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# Changes to TSR Control Set Due to Changes in Mission and Lessons Learned

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## ABSTRACT

Previous Technical Safety Requirements (TSRs) established to support plutonium production activities at the Rocky Flats Environmental Technology Site (RFETS) were heavily focused on engineered safety features that would mitigate potential accidents. With the change in mission in 1992 to Site closure, and considering antiquated equipment nearing the end of their useful life, a change in philosophy was adopted to emphasize preventive controls that are mostly administrative. The new Administrative Controls (ACs) developed in the last few years include discrete attributes of safety management programs (SMPs) that are specifically credited to prevent or mitigate an accident, and include requirements on handling individual deviations, programmatic deficiencies, and TSR AC violations. The primary benefit of these changes is fewer requirements on equipment that allow the contractor more flexibility to maintain the defense-in-depth safety systems in a more cost-effective manner. A disadvantage of these new ACs is that implementation has become cumbersome and difficult to manage, e.g., resulted in an increased burden of demonstrating compliance and required an additional infrastructure to track deviations and deficiencies.

In order to improve the efficiency of the authorization basis (AB) process to support accelerated Site closure according to the "2006 Plan", the Site has recently modified the ABs to better focus on the programmatic elements that were credited in the accident analyses, and to rely on the Integrated Safety Management System to implement SMPs via one general TSR AC requirement. The credited programmatic elements for the remaining ACs have been revised to be more consistent with the DOE Standard 3009 approach for TSR ACs.

Another change is that criteria are also being developed to provide a logic for stepping down from Limiting Conditions for Operation (LCOs) to ACs as hazards and risks are significantly reduced or eliminated during deactivation and decommissioning (D&D), for example, preconditions (or "modes of operation") are achieved that meet an *operationally clean* state where TSR controls are no longer warranted. From the Building 779 D&D project lessons learned, a clear definition of *operationally clean* based in part on the accident analysis is paramount to determine when the TSR control set is no longer needed. This is likely above the threshold for a Hazard Category 3 facility and may very well be above the Hazard Category 2 definition (e.g., > 900 grams $^{239}$Pu).

At the request of DOE/RFFO, a self-assessment of the Rocky Flats AB program was performed in November 1998 by Victor Stello, DOE Headquarters, along with representatives from other DOE sites and Defense Programs. Results of this self-assessment confirmed that the proposed AC changes would be beneficial and provided specific recommendations.

### Introduction

The current mission of the Rocky Flats Environmental Technology Site (RFETS or Site) is to stabilize plutonium metal, oxide, and residues per the commitments of the Defense Nuclear Facility Safety Board

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Recommendation 94-1 implementation plan by 2002 (i.e., a risk reduction mission), and to close the Site per the "2006 Closure Plan" that would be completed in the 2006 to 2010 timeframe. Since the change in Site mission from the plutonium pit production mission that ended in 1992, new authorization bases (ABs) have been developed for Category 2 and 3 nuclear facilities at the Site. Most of the plutonium facilities' ABs have been developed per the Basis for Interim Operation (BIO) guidelines from DOE Standard 3011 (Reference 1), two have been developed at the Site per DOE's "necessary and sufficient" process called Basis for Operations (BFOs), and a few transuranic (TRU) and low level waste (LLW) facilities have Safety Analysis Reports (SARs) developed per DOE Standard 3009 (Reference 2). The recently developed BIOs and BFOs are "enhanced" to be similar to graded SARs as discussed in DOE Standard 3009.

This paper addresses changes in AB philosophies that evolved to support current risk reduction activities and accelerated implementation of D&D. Three major safety analyses philosophies are presented as the Site has transitioned from production-era 1980s Final SARs to current BIO-type ABs, and the need to transition to D&D ABs (i.e., BIOs, BFOs, or SARs). Lessons learned regarding Technical Safety Requirement (TSR) development and methods to step down and out of TSR controls through D&D phases are also discussed.

**TSR Administrative Control Lesson Learned**

Previous TSRs and former Operational Safety Requirements (OSRs) established to support plutonium production activities at RFETS were heavily focused on engineered safety features that would detect or mitigate potential accidents. With the change in mission to accelerated Site closure, and considering the antiquated facility equipment, a change in philosophy was adopted in the mid-1990s that emphasized preventive controls that were mostly administrative. New TSR control sets were established based on upgrading the authorization basis (i.e., developing BIOs, BFOs, and SARs) and evaluating hazards and controls for the current/new mission.

