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Cover Page Footnote

Contributions to this paper by Lieutenant Colonel Katherine C. Mack were made in her capacity as an Air Force Fellow at the Stimson Center. The views presented are those of the authors and do not necessarily represent the views of the US Department of Defense or its components.

Gender Undone: Confronting Bias in the Nuclear Field

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The Stimson Center

Abstract

In the face of evolving security needs, diversity is critical in nonproliferation, nuclear security, and other related fields. Despite multiple studies highlighting the need for gender balance and diversity in the nuclear nonproliferation and security space and targeted recruitment and capacity-building efforts by the International Atomic Energy Agency and states, gains in the representation of women (as well as historically underrepresented groups) have been set back by the gendered effects of the COVID-19 pandemic and slow cultural change at nuclear facilities and organizations. This issue is in large part due to the inability of initiatives aimed at diversity, equity, inclusion, and accessibility (DEIA) to deal with the structural biases of who *belongs* in nuclear security.

Accordingly, this paper will address potential solutions and good practices for reforming organizational nuclear security culture in the United States. Integrating policies to actively confront and undo structural biases and gendered assumptions about women in nuclear security is the start of building DEIA into the broader nuclear industry and its associated organizations. Although bias is an inevitable symptom of the human condition, employers in the nuclear field can work to check biases by integrating DEIA values and assumptions that deal with gender representation into the organizational culture. This paper finds that significantly more transparency and public data reporting is needed in the sector to understand the scope of the challenge and posits the creation of a DEIA nuclear security organizational culture more reflective of DEIA values to strengthen nuclear security and improve the diversity of the nuclear field in the long term.

Keywords: nuclear security, women, gender, bias, DEI, DEIA, diversity, equity, inclusion, accessibility, nonproliferation

1. Introduction

In recent years, socially galvanizing events have thrown into stark relief the enduring social and institutional biases that continue to work against women and historically marginalized groups in the United States. These events include the Harvey Weinstein sexual abuse trial and subsequent #MeToo movement that forced society to confront not just a widespread tolerance of abuse in certain sectors but also an equally or perhaps even more damaging cultural tendency to discount and dismiss women's lived experiences of discrimination. Years before that, the Black Lives Matter movement grew out of police and vigilante killings of African Americans. With the explosion of social outrage at the murder of George Floyd in 2020, the movement helped elevate to international consciousness not just the routine violence perpetrated against Black people but also the structural racism that pervades the United States. As institutions across the country continue to examine and attempt to address their own structural bias and racism, nuclear facilities and organizations have also come under scrutiny on diversity, equity and inclusion issues.

Given that a 2013 study found that the first thing a person would notice when interacting with another individual was their race and gender, it is fitting to examine the subconscious biases associated with these traits to understand why and how the nuclear field has become too exclusionary and, more importantly, what can be done to change it for the better [1]. Diversity, equity, inclusion, and accessibility (DEIA) initiatives have so far failed to deal with the structural biases informing antiquated perceptions of who belongs in the security space, to understand how to include more diverse candidates, or to clarify what is needed to retain women and other underrepresented groups in the field. Despite this fact, years of social science research on diversity and performance, combined with newer studies on commercial performance, demonstrate the link between diverse workforces, improved critical thinking, problem solving, innovation, talent retention, and improved organizational outcomes [2–6].

Despite multiple studies highlighting the need for diversity in nuclear nonproliferation and security and targeted recruitment and capacity-building efforts by the International Atomic Energy Agency (IAEA) and states, gains in the representation of women and historically underrepresented groups have been slow. For example, a recent Gender Champions in Nuclear Policy (GCNP) membership survey found that women were more likely than men to report that caregiving duties had affected their ability to be fully engaged professionally [7]. The exclusion of groups on the basis of gender, race, sexual preference, identity, or any other marginalization marker is a structural problem that requires long-term and sustainable structural solutions. Although bias is an inevitable symptom of the human condition, employers in the nuclear field can work to check biases by acknowledging their existence and working to eliminate them through culture shifts and policies to strengthen DEIA. This paper finds that significantly more transparency and public data reporting is needed in the sector to understand the scope of the challenge and posits the creation of a DEIA nuclear security organizational

culture more reflective of DEIA values to strengthen nuclear security and improve the diversity of the nuclear field in the long term.

2. Gender and Diversity in Nuclear Security: The State of the Field

The availability of workforce demographic data for specific sectors of the US economy varies by sector. For US nuclear security workers, however, the data are sparse whether one considers the private industry, the nonprofit policy community, or the government sector. Nevertheless, several proxy sources of data, in particular from US Government sources, provide some sense of the state of the field. For instance, the US Department of Energy's (DOE's) *United States Energy and Employment Report 2022* found a gender imbalance overall in the nuclear electricity industry, with a 65% male workforce compared with a 55% male workforce nationally. The same report noted that although the nuclear electricity workforce has a higher percentage of nonwhite workers than the national average (34% compared with 22% nationally), African-Americans and Hispanic or Latino workers, as well as people with disabilities, are underrepresented [8].

