifa case was also a non-standard intelligence target in that a mix of state and non-state actors were looked at in the assessment process. In a somewhat similar manner to Iraq, the verification task was heavily informed by

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[1073] The two other main cases are Germany in the post-World War I period, and the 2013 developments regarding the internationally verified destruction of CW in Syria.

[1074] See Table 6.5.

[1075] Ben-Israel (note 407).

[1076] Fingar (note 25), p. 72.

[1077] Fingar (note 25), pp. 73–74.

[1078] Fingar (note 25), p. 74.

sampling and analysis (which ought not be be susceptible to misinterpretation motivated by political preferances, but was also not the sole basis for the net US assessment) having longer-term relevance to both national intelligence and multilateral arms control verification. As with Iraq, this case displays an interaction between various international actors where CW production is alleged. Two key questions in this regard include the extent to which arms control regimes (such as the UN Secretary-General investigative mechanism, and the OPCW) can or should be engaged. How, for example, can or should national security priorities shape or prevent such engagement? More generally how can national, regional and international security priorities interact with arms control regimes and other international legal norms in the consideration of whether and how to use military force?

Assessments for all three cases have almost certainly been occasionally hampered by a lack of understanding of organizational and national cultures. All arms control verification and national intelligence assessments are subject to varying degrees of uncertainty in the absence of a 'smoking gun' proving non-compliance.[1079]

15.2. Motivations

This study provides no clear insight into motivations of states and non-state actors to acquire or use chemical weapons. This suggests the hybrid form of ACH presented here is not suited to addressing this question. It rather provides a structured method to achieve iterative improvements in understanding of a state or non-state actor's capabilities and intentions.

It also assists in providing a better understanding of the specific types of threats posed by non-state actors. Andreas Wenger and Alex Wilner observe, for example, that in order to improve understanding of whether and how terrorism can be deterred requires *inter alia* 'mapping the interaction effects between the processes of deterrence and terrorism'.[1080] This is because the 'logic of terrorism' and that of traditional deterrence are distinct. Deterrence of non-state actors is only one pillar of overarching counter-terrorism strategies. There may be trade-offs between, and feedback loops and various other interactions among the pillars as the overarching strategy is implemented.[1081] A CW application of ACH can, in principle, help to inform analyses of how such pillars might be best carried out for various non-state actors who contemplate the use or threat of use of such weapons. Such an application of ACH could also help to inform the nature of the interaction effects between the logic of terrorism and the logic of traditional deterrence (the latter being mostly done in the Cold War nuclear weapons context).[1082]

The incentives for states to pursue offensive CW programmes continue to shrink. This is partly reflected by the fact that the CWC currently has 190

[1079] Allan S. Krass, *Verification: How Much is Enough?* (Taylor & Francis: London, 1985).

[1080] Andreas Wenger and Alex Wilner, 'Deterring Terrorism: Moving Forward', p. 315 in Wenger and Wilner (note 290).

[1081] Andreas Wenger and Alex Wilner, 'Deterring Terrorism: Moving Forward', p. 315 in Wenger and Wilner (note 290).

[1082] Andreas Wenger and Alex Wilner, 'Deterring Terrorism: Moving Forward', p. 315 in Wenger and Wilner (note 290).

member states all of whom—in the view of the membership overall—are largely in good standing of their treaty obligations.[1083] More specifically, CWC implementation has resulted in one initially undeclared stockpile being declared by Libya (following quiet pressure by other CWC States Parties), an internationally unsuspected stockpile being subsequently declared by Albania (at a half-forgotten storage site constructed by the previous regime), and a number of informal consultations among the member states that have generally been satisfactory to the parties concerned regarding the completeness and accuracy of declarations made to the OPCW. More generally, CW are usually viewed as obsolete and unethical for inclusion (overtly or otherwise) in states' military doctrines.

In addition, 'new wars' tend to be mobile and dispersed. As such, the type of CW agents of interest and associated doctrine could be closer to the requirements of special forces operations (which may not require 'lethal' agents). Some states have contemplated eliminating their military forces altogether in favour of upgraded police units, while other states have, in effect, militarized their police units in terms of equipment and training.[1084]

More broadly, the main future focus of ACH with respect to states should, in practice, be on the potential risk that some states may attempt to retain a standby offensive CW programme or that S&T developments will result in the development of non-standard chemical and/or biological warfare agents. ACH is well-suited to these analytical tasks in that it assists in clarifying the various ambiguities associated with distinguishing defence and offensive programmes and activity, respectively. This partly assumes that the matrices are reasonably comprehensive and manageable for either a single analyst or larger cooperating groups of analysts.

John Hirst argues that states are more likely to obey international norms and regulations and that they are the 'main vehicles for political accountability' and the 'principal means whereby international agencies can be supervised'.[1085] He also argues that the state donates legitimacy upwards and downwards, including to UN-type organizations and their associated legal regimes (which possess normative behavioural objectives both stated and de facto or implicit).[1086] Efforts by states to engage in deterrence or behaviour modification against non-state actors may have limited effect in view of the fact that the international legal system has been developed and implemented in an inter-state context. Nevertheless, efforts made within the multilateral arms control and strategic trade controls context have devoted much attention since 2001 to trying to ensure that international legal obligations are effectively implemented, including with respect to non-state and transnational actors.

[1083] Two longstanding relevant points here is the distinction between a technical and fundamental treaty violation, and whether a single serious violation is sufficient to fundamentally undermine the treaty regime.

[1084] See, for e.g., Georg Mader, 'Defence Minister: Austrian Military Unaffordable', *Jane's Defence Weekly* (2 Apr. 2014), p. 16.

[1085] Paul Hirst, *War and Power in the 21st Century* (Polity Press: 2001 (reprinted 2004), Oxford), p. 132.

[1086] Hirst (note 1085), p. 133.

15.2.1. Addressing Religously-inspired Non-state Actor Threats in the Context of the Third Case Study

The principal ideological point with which to counteract militant Islamism is on religious legitimacy. Saudi Arabia maintains such a programme in its prison population. The reading of novels and philosophy can also undermine strict Wahhabists' faith. The latter because, as Salafists themselves state, philosophy 'does not accept the overriding authority of God and His law'.[1087] For example, in 1993 Mansour Al-Nogaidan was released under a Saudi pardon after serving less than 2 years of a 16-year sentence for the bombing of a video shop. He reluctantly agreed to look at a book offered to him by his half-brother: *Construction of the Arab Mind*, by Mohamed Abid Al-Jabiri. Al-Jabiri, of the Al-Azhar religious university in Cairo, compares the Koran with philosophical ideas from classical Greek and Persian philosophical works.[1088]

Salman Rushdie has characterized 'fundamentalist Islam' as 'highly-politicized, very radical interpretation of Islam'.[1089] The rhetoric must be counter-acted by the Muslims as well as the means of dissemination, including the indoctrination from madrassas whom Rushdie has labeled 'the seedbed'. Terrorist main players are generally middle class (not poor or 'uneducated' per se).[1090] Atran argues that violent Islamic-inspired groups have tended to become less educated over time.

Some efforts to assess CW threats posed by non-state actors is based on analysis of Internet traffic, including attempts to uncover social networks. Non-state actors are often decentralized. This includes attempts to identify key players, who are often lower level such as drivers and guides. Low-level people may be prominent in social networks because of the degree of their 'connectiveness'. Attempts have been made to discover the 'structural signatures' that indicate the degree of 'connectiveness' of group participants. This includes tracking short phone calls sent just prior to or just after an operation is taken.[1091]

The Internet has facilitated the Islamist recruitment, strategy development and attack planning. It should be noted that some Islamic authorities have issued fatwas against the use of the Internet at all.[1092] However, the Internet is also a powerful (and perhaps overlooked) tool of surveillance. It can allow governments, companies and individuals to probe widely and deeply into the actual and possible political views and habits of individuals (e.g., expenditure, travel, associations). The Internet also provides AQ-sympathizers an opportunity to challenge the orthodoxy of the leading figures of the movement. The Internet is allowing individuals to more easily and systematically review all the major (and minor) strands of Islamic jurisprudence and historical events. This poses a challenge, in particular for separating religious commands contained in the Koran

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[1087] Lacy (note 1023), p. 175.

[1088] Lacy (note 1023), pp. 174–175.

[1089] Salman Rushdie, Interview by Allan Gregg (Oct. 2002), <http://www.youtube.com/watch?v=_LdgehMw3r4>, minute 7.27, (accessed 8 July 2013).

[1090] Rushdie (note 1089), minute 11:00.

[1091] 'Untangling the Social Web' (note 231), p. 13.

[1092] Anonymous, 'Islam and Technology: the Online Ummah', *Economist*, vol. 404, no. 8798 (18–24 Aug. 2012), p. 47.

and the Hadith from tradition (i.e., practice), to established religious authority.[1093]

One possible (proxy) indicator of a shift away from violent extremism is the degree to which alchohol is accepted or even religiously sanctioned.[1094] Another proxy indicator for this could be the nature and extent of alchoholism in Muslim majority countries.

Finally, Omand provides an illustrative list of the type of protected but unclassified information that can be useful to those investigating non-state actors (see Table 15.1).

Table 15.1 Relevant data type for the evaluation of non-state actor threats

-The identities, and aliases, of those suspected of supporting or engaging in terrorism and their past personal history and criminal record.
-Biometric details identifying the root identity of terrorist suspects.
-The location of terrorist suspects.
-Their patterns of behaviour and association.
-The aspirations and operational planning of suspected terrorists.
-Their modus operandi for attacks.
-Their counter-surveillance understanding and measures they take.
-The movements of suspected terrorists.
-The logistics, training and financing of their networks.
-Uncovering their target reconnaissance and target selection.
-Recruitment and communication activities including active use of the internet.
-The belief systems of terrorist groups.
-The attitudes and policies of other relevant countries.
-Mutations, developments and fissures in the threat.

Source: David Omand, *Securing the State* (Hurst & Company: London, 2010), p. 29.

15.3. Relevance for Strategic and Defence Studies

ACH must contribute to *interpretation* and *generalization* of data.[1095] ACH should also ideally permit the development of useful hypotheses, as well as the testing of generalizations (as social science should permit more broadly).

A fundamental methodological difficulty in the social sciences is the dichotomy between 'individualizing' *versus* 'generalizing'. The generalizing principles are progressively undermined as one more closely evaluates specific cases. Therefore, intervening variables must increasingly be added to the analysis as one 'drills down' into the specifics of case studies. Adding such variables—which function as caveats to the general 'principle' or 'law' being developed—undermines the 'generalizability' of the analysis at the higher strategic or theoretical level. When academics and government analysts work with the same information (i.e., the existence of classified information does not result in the two communities using different data sets or information bases), this dichotomy of

[1093] Anonymous, 'Islam and Technology: the Online Ummah' (note 1092), p. 47.

[1094] For a summary of alcohol consumption patterns, alcholism and the potential acceptability of drinking beer and hard spirits in Muslim majority, see Anonymous, 'Islam and Alchohol: Tipsy Taboo', *Economist,* vol. 404, no. 8798 (18–24 Aug. 2012), p. 48.

[1095] The importance of interpretation and generalization are emphasized by Knorr in his discussion about the perceived lack of relevance of the social sciences in the [US] intelligence community in the early 1960s. Knorr (note 6), p. 12.

individualizing and generalizing is perhaps the principal reason for the gap between intelligence practice (and relevance) and academic research.