Numerous Limiting Conditions for Operation (LCOs) on safety systems that were previously credited to detect or mitigate accidents were eliminated and replaced by Administrative Controls (ACs) to prevent the accident. These accident prevention ACs were supplemented with an AC that required the maintenance of these non-LCO safety systems to provide defense in depth. Table 1 summarizes this change in philosophy from an engineered features mitigative strategy to an administrative control preventative strategy with additional engineered features and ACs for defense-in-depth.

The primary benefit of these changes was fewer requirements on antiquated equipment, which provides the contractor with the flexibility to maintain the safety systems that still provide defense in depth. This approach was adopted to emphasize the critical importance of a few essential pieces of equipment that must be maintained, rather than the multitude of worker and public defense-in-depth safety systems covered by the previous FSAR/OSR LCOs. However, Safety Class systems (e.g., fire suppression, HEPA filtration, etc.) that are credited to protect the public are still covered by full TSR requirements. This approach translates into less expense on the defense-in-depth systems, but with tighter LCO compliance requirements on the remaining credited safety systems. The defense in depth safety systems have reached or are nearing the end of their design life and parts are no longer available, but their ability to provide a safety function can be assured with appropriate maintenance programs.

**Table 1. AB Strategies**

| 1987/1992 Resumption SARs | 1st Generation BIOs/BFOs |
|---|---|
| **Safety Analysis Philosophy**<br>• Mitigative (didn't care how accident happens)<br>• Defense in Depth – Many levels of control (or really a complex, interactive control set?)<br>• Many worker LCOs/ACs<br>• Equipment/Systems focus ($10^{-3}$ to $10^{-4}$) | **Safety Analysis Philosophy**<br>• Preventative (how accidents can be initiated is essential)<br>• 1 level of mitigative control for some accidents<br>• Defense-in-Depth – Robust SMP ACs to lessen accident initiation and maximize accident response<br>• 1 Worker LCO/Many ACs<br>• Administrative/People focus ($10^{-1}$ to $10^{-2}$) |
| **LCOs**<br>• Exhaust Filtration 4/2 stages<br>• Zone II/III to Atm d/p<br>• Glovebox to Room d/p<br>• Plant Air Systems (HVAC)<br>• Hoods (airflow)<br>• Fire Protection Systems (sprinklers, deluge, flow alarms)<br>• Inert Ventilation Systems<br>• Glovebox Overheat Detectors<br>• O2 Analyzers<br>• Criticality Alarm System (detectors, beacons, battery back-up)<br>• Criticality Safety Operating Limits (CSOL)<br>• Normal/Alternate Power<br>• Diesel Generators (fuel supply, tower water supply)<br>• Uninterruptible Power System<br>• Life Safety/Disaster Warning System<br>• SAAMs (room/effluent, HP Vacuum)<br>• NDT gamma detector<br>• Zone I/IA duct hold-up MAR control | **LCOs**<br>• Exhaust Filtration 1 stage (typical)<br>• Fire Protection Systems (sprinklers, deluge, flow alarms)<br>• Criticality Alarm System (detectors, beacons)<br>• Zone II/III to Atm d/p<br><br>**Example Discrete or DID-Required ACs**<br>• Combustible control<br>• Ignition source control<br>• Inventory control and material management<br>• Work control<br>• Approved containers and packaging<br>• Exhaust Filtration non-credited stages<br>• Glovebox to Room d/p<br>• Plant Air Systems (HVAC)<br>• Hoods (airflow)<br>• Inert Ventilation Systems<br>• Fire Alarm Pull Stations and Phones<br>• Glovebox Overheat Detectors<br>• O2 Analyzers<br>• Criticality Safety Operating Limits and required engineered features<br>• Normal/Alternate Power<br>• Diesel Generators (fuel supply, tower water supply)<br>• Uninterruptible Power System<br>• Life Safety/Disaster Warning System<br>• SAAMs (room/effluent, HP Vacuum)<br>• Emergency and Egress Lighting<br>• Lightning Protection System |
| **Design Features**<br>• Site boundary<br>• Meteorological monitoring<br>• Structural NPH capabilities | **Design Features**<br>• Outer 2-hour Fire Barrier<br>• Final/Tertiary Confinement Barrier |

The 1980s strategy didn't have any defined "defense-in-depth" items, but it had a lot of items uniquely credited in accident event trees. Resumption of Pu operations in the early 1990s brought the concept of certain SMPs in the AB for defense-in-depth. With the recent BIO and BFO approaches, the accident analyses became more conservative for simplicity, but the controls selected defaulted to a few final barriers for mitigation, thus fewer LCOs. Somewhat because of the conservatism of the new accident analyses and their resulting higher dose consequences, the need to lower accident frequency became more apparent. Consistent with DOE Standard 3009 guidance, emphasis was placed first on identifying preventive controls where feasible (e.g., use of DOE Type B containers and filtered vents on waste and residue drums), then mitigative controls. Since most accident initiation was often independent of engineered systems, ACs became the default approach to accident prevention. Since the new control schemes lacked engineered features in prevention and a large quantity of controls in mitigation, the application of defense-in-depth, in the form of the 17 SMPs, were needed to credit reducing frequency to achieve below Risk Class II events where possible.

