

Criticality Differences in Methodology Between SRS Onsite Transportation and Offsite Transportation of Packages

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Scope

- Basis of the criticality evaluation for Savannah River Site (SRS) onsite transportation that support routine transfers by an Onsite Safety Assessment (OSA).
- Basis of the criticality evaluation for offsite transportation that support transfers by a Safety Analysis Report for Packaging (SARP).
- Key differences in methodology.

Flow of Onsite Transportation Evaluation

Determine Scope for Onsite Transport

Identify Parameters Important to Criticality Safety

Establish Normal Condition of Operation

Process Upset Evaluation (Abnormal Conditions)

Evaluation of k_{safe} based on facility validation and MSM

Evaluate Normal and Credible Abnormal Conditions

Establish Limits and Controls

Flow of Offsite Transportation Evaluation

Determine Scope for Offsite Transport

Identify Parameters Important to Criticality Safety

Establish Prescribed Conditions

Evaluation of k_{safe} based on NUREG/CR-5661 MSM

Evaluate Prescribed Conditions

Calculate Criticality Safety Index (CSI)

Establish Limits and Controls

Description of the Onsite Transportation Evaluation

- Identification of the routine or non-routine transfer of fissile material between onsite facilities at SRS. The requirements set for transport are based on site specific documents SCD-3, *Nuclear Criticality Safety Manual* and SRNS-SA-2008-00004, *Transportation Safety Document*.
- Identification of the fissile material parameters and overall process conditions important to criticality safety for the fissile transfer.
- Evaluation of normal and credible abnormal conditions for the package(s) during onsite transportation, as evaluated per a hazard analysis with other engineers, operations, etc.
- Evaluation of normal and credible abnormal conditions as compared against the established k_{safe} .
- Establish administratively controlled limits and controls that will maintain subcriticality of the transported packages.

Description of the Offsite Transportation Evaluation

- The package to be transported that is of criticality concern is identified and described. The requirements for transport are based on 10 CFR 71.55 and 10 CFR 71.59.
- Identification of the fissile material parameters and overall package conditions important to criticality safety for the transfer of a fissile package.
- Evaluation of the prescribed conditions per 10 CFR 71 - Single Package, Normal Conditions of Transport (NCT) and Hypothetical Accident Conditions (HAC).
- Evaluation of the k_{eff} for the prescribed conditions as compared against the established k_{safe} .
- Development of the CSI - the number of packages on a single transport vehicle to ensure subcriticality of the group of packages.
- Establish limits and controls.

Differences Between Onsite and Offsite Transportation

Onsite Communicated Through An OSA

Offsite Communicated Through An SARP

Establish Normal Condition of Operation

Establish Prescribed Conditions

Establish Normal and Credible Abnormal Conditions

Evaluate Prescribed Conditions

Evaluation of k_{safe} based on facility MSM

Evaluation of k_{safe} based on NUREG MSM

Evaluate Normal and Credible Abnormal Conditions

Calculate Criticality Safety Index (CSI)

Key Featured Differences

- **Normal and Credible Abnormal Conditions**

- *Normal conditions are the initial conditions for shipment of the fissile material in a container. These conditions are bounded as the critically safe conditions with no change in the criticality safety parameters (such as mass, concentration, reflection, and interaction) maintaining subcriticality of the package(s).*
- *Credible abnormal conditions are those hazards that result in damage to the package or contents including, but not limited to, loss of containment or geometry.*

- **Prescribed Process Conditions**

- *Single Package analysis in its most reactive credible configuration, including moderation by water.*
- *Normal Conditions of Transport Array analysis of an undamaged package with fissile material in its most reactive credible configuration, no inleakage of water into containment is considered unless it is deemed to leak.*
- *Hypothetical Accident Conditions Array analysis of a damaged package with fissile material in its most reactive credible configuration, no inleakage of water into the containment is considered unless it is deemed to leak.*

Key Featured Differences

- **Calculating k_{safe}**
 - $k_{safe} = k_B - AOA - MSM$
 - *Faciality Specific MSM (typically 0.02)*
 - *Regulatory NUREG/CR-5661 MSM (typically 0.05)*
- **Calculating Packages For Transport**
 - *The onsite number of packages to be transported is based on the number of packages that are safely subcritical under normal and abnormal conditions.*
 - *Offsite calculates a criticality safety index (CSI) for the NCT and HAC array analyses, as a function of undamaged and damaged packages, whereas at a CSI of zero an unlimited number of packages are determined to be subcritical for transport. One hundred (100) is the maximum CSI. Simply put, $0 \leq CSI \leq 100$.*

Questions