Thus, Marrin observes:

> *'Even though the benefits of these kinds of structured analytic techniques have yet to be proven, and many analysts do not use them for a variety of different reasons, teaching these structured methods could be beneficial since having a structured approach to assessing a problem is better than no structure at all. In terms of teaching, there is value to familiarizing analysts and future analysts with the rudimentary science of the field. But it is also important to take a step back and ask how structured intelligence analysis should be, and whether or not that structure will actually lead to improved analysis. While there may be benefits to the teaching of structured analytic techniques, in terms of practice or application the approach should be more circumspect. In particular, mandating use of structured methods is problematic given the general intuitive approach that analysts use and the relative pausity of data showing that structured techniques would improve accuracy. Instead, more time, money, and effort should be devoted to developing the capacity to evaluate the utility of these approaches rather than just to developing, teaching, or using them'.*[1096]

Conversely, any principles (or 'laws') developed at the higher strategic or theoretical level tend to lose their applicability or relevance when (or if) they are applied to actual cases so as to reflect operational aspects of the intelligence cycle and the like.

Giovanni Sartori recommends that this problem of relating universals to particulars be addressed by organizing categories of the analysis along a 'ladder of abstraction' which connects upward aggregation and downward specification.[1097] This results in an inverse relationship between two types of concepts: those which are mainly characterized by connotation (intension) and those that are mainly characterized by denotation (extension).[1098] At the strategic or theoretical level, the characteristics and properties of the concepts should be reduced. The analysis at the case study level should, by contrast, be 'contextually adequate'.[1099]

In a similar vein, Knorr states: 'While the social scientist forms general hypotheses about classes of events, the intelligence officer must form particular hypotheses about a concrete stream of events'.[1100] For the intelligence context, Knorr cites four characteristics of theoretical work in the social sciences that are directly relevant to intelligence requirements:

[1096] Marrin (note 19), pp. 79–80.

[1097] Giovanni Sartori, 'Comparing and Miscomparing', p. 159 in Eds. David Collier and John Gerring, *Concepts and Method in Social Science: the Tradition of Giovanni Sartori* (Routledge: London, 2009).

[1098] Giovanni Sartori, 'Comparing and Miscomparing', p. 160 in Collier and Gerring (note 1097).

[1099] Giovanni Sartori, 'Comparing and Miscomparing', p. 160 in Collier and Gerring (note 1097).

[1100] Knorr (note 6), p. 26.

> (*a*) the interpretation of data seeks to replace intuition and 'common sense' with new and 'more sophisticated' concepts and tested hypotheses,
> (*b*) the social scientist engages in prediction when he or she attempts to state and explain why two or more variables are necessarily associated,
> (*c*) the social scientist begins by observing actual events, selecting variables of interest and which (if successful) are 'critical' in explaining a large number of variables in a class of events, and
> (*d*) resorting to the abstract increases the generalizibility of the analysis but often at a cost of making it less useful to policymakers and intelligence officers.[1101]

ACH acts as such a 'ladder of abstraction'—both qualitatively and quantitatively. It also adds 'contextual adequacy' to the case studies.

15.4. Integration of ACH into Arms Control Verification

A key factor to the possible integration of any intelligence assessment methodology is its political acceptability in the multilateral arms control and disarmament context. To an extent, this sensitivity can be met through the use of alternate terminology. To suggest this implies avoiding explicit discussion of national intelligence and such terms must probably be avoided. The acceptability of such a methodology is also dependent on how such a system is introduced within this environment procedurally. Its application could, for example, be employed for background information and training purposes, while analyses of actual cases could be produced under the responsibility of individual member states subject to a secretariat validation or review process.

Acceptability of analytical techniques and how they are used to inform higher-level geopolitical analysis within international treaty regimes is also a function of implementation practice. The former ACDA legal advisor Thomas Graham Jr. argues:

> *'Under generally accepted rules of international law on treaty implementation, treaties are interpreted on the basis of the language of the text, and where the treaty language is ambiguous the treaty language should be understood as reflected by the practice of the parties in implementing the treaty, referred to as "subsequent practice." Recourse can be had to the negotiating record only on a secondary basis to help clear up issues that the treaty text and subsequent practice do not resolve. Subsequent practice under international law is considered far more authoritative than the negotiating history, since practice reflects the understanding of [the] states as they carry out their obligations, while all negotiating records are by their nature somewhat confusing. As the ebb and flow of the discussion goes on, different people record this or that in their own way'*.[1102]

Graham also supports the position that under international legal rules, treaties are 'interpreted on the basis of plain meaning of the text in light of any

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[1101] Knorr (note 6), pp. 13–16.
[1102] Graham Jr. (note 284), pp. 152–153.

subsequent practice'.[1103] Within the CWC context, a dichotomy exists between those who refer to the intent of the drafters of the treaty and those who largely dismiss this by arguing the treaty should be read 'as is'. In practice, which position a delegation takes partly depends on its negotiating position or preferred outcome. Usually a delegation's position is informed to a great extent by a desire to limit the cost, scope and level of intrusiveness of the treaty regime.

Finally, the matrices should also be modified partly with a view to addressing deterrence of non-state actor questions. Evaluations of state behaviour have long been provided within a framework grand military strategy or international relations theory. Evaluations of non-state actors (who may or may not interact with state actors—officially or unofficially) are more the domain of cognitive psychology and the study of predicting human decisionmaking, including on the basis of brain science.[1104]

15.5. Towards a Strategic Theoretical Application

For a theory to have strategic relevance, it must explain a unit's behavior. The standard categories (or 'images') in political science are the individual, the state and the international system. Analysis on the 'individual unit' focuses on discovering the cause of events among individuals or small groups with decision-making power or influence over decision-making. Carried to its logical conclusion, great leaders shape world events. Analyses that focus on the state seek to find causes for events within the nature of the states. Systemic-level analyses seek to find causes for events from *inter alia* the role and actions of states and their interrelationships within the international system. If truly successful, the analytical framework that is attempting to earn the title 'theory' should have predictive power. Linking operational-level detail with strategic analysis is desirable for weapon systems analysis in a strategic and defence studies context. A good theory should fit the facts as they are understood and may be said to be successful when new information or facts (as they become available) do not contradict it (ACH is explicitly structured to do this). A theory becomes accepted if it explains or facilitates understanding of existing facts or developments. An additional (but non-essential) criterion for a theory to be successful is if it is predictive of new facts or developments.

15.5.1. Intelligence Theory and Praxis

Intelligence officials must concern themselves with the details of events and cases, and attempt to make specific predictions regarding particular events or developments.[1105] Social scientists, by contrast, are more apt to concern themselves with discovering and testing a limited number of variables that are more broadly generalizable (such variables therefore possess inherently less predictive value in any particular circumstance).[1106] Knorr also observes that

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[1103] Graham Jr. (note 284), p. 160.

[1104] E.g., through through the neurophysiological study of brain function, including through MRI mapping.

[1105] Knorr (note 6), pp. 16–17.

[1106] Knorr (note 6), pp. 16–17.

there is some justice to the observation that historians and intelligence officers are both 'confronted with continuous gradations of facts and possibilities' and seek to achieve a 'contextual approach' that appreciates 'the flow of events in their wholeness'.[1107] This is in contrast to various forms of reductionism whereby greater significance can sometimes be attached to the parts of the whole while losing sight of their cumulative or overall significance. Practitioners of the natural and engineering sciences not infrequently exhibit the latter characteristics.

Knorr also observes that both historians and intelligence officers must derive meaning from incomplete (and even unknowable) information.[1108] Simultaneously, Knorr argues that the work of social scientists is also relevant partly because of their focus on developing and using indicators for the purpose of inference in order to explain developments and their interaction, such as economic conditions and social stability.[1109] He also reiterates the potential relevance to intelligence practitioners of employing medical procedure decision flow charts as a mechanism by which it has been shown that mistakes even by leading physicians and nurses can be significantly reduced.[1110] Some social science indicators are of immediate utility to intelligence practioners in and of themselves (e.g., economic indices and opinion polls).[1111]

Two dichotomies in intelligence analysis are tactical *versus* strategic and puzzle *versus* mystery.[1112] Mysteries include numbers of tanks or classified economic data. Many international policy questions, by contrast, can be called mysteries because they depend on understanding the intention of others (which is often problematic) or have no particular 'answer' because the questions are so broad, fundamental or geopolitical in nature. Such questions include: Will North Korea adhere to a nuclear agreement with the United States and will China continue its rapid economic growth or fragment?[1113] Treverton suggests that while solving puzzles in the Cold War era depended greatly on the collection of secret information, attempting to come to grips with (or to clarify) mysteries depends more on achieving a proper understanding of open information.[1114]

Treverton also cautions that, for many intelligence analysts, if the information is not on the computer it does not exist.[1115] To illustrate, he notes that the CIA's Office of Trans-National Security, Trade and Technology not infrequently yielded analyses that were inferior to private sector economic

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[1107] Knorr (note 6), p. 17.

[1108] Knorr (note 6), p. 19.

[1109] Knorr (note 6), p. 20.

[1110] Knorr (note 6), p. 27.

[1111] Knorr (note 6), p. 22.

[1112] Gregory F. Treverton, 'Intelligence Since the Cold War's End', p. 125 in Goodman, Treverton and Zelikow (note 20).

[1113] The questions, with minor modification, are given as examples by Treverton. See Gregory F. Treverton, 'Intelligence Since the Cold War's End', p. 107 in Goodman, Treverton and Zelikow (note 20).

[1114] Gregory F. Treverton, 'Intelligence Since the Cold War's End', pp. 107–108 in Goodman, Treverton and Zelikow (note 20).

[1115] Gregory F. Treverton, 'Intelligence Since the Cold War's End', p. 110 in Goodman, Treverton and Zelikow (note 20).

reporting.[1116] Treverton also observes that, in the traditional US Cold War context, 'conventional wisdom assumed that intelligence should not get too close to policy lest it be "politicized"—that is, have its detached objectivity tainted by the stakes of policy and policy makers….intelligence pays little price for irrelevance. It does, by contrast, pay a price for "politicization," for being seen to cross—or be pushed—across the line from objectivity to argument, for "joining the policy team."'[1117]

NIEs are 'the most authoritative judgements' of the US intelligence community.[1118] Fingar cautions that NIEs are not predictions, but rather more meant to flag (offer 'signposts') that will help policy and decisionmakers to understand the nature and course developments and main trends ('trajectories') in order possibly 'reinforce, stall, or deflect' changes.[1119] Fingar also observes that NIEs are distinct from academic studies. NIEs attempt to explain what might occur 'under partially or largely unknown conditions', while academic studies employ historical data where outcomes are known.[1120]

Intelligence estimates typically do not explain why the 'consensus' conclusions are valid. Jervis notes that estimates generally contain assertions, rather than evidence-based arguments and that 'Often it is only their inherent plausibility that would lead one to accept the conclusions'.[1121]

Finally, there are limits to which analysts can identify and determine a variety of problematic aspects of human attitudes and behaviour including: (*a*) what constitutes logical or rational action, and (*b*) whether and to what extent historical events are 'deterministic' in the consideration of current trends and prediction. It should also be noted that intelligence failures are public, while the successes are generally not made public.[1122]

15.5.2. Security Dilemma and Security Deficit

Security requirements and threat perceptions can be considered in terms of a 'security dilemma' which has been characterized as the 'perennial dilemma of world politics' and defined as 'the irresolvable uncertainty state B faces when interpreting state A's weapons acquisition programme'—including whether the programme is 'defensive' or 'offensive'.[1123] Internal political requirements and one's own capabilities and intentions may not be driven by a desire to determine State A's intentions and capabilities. For example, State B may consider the possible benefits to itself in declaring State A's programme to be offensive or

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[1116] Gregory F. Treverton, 'Intelligence Since the Cold War's End', p. 110 in Goodman, Treverton and Zelikow (note 20).

[1117] Gregory F. Treverton, 'Intelligence Since the Cold War's End', pp. 121–122 in Goodman, Treverton and Zelikow (note 20).