Women and other underrepresented groups have been present in the broader US nuclear policy and security fields since the 1970s, even holding leadership positions across key US Government agencies with nuclear responsibilities (US Departments of State, Energy, and Defense, National Security Advisors, and the Arms Control Disarmament Agency). Broader analyses of women and minorities in positions of US national security leadership generally have shown a positive trend of increasing female appointees to cabinet-level positions with successive presidential administrations since President Kennedy [9, 10]. However, a recent 2019 tally of women and minorities in leadership positions in US Government departments with nuclear responsibilities showed them to be vanishingly small, with data in some cases unavailable for groups other than women [12]. About 32% of the overall National Nuclear Security Administration (NNSA) workforce are women, a statistic broadly replicated across the 17 national laboratories of the DOE [12, 13]. Similarly, about 33% of the NNSA's total workforce self-identify as members of historically underrepresented groups, and members of "underrepresented minorities" and "other people of color" together made up about 32% of the combined workforce of the 17 national laboratories in 2022.

The US Department of Defense (DoD) oversees a diverse portfolio of nuclear facilities, ranging from consolidated weapons storage, maintenance warehouses, and operationally deployed sites. After George Floyd was murdered, the DoD undertook a review of racial disparities within the uniformed military. Although these reports were not specifically focused on nuclear security or personnel in nuclear security, the overall trends in the services can reasonably be used as representative proxy data for members that are part of the nuclear field. Because the Departments of the Air Force and Navy are responsible for the large majority of nuclear facilities, security, and operations in the DoD, data from these two services are presented here as particularly relevant. In June of 2020, then-Secretary of Defense Mark T. Esper directed a wide range of initiatives "to promote morale, cohesion, and force readiness" [14]. The resulting report acknowledged that although the DoD sees itself and its organizational

history as a “leader on issues of [diversity and inclusion],” it is not “immune to the forces of bias and prejudice” [14]. The data provide a snapshot in time of slight minority overrepresentation in enlisted ranks and underrepresentation in officer ranks (both as a comparison against the *eligible* US population) and of minority promotion and retention rates; the report also presents one short chart that includes a breakout for women in the officer corps [14, pages 7–11]. However, the report’s short overview of fewer than five pages does not offer a detailed breakdown of disparities for minorities.

The Department of the Navy’s 2020 review provides even less statistical data on representation, promotion, or opportunity, with a total of three pages of charts and basic analysis, and is weighted heavily toward officer corps data, which represented only about 16% of total active-duty Navy personnel in 2022 [15]. The Navy’s analysis does include a very limited but needed identification of career field specialty areas, such as special warfare, submarines, and naval aviation, with significantly less diversity in the junior ranks than other fields. This lack of diversity in the lower ranks exacerbates underrepresentation in more senior ranks [15]. The Department of the Navy states that it is “able to track demographic data, such as gender, race and ethnicity by rank, rate, community, designator and rating” for the last 20 years, but it does not provide an historical breakdown for the enlisted corps, which represents nearly 84% of active-duty Navy personnel, or specifically for gender [16]. A few sentences about increased percentages in the last 20 years appear to be focused on showing that the Navy has improved rather than providing a detailed analysis of what could be causing systemic DEIA issues [16].

The Department of the Air Force took a much more detailed approach in its 2020 review of racial disparity. The initial review in 2020 focused on African Americans in the Air Force [17], and a follow-on review applied the same framework to women and Asian American, Native American, Pacific Islander, and Hispanic/Latino racial and ethnic minorities [18]. The Air Force also analyzed disparities across the following areas: military justice and discipline, administrative disciplinary actions and discharges, investigations, accessions, professional military education, promotions, and retention; they included interviews and survey responses from over 123,000 members [17]. Within these broad areas, the Air Force analyzed more granular areas, consistently breaking down each issue into officer, enlisted, and civilians, as well as identifying specific types of disciplinary issues, such as drug use or sexual harassment; types of career fields (operations or support); rates for nomination, selection, and professional development opportunities; and rates at which a given minority is placed in senior leadership positions. In total, the Air Force collected and published nearly 300 pages of detailed statistics on a variety of issues that affect DEIA for its members, providing a granularity that most DoD reports cannot.

Although broader than the US geographic scope chosen for this study, United Nations (UN) data also yield interesting insights into trends for women’s participation, which has increased overall but not evenly across all forums or committees [12, 19, 20]. Focusing on leadership in the Nuclear Non-Proliferation Treaty (NPT) Preparatory Committee and

Review Conferences, the overall number of women heads of delegation have increased but not at the same rate as general attendees [20].

