



Washington Group International

Integrated Engineering, Construction, and Management Solutions

Preliminary Nuclear Criticality Safety Evaluation for the Container Surveillance and Storage Capability (CSSC) Project

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Outline

- ◆ **CSSC Project Facility Description**
- ◆ **NCSE Approach**
- ◆ **Results**
- ◆ **Conclusions**

CSSC Project Description

- ◆ **The CSSC Project will perform surveillances on 3013 containers to verify that they meet the DOE-STD-3013 for plutonium storage.**
 - **This surveillance will include Non-Destructive Analyses (NDA) and some destructive analyses**

CSSC Project Description

- ◆ **Divided into five areas**
 - **Non-Destructive Assay Room**
 - Neutron Multiplicity Counter (NMC), Calorimeter
 - **Packaging Area**
 - **Glovebox Room**
 - Furnace, Can Cutter
 - **Storage Area/Vault**
 - Storage Racks
 - **Ventilation System**
- ◆ **CSSC General Design Features**
 - **Moderator controlled zones**
 - No significant sources of moderation
 - **Non-hydrogenous fire suppression system**
 - **Incorporates Criticality Accident Alarm System (CAAS)**

Nuclear Criticality Safety Evaluation Approach

- ◆ The approach is compliant with DOE-O-420.1B and DOE-STD-3007-2007
- ◆ Approach
 - Determine the scope of the effort
 - Perform a walk-down
 - Establish the facility and process boundaries
 - Determine potential criticality scenarios
 - Control development
 - List all potential controls
 - Defense in Depth (DiD)
 - Use a Passive Engineered, Active Engineered and Administrative controls hierarchy

NCSE Approach - Scenario Credibility

- ◆ **Double Contingency Principle**
 - **Process designs should incorporate sufficient factors of safety to require at least two unlikely, independent and concurrent changes in process conditions before a criticality is possible**
 - **Compliance does not ensure an event is not credible**
- ◆ **Demonstration that a scenario is not credible requires a higher level of assurance**
 - **To assist the team in making this judgment the team use the following guidelines:**
 - **Four or more independent and unlikely human failures of a robust barrier to criticality**
 - **Three or more independent equipment failures**
 - **Any justifiable combination of the above two guidelines**
 - **Can not assemble a critical configuration**
 - **These guidelines are only intended to bring a measure of consistency and direction to the engineering judgment discussions of the DCA team and are not intended to provide a counting process**

Nuclear Criticality Safety Evaluation Approach

◆ Approach (continued)

- Determine if the scenario development process identified the need for additional limits or new evaluations
- Develop NCSE per guidelines
- Perform Technical and Facility Review of the NCSE and Incorporate Comments
- Submit the NCSE for the Implementation and Final Approval

Results

- ◆ **Scenarios were developed for Technical Safety Requirement (TSR) normal and a TSR restricted mode, as well as abnormal operations in each of the five project areas**
- ◆ **Approximately 70 scenarios identified**
- ◆ **The physical form of the fissile material involved (oxide or metal) is also significant**
 - **Limiting scenarios involve metal and the number of units allowed in the glovebox room**

Results

- ◆ **Separation between units, total mass, moderation, and reflection are some of the parameters that were evaluated**
 - Use of separate work stations/areas and geometrically safe storage racks
 - TSR Normal and Restricted modes that limit the number of units allowed out of the storage racks at one time
 - Moderator control zones and non-hydrogenous fire suppression system
 - CAAS as a mitigator
- ◆ **Compliant with Double Contingency Principle**

Conclusions

- ◆ **The facility, as currently designed, can be operated safely**
- ◆ **Compliant with the Double Contingency Principle**
- ◆ **If ALL identified controls are implemented, could make a reasonable case that a criticality is not credible**
- ◆ **A CAAS is included in the project scope because the facility is intended to handle significant quantities of fissile material, the facility is intended to have a long mission life, the current project design is only about 30% complete, and the controls set contains administrative controls**
- ◆ **The facility will be re-evaluated when the facility design is closer to completion**

Questions?

DOE Order/Standards

- ◆ **DOE-O-420.1**
 - Establishes facility and programmatic safety requirements.
- ◆ **DOE-STD-3007**
 - Sets forth guidelines on the structure and contents of an NCSE.
- ◆ **DOE-STD-3013**
 - Regulations for stabilization, packaging and safe storage of plutonium bearing metals and oxides.