[1118] Fingar (note 25), p. 71.

[1119] Fingar (note 25), p. 74.

[1120] Fingar (note 25), p. 75.

[1121] Jervis (note 399), p. 47.

[1122] John F. Kennedy told Allen Dulles 'Your successes are unheralded, your failures are trumpeted'. Dulles (note 90), p. 5.

[1123] Pinar Bilgin, 'Identity/Security', p. 85 in Ed. J. Peter Burgess, *The Routledge Handbook of New Security Studies* (Abingdon, Oxon, United Kingdom, 2010).

defensive, thus signalling, for example, that it does not fear State A's programme.

The logic of the Cold War arms race was for State B to assume that the other state's programmes were offensive. It therefore begins or accelerates its own corresponding (or 'functionally equivalent') weapon programme which, in turn, eventually results in greater insecurity for both states.[1124] Schelling and Halperin have also observed, in a bilateral arms control context, that 'Limitations on particular weapons may enhance each side's interest in the other's research and development of new weapons'.[1125]

Today the security calculus has more variables partly because of the possible role of non-state actors and a blurring of technical signatures associated with traditional state military programmes. Some programmes are more straightforward than others. Interpretation is too frequently influenced by the worst-case scenario approach only.

Various attempts have also been made to recharacterize ideological convictions or descriptions of processes affecting the formation of 'identity perceptions' in order to circumvent the security dilemma or at least to begin to frame the discussion in a manner which can be put into practical effect. The operational goal would be to limit or prevent processes of reactive weapon system acquisition. Such efforts focus on definitions of terms whose significance at the operational level is often unclear and perhaps irrelevant.[1126]

Other factors related to security dilemma considerations include force structure, industrial structure and the incorporation of weapon systems into military doctrine and the degree to which command and control can be utilised to implement political and military objectives.[1127]

15.5.3. The Overall Role of Intelligence Cold War Assessments of Soviet CW Stockpile

The ongoing periodic assessment of Soviet World War II CW capabilities and intentions helped to inform the consideration of the proper role of nuclear deterrence during the Cold War.

Maddrell states that German chemical warfare experts—probably Hirsch and Ochsner—on Soviet doctrine that continued to be relied on until Oleg Penkovsky was recruited.[1128] Col. Oleg Vladimirovich Penkovsky, a well-connected officer in the Main Intelligence Directorate (GRU) of the Chief

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[1124] Since the 1960s, Julian Perry Robinson and, more recently, Jean Pascal Zanders have incorporated variations of the concept of functional equivalence in a chemical and biological weapon arms control and disarmament context. Francis Fukuyama uses the term in a more prosaic manner when observing that princely societies all share 'a functional equivalent' to the Chinese concept of the Mandate of Heaven. Francis Fukuyama, *The Origins of Political Order: from Prehuman Times to the French Revolution* (Farrar, Straus and Giroux: New York City, 2011), p. 299.

[1125] Schelling and Halperin (note 267), p. 92.

[1126] Partly based on P. Bilgin, 'Identity/Security', p. 85 in Burgess (note 1123).

[1127] For a review of the security dilemma literature and a framework for applying it outside a traditional interstate context, see Paul Roe, 'The Intrastate Security Dilemma: Ethnic Conflict as a "Tragedy"?', *Journal of Peace Research*, vol. 36, no. 2 (1999), pp. 183–202.

[1128] JS/JTIC(49)70, 'Russian Chemical Warfare Equipment', 7/9/1949, DEFE 41/150; Capt. Hogwood, MI10B Conference 1952, DEFE 41/126. As cited by Maddrell (note 129), p. 24.

Intelligence Directorate of the General Staff, worked for the UK and US intelligence in the early 1960s.[1129] He played a key role in informing the UK and US of Soviet capabilities and intentions during the 1962 Cuban Missile Crisis. In April 1961 he travelled the UK as head of a trade mission during which time SIS and CIA officers debriefed him.[1130] Penkovsky was arrested in late 1962 and was executed in 1963.[1131] Most of his revelations are summarized in *The Penkovsky Papers* (1966). His contribution on the chemical side is not so well-known and forms a very small part of the work. Declassified transcripts of his meetings with the British and US intelligence in the UK are available via a US academic library system digitial declassified documents database.

The US understood Soviet strategic and tactical military doctrine on nuclear and chemical weapons in the 1960s to be linked. A 1969 NIE discusses doctrine linkages and overlap between these two weapon types only (i.e., radiological and biological weapon discussion is absent in the assessment).[1132] This NIE also stated 'Although CW was not used during World War II, the Soviets had an ample supply of chemical munitions and required no assistance in this respect from their allies'.[1133] It also estimated the Soviet CW stockpile to be 'on the order of 275,000 tons, but there is recent evidence which suggests that this figure may be high'.[1134] The recent evidence may have come from Penkovsky. The NIE estimate also perhaps includes munition weight. Since the opening of signature of the CWC and its entry into force, the estimates states have provided have usually been for agent weight only. This gives a lower and therefore more politically acceptable figure. It is also what the CWC requires.

The Soviet delegation to the Conference on Disarmament (CD) also tabled an official paper on the results of the 1987 confidence-building visit to Shikhany and associated literature. In 1987 the Soviets hosted more than 130 representatives from 45 countries at Shikhany.[1135] Some argued that the CW

[1129] The US Code Name for him was HERO, while the British code name for him was YOGA.

[1130] Stephen Twigge, Edward Hampshire and Graham Macklin, *British Intelligence: Secrets, Spies and Sources* (The National Archives: Kew, United Kingdom, 2008), p. 99.

[1131] The Soviet press stated that he was shot by firing squad. Another version, circulated by Viktor Suvurov, was that Penkovsky was cremated alive and that a film was made of the procedure in order to show to new GRU officers as a warning against committing treason. Viktor Suvurov, *Aquarium: the Career and Defection of a Soviet Military Spy* (Hamish Hamilton: London, 1985), pp. 1–4, quoted in Robert Wallace and H. Keith Melton (with Henry R. Schlesinger), *Spycraft: the Secret History of the CIA's Spytechs from Communism to Al-Qaeda* (Dutton: New York, 2008), p. 31. Wallace was formerly the director of the CIA's Office of Technical Service. Melton is an historian who specializes in espionage tradecraft. Some view such accounts as bordering on unwarranted (and unprovable) hearsay.

[1132] *Soviet Chemical and Biological Warfare Capabilities*, NIE report no. 11-11-69 (CIA: 13 Feb. 1969), pp. 1–3.

[1133] *Soviet Chemical and Biological Warfare Capabilities* (note 1132), p. 1. This assessment presumably reflects the UK and US consultation on CW-related matters, including any possible requests by the Soviet side for assistance under, for example, the Lend Lease cooperation framework.

[1134] *Soviet Chemical and Biological Warfare Capabilities* (note 1132), p. 5.

[1135] 'Letter dated 16 December 1987 from the Representative of the Union of Soviet Socialist Republics addressed to the President of the Conference on Disarmament transmitting a working paper entitled "Information on the presentation at the Shikhany military facility of standard chemical munitions and of technology for the destruction of chemical weapons at a mobile

displayed were not state-of-the-art and that no binary or multi-component CW munitions were displayed.[1136] The Soviet Union did not declare binary CW to the OPCW when it acceded to the CWC.

In general, in the context of Western monitoring of Soviet weapons research during the Cold War, the US military and industrial R&D analyst Russell J. Bowen has argued that, provided the USSR only possessed 'limited numbers of key weapons technologists and related specialists', it should have been possible 'to trace certain aspects of complex weapons development programs through such individuals. Thus, personalities and technical communications are much more important to weapons development than to the production phase, where the predominance of managerial personnel and administrative communications provide greater opportunity for disguising the nature of an operation'.[1137] Bowen also observed that the 'quite practical nature' of work carried out by Soviet design bureaus required them to work closely with a wide range of organizations, as opposed to research institutes that focused on 'theoretical and applied-research aspects of over-all [weapon] systems'.[1138] This is because research institutes tended to focus on paper studies and preliminary laboratory work.[1139]

Bowen also observed that, because information was the 'lifeblood' of military R&D, any understanding of how the Soviet 'information centers' were utilised by facilities and personnel could, in principle, serve as a check on weapons development work—at least in a theoretical arms control verification context.[1140] Finally, in a Cold War arms control context at least, any verification regime that was capable of evaluating the role of the various R&D coordinating

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unit"', Conference on Disarmament document CD/789, 16 Dec. 1987, p. 1. See also 'Shikany: Confidence-Building Step', *Soviet Military Review*, Nov. 1987 (in English); and Anonymous, *An Important Confidence-building Step: Foreign Observers Visit the Shikhany Military Area in the Soviet Union* (Novosti Press Agency Publishing House: Moscow, 1988) (in English).

[1136] Nancy Cooper, Fred Koleman and Richard Sanza, 'Candor in the Kremlin: the Soviets Signal that They are Ready for a New Deal on Chemical Weapons', *Newsweek*, vol. 110, no. 16, 19 Oct. 1987, pp. 18–19.

[1137] Russell J. Bowen, 'Soviet Research and Development: Some Implications for Arms Control Inspection', *The Journal of Conflict Resolution*, vol. 7, no. 3 (Sep. 1963) p. 445; in Ed. J. David Singer, *Weapons Management in World Politics: Proceedings of the Internationl Arms Control Symposium*, December 1962, Ann Arbor, Michigan, 17–20 Dec. 1962. At the time, Bowen was a research chemical engineer employed by Arthur D. Little, Inc. trained in mathematics and physics and who had done analyses on industrial and military R&D. ('Appendix A, Biographical Notes', *The Journal of Conflict Resolution*, vol. 7, no. 3 (Sep. 1963), p. 648; in Ed. J. David Singer, *Weapons Management in World Politics: Proceedings of the Internationl Arms Control Symposium*).

[1138] Russell J. Bowen, 'Soviet Research and Development: Some Implications for Arms Control Inspection', *The Journal of Conflict Resolution*, vol. 7, no. 3 (Sep. 1963) p. 445 in Singer (note 1137).

[1139] Russell J. Bowen, 'Soviet Research and Development: Some Implications for Arms Control Inspection', *The Journal of Conflict Resolution*, vol. 7, no. 3 (Sep. 1963) pp. 445–446 in Singer (note 1137).

[1140] Russell J. Bowen, 'Soviet Research and Development: Some Implications for Arms Control Inspection', *The Journal of Conflict Resolution*, vol. 7, no. 3 (Sep. 1963) p. 446 in Singer (note 1137).

bodies would also be helpful in clarifying the nature and purpose of weapons-related work.[1141]

More broadly, Michael Herman, who served as a Senior Analyst in the UK's Government Communications Headquarters in 1952-87 with secondments to the Cabinet office and Ministry of Defence, provides some insight into Western efforts to understand Soviet threats during the Cold War in general and the relation between capabilities and intentions in particular. He observes:

> *'Soviet military capabilities, including production, logistics and similar factors, were in principle knowable. But there was still a dearth of hard facts and the uncertainty of the analytic ones. Moreover, the important Western interest was often in the future rather than the present: what would the next Soviet weapons be, and when would they appear? Since there was rarely any firm evidence, answers drew on guesses about the adversary's intentions, often indeed on what his reaction might be to American plans. Would the USSR react to President Kennedy's nuclear programme of the early 1960s by seeking nuclear supremacy, parity or something less? Intentions in turn went back to capabilities: surely the size and composition of Soviet forces must be a good pointer to the regime's objectives? Deductions on the two were mutually reinforcing. Intelligence had the status of Keeper of the Threat, but this remained a mental construct with a lot of conjecture to it'*.[1142]

A study on Soviet military technological challenges issued by a panel of US academics and government officials characterized the Soviet chemical and biological warfare threat as follows:

> *'The Soviet Union has a substantial chemical warfare capability in its army units. Both the United States and the Soviet Union have long been interested in biological agents and vaccine defenses against them. The United States is demonstrating in Vietnam that defoliants and anticrop chemicals can be effective. There is room for considerable improvement in such areas of chemical and biological warfare as nonlethal and incapacitating agents, antipersonnel chemicals and antichemical agents and lethal types of agents.*
>
> *A strong attitude exists in the United States that escalation from use of nonlethal to lethal chemical and biological agents could too easily occur, and hence that the United States should not develop them. No such attitude toward research and development in chemical and biological warfare, however, has been manifested in the Soviet Union. To the contrary, the Soviets have maintained an aggressive program and have conducted maneuvers which simulated defense against biological and chemical agents. They seem to have permitted the Egyptians to use*

[1141] Russell J. Bowen, 'Soviet Research and Development: Some Implications for Arms Control Inspection', *The Journal of Conflict Resolution*, vol. 7, no. 3 (Sep. 1963) p. 447 in Singer (note 1137).