Those ACs that are specifically credited in the BIOs/BFOs to prevent or mitigate an accident are covered by detailed TSRs, including general application requirements on handling individual procedural deviations, programmatic deficiencies, and AC TSR violations. The new ACs were also developed to specify requirements on specific elements or attributes of safety management programs (SMPs) that are directly credited or assumed to be credited in the accident analysis. Table 2 compares the BIO/BFO ACs to DOE Standard 3009 guidelines (i.e., either from the Standard, the DOE/HQ-sponsored training course on Standard 3009, or the DOE/HQ-sponsored training DOE Order 5480.22).

**Table 2. Administrative Control Comparisons**

| Safety Management Program (SMP) | RFETS TSR AC | DOE Standard 3009 TSR AC |
|---|---|---|
| **Criticality Safety** | √ | √ |
| **Radiation Protection** | √ | √ |
| **Hazardous Material Protection** | √ | √ |
| **Waste Management and Environmental Protection** | √ | √ |
| **Transportation** | (addressed in Site SAR) | √ |
| **Testing, Surveillance, and Maintenance** | √ (on credited and DID safety systems) | √ |
| **Conduct of Operations** | Work Control | √ |
| **Fire Protection** | √ | √ |
| **Industrial Hygiene/Occupational Safety** | √ | √ |
| **Procedures and Training** | √ | √ |
| **Quality Assurance** | | √ |
| **Emergency Preparedness** | √ | √ |
| **Management and Organization** | √ | √ |
| **Configuration Management** | √ | √ |
| **Occurrence Reporting** | √ | √ |
| | Inventory Control<br>Control of Combustibles and Ignition Sources<br>AC 5.0 General Application | Scenario-specific ACs as appropriate |

For some of the SMPs, program elements or attributes were credited in the accident analysis to provide a safety function and were therefore addressed in the TSRs. An example of how credited program elements and SMP attributes have been recently addressed in TSRs, along with their safety function and interpretation for an individual deficiency, is shown in Table 3 for the Radiation Protection Program, Fire Protection Program, Criticality Safety Program, and Emergency Response Program.

**Table 3. Example TSR Coverage of Program Elements/Attributes**

| AC / Safety Management Program | Safety Function | Individual Deficiency | Program Element/Attribute |
|---|---|---|---|
| Criticality Safety Program | Specifically credited to reduce probability of criticalities | Double contingency lost | • Crit safety evaluations for new processes or activities<br>• Established NMSLs/CSOLs, postings, controls and evaluations<br>• Use of engineered design features<br>• Written procedures on fissionable material handling and storage<br>• Crit safety training |
| Radiation Protection Program | DID to prevent significant unplanned worker exposures | • Level 1 Radiation Deficiency Report or<br>• Ineffective contamination control results in large release | • Radiation Work Permit<br>• Postings<br>• Radiological training<br>• Engineered radiological controls |
| Fire Protection Program | DID/credited to prevent or mitigate fires, explosions, and NPH-induced events | • Failure to prevent/mitigate combustion-caused release<br>• Significant increase in the potential for combustion-caused release<br>• Significant degradation in effectiveness of Fire Dept. | • Periodic fire prevention inspections per HSP 31.01 and 31.06<br>• Fire watches per HSP 34.01<br>• Fire Dept. available for response |
| Emergency Response Program | • Credited to mitigate Immediate Worker consequences for most accidents (e.g., CAMs and evacuation, PPE)<br>• Credited to mitigate MOI/CW consequences for explosion (Spill Response), severe weather response, and seismic response<br>• DID to mitigate MOI/CW consequences for rad and chemical spills, criticalities | • Failure to mitigate accidents as specifically credited<br>• Not mitigating spills, ensuring PPE, clear evidence that the required function would not have been provided had the need for it arisen (e.g., drill failures) | • Approved building emergency plan<br>• Spill response<br>• Provisions for personnel protection (e.g., evacuation, drills)<br>• Seismic response<br>• Severe weather<br>• Equipment and material maintained |