Additionally, these UN data reveal particularly concerning trends over the last 10 years. First, UN committees appear to have gendered participation, determined by whether that policy area is gendered as *masculine* or *feminine* [20]. Additionally, women's participation and leadership rates in the NPT Review Conference appear to have peaked in 2010 before declining in 2015 [20]. The Gender Champions in Nuclear Policy (GCNP) report *Tested by Crisis* released in 2021 highlighted the additional negative effect of the COVID-19 pandemic in the last few years, suggesting that the load of “unpaid care work” for sick relatives and children is disproportionately borne, even in nonpandemic times, by women [7]. The report also cited research on the pandemic's effect on GCNP members in nuclear policy. Acknowledging that the college-educated nuclear policy workforce had by and large transitioned to remote work—with far more ease than retail, food service, and other public-facing sector workers—the GCNP nevertheless found that women [in nuclear policy] were nearly twice as likely to have experienced economic hardship as men, and more than three times as likely to have had their work hours reduced. Among those whose work hours were reduced, 86% of women attributed reductions to an increased volume of care work while zero percent of men did the same [in a sample size of 231 individuals]. Women also tended to spend more time overall on care work; the median percentage of total time spent on care work during an average day was two times higher among women than men. The obvious and immediate impacts of the pandemic directly challenged women's ability to stay engaged in the professional sphere, a challenge much less pronounced for their male colleagues [7].

Given the tiny proportion of other historically underrepresented groups in the nuclear sector (for example, black representation in the national laboratories' workforce hovers in the low single digits) and the lack of research and data on them, assessing the effects of the COVID-19 pandemic is necessarily an anecdotal exercise, which must be supplemented by inferring from broader societal trends. Nevertheless, numerous studies have shown a link between poor environmental factors and higher incidents of disease—a correlation that has made communities of color much more susceptible to the worst effects and outcomes of the pandemic. (These effects also included higher rates of hospitalization and death than the population at large [21].) It is reasonable to infer, therefore, smaller subsets of these communities that work in the nuclear security field could have been similarly affected.

3. Structural Causes of DEIA Barriers to Entry in the Nuclear Field

To illustrate the structural biases at play in society, sociologist Victor Ray points to the way many people routinely refer to “Black capitalism,” “Black banks,” and “ethnic restaurants” yet think of banks that are run by and serve predominantly white communities simply as “banks” and white corporations simply as “businesses” [22]. This type of thinking reinforces white people as the default portrayal of Americans and *others* the experiences and reality of people of color in the country, thus demonstrating the way

that power structures reproduce racial exclusion and marginalization in organizations and life [22]. In the nuclear sector, this exclusionary power dynamic is evident in its lack of diversity and the ongoing challenge it has faced in addressing the structural inequalities of the field's foundation. From the earliest days of the Manhattan Project, the racial, political, and social hierarchies created by nuclear colonialism prioritized white, upper-class personnel and placed people of color, women, and the poor under erasure [23]. Nuclear weapons were built and tested on lands that belonged to the most vulnerable in society. Indigenous populations, disenfranchised communities, former colonies, and people of color were subject to the ill effects of nuclear colonialism without their consent or any consideration given to their lives. The effects of these choices have affected communities for decades; they bear the radioactive legacies of uranium mining and nuclear testing on their lands and bodies [24].

Despite the decades that have passed, the nuclear field remains a predominately white and male space. The narrative of the development of the bomb, as with many other scientific endeavors, painted over the contributions of the people of color and women who made unequivocal contributions to the development of the atom bomb, despite the initial diversity of the Manhattan Project team [25]. This whitewashing of history set the precedent for the exclusion of those deemed *other* from participation in the nuclear weapons field and for ousting them from the nuclear community, thus allowing the gatekeepers of the nuclear field to preserve their own image. As Mareena Robinson Snowden writes, “the benign, seemingly passive metric of ‘seeing yourself’ in an applicant can be a key driver to the preservation of the existing racially inequitable status quo” [23]. Indeed, homogeneity is often encouraged in the nuclear community, and the way the field is taught and its research products are constricted to a single frame of reference by the experiences of perspectives of the historically dominant identities [26]. This phenomenon trickles down to mentorship and pathways for advancement; leaders most often prefer to mentor junior colleagues who reflect themselves—posing additional challenges to the representation of women and historically marginalized demographics in leadership roles [27].