[1142] Michael Herman, 'Intelligence Effects on the Cold War: Some Reflections', p. 22 in Herman, McDonald and Mastny (note 281). The publication was based on a conference organized in Oslo by the Norwegian Institute for Defence Studies in 2005 entitled 'Intelligence in waging the Cold War: NATO, the Warsaw Pact and the Neutrals, 1949–1990'.

chemicals in the Yemen war, and might have done the same in the Israeli conflict if reports that the Eygptians had large stocks of chemical agents for use against the Isrealis are true'.[1143]

The same panel outlined the difficulties faced by US policy makers when attempting to ensure that Soviet S&T developments did not give the Soviet Union an advantage as follows:

'To pursue the potential military application of each and every promising scientific and technlogical theory or development within the adversary's capability would be impossible [for the United States], but to limit oneself only to those that one believes the potential enemy might find attractive would be too risky. To escape from the dilemma the policy maker must put priority on long lead time items in the most important fields, carefully considering the risks of delay and faulty decision making. At the same time, he must continue to build an expanding base of technology that can both advance our own capabilities for new systems and reduce reaction time when a new weapon actually appears in the arsenal of the potential enemy. He must constantly look for military applications the potential enemy may not have recognized or may have failed to pursue. All of these investments must be compared against the expected value of other investments in new intelligence systems that might increase our warning time concerning progress on the other side'.[1144]

15.5.4. IR Theory

A CW application of ACH can be utilized as a 'ladder of abstraction' for the elucidation of intelligence and arms control verification assessment processes and relevance, respectively. Two IR schools in particular are flagged: neoliberal institutionalism and realism.

Realism is characterized by: (*a*) States are the principal unit of political organization, (*b*) the state enjoys a monopoly on the use of force, and (*c*) international law recognizes the legal and moral authority of states as the legitimate actors for performing internal and external security functions.[1145] Realists also believe that the world is fundamentally characterized by anarchy.

Neoliberal institutionalism has been defined as: 'A world in which actors other than states participate directly in world politics, in which a clear hierarchy of issues does not exist and in which force is an ineffective instrument of policy'.[1146]

[1143] Center for Strategic Studies, *The Soviet Military Technological Challenge*, Special Report series no. 6 (Georgetown University: Washington, DC, Sep. 1967), p. 76. The members of the panel were Admiral (ret.) Arleigh Burke, Harold M. Agnew, Robert D. Crane, John Ford, Bernard A. Schriever, Cornelius D. Sullivan, Arthur G. Trudeau, Richard J. Whalen and Thomas W. Wolfe.

[1144] Center for Strategic Studies (note 1143), p. 96.

[1145] Edward A. Kolodziej, *Security and International Relations* (Cambridge University Press: Cambridge, 2005), p. 128.

[1146] Robert Koehane and Joseph Nye, *Power and Interdependence: World Politics in Transition* (Little, Brown: Boston, Mass., 1977), cited in Peter Sutch and Juanita Elias, *International Relations: the Basics* (Routledge: London, 2007), p. 72.

Several points can be made with respect to the consideration of the potential higher-level relevance of CW assessments in IR theory in general and these two schools in particular.

One question is whether the United States would have attacked the al-Shifa facility had Sudan been a member of the CWC. Had Sudan been a party to the treaty, would the national threat assessment process been modified to take into account the existing arms control verification structures and procedures that the United States utilises to support CWC implementation in general? Would the INR dissent to the NIE on al-Shifa been afforded greater weight? Would sampling and analysis questions been given greater consideration by the 'small group'? What would have been the political costs of a US attack in terms its influence and engagement in the CWC regime? A theoretical counter-factual thought experiment is to ask whether the United States would have felt sufficiently confident in its CW assessment had Sudan already been a member of the CWC. Would the United States have been prepared, for example, to damage its moral and legal authority and political influence within the CWC regime and elsewhere by unilaterally attacking another State Party without first attempted to utilize the Convention's provisions (either pro forma or with serious intent) on consultation, clarification and fact-finding?

An underlying geopolitical theme to the debate on the content, methodology and meaning of assessments of Iraqi CW in the lead up to the 2003 US-led invasion can also be seen in terms of neoliberal institutionalism (as reflected in by multilateral arms control assessments) and realism (as reflected through state intelligence assesssments according to state-defined national interests). As mentioned previously, it has been reported (most recently in 2013) that the main reason the US successfully organized the ouster of former OPCW Director-General Ambassador José Bustani of Brazil was that he was attempting to reach out to Iraq to join the CWC through informal diplomatic channels.[1147]

In summary, the application and refinement of a CW-focused ACH can be used as a means in a 'ladder of abstraction' that informs security and defence policy (e.g., through schools of the neoliberal institionalism and realism) as it relates to strategies and policies for defeating and/or manipulating the behaviour of state and non-state actors.

[1147] Simons (note 783).

16

CONCLUSIONS

This study provides a systematic consideration of selected academic fields and operational practice relevant to arms control verification and intelligence studies. In particular, it develops a unique variation of an established cognitive psychology-based counter-factual method taken from intelligence operational art in order to analyse, explain and facilitate the prediction of CW acquisition, development, production and stockpiling. In so doing, this study helps to narrow the gap between arms control verification and intelligence practice for CW in particular and weapons acquisition and use more generally.[1148] It also places intelligence operational art on a more secure theoretical academic foundation in the CW-related context, partly by providing a useful basis for the understanding of the operational- and strategic-level analysis of CW threat assessments and appropriate policy responses. It shifts ACH practice closer to theoretical international relations models with respect to higher-level strategic and defence analysis, and IR theory as it relates to WMD-related international peace and security questions. It does so partly by suggesting that a corollary exists between the role played by national intelligence requirements, on the one hand, and, on the other hand, that played by arms control verification. In particular, the information taskings for both weapon-specific arms control verification and national intelligence overlap to a great extent. However, the priorities and perceived political acceptability for arms control verification and intelligence assessments are distinct and, in many respects, opposed to each other. For example, an arms control assessment carried out within a multilateral legal regime tends to possess greater overall international credibility and weight so long as it is done in a professional technical manner whose findings then inform the subsequent political and legal considerations. National based intelligence assessments are, as a rule, necessarily kept secret to protect sources and methods and are also more likely to be questioned on the grounds that the conclusions support national policy. Nevertheless, the information taskings should, on the basis of their respective technical requirements, yield similar outcomes. While in practice this does not necessarily occur, the gap can perhaps be narrowed on the basis of better operational-level understanding of how such assessments should ideally be carried out.[1149] National intelligence-driven processes, procedures and purposes can perhaps be better described at the strategic level by realism IR theory, while those for arms control verification can perhaps be better described by neoliberal institutionalism.

[1148] Marrin (note 19).

[1149] E.g., in the case of the attack on al-Shifa and the international understanding of Iraq's CW programme and holdings prior to the 2003 US-led invasion.

The matrices and the ACH application can be improved and further adapted in a number of respects. This includes further consideration of the extent to which they are suited for analysing and assessing facilities where toxic chemicals and their precursors are absent (e.g., where base research is conducted using computer modeling). Further consideration should also be given to linking IR requests and evidence chains to various proliferation pathway models. The timescale for production may not correspond to that of traditional state CW programmes. Military doctrine-related issues should also be further considered with respect to the motivations of individuals and groups.[1150] Related broader questions include the extent to which evidence should be equally weighted given the fact that some has greater diagnostic value, how to better account for deception, the extent to which a worst-case scenario approach is counter-productive or harmful, how the reliability of underlying information can be better flagged in estimates, and whether and how ACH can be applied meaningfully to more than two hypotheses at a time.

The purpose and operation (including overlap) between national intelligence and arms control verification should also be further considered. The audiences, objectives and political contexts for both, while related, are distinct. In particular, standards for what constitutes 'reasonable doubt' or 'reasonable effort' to satisfy a verification or assessment process can differ substantially.[1151] The processes for structuring and implementing national intelligence are fairly well-developed in the literature.[1152] For multilateral arms control verification, however, the situation is less clear. Reasons include the fact that delegations from many states interact with each other in a mainly diplomatic setting that entails the sending and receiving of political signals. As such, controversial topics (including the use of the word 'intelligence') tend to be referred to somewhat allusively or not at all. While it is permissible (and desirable) to define and implement effective verification methodologies in the abstract, their actual implementation can be complicated by an ill-defined and variable relationship with national intelligence bodies under the rubric of NTM. Another distinction between the requirements and expectations of national intelligence, on the one hand, and multilateral arms control verification, on the other hand, is the fact that information used for the latter purpose can be (and is) restricted as a matter of policy (e.g., to support the drafting of an inspection mandate, and with respect to 'managed access' provisions for onsite inspections by OPCW inspectors). The validity and independence of multilateral arms control verification must not be undermined by improper relationships with national intelligence processes and priorities (e.g., by 'piggy-backing' collection operations). The former must be impartial and correct, regardless of the broader political sensitivities and preferred political interpretations and outcomes. The relationship between national intelligence and multilateral arms control need not necessarily be viewed as a 'one-way' or 'two-way' street. It instead may have its own variable logic informed by the particular political and technical circumstances associated with a given case. Given the political will and proper formulation, such issues (e.g.,

[1150] However problematic this might be in some respects.

[1151] I would like to thank one of the anonymous reviewers for drawing my attention to this.

[1152] Caveats, such as language and great power perspectives, should be kept in mind.

military and security services doctrine) could perhaps be more fully considered by the OPCW and others under the rubric of effective national implementation.

Areas for future research also include: (*a*) the carrying out of comparative studies by different authors on the same analytical themes and using both ACH and other SATs, and (*b*) the further development and validation of generalized diagnostic factors for evaluating the acquisition, development, production and stockpiling of a given weapon system, while taking due regard of indicators from the security and defence acquisition literature.

Such evaluations can assist the consideration of what verification data actually mean and how technical and scientific findings relate to the question of treaty compliance by states and the resulting implications for the strength of the rule-of-law at the inter- and intra-state levels, as well as for strategic and defence studies in general.

ANNEXES

ANNEXE A. DEFINITIONS AND TERMS

This section consolidates key definitions of terms used in the study. They are meant to be authoritative, but not necessarily definitive.

'Activity'. Activity and programme are distinct concepts that inform any analysis of the intent of work carried out in the chemical field. Activity can occur in the absence of overall coordination and in the absence of policy guidance or contrary to policy (stated or implied). It may consist of the actions of an individual (authorized or not).[1153]

'Assess'. The US intelligence community uses this term routinely in NIEs, statements and private briefings to the President and Congress.