As this transition from many OSR LCOs on safety systems to fewer more focused TSR LCOs on critical safety systems and the addition of more ACs occurred in the 1994 – 1996 timeframe for new ABs, DOE RFFO had a lack of confidence in the status of implementing all SMPs. Therefore, programmatic ACs were established for most of the SMPs as an added enforcement incentive. Also, many of the SMP key elements credited in the accident analysis became discrete ACs in the BFOs and BIOs. At the same time, building management wanted a "one-stop shopping" concept where the AB would capture the universe of mandatory controls required by the AB and all SMPs. This turned out to be a mistake because although it streamlined LCOs to get to a more controlled focus of critical equipment, the "one-stop shopping" concept defocused ACs significantly. Also, emphasizing only the few key elements directly credited in the accident analysis in the ACs led to the impression that compliance with the rest of the SMPs were not important, even though they were covered by programmatic ACs.

However, implementation of the numerous discrete and programmatic AC controls became cumbersome and difficult to manage. Extensive procedural development was required, along with increased surveillance to assure that workers were complying with the new ACs. One of the major adverse impacts was that the implementation of the new ACs relied heavily on management interpretation, which increased the burden of demonstrating compliance and, in some cases, of developing an additional infrastructure to track deficiencies.

A lesson learned from this TSR philosophy transition came from an "AB Summit" organized by Kaiser-Hill with the DOE Rocky Flats Field Office (RFFO) in September 1998. Senior management from RFFO and the Kaiser-Hill team, including Safe Sites of Colorado and Rocky Mountain Remediation Services, key operating management representing two of the nuclear facilities, and supporting AB staff from RFFO and the contractor participated. The goal of the AB Summit was to improve the efficiency of the AB process to support accelerated Site closure according to the "2006 Closure Plan".

Agreements were reached at the AB Summit on principles to revise the numerous ACs to establish a commitment to implement SMPs via one general AC. The SMPs and their attributes would then be relied on only to provide for worker protection and defense-in-depth safety functions, not credited preventive or mitigative safety functions in the nuclear accident analysis. Other specific, discrete ACs will continue to be included in the TSRs, such as Inventory Control and Material Management, Control of Combustible Materials and Ignition Source, Maintenance and Surveillance of SC-3 SSCs (i.e., primarily Safety Significant SSCs that are discussed later), Organization and Management, Emergency Response, and revised General AC Application rules (AC 5.0). These five discrete ACs specify Requirements, Credited Programmatic Elements, Specific Controls or Restrictions, Conditions, Required Actions, Completion Times, Surveillance Requirements, and Bases. Surveillance Requirements are specified for all discrete ACs, e.g., combustible control Surveillance Requirements. Like the LCO approach on equipment, this approach was adopted to emphasize the critical importance of a few ACs credited to reduce frequency or mitigate consequences, rather than the multitude of best management practices from SMPs that were converted into previous discrete ACs that arose from the BFO necessary and sufficient process.

Individual failures to comply with a Credited Programmatic Element of these five discrete ACs, which are isolated and not systemic in nature, do not constitute non-compliance with the AC. An individual failure of a discrete AC limit and its action statement is an AC violation. Individual failures, deemed to be systemic in nature, are addressed under the AC Programmatic Deficiency requirements specified in AC 5.0. The AC 5.0 requirements for AC Programmatic Deficiencies address reporting requirements, corrective action process, and intentional violations or misrepresentations consistent with the PAAA program.

All other SMPs are evaluated through self-assessments conducted in accordance with the requirements of the specific SMP, i.e., Radiological Improvement Reports, Criticality Safety Infractions, or Occurrence

Reports. Individual deficiencies of a SMP are not subject to AC 5.0, but are subject to PAAA and other regulatory enforcement requirements. Therefore, the need to track individual deficiencies for TSR compliance has been eliminated, thus eliminating for the most part duplication of efforts by most of the SMP programs. Since the 1994 – 1996 timeframe, a lot of effort has gone into verifying the state of compliance with SMPs, including implementing the Integrated Safety Management System developed in response to Defense Nuclear Facilities Safety Board Recommendation 95-2.

The AB Summit agreements noted above, resulted in the establishment of a team of contractor and DOE personnel to propose an AC Template for all the nuclear facilities to resolve the difficulty in implementing the BIO/BFO ACs and to make the revised ACs portable from facility-to-facility. The team has completed the AC Template, DOE RFFO has approved it, and the contractor is currently integrating it into the Building 776/777 and 707 BIOs as prototypes.