4. Barriers to Inclusion Faced by Women and Historically Marginalized Groups in the Nuclear Field

Women in particular face a unique set of challenges that can make it more difficult for them to enter the nuclear field and stay there in the long run. These challenges, some related to the ingrained structural bias in US culture and society referenced in the previous sections that assigns women a disproportionate share of unpaid care work, include significant travel, few job opportunities at the top level of the organization, lower pay relative to other parts of the private sector, and lack of opportunities at the undergraduate and graduate levels for women to learn about nuclear weapons [28]. The lack of opportunities in academia is often referred to as the *leaky pipeline* because women, people of color, and other historically marginalized groups experience normalized sexism and racism throughout their education to the point that they are driven to leave what otherwise could have been successful and influential careers [29]. Decisions to leave may be influenced by blatant bias or less-direct signals, such as a lack of representation in the classroom (in terms of faculty and students) and gender

bias in nuclear curricula. Only one in five required readings in core international relations graduate seminars are written by women [29, 30]. This lack reproduces the gender biases women face, which delegitimize women as knowledge-producers and participants in the nuclear field [31, 32].

This leaky pipeline has led to only 12.7% of nuclear engineers being women, a statistic that has remained relatively stable since 2010, according to Zippia, which analyzed a database of 30 million profiles [33].¹ For nuclear security officers, only 14.1% are women [34]. Studies have found that women have difficulty staying in these roles or entering the field because of a lack of appropriate mentoring and female role models, gender stereotyping, and less family-friendly flexibility [35, 36]. Women are underrepresented in multiple aspects of education, research, and leadership, with women holding a disproportionately low share of science, technology, engineering, and mathematics (STEM) undergraduate degrees. However, even with a degree, women are less likely than their male counterparts to work in a STEM occupation [36].

These structural biases on the basis of race or sex are perpetuated by outcomes of power relations—power produces and reproduces knowledge, meaning, and identities by practice and discourse, thus unconsciously excluding historically marginalized groups from participation in the nuclear space [37]. The underlying issue in learning how to attract more diversity to the nuclear security field entails understanding how conscious or unconscious biases inform barriers to inclusion for women and historically marginalized communities.

The barriers women face in the nuclear community are rooted in the male-dominated origin of the nuclear field. These creators of strategic doctrine referred to themselves as “the nuclear priesthood,” emphasizing an element of self-awareness when it came to the exclusivity and male-dominated nature of the field [38]. As the nuclear field eventually moved away from theoretical approaches to deterrence and expanded into subsections that included arms control, nonproliferation, and security, it removed formal barriers that had hitherto limited women’s participation. However, hurdles to participation for women and other historically marginalized groups remain.

Resulting barriers to accessibility in the field include the vocabulary of nuclear weapons and a culture of “expertise” that made it difficult for historically marginalized groups to participate and enter the space [38]. Women seeking to advance in the field must often adapt and maneuver through the linguistic and cultural barriers to entry. Former Under Secretary of Defense for Policy Michèle Flournoy described the process, saying, “There are some very clear rites of passage. You had to master the orthodoxy. And you had to master the technical details before you could have an opinion” [11]. There are rigid ideas about what is considered legitimate policy ideas or not—as one of the authors of the *New America* study, Heather Hurlburt, elaborates, “In order to be taken seriously in the field, whether you are male or female, you have to agree to restrict yourself and keep your discourse inside the boundaries of what somebody else decades ago sort of

¹ Zippia’s estimates are verified against US Bureau of Labor Statistics data, US Census data, and current job openings for accuracy.

decided were the limits of the field” [39]. This notion of conditional participation within defined bounds and procedures has been referred to a “Consensual Straitjacket” [40]. This trend of restricted participation, cultural conformity, and linguistic barriers has resulted in a resistance to outside thinking and modernizing the field, thus perpetuating the exclusion of women, people of color, and other historically marginalized perspectives.