'Assessment'. The US DoD has defined this term as '1. Analysis of the security, effectiveness, and potential of an existing or planned intelligence activity. 2. Judgment of the motives, qualifications, and characteristics of present or prospective employees or "agents"'.[1154] In the security and defence field, the term has been defined as 'Part of the intelligence process whereby an analyst determines the reliability or validity of a piece of information. An assessment could also be a statement resulting from this process'.[1155]

'Biological weapon'. A biological weapon can be understood to consist of one or more of three elements: the toxic fill, munition body and/or specialized devices and equipment designed to be used to deliver the fill or munition body. The parties to the BTWC 'undertake never in any circumstances to develop, produce, stockpile or otherwise acquire or retain: 1. Microbial or other biological agents, or toxins whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes; 2. Weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict'.[1156] Some biological and chemical warfare-related actitivies overlap. Some agents, such as toxins, are covered by both the BTWC and CWC. The development of some biochemicals may blur the distinction between chemical and biological warfare in future. Both the BTWC and CWC prohibitions against biological and chemical warfare embody a general purpose criterion (GPC).

'Capability'. Capability may be defined as 'power or ability in general, whether physical or mental: capacity'.[1157] Capability, capacity and ability are essentially synonomous in the CW evaluation context.

'Chemical weapon'. The internationally accepted definition of a chemical weapon is provided in the CWC. The internationally accepted definition of a biological weapon is provided in the BTWC. A chemical weapon defined by the CWC, means the following, together or separately:

(a) toxic chemicals and their precursors, except where intended for purposes not prohibited under this Convention, as long as the types and quantities are consistent with such purposes;

[1153] For a consideration of such distinctions in the biodefence context, see Roger Roffey, John Hart and Frida Kuhlau, 'Crucial guidance: a code of conduct for biodefense scientists', *Arms Control Today*, vol. 36, no. 7 (Sep. 2006), pp. 17–20.

[1154] DoD, *Dictionary of Military and Associated Terms*, JCS publication no. 1 (Joint Chiefs of Staff: Washington, DC, 3 Sep. 1974), pp. 36–37 (unclassified).

[1155] Wolfram F. Hanrieder and Larry V. Buel, *Words and Arms: a Dictionary of Security and Defense Terms with Supplemental Data* (Westview Press: Boulder, Colorado, 1979), p. 13.

[1156] BTWC, Article I.

[1157] *The Oxford English Dictionary* (note 398), vol. II, C, p. 88.

(b) munitions and devices, specifically designed to cause death or other harm through the toxic properties of those toxic chemicals specified in subparagraph (a), which would be released as a result of the employment of such munitions and devices;
(c) any equipment specifically designed for use directly in connection with the employment of munitions and devices specified in subparagraph (b).[1158] Jean Pascal Zanders has compiled 27 definitions of 'chemical warfare'.[1159]

'Chemical weapon production facility'. The CWC defines such a facility as: (a) Means any equipment, as well as any building housing such equipment, that was designed, constructed or used at any time since 1 January 1946; (i) As part of the state in the production of chemicals ("final technological stage") where the material flows would contain, when the equipment is in operation: (1) Any chemical listed in Schedule 1 in the Annex on Chemicals; or (2) Any other chemical that has no use, above 1 tonne per year on the territory of a State Party or in any other place under the jurisdiction or control of a State Party, for purposes not prohibited under this Convention, but can be used for chemical weapons purposes; or (ii) For filling chemical weapons, including inter alia, the filling of chemicals listed in Schedule 1 into munitions, devices or bulk storage containers; the filling of chemicals into containers that form part of assembled binary munitions and devices or into chemical submunitions that form part of assembled unitary munitions and devices, and the loading of the containers and chemical submunitions into the respective munitions and devices;

(b) Does not mean: (i) Any facility having a production capacity for synthesis of chemicals specified in subparagraph (a) (i) that is less than 1 tonne; (ii) Any facility in which a chemical specified in subparagraph (a) (i) is or was produced as an unavoidable by-product of activities for purposes not prohibited under this Convention, provided that the chemical does not exceed 3 per cent of the total product and that the facility is subject to declaration and inspection under the Annex on Implementation and Verification (hereinafter referred to as "Verification Annex"); or (iii) The single small-scale facility for the production of chemicals listed in Schedule 1 for purposes not prohibited under this Convention as referred to in Part VI of the Verification Annex'.[1160]

Definitions, including this one, were negotiated in a broader context. For example, prior to the entry into force of the CWC, one delegation proposed narrowing the scope of this particular definition. It did so by referring to the phrase: 'Means any equipment, as well as any building *housing* such equipment' [emphasis added]. Because the word 'housing' is in the present tense, some facilities could, in principle, be excluded from declarations by States Parties to the OPCW. The delegation took this position at least partly as a negotiation point in order to obtain flexibility on ensuring that proposals to convert former CWPFs would be granted by the organization (as originally drafted by treaty negotiators in Geneva, such conversion was meant to be the exception, not the norm).

'Confirmation bias'. Kahneman observes 'The operations of associative memory contribute to a general *confirmation bias* [italicized in original]…A deliberate search for confirming evidence, known as *positive test strategy* [italicized in original], is also how System 2 tests a hypothesis. [This strategy]…seek[s] data that are likely to be compatible with the beliefs [people] currently hold'.[1161] Scientific method, by contrast, seeks to refute hypotheses or to treat knowledge as provisional.

[1158] CWC, Article II, para. 1.
[1159] Zanders (note 696) pp. 315–327.
[1160] CWC, Article II, para. 8.
[1161] Kahneman (note 26), p. 81.

'Data mining'. Data mining, Knowledge Discovery in Databases (KDD) or Knowledge-Discovery and Data Mining refers to automated searches of large volumes of data for patterns. A variety of computational theories and tools have been developed in order derive meaning from the data and to extract the meaning in a usable format. Techniques to uncover patterns include association, classification and clustering. The Internet contains a number of sites where 'knowledge discovery' resources are compiled.[1162]

'Defensive'. The term may be defined as '1. Having the quality of defending against attack or injury; serving for defence; protective; 2. Made, formed, or carried on for the purpose of defence: opposed to *offensive* (=aggressive); 3. Of or belonging to defence'.[1163] Within the context of chemical warfare, a defensive activity or programme is defined as work carried out to protect against the use of such weapons. Defensive measures against chemical warfare do not include the use of such weapons.

'Doctrine'. The US term 'doctrine' has been defined as 'Fundamental principles by which the military forces or elements thereof guide their actions in support of national objectives. It is authoritative but requires judgment in application'.[1164]

The Soviet term 'military doctrine' (voyennaya dotrina) has been defined as 'A system of views held in a state at a given specific time on the essence, aims, and character of possible future war; on the preparations of the nationa and it's armed forces for such a war; and on ways of conducting it'.[1165] Voyennay doktrina 'has two closely interrelated sides—sociopolitical and military-technical. Its directives govern all activities of the military and unify the views of military personnel in the solution of the present day tasks'.[1166]

'Estimate'. Estimate refers essentially to an intelligence evaluation. The term may be defined as 'An approximate judgement based on considerations of probability, respecting the number, amount, magnitude, or position of anything; the quantity assigned by such a judgement'.[1167] In an intelligence context the term has been defined as 'best-effort attempts to interpret, explain, and anticipate on the basis of imperfect knowledge of capabilities, intentions, and many other critical variables'.[1168]

'General Purpose Criterion'. Both the BTWC and CWC prohibitions against biological and chemical warfare embody a general purpose criterion (GPC) whereby all toxic chemicals and their precursors as well as biological substances are prohibited *except where for permitted purposes.* The phrasing of the GPC, which is part of the conventions' language of on prohibited activity, is the mechanism by which the prohibitions against chemical and biological warfare is made comprehensive. The GPC does not permit legal exclusions through questions on definition or categories. It also allows the conventions to capture future scientific and technological developments, including non-traditional agents. The weakness of the GPC is that states can still dispute definitions through legal and political argument. However, without the GPC, such

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[1162] Marcus P. Zillman, 'Knowledge Discovery Resources 2010—An Internet MiniGuide Annotated Link Compilation', *LLRX.com* [*Law and Technology Resources for Legal Professionals]*, 7 May 2010, <http://www.llrx.com/features/knowledgediscovery2010.htm>, (accessed 12 May 2013).

[1163] *The Oxford English Dictionary*, vol. III, D-E (note 398), p. 132.

[1164] *Comparative Lexicon of US-Soviet Military Technical Terminology*, report no. PB89-125553 (BDM Corp.: McLean, Virginia, 1988), p. 462. Prepared for Foreign Broadcast Information Service (FBIS), Washington, DC (unclassified).

[1165] *Comparative Lexicon of US-Soviet Military Technical Terminology* (note 1164), p. 462.

[1166] *Comparative Lexicon of US-Soviet Military Technical Terminology* (note 1164), p. 462.

[1167] *The Oxford English Dictionary*, vol. III, D-E (note 398), p. 302.

[1168] Fingar (note 25), p. 103.

disputes would be worse. Within the context of the CWC, the GPC must also be considered in terms of whether toxic chemicals and their precursors are being used in 'types and quantities' consistent with CWC-permitted activities. This is an issue of fundamental importance to any assessment of suspected chemical warfare programmes and will be considered below in general terms of the ACH matrix system and with respect to each of the case studies. Although this may appear to be a somewhat obscure legal or definitional question, it should become much easier to appreciate when considered in the context of the case studies.

'Indicator'. The term has been defined in a military context as 'an item of information which reflects the intention or capability of a potential enemy to adopt or reject a course of action'.[1169]

'Intelligence'. Intelligence has been defined as 'The product resulting from the collection, evaluation, analysis, integration, and interpretation of all information concerning one or more aspects of foreign countries or areas which is immediately or potentially significant to the development and execution of plans, policies, and operations'.[1170] It may be understood to mean information collected by states or institutions to inform policy decisions, including for national defence. It is often classified in order to protect sources and methods of collection. Treverton distinguishes 'data' from 'information'. Data is unprocessed, while information has been transformed into a form that is usable (e.g. through analysis or disaggregation of random data points. Allen Dulles stated that incoming intelligence consists of three categories: (*a*) daily and hourly handling of current intelligence, (*b*) researching intelligence on a given topic of interest to policy makers ('basic intelligence') and (*c*) the preparation of an intelligence assessment.[1171] Marrin observes that the definition of intelligence broadly driven by whether it is military technological *versus* civilian strategic in nature.

'Intelligence failure'. Jervis distinguishes two types of intelligence failure. One is a 'mismatch between the estimates and what later information reveals'.[1172] Another type of intelligence failure is 'a falling short' of what one would 'expect from good intelligence'.[1173] Jervis argues that the first type of intelligence failure is not particularly relevant because intelligence estimates are frequently incorrect and events will eventually make this clear. The second type of failure is of great importance because this is where technique and expertise play an important role in ensuring that the best possible analysis is produced. The second type of failure may result from missed opportunities to collect information or whether the available information was properly utilised.[1174] In short they consist of distinctions between the quality of information and analysis, respectively.[1175]

'Intent'. For CW assessment purposes, the term may be defined as being resolved to undertake an action. Assessing intent may ultimately depend on access to internal policy documentation. This assumes the policy is in fact written down (there are examples of where attempts are made to keep the policy formulation and dissemination verbal only) and what is written reflects the actual policy.

[1169] DIA, *Terms & Definitions of Interest for DoD Counterintelligence Professionals* (Office of Counterintelligence (DXC): 2 May 2011), p. GL-88 (unclassified), <http://www.fas.org/irp/eprint/ci-glossary.pdf>, (accessed 12 May 2013).

[1170] *Dictionary of Military and Associated Terms* (note 1154), p. 175.

[1171] Dulles (note 90), p. 156.