Expected benefits from this change in TSR ACs include:

- Focuses resources on most significant nuclear safety issues
- Consistent performance expectations
- Reduction of AC implementation and maintenance cost
- Transferable AC maintenance infrastructure from facility-to-facility
- Elimination of duplicate tracking and trending programs for individual deficiencies, and performing safety evaluations on them
- Reduction in management time and attention on ACs after initial implementation.

The most difficult issues that confronted the AC Template development were the establishment of a uniform protocol for grading program requirement deviations from isolated occurrences through TSR violations, and the enhancement of the typical AB document SMP Chapter to reflect the new status of SMPs in the AB. The former issue was resolved by creating a graded construct that started with "individual failures" that were not systemic, then graduated to "programmatic deficiencies" using the PAAA evaluation criteria, and finished with TSR violations based on PAAA level non-compliance and/or failure to perform Required Actions or Surveillance Requirements for Specific Controls and/or Limits, as derived from the safety analysis. The AC development part was simple, i.e., was more focused on the five remaining discrete ACs which needed development of a Bases that didn't exist before, and negotiation on Required Actions, Completion Times, and Surveillance Requirements.

The SMP Chapter issue was closed through an evolution of sample constructs that eventually met the needs of the regulator, while keeping individual facility AB development and maintenance costs to a minimum. A problem with implementing the new AC Template is to determine how much proof of compliance is enough for SMPs, especially how to demonstrate floor-level implementation for defense in depth. The revised SMP Chapters of the AB document focused on identifying what and how much "grout" is enough for an effective SMP, where emphasis can be placed on their enforcement.

**TSR Development Criteria Lesson Learned**

A second lesson learned from the AB Summit was related to establishing a risk management approach to D&D. The Site recognized the need to improve up-front planning of AB for closure activities. Major D&D work was not sufficiently analyzed in old SARs and first generation BIOs/BFOs for multiple D&D activities (e.g., with unique hazards and accident initiators), and interactions of all D&D and mission baseline activities going on at the same time. These older ABs did not provide a basis to optimize the risk strategy for D&D with ongoing nuclear and waste material storage missions, and eventual step-down of TSR controls as hazards are reduced.

Most recently-approved AB documents at RFETS have been based on the DOE Standard 3011 (Reference 1) risk assessment methodology with qualitative estimates of frequency of occurrence binned into Anticipated, Unlikely, and Extremely Unlikely events, and quantitative estimates of radiological consequences to the collocated worker and the public binned into three severity levels (Low, Moderate, High). Risk Class I and II events after application of controls to prevent or mitigate the accident are designated as risk-dominant scenarios. Accident EGs for selection of TSRs are based on the frequency and consequence bin assignments to identify controls that can be credited to reduce risk to Risk Class III or IV, or that are credited for Risk Class I and II scenarios that cannot be further reduced. These are illustrated in Table 4. Application of the DOE Standard 3011 Evaluation Guidelines at RFETS is different than the sole purpose of Evaluation Guidelines defined in DOE Standard 3009 (Reference 2), i.e., to identify Safety Class structures, systems, and components to protect the public and to establish TSRs on them. This Standard 3011 methodology resulted in several risk-dominant scenarios for either the collocated worker or the public that warranted consideration on whether additional controls should be implemented. However, even after all available, feasible preventive and mitigate controls were credited, many accident scenarios continue to be identified as risk dominant events requiring justifications for their risk acceptance.

**Table 4. RFETS BIO/BFO Evaluation Guidelines**

| Accident Frequency Bin | Public EGs (rem CEDE) | Collocated Worker EGs (rem CEDE) |
|---|---|---|
| Anticipated (< 1E-2/yr) | ≤ 0.1 | ≤ 0.5 |
| Unlikely (1E-2/yr – 1E-4/yr) | ≤ 0.1 | ≤ 0.5 |
| Extremely Unlikely (< 1E-4/yr) | ≤ 5 | ≤ 25 |

After developing the first generation of BIOs and BFOs, and SARs on new waste storage facilities where HEPA filtration is not available, both DOE and the contractor realized that the BIO risk class EGs were overly conservative for safety classification and TSR development compared to practices at other DOE sites. At the AB summit, both sides agreed to adopt a new set of accident EGs that are more consistent with the majority of the DOE complex. These new EGs for the public, as well as for the collocated worker that are discussed next, are summarized in Table 5.

