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DRIVING THE FUTURE OF NUCLEAR TECHNOLOGY

Criticality Accident Alarm System Removal Methodologies

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Portsmouth/Paducah Project Office (PPPO) Mission - To conduct the safe, secure, compliant, and cost effective environmental legacy cleanup of the Portsmouth and Paducah Uranium Enrichment Sites on behalf of the local communities and the American taxpayer.

C-340 Metals Plant Complex

C-340 Metals Plant Complex Slab

Purpose: To provide Methodologies for Removing a Criticality Accident Alarm System (CAAS) from Service

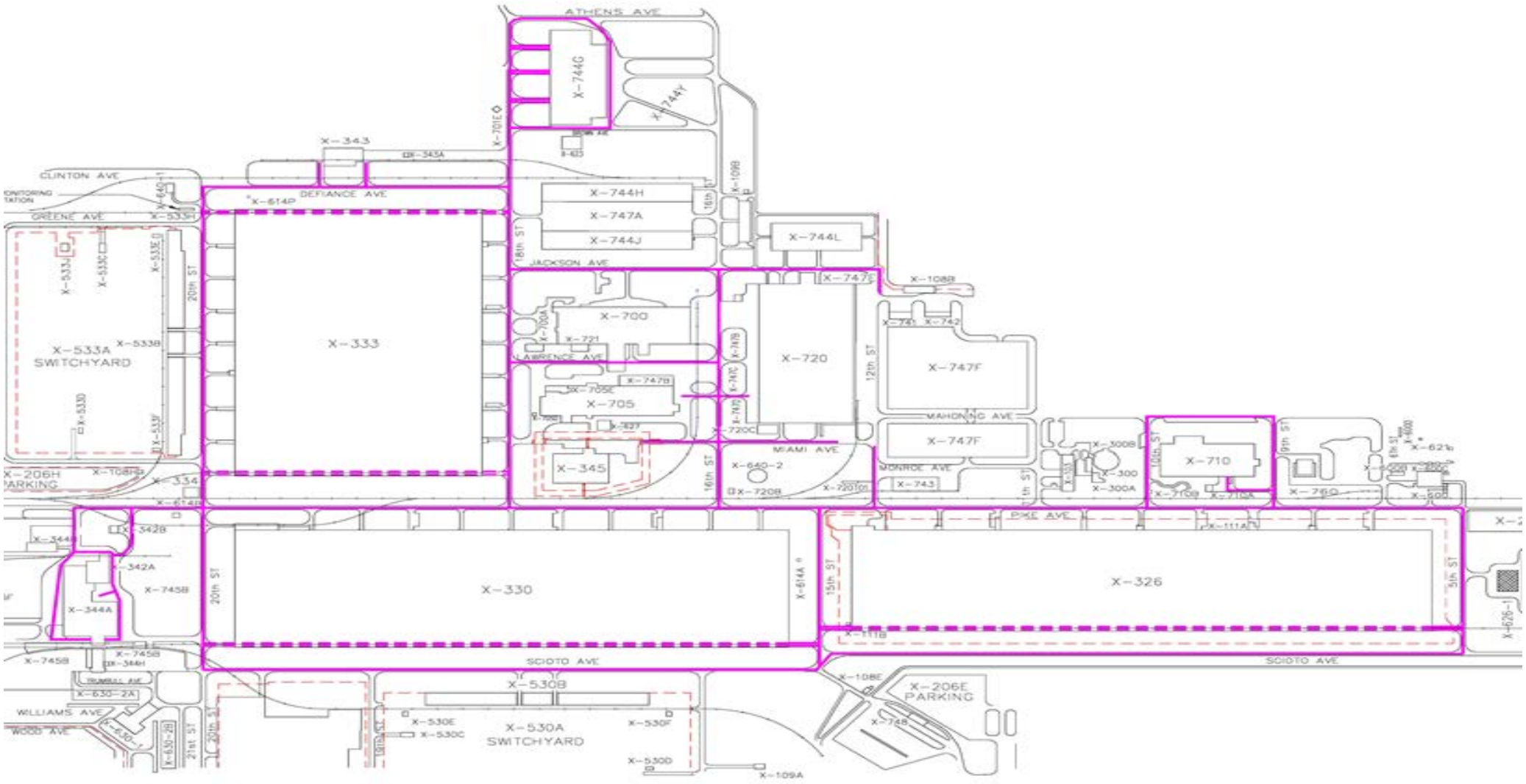
ANSI/ANS-8.3-1997 requires (in part);