[1172] Jervis (note 399), p. 2.

[1173] Jervis (note 399), p. 2.

[1174] Jervis (note 399), p. 17.

[1175] Jervis (note 399), pp. 2–3.

'Islamist'. See Militant Islamic Group.

'Judge'. As a transitive verb used in the CW assessment context, the term may be understood to mean 'To pronounce an opinion upon, to criticize; *esp.* to pronounce an adverse opinion upon, to condemn, censure'.[1176] The US intelligence community defines 'judge' in a distinct manner.

'Key component'. The CWC defines a 'key component' of binary or multicomponent systems as 'The precursor which plays the most important role in determining the toxic properties of the final product and reacts rapidly with other chemicals in the binary or multicomponent system'.[1177] Krutzsch and Trapp observe that the CWC's phrasing of 'key component' is not strictly speaking scientific because, in many cases, it is imposssible to assign a key toxic property of a chemical to a single structural element.[1178] For organophosphorus nerve agents, the chemical donating the phosphorus atom will probably be considered to be the key precursor.[1179] Krutzsch and Trapp observe that a sulphur donating chemical is required in order to manufacture sulphur mustard.[1180] However, a chlorinating agent (donor) is also required and, although the sulphur donating chemical may be designated as the key precursor by States Parties to the CWC, key chlorinating agents may also be considered to be 'key precursors' within the transfer control context, including through the implementation of Australia Group (AG) guidelines.[1181] Krutzsch and Trapp also observe that the term 'reacts rapidly' can be problematic if one considers specific cases and argue that the term has 'no definitory function at all'. This is partly because a chemical reaction requires at least two chemicals (not just the 'key precursor'). If a binary or multicomponent CW system does not react with sufficient speed, the weapon system is dysfunctional.[1182] One might also add that the rapidity is also not quantified. (See 'precursor').

'Meta Data' has been defined as 'structured information that describes, explains, locates, or otherwise makes it easier to retrieve, use, or manage an information resource. Metadata is often called data about data or information about information'.[1183]

'Methodology' is broadly understood to mean the key *concepts*, *principles* and *procedures* necessary in order to reach a reasoned and balanced understanding of the target of analysis. Such an understanding must encompass a 'spectrum of certainty' in terms of what is known and what can be known or might become known about a given programme or activity. There are numerous overlapping factors and considerations connected to the derivation and use of information. An attempt is made to systematically review them with reference to examples is contained in a general background chapter. The case studies and three areas of methodological focus are considered in then greater detail. In order to understand how a methodology can be

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[1176] *The Oxford English Dictionary*, vol. V, H-K (note 398), p. 618.

[1177] CWC, Article II, para. 4.

[1178] A possible exception is the phosphorus methyl group (P-CH_3) present in VX and V-agent. This bond is partly responsible for the human toxicity effect of the chemical and tends to remain intact in various degradation products. See also Chapter 2 of this volume.

[1179] Walter Krutzsch and Ralf Trapp, *A Commentary on the Chemical Weapons Convention* (Kluwer Academic Publishers: Dordrecht, Netherlands, 1994), p. 33.

[1180] Krutzsch and Trapp (note 1179), p. 33.

[1181] See Australia Group, 'Export Control List: Chemical Weapons Precursors', <http://www.australiagroup.net/en/precursors.html>, (accessed 5 Aug. 2014).

[1182] Krutzsch and Trapp (note 1179), p. 33.

[1183] National Information Standards Organization (NISO), *Understanding Metadata* (NISO: Bethesda, Maryland, 2004), p. 1, <http://www.niso.org/publications/press/Understanding Metadata.pdf>, (accessed 12 May 2013).

implemented one must also understand the nature of the actors carrying out the analysis, the definition and characteristics of prohibited activities and legal and analytical standards of 'proof'. An analyst's understanding may be influenced by organizational factors. It may also be affected by a lack of understanding of political processes by which information is progressively refined and used, ignorance of historical precedents, ignorance of science and technology, and ignorance of the role of compartmentalization of information and personal interaction. Nor should cultural, language and political imperatives should be overlooked.

'Military science'. Military sciences is equivalent to krigsvetenskap. It has been defined as: 'study of the conduct of warfare and the strategic, tactical, and logistical principles relating to it'.[1184] The modern principles of war (i.e. contemporary military sciences) include:

'military objective or aim; offensive action; unity of command; mass or concentration of power; simplicity; manoeuvre or disposition of forces; economy of forces; security; and surprise. The application of these principles in a wide variety of combat situations is the central focus of military science. …The development of mathematical game theory and computers has facilitated the development of elaborate models of warfare to aid in the study of potential wars'.[1185] One Soviet definition of military art is: 'The theory and practice of preparation for and conduct of military operations on land, sea and in air'.[1186] The Soviet Union considered 'military art' (*voennoe iskusstvo*) to be a part of 'military sciences' (*voennaya nauka*).[1187] Military sciences may be said to encompass threat assessments and the development and implementation of military and other defensive measures to counter identified threats.

The term has also been defined by Pokrovsky, an influential Soviet scientific expert and officer who achieved the rank of General, as the following.

> *'Military science is that system of knowledge which is necessary under contemporary conditions for the preparation of the defense of the country and for the conduct of war as a whole. It embraces those problems of the military art which are concerned with direct armed conflict and with the means of securing victory. In addition to solving the problems of military art—and also of military organization, armament, and preparation—military sciences also studies the total of the socio-political, the economic, the morale, and the other factors influencing military affairs as a whole. Thus military science goes far beyond the limits of problems directly connected with military technology. But, precisely for this reason, military science is able to serve as the foundation for evaluating individual fields of military technology and for evauluating all the sciences on which that technology is based. Only on the basis of military science is it possible to establish the inter-relation of the various forms of military technology, showing the way to a harmonious combination of its various forms and to its most effective employment in combat'*.[1188]

1184 *The New Encyclopaedia Britannica*, vol. 8, 15th edition (Encyclopaedia Britannica, Inc.: Chicago, 1985), 'military science', p. 129.

1185 *The New Encyclopaedia Britannica* (note 1184), p. 129.

1186 Eds. N. V. Ogarkov, et al., *Voenny Entsiklopedichesky Slovar'* (Military Publisher: Moscow, 1984), p. 140. Volume issued by the Institute of Military History of the Ministry of Defence of the USSR. Ogarkov was Marshal of the Soviet Union. A post-1972 Soviet biological weapon programme was informally referred to as 'The System' or 'Ogarkov's System'.

1187 Ogarkov (note 1186), p. 140.

1188 Georgy I. Pokrovsky, *Science and Technology in Contemporary War*, translated and annotated by Raymond L. Garthoff (Atlantic Books, Stevens & Sons, Ltd.: London, 1959), p.

'Militant Islamic Group'. Ibrahim Karawan argues for the following distinctions regarding terminology of militants motivated by Islam. He argues that 'Islamic', 'Islamist' and 'violent groups' not be lumped together.[1189] He states that 'Islamic' groups often focus on individual redemption, while 'Islamist' groups emphasize obtaining political power.[1190] He further states that militant Islamic groups (MIGs) are a subset of Islamists and that MIGs seek to 'eradicate existing state structures via a combative insurrectional approach'.[1191] Karawan also states that various 'Islamic arguments' can be contradictory to each other and that such arguments should be viewed more in terms of how they are used to reflect tensions inherent to a 'colonial setting' or ethnic conflict.[1192] Karawan observes that MIG violence 'reflects a strong sense of urgency, emergency, and immediacy to act in a confrontational manner within a setting marked by cultural, political and economic inequality and marginalization'.[1193]

Further distinctions may result from Arab *versus* non-Arab differences or dichotomies, and 'AQ central' *versus* 'AQ regional' groupings. Akbar Ahmed, a former Pakistani political officer to Waziristan and currently a Professor at American University, emphasizes the dichotomy between the urbanized, often Westernized and repressive centre *versus* the periphery characterized by tribal customs as more important to understanding current discussions on Islamicly-inspired threats, the Global War on Terror (GWOT), and the like.[1194]

'Mirror Imaging'. This occurs when those carrying out the analysis 'acted as though the opponent would [have] use[d] a "rational" decision-making process, as *they* defined "rational"'.[1195] [emphasis by Clark]

'Mystery' has been defined as 'highly desirable information concerning intentions not yet crystallized into decisions or predictions of the outcome of events that have not yet taken place'.[1196] There is a view that intelligence services should undertake to discover and assess secrets only and that they should not attempt to make judgements concerning mysteries. The dichotomy here is similar to that of a technical secretariat which is tasked to determine the technical basis for possible noncompliance with an arms control and disarmament agreement, while the member states are supposed to determine whether the party is in compliance. In practice, the distinction can become blurred. This was shown by the controversy surrounding the US decision to attack Iraq in 2003 based on its assessment of Iraq's NBC weapon and ballistic missile programmes and holdings. It is also evident in the work of the International Atomic Energy Agency (IAEA) and possibly the OPCW.

'National technical means' is a term that arose from nuclear arms control negotiations between the Soviet Union and United States. It initially referred to overhead imagery and signals intelligence for verification purposes.[1197] The two sides

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162. Originally published as pamphlet by the All-Union Society for the Dissemination of Political and Scientific Knowledge (Moscow: Znanie Press, Oct. 1957).

[1189] Karawan (note 914), p. 53.

[1190] Karawan (note 914), p. 53.

[1191] Karawan (note 914), p. 53.

[1192] Karawan (note 914), p. 53.

[1193] Karawan (note 914), p. 54.

[1194] Ahmed (note 920).

[1195] Clark (note 29), p. 250.

[1196] Omand (note 13), p. 46.

[1197] Thomas Graham Jr. who served for 15 years as the General Counsel for the US Arms Control and Disarmament Agency (ACDA) provides first hand information on how NTM came about during US-Soviet nuclear arms control negotiations in the 1960s. Graham Jr. (note 284), p. 37.

agreed not to encrypt telemetry during test flights of ballistic missiles and to leave open silo doors when satellites passed over to allow the other side to determine whether the silo was empty. Today it is generally understood to mean all information available to a state, including that derived from intelligence. It is also sometimes used as a synomym for intelligence.

'Offensive'. A chemical warfare programme is offensive where a policy exists that envisages the use of chemical weapons (either as a first strike or retaliatory purposes). In the CWC context, an offensive chemical weapon programme or activity is any that seeks to employ such weapons as 'a method of warfare' or to 'cause death or other harm' directly through the properties of toxic chemicals or their precursors.

'Open source intelligence'. 'Open source information has traditionally meant published material that is publicly available—newspapers, books, and periodicals…Today [open source intelligence] includes much more than traditional published sources. Large volumes of imagery, for example, are becoming publicly available from commercial imaging satellites. Commercial databases hold vast quantities of economic data that are available for the price of a subscription. All fit the open source category, though they are not published in the traditional sense'.[1198]

'Precursor'. The CWC defines a precursor as 'Any chemical reactant which takes part at any stage in the production by whatever method of a toxic chemical. This includes any key component of a binary or multicomponent chemical system'.[1199] (see 'key component').

The CWC requires that any precursor that has been manufactured into order to be used the manufacture of a chemical weapon must be destroyed. In CW assessments, ambiguity may arise over whether the intent behind the production of a precursor was: (*a*) to form part of a standby capacity for CW production, (*b*) to be used to manufacture and stockpile CW or (*c*) to be used for peaceful purposes (i.e. civilian purposes or CW protective purposes).

'Production capability'. A CW production capability implies a standby capacity only and that production and stockpiling are not occurring. It also implies that the infrastructure for largescale production is in place (e.g., through the conversion of dual-purpose chemical facilities, the existence of CW quality control mechanisms, the existence of munitions filling facilities and the like).