**Table 5. New RFETS Evaluation Guidelines**

| Accident Frequency Bin | Public EGs (rem CEDE) | Collocated Worker EGs (rem CEDE) |
|---|---|---|
| Anticipated (< 1E-2/yr) | 0.5 | 5 |
| Unlikely (1E-2/yr – 1E-4/yr) | 5 | 25 |
| Extremely Unlikely (< 1E-4/yr) | 25 | 100 |

The current RFETS safety classification system has not been revised to integrate with the DOE Standard 3009 Safety Class and Safety Significant designations, and generally relies on two levels of safety classifications: System Category 1/2 (SC-1/2) as credited in the AB to protect the public, and System Category 3 (SC-3) that protects the workers and provides defense in depth for the public. In general, engineered safety features that are credited in the accident analysis to protect the public to be within the BIO-based EGs (Table 4) were designated as SC-1/2, which are equivalent to the Safety Class concept from DOE Standard 3009. However, a Site standard for how to classify SSCs that are credited in the accident analysis to protect the collocated worker to be within the BIO-based EGs has not been consistently applied in recently developed ABs. For example, some ABs identify these Safety Significant SSCs that protect the collocated worker as SC-1/2, while others identify them as SC-3. Guidance to implementing the new collocated worker EGs (Table 5) still needs to be developed, which is also expected to include guidance on when to establish LCOs vs. ACs.

The new EGs for both the public and the collocated worker will also be used to establish TSR ACs on those administrative features credited in the accident analysis to provide a safety function to prevent or mitigate accidents. This is similar to how it has been credited in the recent BIOs/BFOs.

Application of the new EGs are expected to yield more TSR control set consistency from facility-to-facility for similar hazard characterizations, keep RFETS more consistent with other DOE sites in their approach to risk management and acceptance, and avoid unwarranted over-conservatisms in the finalization of TSR control sets.

**Interactive D&D Scenarios**

Another decision from the AB Summit was to investigate criteria for stepping down from LCOs to ACs, or completely eliminating the TSR requirements as D&D progresses. The Site is developing preconditions (or "modes of operation") that can be achieved to justify a lesser control set and that meet an *operationally clean* state where TSR controls are no longer warranted. Some of these preconditions or modes of operation could include restricting locations, segregation, specify facility configuration, physically deny access, etc. Additional experience, as Buildings 779 and 886 are demolished in the next year, is expected to help identify when TSR controls can be stepped down or are no longer warranted. Based on lessons learned from the Building 779 D&D project, a clear definition of *operationally clean* will determine when the TSR control set is no longer needed. This may very well be above the Hazard Category 2 definition (e.g., > 900 grams $^{239}$Pu).

A second team was established at the AB Summit to develop interactive accident scenarios based on sequencing of D&D activities concurrent with other facility baseline activities that could impact the TSR set. The D&D interactive accident scenario team has developed and proposed a revised accident analysis with TSRs for revision to the Building 771 BFO to support the start of major D&D activities in 1999. This was accomplished by considering the multiple activities associated with D&D and baseline activities, potential interactions, and work sequences as a strategy to minimize risk. The interactive accident scenarios define the risk associated with the early phases of D&D when they are the highest. It therefore defines the most robust set of TSR controls needed to conduct D&D. However, as the hazards are reduced and risks are decreased as D&D progresses to its final phases, some and eventually all, TSR level controls will become unnecessary because the remaining hazards can be adequately controlled via SMPs. The need is to define a logical and efficient methodology to step down the controls as D&D progresses.

D&D is a non-uniform set of tasks repeated under hazardous conditions that vary from location to location. Similar to construction work (i.e., "de-construction work"), the presence of accident initiators is high. Because RFETS facilities are no longer in an "operational" mode (i.e., performing nuclear material processing operations) and facility life is expected to be less than 5 years, the accidents of concern are primarily those of an industrial facility or major construction site, but with the nuclear and radiological hazards added. In this type of environment, accident prevention becomes key. Since facility configurations are in a constant state of change, it becomes more difficult to ensure that engineered safety features continue to provide needed capabilities. This coupled with the aged and degraded condition of these engineered safety features, points to an emphasis on administrative controls for accident prevention rather than engineered systems to contain bounding accidents. The other benefit of an accident prevention approach is that it provides risk reduction for immediate workers as well as the public and collocated worker. At RFETS, few engineered safety features afford the immediate worker any risk reduction. Built into the preventive AC approach to D&D safety analyses and controls is the opportunity for a risk management approach to D&D rather than a broad risk acceptance or risk rejection approach.