Furthermore, the nuclear orthodoxy is not only jargon-rich but also requires women to go above and beyond to prove their mastery to male colleagues. Flournoy made no mention of her male colleagues having to prove themselves in a similar manner but made it clear that developing expertise was critical to gaining the respect of her male colleagues [11]. Other interviewees in the *New America* study described working in the priesthood as “especially draining or restricting,” and many changed their careers to move forward [11]. In 2021, The Belfer Center on Managing the Atom at the Harvard Kennedy School hosted a Zoom panel on the gender gap in nuclear security. One woman panelist, Jenny Town, a senior fellow at the Stimson Center, noted that being the only woman in the room means that you have to arrive “overprepared” and ready to be “questioned on everything” [41]. The bureaucracy of secrecy that dominates American nuclear weapons research has also formed the basis for exclusion in the nuclear field. Nuclear labs especially are regulated by an “elaborate system of rules and taboos” [42]. The development of the bomb during World War II and the arms race of the Cold War years exacerbated chronic secrecy necessary for national security. However, compartmentalizing knowledge and institutionalizing a need-to-know logic of access work as forms of social control and create hierarchies, thus allowing secrecy to be used as a tool for exclusion in the national and nuclear security fields [43]. The authors of *The 9/11 Commission Report* found that qualified applicants who were foreign-born or had relatives abroad were discouraged from applying from sensitive national security positions and faced barriers to obtaining a security clearance owing to foreign ties [44, 45]. In recent years, diplomats, military and veteran families of color, and members of the intelligence community have again raised concerns about the persistence of racial biases affecting their careers [46, 47]. A 2022 report examining racial bias in the security clearance process found that preconceived notions held by investigators about the lack of trustworthiness of minority racial or ethnic group or disproportionate concerns about the mitigation actions needed to address risks could result in some racial groups being denied security clearances at a disproportionate rate [45]. Reporting has found that these biases produce recruitment, retention, and advancement challenges that exacerbate diversity issues in the national security—and, subsequently, nuclear security—field [46]. The conscious and subconscious biases that inform who is allowed access to the nuclear and national secrets result in unwarranted scrutiny and exclusionary practices that bar historically marginalized groups from the field.

The nuclear field has also restricted how historically marginalized groups can participate as knowledge producers. White men tend to dominate debates in terms of representation at panel discussions—often ironically referred to as *manels*. A survey conducted over a 1-month period on *The New York Times*, *The Wall Street Journal*, and

The Washington Post found that at least 28 articles on nuclear security policy cited only male experts—a phenomenon dubbed *marticles* [48].² The authors who conducted this study looked at publications such as *Defense News*, *Politico*, *Vox News*, *Bloomberg*, *The Guardian*, *The Atlantic*, *CNN*, *Reuters*, and more but admitted that there were likely other pieces that featured male nongovernmental experts exclusively—such as radio and television statistics. When it comes to women being cited by others as experts in the field, women over 65 are less likely to be cited as an expert in the media than boys between the ages of 13 and 18 [49].

The lack of representation in articles also comes down to the lack of women in the field and reveals a concerning set of trends. The IAEA reports that women comprise less than a quarter of professionals working in the nuclear sector globally—especially when it comes to senior roles [50]. The DOE also reports that less than 20% of women make up the nuclear workforce [51]. When it comes to nuclear diplomacy, for the gender distribution of meetings with less than 100 participants, women tended to comprise 20% of the total number of participants on average, and they only averaged 32% of the total participants in larger forums [20]. The 2019 UN Institute for Disarmament Research report noted this trend came from a representative sample of multilateral settings over the past decade, where women participated in arms control, nonproliferation, and disarmament [20]. Although groups such as GCNP have attempted to combat these trends with a “Panel Parity Pledge,” encouraging members not to participate in panels, it has inadvertently resulted in whitewashed panels, revealing the intersectional depth of the structural biases excluding women and people of color from the field [52].

Similar to the systemic issues that keep organizations from incorporating effective DEIA initiatives into their day-to-day operations, the challenges women face are the result of deeply ingrained structural problems that continue to keep the nuclear profession a mostly male-dominated field. For example, the nuclear field requires skills and attributes traditionally understood to be inherently masculine, such as decision-making, war engagement, policymaking, strategizing, threat assessment, and response [37]. Structural challenges are perpetuated by outcomes of power relations—power produces and reproduces knowledge, meaning, and identities by practice and discourse [37]. This structure creates an “unconscious bias” against women in the nuclear space [37]. The underlying issue in learning how to attract more women to the security field entails understanding how the conscious or unconscious biases play a role in establishing women’s fitness for the task.

The long-standing omission of women from participating in the nuclear space has also allowed an alternative discourse to develop that characterized opposition to nuclear weapons as soft and feminine—as opposed to the more masculine traits associated with advocacy for nuclear deterrence [53]. Considering that women are still relative newcomers to the field, many experience the decades-growth of gender biases regarding their social identity in science and security fields. Indeed, ideas about gender can further serve to mold and limit the professional and political discourse surrounding nuclear weapons. Gender is understood as a social phenomenon of conceptual

² The authors did not include the total number of articles analyzed.

dichotomies correlating certain assumptions and behavioral traits with sex [54]. Masculinity, as it is typically understood, is in opposition to femininity. These concepts derive their meaning in relation to the other. In other words, masculinity gains its meaning when it is placed in contrast to femininity [55]. Thus, when femininity is discredited in nuclear spaces, it in turn excludes women as valued contributors. Anthropologist Hugh Gusterson writes that “Nuclear weapons scientists operate in a gendered world in which the mission of the laboratory is coded as masculine, rational, and superordinate while the subordinate sentimental and emotional values associated with women and children are ghettoized in the domestic sphere” [56]. Thus, the power structure of the nuclear field reflects gendered assumptions that hinder women from being seen as viable knowledge producers in the nuclear field.

