ANSI/ANS 8.10
Potential Applications

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ANSI/ANS 8.10 Summary

ANSI/ANS-8.10 provides an alternative to the Double Contingency Principle for shielded facilities with controls to limit the release of radioactive materials. This standard only applies to areas that do not require personnel access. The protection of the shielded facility provides the protection of one control, so that only one other process control is required.

ANSI/ANS 8.10 Examples

Yucca Mountain – The mountain provides shielding and confinement. The tunnels are backfilled after waste emplacement to provide confinement and prevent access.

Waste Treatment and Immobilization Plant (WTP) – The Black Cells of the WTP do not have personnel access, and provide shielding and containment.

Uranium Processing Facility (UPF) – Personnel work directly with HEU without shielding.

Yucca Mountain Criticality Issue

Yucca Mountain would store commercial and government spent fuel for geological periods. After tens of thousands of years, the initial criticality controlled geometry of a waste package could degrade, so that the geometry and absorber controls of an undamaged waste package are replaced by a “nuclear pizza”, with fuel masses spread through a clay-like mixture of the original materials of construction.

Yucca Mountain 8.10 Application

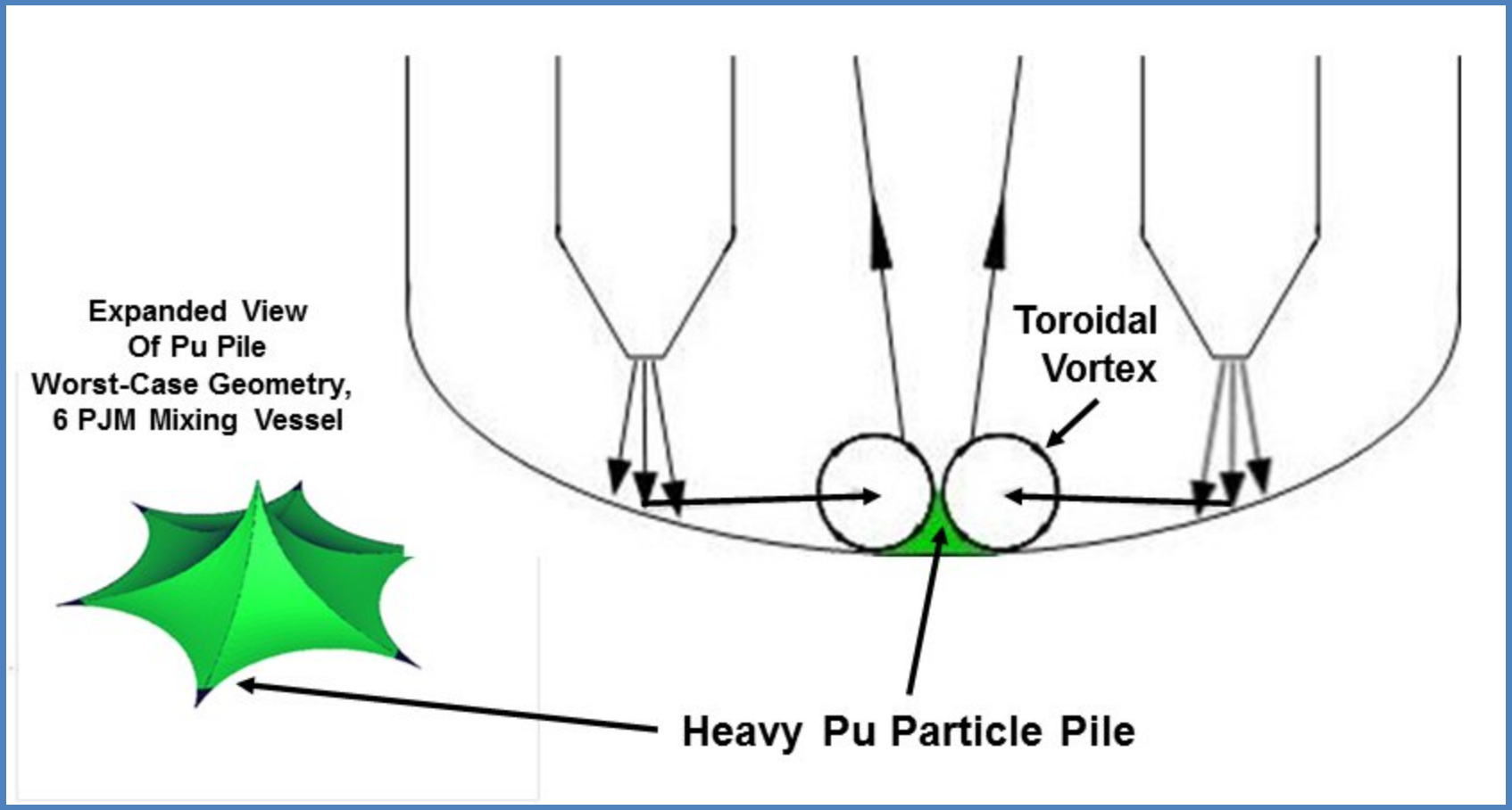
Applying ANSI/ANS 8.10 to the mountain and tunnels means that only one process control is required for criticality safety. For commercial PWR and BWR spent fuel, the criticality control can be neutron absorbers and/or Burnup Credit for long periods. (Prior to emplacement, typical package and facility controls are applied.)