- The need for criticality alarm systems shall be evaluated for all activities in which the inventory of fissionable materials in individual unrelated areas exceeds 700 g of U-235, 500 g of U-233, 450 g of Pu-239 or 450 g of any combination of these three isotopes. [4.2.1]
- A criticality alarm system meeting the requirements of this standard shall be installed in areas where personnel would be subject to an excessive radiation dose. [4.2.2]
- In areas in which criticality alarm coverage is required, a means shall be provided to detect a criticality accident and to signal that prompt protective action is required. [4.2.3]

Numerous CAAS clusters were needed when the facilities were processing and storing thousands of pounds of fissile material.

After the facilities are characterized and as they are deactivated, a methodical approach can be used to reduce or eliminate the need for CAAS.

Currently Portsmouth has about 200-Acres of CAAS Coverage



Aerial View of Portsmouth

Aerial View of Paducah

Typical CAAS Cluster

Support Systems - Typical Electronic Horn

Support Systems - Typical Air Whistle

Support Systems - Typical Air System

So……Keeping all this Stuff “Operable” Requires Personnel, Parts, and Procedures (P^3).

$$P^3 = \$\$\$$$

Once a facility is deactivated and characterized, keeping a CAAS operable when the residual fissile material would not need coverage is

CAAS for operations that no longer have a criticality hazard diminishes personnel focus on the needed safety controls (human factors).

Removal Methodologies

1. Demonstrate a facility is non-fissile.

When the plants were enriching uranium a maximum assay (i.e., wt. % ^{235}U) was assigned to each cell based on historical operation. This maximum assay is based on the highest assay that was present at some point in the life of the enrichment operation at that location.

There are large sections of process buildings where this maximum assay is slightly above fissile (i.e., 1 wt. % ^{235}U) but mainly operated at a lower assay. For example the maximum cell assay in building C-333 at Paducah is approximately 1.2 wt. % ^{235}U and only for 2 of the 60 cells in the building. A comprehensive characterization could finalize the assay and the CAAS coverage could be reduced or eliminated.

- C-333 has 4 CAAS clusters that could be eliminated if characterization demonstrates the facility is non-fissile.

Removal Methodologies

2. Demonstrate the facility contains less than 700 g ^{235}U (or other applicable isotope).

- The majority of the uranium processing equipment has been removed from the C-400 decontamination facility.
- The facility is segmented from other site facilities.
- The remaining fissile material has been demonstrated to be < 700 g ^{235}U.

Removal Methodologies

3. Evaluate fissile material operation and place controls such that the probability of criticality is so low that a CAAS is not needed.

This option may be beneficial for large or complex deactivated facilities where only residual fissile material remains but cannot be shown to be < 700 gram ^{235}U.

For example, currently Nuclear Criticality Safety Evaluations for UF_6 cylinder yards demonstrates with passive and administrative controls that the probability of a criticality is very low and a CAAS is not needed.

Removal Methodologies

4. Demonstrate the residual fissile material that remains in a facility cannot support a criticality (i.e., Criticality Incredible)

Example PORTS X-326 facility:

- The major fissile components have been removed and shipped to an off-site waste disposal facility.
- NCS staff are developing the limits for the residual fissile material that may remain in the facility.
- The remaining fissile components (piping, valves, small diameter copper tubing, etc.) are being characterized.

The CAAS can be removed from service once the remaining components are demonstrated to meet the CI limit or removed from the facility.

Removal Methodologies

Example PORTS X-326 facility:

Documentation is Essential

- Documentation is the complete facility data and evaluation records with supporting information that demonstrates the status of the facility.

- Provides the basis for DOE approval of removing the CAAS.

Conclusion

- A one-size-fits-all methodology for CAAS removal is impractical for most sites.
- Each fissile material operation requires an evaluation by cognizant personnel to tailor a method that suits CAAS removal.
- Comprehensive walk downs and documentation of the entire CAAS covered area are essential to ensure all fissile material locations are considered in the removal analysis.
- Obtain stakeholder input (contractor and regulator) early and throughout the task. DQOs are key in obtaining agreement from all relevant parties.
- Frequent feedback on progress and problems is essential.
- Comprehensive documentation will result in time savings and eliminate re-work.

Questions/Open Forum