'Production capacity'. For traditional CW threat assessment purposes, the cumulative annual production capacity for a major state military should be in the thousands of tonnes. A single CW production facility meant to support the filling of munitions in military significant quantities should be a minimum of 500 tonnes/year.

'Programme'. Programmes and activities are distinct. A programme is understood to mean an organized set of activities to achieve a desired goal (capability, weapon system development or production, etc.).

If CW agent development and testing is occurring at a small scale for protective evaluation purposes, the activity is probably not a violation of the CWC (if declared in accordance with the relevant provisions).[1200] If the programme elements are broken up (i.e., many or all of the elements do not know how their activity fits into the overall programme) or if the programme consists of developing and supporting a standby breakout capacity, the programme would be prohibited. Largescale production and testing of single purpose CW munitions would indicate the programme is offensive. However, where the line separating defensive and offensive CW programmes can, in

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[1198] Clark (note 29), p. 91.

[1199] CWC, Article II, para. 3.

[1200] See, for e.g., CWC, Verification Annex, Part VI.

practice, be unclear or politically contentious. The non-state actor CW context further complicates consideration of this distinction.

'Scientific intelligence' has been defined as 'intelligence of research projects, scientific ideas, or capabilities', including future weapons.[1201]

'Secret'. Restrictions on access to information, data or analysis are inter alia meant to protect intelligence sources and methods.[1202] The imposition of such restrictions may be done for political or technical reasons. For example, delicate negotiations between states could be undermined by the release of certain types of information on their status. Technical specifications for weapons systems may be deemed too sensitive to make public (e.g., nuclear warhead design parameters). Secrecy may also be driven by organizational or institutional imperatives. Those with access to such information may become more 'privileged' in their interactions with other institutions, including in terms of the individual's sense of self worth.

'Sensemaking'. The term has been defined to include inter alia: 'Sensemaking goes beyond analysis, a disaggregative process, and also beyond synthesis, which meaningfully integrates factors relevant to an issue. It includes an interpretation of the results of that analysis and synthesis. It is sometimes referred to as an approach to creating situational awareness "in situations of uncertainty'.[1203]

'Structured analytical techniques'. Structured analytical techniques 'usually guide the [intelligence] analyst in thinking about a problem rather than provide the analyst with a definitive answer as one might expect from a method. Structured analytical techniques in general, however, do form a methodology—a set of principles and procedures for qualitative analysis of the kinds of uncertainties that intelligence analysts must deal with on a daily basis'.[1204] A diagram of structured analytical techniques is provided by Heuer and Pherson.[1205]

'Taxonomy'. In the intelligence studies context, Robert M. Clark has defined the term as 'a classification system in which objects are arranged into natural or related groups based on some factor common to each object in the group'.[1206] Taxonomies may reflect policy-making level or operational-level intelligence taskings or information requests.[1207]

'Technical intelligence' has been defined as 'intelligence of weapons in being, whether at the planning stage or in production'.[1208] Thus, once the weapon is created, the intelligence becomes 'technical intelligence'.[1209]

'Terrorism'. There is no universally agreed definition of 'terrorism'.[1210] The US Code of Federal Regulations defines terrorism as 'the unlawful use of force and

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[1201] Based on 'Preliminary notes for Dr Blount', 29/7/1949, DEFE 40/26. Cited by Maddrell (note 129), p. 1.

[1202] Clark (note 29), p. 171.

[1203] Moore (note 414), p. xxxv.

[1204] Heuer Jr. and Pherson (note 5), p. 4.

[1205] Heuer Jr. and Pherson (note 5), back cover.

[1206] Clark (note 29), p. 28.

[1207] Clark (note 29), p. 28.

[1208] Based on 'Preliminary Notes for Dr Blount', 29/7/1949, DEFE 40/26. Cited by Maddrell (note 129), p. 1.

[1209] Based on 'Preliminary notes for Dr Blount', 29/7/1949, DEFE 40/26. Cited by Maddrell (note 129), p. 1.

[1210] Walter Laqueur, 'Appendix: Toward a Definition, or Humpty Dumpty and the Problem of Terrorism', *No End to War: Terrorism in the Twenty-First Century* (Continuum: New York City, 2004), pp. 232–238.

violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives'.[1211]

'Theory'. Heuer defines theory as 'a generalization based on the study of many examples of some phenomenon. It specifies that when a given set of conditions arises, certain other conditions will follow either with certainty or with some degree of probability. In other words, conclusions are judged to follow from a set of conditions and a finding that these conditions apply in the specific case being analyzed'.[1212]

'Threat'. Much confusion and uncertainty in threat perceptions and threat assessments arise from how this term is defined and applied in practice. Oftentimes it is broadly understood to mean a combination of capability and intention. In the absence of clear understanding of intention, analysts may approach a threat assessment by carrying out a worst case scenario. This entails systematically maximizing estimates of capabilities. For non-state actor threat assesments agreeing the intention to use CBRN weapons remains a topic of some debate. Some analysts take this as a given. Others are more sceptical. Similarly, there are two schools of thought on the capabilities of non-state actors. Some point to the case of Aum Shinrikyo which had more than 1 billion euro worth of resources at its disposal and carried out field testing and scale up studies for chemical and biological warfare, but with decidedly poor overall results. Milton Leitenberg has argued that although 'threat' has been used to refer to *agents*, *tools* and *technologies* that could potentially be used to cause harm, it should instead only be understood to mean 'an entity that has the intent and capability to cause harm'.[1213]

'Toxic chemical' is defined by the CWC as: 'Any chemical which through its chemical action on life processes can cause death, temporary incapacitation or permanent harm to humans or animals. This includes all such chemicals, regardless of their origin or their method of production, and regardless of whether they are produced in facilities, in munitions or elsewhere. (For the purpose of implementing this Convention, toxic chemicals which have been identified for the application of verification measures are listed in the Schedules contained in the Annex on Chemicals.)'.[1214]

'Toxic industrial chemical' has been defined as having an LCt_{50} (lethal concentration for half of those exposed) of less than 100 000 mg-min/m^3 and being produced in amounts of over 30 tonnes annually at any given facility.[1215]

'Types and quantities'. When the CWC was negotiated, the term referred to militarily significant quantities of toxic chemicals (i.e., the amount of agent that can affect a conflict among two armies in the field). This is reflected in the CWC's production ranges and capacities (e.g., above 1 tonne).[1216] In the non-state actor threat context and in view of S&T developments in chemistry and the life sciences, the term has lost some of its relevance.

'Weapon of Mass Destruction'. W. Seth Carus has collected more than 40 definitions of WMD which falls under five main categories: (*a*) nuclear, biologial and

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[1211] National Institute of Justice (US Department of Justice), <http://www.nij.gov/topics/crime/terrorism/>, (accessed 12 May 2013).

[1212] Heuer, Jr. (note 427), p. 34.

[1213] Personal communication with Milton Leitenberg, 2010.

[1214] CWC, Article II, para. 2.

[1215] Sun and Ong (note 549), p. 9.

[1216] This is reflected by the phrasing in the CWC's definition of a chemical weapon which inter alia consists of 'Toxic chemicals and their precursors, except where intended for purposes not prohibited under this Convention, as long as the *types and quantities* are consistent with such purposes' [emphasis added]. CWC, article II, para. 1(a).

chemical (NBC) weapons, (*b*) chemical, biological, radiological or nuclear weapons (CBRN), (*c*) CBRN and high explosive (CBRNE) weapons, (*d*) weapons that cause massive destruction or which kill large numbers of people and do not necessarily include (or exclude) CBRN, and (*e*) weapons of mass destruction or effect, possibly including CBRNE and other means of causing mass disruption, such as cyberattacks'.[1217]

[1217] W. Seth Carus, *Defining "Weapons of Mass Destruction"*, Occasional Paper no. 4 (Center for the Study of Weapons of Mass Destruction, National Defense University Press: Washington, DC, Jan. 2006), p. 7.

ANNEXE B. UN SECRETARY-GENERAL'S GUIDELINES ON THE INVESTIGATION OF ALLEGED CBW USE

Table B.1 The UN Secretary General's mechanism guidelines for the conduct of interviews

Interviews may be an important element of a fact finding mission. Therefore, ample consideration should be given the need for and the modalities of interviews in the planning of a mission. Such planning should consider the involvement and consent of the Member State receiving the investigation. Any questionnaires employed should be directly related to the investigation of alleged use of CBT weapons. Applicable epidemiological, medical, veterinary medical, and other questionnaires have been developed by relevant international organizations.
During pre-mission planning, the expert(s) should work from those models to tailor a questionnaire to the circumstances at hand, as indicated in Appendix A. Interviews should be conducted to elicit information pertinent to the investigation and with consideration to tailoring interview techniques to reflect cultural factors that might otherwise inhibit eliciting of useful information. Interview roles and responsibilities should be assigned with, at a minimum, the designation of which team member will serve as the lead interviewer and which team member will record comments.
Investigators should ask unambiguous questions. They should refrain as far as possible from leading witnesses or victims and should leave them to say what they saw, heard or felt. Interviews should be conducted with openness to the possibility that the interview may reveal unexpected information. In such instances, the interviewer should ask follow-up questions appropriate to develop possible investigative leads.
The witnesses/victims should be asked to illustrate their account by drawing a sketch map of the area of the incident and, if possible, diagramming any munitions and/or devices and markings on those items.
All interviews should be recorded. The investigation team will inform all interviewees that it will handle all interview data in a confidential manner.

Source: 'Appendix IX, Interviewing of witnesses/victims', <http://www.un.org/disarmament/WMD/Secretary-General_Mechanism/appendicies/IX/>, (accessed 2 Jan. 2011).

Table B.2 The UN Secretary General's pre-mission planning guidelines

When the Secretary-General decides to initiate an investigation of the alleged use of CBT weapons, pre-mission planning should immediately be initiated. Pre-mission planning includes a variety of activities.

The Secretary-General should convene expert(s) to assess the health, safety, and security risks that the team could reasonably anticipate during the mission based on the information provided by the requesting state (see Appendix 1) and all sources of pertinent, data available to the Secretary-General. As new data becomes available, the state requesting the investigation should update the information that it provides to the Secretary-General. The investigating team should reassess the health, safety, and security risks as it arrives at the investigation site and periodically throughout the mission.

The expert(s) should also develop a mission plan that consists of several elements, including the following:

a sample collection and analysis plan;
an interview plan;
resource requirements;
logistics plan, and,
command and control plan.

The sampling plan. Specific to the alleged event, the expert(s) should articulate the appropriate measures to establish whether CBT' weapons have been used. The expert(s) should work out the details of the sampling plan in consultation with the laboratories likely to perform the sample analysis. The sampling plan should include:

the sample collection strategy and techniques to be used, including sampling from locations where the agent might naturally concentrate;
the amount of samples to be collected, based on available guidelines for sampling and in consultation with laboratories likely to perform sample analysis;
the materials and storage conditions, including packing for shipment, necessary to preserve the integrity of samples during storage and transportation;
analysis methods to be employed;
identification of samples previously taken by other authorities and organizations and consideration of how such samples might factor into the investigation; and,
consideration of any special requirements for chain of custody, shipment of samples, including initiation of clearances with carriers and the Member State(s) involved.

This sampling plan should be refined once the team is on location.

The interview plan. During the pre-mission planning process, the expert(s) should create an interview plan specific to the circumstances known from the risk assessment. Working from medical, epidemiological, and other (e.g., veterinary) questionnaires developed by relevant international organizations, the experts should tailor interview questionnaires (See Appendix IX.).