Based on lessons learned from Building 779 D&D efforts, a more thorough process in both hazards analyses and TSR control selection needed to be developed to define the step-down for the following D&D stages:

1. All equipment (e.g., gloveboxes, tanks, piping) holdup and storage of Pu residues and TRU wastes and other hazards
2. Only equipment holdup as storage missions are eliminated
3. Only holdup in ventilation plenums and ductwork after gloveboxes, tanks, and piping have been removed from a room that can be appropriately segregated from other higher hazard rooms
4. Only fixed contamination in the room.

This would allow precluding interactions to justify a lesser TSR control set.

By analyzing interactive accident scenarios for each of these stages and approving them in the AB, lower threshold criteria can be established for future USQ safety evaluations of changing D&D plans. This can help prevent future positive USQs or discovery issues such as the need to routinely breach confinement by opening both airlock doors to facilitate removal of large containers of wastes when significant hazards are still present in the facility. It is also expected to help when a discovery issue arises after meeting the operationally clean criteria to determine what removed TSR controls should be re-instituted.

**TSR Lessons Learned from External Self-Assessment of AB Program**

At the request of RFFO, a previously scheduled self-assessment of the Rocky Flats AB program was performed in November 1998. Mr. Victor Stello, DOE Headquarters, along with representatives from other DOE sites (Chris Steele from DOE-LAOO and Roy Schepens from DOE-SRO) and Defense Programs (Dae Chung), performed the assessment with the assistance from Roger Mattson from SCIENTECH. This team performed a review of how DOE RFFO was performing in terms of approving ABs. This process included reviewing four recently-approved ABs and their DOE Safety Evaluation Reports, reviewing analytical methods for AB development, reviewing training records for the DOE RFFO AB Division staff, interviewing DOE AB staff and RFFO management, and interviewing key management from nuclear facilities and AB staff from the contractor to evaluate the Site's AB program performance and degree of facility ownership of their AB.

Results of this self-assessment related to the topics of this paper confirmed that the AC changes proposed at the AB Summit, and to be developed in the AC Template, would be beneficial. The Assessment Team was concerned that the direction the Site had gone in the last few years to identify specific key attributes from every SMP that could be directly linked to the accident analysis and only invoke TSR discrete ACs on them was diluting the importance of all SMPs, and contrary to the philosophy of the new Integrated Safety Management System. Their concern is one of thoroughness, i.e., how do you know that every key element of the program was included in the accident analysis. The Assessment Team believed that DOE RFFO had "sold the farm" by only establishing ACs on the SMP key elements credited in or linked to the accident analysis, instead of insisting on a level of compliance with all elements of an SMP that are the "grout" that hold an effective program together. The Assessment Team also recommended that additional training on violation criteria for a SMP AC should be pursued, which has been accomplished in the new AC Template via PAAA-like language.

The problem RFETS created in trying to find important attributes for all SMPs and enforce them through the TSRs, was that the Site focused resources and management attention on a broad spectrum of controls that all had equal significance, and thus dedicated an enormous amount of facility operational resources to simply managing the AC programs. The AC Template allowed for a de-staffing for SMP attribute management and an emphasis on those common or generic programmatic elements that are credited or should be credited in nearly all RFETS nuclear facility accident analyses. The latter is the five discrete ACs and their Credited Programmatic Elements discussed earlier. These "Big 5" are not synonymous with the more general Integrated Safety Management System approach invoking all SMPs. Moving the SMPs back to the basic AB document put the proper credit and attention on them and made their support of facility safety more like the construct of commercial nuclear facilities. It also helped to better focus on the significant credited items for AC development.

The Assessment Team also recommended that some specific ACs on inventory controls and combustible controls should be converted into LCOs with specific Required Actions and Surveillance Requirements. The Site has chosen to not convert them into LCOs at this time from a cost/benefit perspective. The Site culture and infrastructure that has evolved over the last few years to implement the new ACs would require a lot of effort to convert ACs to LCOs for every nuclear facility, to revise building and support group implementing procedures, to train facility and support personnel, etc., for no real change in safety benefits. Rather, the Site will include the Required Actions, Completion Times, and Surveillance Requirements in the TSR ACs for these two programs as the AC Template is implemented. This also led to a recommendation that the Site should clarify the role of TSRs and ABs to clarify the differences between LCOs and ACs. For example, the maintenance AC on defense-in-depth safety systems should have been an LCO in their opinion rather than an AC.