These negative stereotypes that women face create a significant imbalance and add stress, which, in turn, impairs female performance [37]. These experiences can include unconscious biases that negatively influence the perception of women’s abilities, as well as social and cultural factors such as those that lead to an unequal distribution of domestic labor, which can in turn adversely affect work performance [57]. These traditional assumptions about gender roles can also make it more difficult for women to participate in the same manner as men (for instance, balancing childcare with business travel). The numerical minority status of women creates a structural barrier that triggers gender stereotypes and a social identity threat, causing many women to think that they are not skilled or do not belong in the nuclear work setting [37]. The unconscious bias, or the *glass ceiling*, for women may result in unconscious self-undervaluation, preventing an overturn and change in the structure. Moreover, women must also pay a *gender tax* in varying forms. In other words, on top of the job’s inherent complications and high stress, as Daniel Drezner notes, “women also had to perform the constant mental and emotional calculus that comes with implicit sexism, explicit sexism, and discrimination; gender and sexual harassment; and gendered expectations” [58].

Figuring out how to attract more women to the field necessitates understanding these biases and the gender taxes that women must pay while also taking into consideration that other factors such as race, sexual preference, disability, and more create complex intersectional marginalization barriers that produce greater obstacles and require a more nuanced approach to overcome.

5. A DEIA Nuclear Security Culture

Having outlined the structural biases underlying the exclusionary practices in the nuclear security and nonproliferation field, we turn now to the challenge of developing structural solutions to structural problems. Following the uprisings and calls for racial justice in the summer of 2020, organizations across the country began to address their proximity and role in upholding structures of systemic and institutional racism. The nuclear community followed suit, publishing statements condemning systemic racism and signing onto initiatives such as the *Solidarity Statement by Organizations and Individuals Against Racism and Discrimination* that was issued by Women of Color Advancing Peace and Security and signed by more than 200 organizations, network leaders, and individuals in the security and foreign policy fields [59]. However, the

continuing lack of diversity and inclusivity in the nuclear security community demonstrates that statements alone are insufficient in addressing systemic issues, and sustainable DEIA values require far more in-depth structural shifts. This issue is where the DEIA lens comes in [60]. For systemic change to take root at every level, the nuclear field must incorporate key diversity, equity, and inclusion factors into the organizational security culture of a nuclear facility.

The idea of incorporating DEIA into nuclear organizational culture is not new. The IAEA emphasizes the importance of inclusivity in its 2008 *Nuclear Security Culture* guide, noting that “the quality of a decision is improved when the individuals involved can contribute their insights and ideas” [61]. More recently, the World Institute of Nuclear Security debuted their Advancing Gender Equality, Diversity, and Inclusion in Nuclear Security self-assessment, evaluation, and action plan tool for organizations working in the nuclear sector in 2022 [62]. The tool provides a comprehensive overview of best practices while assessing the ability of an organization’s culture to ensure that women and gender-diverse individuals are hired, thrive at the organization, and are retained in the long term. This type of initiative not only lays the groundwork for integrating gender diversity by design into a nuclear facility’s culture but also creates a baseline for data collection relating to the diversity of its workforce composition. Developing an organizational culture that espouses DEIA principles is a critical prelude to developing a DEIA nuclear security culture. By incorporating DEIA beliefs and values into the organizational culture, more inclusive attitudes and behaviors from facility stakeholders, leaders, and employees will result in long-term gains in the diversity, equitable nature, inclusivity, and accessibility of an institution, as well as subsequent improvements in the outcomes of the organization [63].

However, further resources, tools, and research are needed to develop a DEIA nuclear security culture. Structural biases must be recognized as an inherent weakness of nuclear security, and DEIA values and advancement must be seen as crucial variables for nuclear security rather than just a trendy tagline. Appealing to DEIA as a security asset also broadens the legitimacy of the principles as values that have long-term benefits to an organization’s performance, reputation, and leadership. Because creating and upholding security culture is the shared responsibility of a range of stakeholders, changing it similarly requires buy-in from the state, organizations, managers, personnel, the public, and the international community [61].