WTP Criticality Issue

Highly-Active Waste from Hanford reprocessing activities are stored in tanks containing plutonium oxide particles. The waste is mixed with chemicals in the PTF, and the mixing could cause the separation of hypothetical Heavy Pu Particles (HPP, hypothetical 100 micron spheres of PuO_2) and collection into a moderated “fluted horn” geometry.

WTP Criticality Concept

Pulse Jet Mixers at Bottom of Tank



WTP 8.10 Application

The Black Cells of the WTP Pre-Treatment Facility (PTF) are sealed after construction. The Black Cells are heavily shielded and provide containment. Some straight pipes penetrate the shield wall, but personnel access is limited. Similarly, many straight pipes penetrate the shield ceiling, but maintenance access is pre-planned and infrequent.

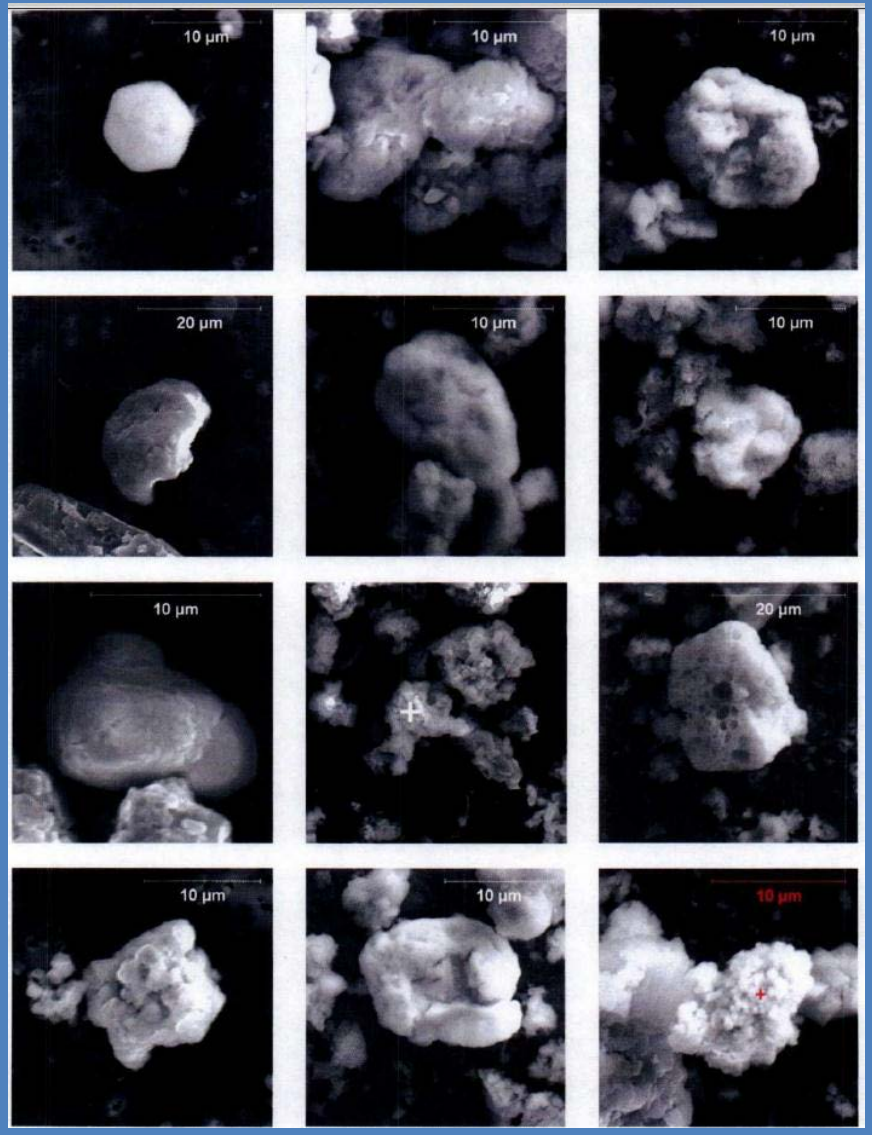
WTP 8.10 Application

The Black Cells thus provide shielding and containment.

The second criticality control can be mass control, allowing less than 2.5 kg. (The mass of Pu can be measured before processing, but not the particle size distribution. Thus the criticality analyses use the optimum particle size of 100 microns. Actual maximum size is 10-20 microns.)

Pu Particle Shapes

Plutonium Oxide Particles (Reynolds, Kadinger, Venetz)



UFP 8.10 Criticality Issue

Like Y-12, the UFP requires “hands-on” personnel activities in glove-boxes. The addition of a powerful sprinkler system, not present at Y-12, creates the potential for large volumes of water in glove boxes and on the floors. Movement of up to 20 kg of HEU in cans, combined with an earthquake and sprinkler activation, creates a possible criticality issue.

UFP 8.10 Application

The UFP is not a shielded facility, because HEU is primarily an alpha emitter and contact dose rates are minimal. The facility does provide confinement. Personnel are present in the facility at all times. Thus, ANSI/ANS 8.10 can not apply and Double Contingency must be achieved.