It should be noted that the difference between the Assessment Team's desire for administrative LCOs and what several RFETS facilities were already doing was more a matter of format than substance. Building 771, for example, had instituted Discrete Administrative Control Requirements (ACRs) that were implemented like administrative LCOs. Most had Required Actions and many had Surveillance Requirements. Their TSR impact was LCO-like and could easily garner a TSR violation versus the Programmatic ACRs, which were really the SMPs. The path chosen by the AC Template regarding this issue retains the intent of Discrete ACRs under the title of specific controls and limits from the accident analysis, but reformats their presentation to look LCO-like and mandates Required Actions and Surveillance Requirements for these specific controls and limits. What the Assessment Team wanted that has not yet been adopted, was for the administrative control of SC-3 engineered features to be changed to control by LCOs for all defense-in-depth systems that protect the public (e.g., diesel generators). Some format concession to this position was accommodated within the AC Template for Conditions, Required Actions, and Surveillance Requirements for selected SC-3 items.

Regarding the new EGs, the Assessment Team did not disagree with the new EG thresholds to be applied for their intended purpose as specified in DOE Standard 3009 (i.e., safety classification and TSR development on Safety SSCs and ACs). It was interesting to note that two different sets of EGs have been supported by the representatives, neither of which exactly agrees with the RFETS revised EGs presented in Table 5. For example, DOE Headquarters Defense Programs DOE-LAOO support the current DOE Headquarters Environment and Health initiative to finalize the draft Appendix A to DOE Standard 3009 that recommends a 25 rem CEDE EG for the public to identify Safety Class SSCs, and no numerical EGs for the collocated worker (or immediate worker). DOE-SRO supports the frequency based EGs similar to those presented in Table 5 (e.g., 0.5/5/25 rem CEDE for the public), but differs slightly for the collocated worker (i.e., 25 rem CEDE for Anticipated and Unlikely accidents, and 100 rem CEDE for Extremely Unlikely accidents, however, they also assume median meteorology instead of a $95^{th}$ percentile). The new RFETS EGs presented in Table 5 are more restrictive than either of these two sets of EGs, are consistent with some of the other DOE sites like Hanford and INEEL, and will allow some relief over the more conservative DOE Standard 3011 EGs that have been applied in the past few years.

**Summary**

The key lessons learned regarding development of new TSRs are related to changes in LCOs, ACs, and SMPs. These are a result of the Site's change in AB and TSR philosophy that was adopted to emphasize preventive controls that are mostly administrative as the Site transitions to D&D.

The new ACs developed in the last few years included discrete attributes of SMPs that are specifically credited to prevent or mitigate an accident, and included requirements on handling individual deviations, programmatic deficiencies, and TSR AC violations. The primary benefit of these changes was fewer requirements on equipment that allow the contractor more flexibility to maintain the defense-in-depth safety systems in a more cost-effective manner, while maintaining LCO requirements on those Safety Class systems still credited to protect the public. This approach was adopted to emphasize the critical importance of a few essential pieces of equipment that must be maintained, rather than the multitude of worker and public defense-in-depth safety systems covered by the previous FSAR/OSR LCOs. A disadvantage of these new ACs is that implementation of a broad spectrum of controls with equal significance had become cumbersome and difficult to manage, e.g., resulted in an increased burden of demonstrating compliance and required an additional infrastructure to track deviations and deficiencies.

The Site has recently modified the ABs to better focus on the programmatic elements that were credited in the accident analyses, and to rely on the Integrated Safety Management System to implement SMPs via one general TSR AC requirement. The credited programmatic elements for the remaining discrete ACs have been revised to focus on Required Actions, Completion Times, and Surveillance Requirements. This has been accomplished through development of an AC Template and revision of the AB SMP Chapter. Like the LCO approach on equipment, this approach was adopted to emphasize the critical importance of a few ACs credited to reduce frequency or mitigate consequences, rather than the multitude of best management practices from SMPs that were converted into previous discrete ACs that arose from the BFO necessary and sufficient process. This focusing on the significant ACs and floor-level implementation of SMPs should minimize previous efforts on interpreting compliance with the SMP ACs.

Another change is that criteria are also being developed to provide a logic for stepping down from LCOs to ACs as hazards and risks are significantly reduced or eliminated during D&D, for example, preconditions (or "modes of operation") are achieved that meet an *operationally clean* state where TSR controls are no longer warranted. From the Building 779 D&D project lessons learned, a clear definition of *operationally clean* based in part on the accident analysis is paramount to determine when the TSR control set is no longer needed.

**References**

1. *DOE Standard: Guidance for Preparation of DOE 5480.22 (TSR) and DOE 5480.23 (SAR) Implementation Plans*, DOE-STD-3011-94, U.S. Department of Energy, Washington D.C., November 1994

2. *DOE Standard: Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports* , DOE-STD-3009-94, U.S. Department of Energy, Washington D.C., July 1994