



Impacts to Criticality Safety from Recent Revisions to DOE Standards

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DOE-STD-3007-2017

Many changes aligned with ANSI/ANS-8.1

- Application of Unlikely
 - Removed “once in the lifetime” qualifier
 - Added guidance on using judgment
 - Allowed Y-12 to eliminate “anticipated abnormal conditions” and apply traditional process analysis
- Double Contingency Principle
 - Recognizes DCP as a technical practice
 - Eliminated language suggesting DOE approval if only one parameter is controlled
 - Allowed Y-12 to eliminate improper use of DCP in DSAs, HAs, and administrative procedures
 - Allowed Y-12 to eliminate confusing criteria for determining when DOE approval is required
 - Allowed Y-12 to relegate DCP to a technical practice for use by NCS practitioners



NOT MEASUREMENT
SENSITIVE

DOE-STD-3007-2017
December 2017

DOE TECHNICAL STANDARD

PREPARING CRITICALITY SAFETY
EVALUATIONS AT DEPARTMENT OF ENERGY
NONREACTOR NUCLEAR FACILITIES



U.S. Department of Energy
Washington, D.C. 20585

AREA SAFT

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DOE-STD-3007-2017

- Guidance on analysis of Design Basis Events
 - Added clarification on the meaning of “Design Basis Events”
 - States that a CSE shall not analyze the “smart event”
 - Recent CTA guidance on evaluating DBEs
 - Allows Y-12 to tailor guidance for NCS analysis of DBEs to specific classes of facilities



Department of Energy
National Nuclear Security Administration
Washington, DC 20585



July 15, 2019

MEMORANDUM FOR GEOFFREY BEAUSOLEIL
MANAGER
NNSA PRODUCTION OFFICE

FROM:

JAMES J. MCCONNELL 
CENTRAL TECHNICAL AUTHORITY

SUBJECT:

Central Technical Authority Position on Considering
Design/Evaluation Basis Events in Criticality Safety
Evaluations per DOE Order 420.1C, Chg 2, *Facility Safety*

Introduction

Department of Energy (DOE) Order (O) 420.1C, Chapter III.3.f requires that processes will remain subcritical under normal and credible abnormal conditions, *including those initiated by design basis events.*

This memorandum provides an acceptable approach for considering design/evaluation basis events (D/EBEs) as related to NNSA criticality safety evaluations in existing facilities. This approach has been discussed with members of DOE/AU-30, NPO, NA-19, and NA-50.

Issue

The implementation of DOE O 420.1C, Chapter III.3.f requirement in DOE Standard (STD) 3007-2017 Section 4, as written, results in Criticality Safety Evaluations (CSEs) that exceed the criticality safety design philosophy of the American National Standard Institute (ANSI)/American Nuclear Society (ANS)-8.1-2014. This leads to unnecessarily conservative control identification and significant implementation challenges without a commensurate benefit to public health and safety.

The implementation challenges for existing facilities result from the following, as stated in DOE-STD-3007-2017:

- “For the purpose of this Standard, Design Basis Accidents and Evaluation Basis Accidents will be referred to as Design Basis Events” (DBEs) consistent with the requirement in DOE O 420.1C., which for existing facilities are labeled Evaluation Basis Events (EBEs), and are delineated in each facility’s Documented Safety Analysis (DSA) Accident Analysis section as a bounding event by accident type.



DOE-STD-3009-2014

- Elevation of NCS Controls to the DSA/TSR
 - Added requirements for what NCS hazards to include in the DSA
 - DOE-STD-3007-2017 aligns with DOE-STD-3009-2014
 - Y-12 is currently elevating more to the DSA than what DOE requires
- Description of the Criticality Safety SMP
 - Indicates that description should be high-level and acceptable to reference the DOE-approved CSP
 - Many Y-12 DSAs include descriptions in Ch. 6 down to the process level

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DOE-STD-3009-2014
November 2014

DOE STANDARD
PREPARATION OF NONREACTOR
NUCLEAR FACILITY DOCUMENTED
SAFETY ANALYSIS



U.S. Department of Energy
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DOE-STD-1027-2018

- Demonstrating Criticality Accident as “Not Credible”
 - Added guidance for Not Credible and Nature of the Process
 - Prohibits NCS controls “with-in” the facility (i.e. process-specific)
 - Allows controls that limit forms, amounts, distribution of fissile material, reflectors, and moderators “from entering” (i.e. facility level)
 - Y-12 in the process of approving a non-nuclear facility to coat a high-enriched uranium fast burst reactor part



NOT MEASUREMENT
SENSITIVE

DOE-STD-1027-2018
November 2018

DOE STANDARD

HAZARD CATEGORIZATION OF DOE NUCLEAR
FACILITIES



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Further Guidance is Needed

Design Basis Events (DOE O 420.1C, Att 2, Ch. III, 3.f)

Criticality safety evaluations must show that entire processes involving fissionable materials will remain subcritical under normal and credible abnormal conditions, including those initiated by design basis events.

- DOE-STD-3009-2014 defines design basis accident

Accidents explicitly considered as part of the facility design for a new facility (or major modifications) for the purpose of establishing functional and performance requirements for safety class and/or safety significant controls

- DOE-STD-3009-2014 defines accident

A specific event or progression of a sequence of events resulting from an initiating event that is followed by any number of subsequent events that may lead to a release of radioactive or other hazardous material and/or exposure to a predefined receptor

- Does consideration of “design basis events” only include new facilities and major modifications to existing facilities?

Further Guidance is Needed

NCS Occurrences (DOE O 232.2A)

(3C-2) A condition in which no documented controls are available to prevent a criticality accident. An accident has not occurred due to other, non-documented barriers or controls (RL H)

(3C-3) A loss of one or more nuclear criticality documented controls such that an accidental criticality is possible from the loss of one additional documented control (RL H)

- Why is the control terminology different?
- Can other controls be credited? Such as TSRs, Fire Protection, Security, etc.
- Can existing features be credited when such features are not cited as a control?
- Should issues where no controls are formalized be reported in these categories even when actual conditions are not hazardous? Does this align with the report level?

Further Guidance is Needed

Facility Deactivation

- Process involves removing and/or stabilizing fissile material, downgrading to non-nuclear per DOE-STD-1027, and turning over to DOE EM
- Ultimately the facility and process equipment will be dismantled and sent to a radioactive waste burial facility
- What are the acceptance criteria at the burial facility? (e.g. fissile mass per item/ container, form of fissile material)
- What are acceptable forms of stabilization? (e.g. foams, spray-on fixatives, cutting and capping, etc.)
- Does DOE EM accept minimum needed to downgrade even if more work is needed to remediate fissile inventory for waste disposal?



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