Resource requirements and logistics. Based on the risk assessment and the mission plan, the expert(s) should make several recommendations to the Secretary-General regarding the resources required for the upcoming mission:
the type and number of experts appropriate for the investigation;
the type and amount of equipment required to ensure the health and safety of the team and to enable the anticipated investigatory tasks; and,
the type and number of laboratories selected to perform sample analysis.

As the Secretary-General selects and assembles the investigation team, the expert(s) should plan the appropriate medical support for the team and consider whether any additional training is required for the mission location. The expert(s) should also plan for the interpretation needs for witness and medical interviews and other investigation activities.

To support the team's deployment to the field, the following activities will be necessary:

signing of relevant agreements by experts to be deployed;
fitting of personal protective equipment;
personnel travel planning, including passports and visas;
arrangements for the transport of the equipment required for the investigation; and,
if appropriate, additional training.

Among other factors pertinent to the conduct of the investigation, the Secretary-General will want to establish with the receiving Member State the proper assurances that the equipment and personnel for the investigation mission will be cleared for entry into, movement within, and exit from the Member State. The Secretary-General will also want to seek the cooperation of the receiving Member State in facilitating the investigation team's communications while in country either by: 1) identifying acceptable radio frequencies or, 2) providing communication means for the investigation team.

Organization of the investigating team. Clear command and control is essential to the efficiency and success of an investigatory mission. Command and control principles should be set during the pre-mission planning process and clearly understood among the investigative team to establish authority, responsibility, and accountability among team members. Among other things, command and control principles should clarify:

rules of the investigation, including permissible and non-permissible activities;
chain of command;
specific functions and tasks of various team members;
channels of communication;
agreed protocols for tasks; and,
the agreed priority and schedule for tasks.

The expert(s) may recommend that an individual be identified and designated to manage the collection, chain of custody, storage, and transport of samples.

The Secretary-General will designate a team leader for this investigation mission. Unless another team member is authorized to function in this capacity, the team leader will be the point of contact for interaction with United Nations Headquarters and host authorities.

Pre-planning should be accomplished in a time-efficient manner in order to be able to deploy an investigative team promptly.

Source: 'Appendix A, Pre-mission planning', <http://www.un.org/disarmament/WMD/Secretary-General_Mechanism/appendicies/A/>, (accessed 2 Jan. 2011).

Table B.3 The UN Secretary General's mechanism guidelines for the reporting of investigations activities

The investigation team should file a report that elaborates its activities, the evidence found, and the team's findings. The report could be modeled on the format that follows, adjusted as needed.
Executive summary
Pre-investigation activities
Investigation activities
Findings
Appendices:
Data from state requesting investigation
Terms of reference (e.g., authorizing letter)
Administrative data
Investigation location
Team personnel
Non-destructive evaluation
List of samples taken
List of other evidence collected
By the investigative team
Obtained from other authorities or relevant international organizations
Results of analysis and clinical diagnostics
Sample analysis: laboratory 1
Sample analysis: laboratory 2
Sample analysis: laboratory 3 (if necessary)
Records of interviews conducted
List of medical investigation activities
Summary, clinical data on patients Epidemiological investigation report
Breakdown of medical cases examined
List of plant and animal investigation activities
Data summary regarding affected plants, animals Epidemiological investigation report
Breakdown of cases examined
Record of chain of custody activities
Record of tags and seals
Should there be individual opinion(s) differing from the majority of investigators, they should be reflected in the investigative report.

Source: 'Appendix C, Report of investigation activities', <http://www.un.org/disarmament/WMD/Secretary-General_Mechanism/appendicies/C/>, (accessed 2 January 2011).

Table B.4 UN Secretary General's guidelines for type of information to be provided in reporting possible use of CBT weapons

The request for an investigation of an alleged use of CBT weapons to be submitted to the Secretary-General should describe the basis for the request, including as far as possible the following information:

1. Description of the trigger(s) of suspicion of alleged use of CBT weapons (e.g., outbreak of non-endemic disease, specific event), including the date, time, and subsequent timeline of events related to the alleged use
2. Tentative conclusion regarding alleged attack and, if possible and/or desirable, identification of possible perpetrator
3. Identification of the location
    - (a) location name
    - (b) geographic (GPS) co-ordinates
    - (c) in relation to another known location (by direction and distance)
4. Characteristics of the site(s)
    - (a) military (type)
    - (b) civil (city, rural area, town, buildings affected)
    - (c) nature of the terrain (relief, vegetation)
    - (d) accessibility of the site
5. Meteorological conditions
6. Methods of dissemination used
    - (a) weapons:
        - (i) aerial bombs
        - (ii) rockets
        - (iii) artillery
        - (iv) spray devices
        - (v) others
    - (b) animal and arthropod vectors
    - (c) others (e.g., air, food, water)
7. Extent of the weapons used
    - (a) surface(s) affected
    - (b) number and duration of weapons used
8. Characteristics of the possible CBT agent
    - (a) preliminary identification
    - (b) type, consistency, and persistency of contamination
        - (i) contamination of equipment and buildings
    - (c) formulation
    - (d) transmissibility
9. Effects on humans
    - (a) estimated number of fatalities
    - (b) number of victims
        - (i) hospitalized
        - (ii) other
    - (c) signs and symptoms
        - (i) at the time of the attack
        - (ii) delayed onset
    - (d) epidemiological data
    - (e) treatments and/or other countermeasures used
    - (f) response to treatments and/or countermeasures
10. Effects on animals
    - (a) signs and symptoms
    - (b) epidemiological data
    - (c) treatments and/or other countermeasures used
    - (d) response to treatments and/or countermeasures
11. Effects on vegetation and crops
    - (a) signs of contamination
    - (b) signs and symptoms
    - (c) epidemiological data
    - (d) treatments and/or other countermeasures used
    - (e) response to treatments and/or countermeasures

12. Samples
    (a) types of samples identified in situ, including any unexploded munitions or remnants of munitions
    (b) types of samples analyzed
    (c) results of available analyses
    (d) types of samples accompanying the report
    (e) documentation system for the sampling process
13. Request for medical assistance, and the nature of such assistance
14. Request for technical assistance (detection, decontamination etc.)
15. If the requesting state and the receiving state are the same, for planning purposes, indication of the modalities and assistance available to support an investigation:
    (a) logistics
        (i) transportation
        (ii) housing
        (iii) food/water
        (iv) utilities
    (b) medical support:
        (i) for collection of clinical samples
        (ii) for the investigation team
    (c) sample storage
        (i) secure storage location
        (ii) refrigeration
    (d) interpreters
    (e) expertise in dangerous good packaging, transport
    (f) point of entry or other suggested safe routes of access for the team to the investigation site(s)
    (g) 24-hour point of contact, including telephone, e-mail, and facsimile.

Source: 'Appendix I, Types of information to be provided as available by a Member State to the Secretary-General in reporting the possible use of chemical, biological, or toxin (CBT) weapons', <http://www.un.org/disarmament/WMD/Secretary-General_Mechanism/appendicies/I/>, (accessed 2 January 2011).

ANNEXE C. SELECTED TOXIC INDUSTRIAL CHEMICALS (TICS)

Table C.1 Common TICs according to toxicity and CAS no.

High	Medium	Low
Ammonia (7664-41-7)	Acetone cyanohydrin (75-86-5)	Allyl isothiocyanate (57-06-7)
Arsine (7784-42)	Acrolein (107-02-8)	Arsenic trichloride (7784-34-1)
Boron trichloride (10294-34-5)	Acrylonitrile (107-13-1)	Bromine (7726-95-6)
Boron trifluoride (7637-07-2)	Allyl alcohol (107-18-6)	Bromine chloride (13863-41-7)
Carbon disulphide (75-15-0)	Allylamine (107-11-9)	Bromine pentafluoride (7789-30-2)
Chlorine (7782-50-5)	Allyl chlorocarbonate (2937-50-0)	Bromine trifluoride (7787-71-5)
Diborane (19287-45-7)	Boron tribromide (10294-33-4)	Carbonyl fluoride (353-50-4)
Ethylene oxide (75-21-8)	Carbon monoxide (630-08-0)	Chlorine pentafluoride (13637-63-3)
Fluorine (7782-41-4)	Carbonyl sulphide (463-58-1)	Chlorine trifluoride (7790-91-2)
Formaldehyde (50-00-0)	Chloroacetone (78-95-5)	Chloroacetaldehyde (107-20-0)
Hydrogen bromide (10035-10-6)	Chloroacetonitrile (7790-94-5)	Chloroacetyl chloride (79-04-9)
Hydrogen chloride (7647-01-0)	Chlorosulphonic acid (7790-94-5)	Crotonaldehyde (123-73-9)
Hydrogen cyanide (74-90-8)	Diketene (674-82-8)	Cyanogen chloride (506-77-4)
Hydrogen fluoride (7664-39-3)	1,2-Dimethylhydrazine (540-73-8)	Dimethyl sulphate (77-78-1)
Hydrogen sulphide (7783-0604)	Ethylene dibromide (106-93-4)	Diphenylmethane-4,4'-diisocyanate (101-68-8)
Fuming nitric acid (7697-37-2)	Hydrogen selenide (7783-07-5)	Ethyl chloroformate (541-41-3)
Phosgene (75-44-5)	Methanesulphonyl chloride (124-63-0)	Ethyl chlorothioformate (2941-64-2)
Phosphorus trichloride (7719-12-2)	Methyl bromide (74-83-9)	Ethyl phosphonothioic dichloride (993-43-1)
Sulphur dioxide (7446-09-5)	Methyl chloroformate (79-22-1)	Ethyl phosphonic dichloride (1066-50-8)
Sulphuric acid (7664-93-9)	Methyl chlorosilane (993-00-0)	Ethyleneimine (151-56-4)
Tungsten hexafluoride (7783-82-6)	Methyl hydrazine (60-34-4)	Hexachlorocyclopentadiene (77-47-4)
	Methyl isocyanate (624-83-9)	Hydrogen iodine (10034-85-2)
	Methyl mercaptan (74-93-1)	Iron pentacarbonyl (13463-40-6)

Nitrogen dioxide (10102-44-0)
Phosphine (7803-51-2)
Phosphorus oxychloride (10025-87-3)
Phosphorus pentafluoride (7647-19-0)
Selenium hexafluoride (7783-79-1)
Silicon tetrafluoride (7783-61-1)
Stibine (7803-52-3)
Sulphur trioxide (7446-11-9)
Sulphuryl fluoride (2699-79-8)
Tellurium hexafluride (7783-80-4)
n-Octyl mercaptan (111-88-6)
Titanium tetrachloride (7550-45-0)
Trichloroacetyl chloride (76-02-8)
Trifluoroacetyl chloride (354-32-5)
Isobutyl chloroformate (543-27-1)
Isopropyl chloroformate (108-23-6)
Isopropyl isocyanate (1795-48-8)
n-Butyl chloroformate (592-34-7)
n-Butyl isocyanate (111-36-4)
Nitric oxide (10102-43-9)
n-Propyl chloroformate (109-61-5)
Parathion (56-38-2)
Perchloromethyl mercaptan (594-42-3)
sec-Butyl chloroformate (17462-58-7)
tert-Butyl isocyante (1609-86-5)
Tetraethyl lead (78-00-2)
Tetraethyl pyroposphate (107-49-3)
Tetramethyl lead (75-74-1)
Toluene 2,4-diisocyanate (584-84-9)
Toluene 2,6-diisocyanate (91-08-7)

Source: US Department of Labor, Occupational Safety & Health Administration, 'Toxic industrial chemicals (TICs)', <http://www.osha.gov/SLTC/emergencypreparedness/guides/chemical.html>, (accessed 26 May 2013).

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Publications archive www.doria.fi

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ISBN 978-951-25-2574-4 (pbk.)
ISBN 978-951-25-2575-1 (PDF)
ISSN 1236-4959