To explore how DEIA might be incorporated into nuclear security culture, it is helpful to draw on Edgar Schein’s three-level model for understanding and analyzing an organization’s culture—a model that forms the basis of the IAEA’s nuclear security culture framework [64]. Schein’s model relies on three distinct levels of organizational culture: artifacts, values, and assumptions. The first level in Schein’s model is the visible artifacts or the surface manifestations of culture—the most tangible or evident elements alluding to an organization’s culture [65]: “Artifacts include any overt visible elements in an organization” [66]. Examples of artifacts are typically the things even an outsider can see, such as furniture and office design/layout, dress codes, inside jokes, stories, and mantras [67]. Values, which are the second layer of organizational culture, are best

described as the “espoused justifications” [65]. These are the goals, strategies, philosophy, and norms central to the organization. Values affect how members interact and represent the organization and are often reinforced in public declarations, such as institutional core values, but also in the common phrases and norms individuals repeat often [67]. The final level of Schein’s model encompasses shared basic assumptions: the foundation of organizational culture [65]. Organizational culture encapsulates the beliefs and behaviors so deeply embedded at an institution that they can sometimes go unnoticed [67]. These basic assumptions are the bedrock of culture and the pillar that espoused values and artifacts square themselves against [67].

To develop a DEIA nuclear security culture, DEIA values must be considered critical for strengthening nuclear security and be a part of the basic assumptions of organizational culture. Another key assumption should be that structural biases that inform historic marginalization and exclusion are vulnerabilities for nuclear security. These assumptions must also align with the espoused values and the artifacts of a nuclear facility. If nuclear security culture is “the assembly of characteristics, attitudes, and behaviors of individuals, organizations, and institutions which serves as a means to support and enhance nuclear security,” then nuclear security stakeholders need to understand how DEIA shared values strengthen the characteristics, beliefs, and attitudes of individuals, organizations, and institutions that underpin nuclear security by acknowledging and mitigating the effects of structural biases [61].

One key security vulnerability that DEIA shared assumptions could address for individuals, organizations, and institutions is the homogeneity of individuals in the nuclear field and associated bias against seeing members of one’s own group as a potential threat. The broader the perspectives included in nuclear security decision-making, the more expansive the definition of who or what constitutes a *threat* for nuclear security [60]. Unique individuals with diverse lived experiences move through the world differently and subsequently view risk and threat within the context of their own social position [60]. The practice of viewing threats as *others* or in an *us vs. them* dynamic is vulnerable to affinity bias when it comes to assessing threats from within—a dynamic that is especially troublesome when considered in the context of the rising violent white nationalist threat to national security in the United States and the lack of diversity in the nuclear security field [60]. An example of this increasing threat is the accelerationist threat posed by some white supremacist groups with nuclear ambitions, which may go undetected if a white-majority workforce does not perceive these groups as a relevant threat [68]. Ensuring diversity of personnel can thus help mitigate bias to prevent elements such as race or ethnicity from being used as the sole basis for threat identification [60]. This diversity can refocus security culture frameworks on behaviors rather than falling back on confirmation biases rooted in assumptions about race, gender, or other demographic attributes [60, 69]. This acceptance and encouragement of diverse personnel also must be reflected in hiring and evaluation procedures, including those determining access such as security clearance processes and personnel surety or reliability programs. Shifting to a continual evaluation process, bias training for evaluators, and collecting and reporting on demographic data of applicants during the hiring process could all be helpful in strengthening security culture [45].

Because the goal of nuclear security is to protect nuclear materials, weapons, facilities, technology, and knowledge from unauthorized use, nuclear security culture as a whole benefits from a more expansive view and assessment of who or what could pose a threat [60]. A DEIA security culture can address this lack of diversity, but DEIA values need to be incorporated into the recruitment language and processes for hiring staff. Such measures are key for diversifying personnel and ensuring that they are treated equitably and are included. Seeking to improve the DEIA security culture of a nuclear facility goes beyond diversity statistics—it needs to ensure that personnel at all levels have the training and resources they need to identify characteristics of a threat, secure and accessible procedures for reporting suspicious behavior, and confidence that their perspective and insights will be evaluated fairly.

Developing a DEIA nuclear security culture should be done in tandem with the creation of a DEIA organizational culture to ensure that assumptions about DEIA are shared across all aspects of an organization at every level. One crucial element of a sustainable and pervasive shift in organizational culture is the placement of DEIA values as core values of a facility and acknowledging the structural biases that have built the nuclear field [70]. Ensuring that shared assumptions about the importance of DEIA are also explicit values espoused by the organization is important for ensuring that employees and external stakeholders understand the kinds of characteristics and behaviors that are prized by the organization [67]. DEIA statements also make organizations more attractive for potential hires, improving the volume of qualified and diverse candidates and strengthening an organization's outcomes [71]. Integrating DEIA in artifacts is also important for demonstrating organizational priorities. Able-bodied bias tends to inform building design and ensuring that artifacts such as the design of nuclear labs or power plants are accessible to employees with different accessibility needs is an important step. Similarly, it is important to ensure that unisex personal protective equipment for staff at nuclear facilities is suitable for a variety of body types rather than the default: men from the United States or Europe [72]. Ill-fitting personal protective equipment is a safety hazard from job performance and exposure perspectives. Women are disproportionately affected by this default, and comprehensive DEIA goals necessitate a solution to ensure that all staff have access to equipment to keep them safe to avoid subjecting certain employees to greater risk on the basis of sex [72]. Another artifact is ensuring dress codes are mindful of a broad range of gender identities, where diversity is able to thrive, and heteronormativity biases can be kept in check. Many of these artifacts and values can have a wide-ranging effect on employee perspectives and opinions, as well as larger DEIA goals such as gender parity initiatives, making these organizational cultural changes critical for broader nuclear security culture goals.

A key security vulnerability that a DEIA nuclear security culture could directly address by strengthening DEIA in the organizational culture is employee dissatisfaction. An equitable work environment in which personnel feel included is also less likely to produce disgruntled employees who may be taken advantage of for insider access [60]. Equitable workplaces and security cultures are also likely to breed higher employee satisfaction, which, in turn, improves performance and reduces the likelihood of insider

threats going unnoticed or unreported [60, 73]. DEIA values in an organizational culture correlate with an openness to new ideas and place an emphasis on listening, which is central to creating a security culture in which personnel feel empowered to share instances of concerning or threatening behavior from peers [60, 74]. If nuclear facilities fail to protect personnel from marginalization on the basis of race, sex, sexual orientation, disability, or any other factor, they create a workplace in which individuals are less likely to share concerns or potentially even create an environment in which an employee could be blackmailed for insider information because of how they identify, whether it be the religion they practice or any range of other factors [60]. This is especially relevant in the context of rising far-right extremism in the United States, which often intentionally targets marginalized groups in their rhetoric and violent activities [60, 75]. Furthermore, creating a security culture and an organizational culture where employees feel that complaints or concerns about racism, sexism, ableism, or homophobia will be taken seriously and processed without repercussion will likely improve the retention and performance of all employees—with specific improvements in the retention of women and other historically marginalized staff. Creating a DEIA nuclear security culture requires organizations to ensure that DEIA is seen as a critical component of strengthening security in its artifacts, values, and assumptions at every level, top-down and bottom-up.

Centering DEIA as a core component of nuclear security can result in more comprehensive organizational security culture at nuclear facilities. Being able to improve retention and reliance on personnel, strengthen shared understanding of security priorities, and assess and address a broader range of threats all go a long way in making nuclear security endeavors more successful. However, although much has been written and learned about DEIA in organizational culture generally, incorporating DEIA assumptions into nuclear security culture and acknowledging and addressing the effects of bias on nuclear security procedures, practices, and assumptions require more research, resources, and tools for practitioners at every level. Nuclear security culture is developed in the unique context of every facility, and developing a DEIA nuclear security culture requires even greater nuance and sensitivity to be done well.

6. Conclusion

From the earliest days of the nuclear security field, women have faced numerous barriers to entry, advancement, and acknowledgement of their work. Without confronting structural biases informing the exclusion of women and other historically marginalized groups, it is exceptionally difficult to understand why decades of antidiscrimination and diversity policies deliberately aimed at equalizing opportunity and promoting inclusion have done little to alter the distribution of power, knowledge, and authority. This paper aimed to show that although many organizations have implemented DEIA statements and policies, the nuclear security field has far to go in making workforce demographic data available for true transparency, accountability, and measurement of results and that, currently, successful culture changes and actual diversity in the workforce are less durable than initially hoped. A significant lack of detailed data about diversity in the nuclear field clearly demonstrates that a DEIA culture must include measures of effectiveness at a granular level, or organizations will

continue to run DEIA programs in the dark. DEIA values can only be properly incorporated when organizations address historic hierarchies rather than gilding over the deep-rooted structural issues at play. The nuclear field is fraught with inequities and exclusionary practices, but nuclear security and the nonproliferation field as a whole would benefit from a more diverse staff, more equitable policies, inclusive practices, and an accessible organization. Implementing these cultural shifts in nuclear security requires more than simple DEIA statements; it requires shifts in organizational culture and an understanding of DEIA principles as a legitimate security asset rather than a social fad. The notion of a DEIA nuclear security culture as a solution has merit but requires in-depth evaluation and further research to understand how structural biases manifest in the nuclear workplace and how policies, institutional culture, and individuals must adapt to new priorities. A DEIA security culture is a necessary prelude to achieving broader goals such as gender parity, stronger racial diversity, and more equitable and inclusive nuclear facilities. The nature of exclusion is intersectional, and biases are often intertwined. If the goal is to make the nuclear field truly more diverse, equitable, inclusive, and accessible, more research is needed to understand not only how women can advance in nuclear security but also how women of color, queer women, and trans women face different barriers to entry and prosperity in the nuclear security field.

7. References

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