# Risk Assessment in Support of DOE Nuclear Safety

Office of Health, Safety and Security

## BACKGROUND & PURPOSE:

On August 12, 2009, the Defense Nuclear Facilities Safety Board (DNFSB) issued Recommendation 2009-1, *Risk Assessment Methodologies at Defense Nuclear Facilities.* This recommendation focused on the need for clear direction on use of quantitative risk assessments in nuclear safety applications at defense nuclear facilities. The Department of Energy (DOE) is presently analyzing directives, standards, training, and other tools that may support more effective development and use of risk assessment. Working with the Chief of Defense Nuclear Safety and the Chief of Nuclear Safety, staff from the Office of Health, Safety and Security (HSS) will be seeking input from program and field elements on their needs for and uses of quantitative risk assessments to support a study on use of risk assessment in nuclear safety at DOE. On February 1, 2010, as a follow on to DOE's acceptance of the DNFSB Recommendation, the Secretary committed to the revision of DOE's *Nuclear Safety Policy* to address the use of quantitative risk assessments in nuclear safety.

In light of these actions, HSS is issuing this Information Notice to emphasize that, as with the use of any engineering tool in nuclear safety applications, when risk assessments are employed by DOE or their contractors, they must be used appropriately and in a technically sound manner. This Notice also describes the formation of a technical expert working group established to support appropriate development and use of risk assessment across the DOE complex.


### SYNOPSIS

DOE is in the process of evaluating the use of risk assessment to support nuclear safety at its defense nuclear facilities. In the interim, HSS is issuing this Information Notice to recap existing expectations and inform the DOE complex of the formation of a support group for risk assessments:

- **Risk assessments are activities that address the following questions:**
  - What can go wrong (undesired events)?
  - How likely are the undesired events?
  - What are the consequences of undesired events?
- **DOE uses risk assessment results in many ways, including helping to inform its nuclear safety decisions. Although these may involve the use of quantitative risk assessment tools, the Department's approach to assuring nuclear safety is to conservatively identify and analyze accident scenarios to support the development of subsequent controls to prevent or mitigate their consequences.**
- **Risk assessments that are used to support nuclear safety decisions are subject to DOE quality assurance and oversight requirements.**
- **A technical expert working group is being established to support the DOE evaluation and field implementation of risk assessments.**

*Nothing in this Information Notice establishes new requirements; its purpose is to inform DOE elements of existing requirements and guidance and the status of DOE activities.*


## RISK ASSESSMENT & RISK MANAGEMENT AT DOE:

DOE uses risk assessments and risk management processes to support various decisions by, for example, helping to prioritize needed actions, to compare alternative actions, and to comply with or demonstrate compliance with requirements. The decisions being supported may be in areas such as nuclear and facility safety, project management, security, environmental management, radiation protection, and waste management.

DOE manages the safety of its nuclear operations by ensuring rigorous implementation of its safety requirements, including those in 10 CFR Part 830, *Nuclear Safety Management*, for identifying and analyzing hazards, and identifying engineering and administrative controls to mitigate the hazards. This is an important part of DOE's safety management programs that also include: requirements for conduct of operations, maintenance, and training; safety system design (to include establishing safety margins and defense-in-depth); and quality assurance and safety oversight. The identification and analysis of hazards, and selection of engineering and administrative controls must be accomplished consistent with an approved methodology such as the DOE-Standard (STD)-3009[1], *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Documented*

[1] DOE-STD-3009 and others (e.g., STD 1027, *Hazard Categorization;* STD-1189, *Integration of Safety into the Design Process*; STD-3011, *Guidance for Preparation of Basis for Interim Operation (BIO) Documents*; STD-3016, *Hazard Analysis Reports for Nuclear Explosive Operations; and* STD-3014, *Accident Analysis for Aircraft Crash Into Hazardous Facilities)* define safety analysis methodologies that can be described as risk-informed approaches to the safety assurance process for DOE nonreactor facilities. This is because these documents incorporate some of the analytical techniques that are typically used in quantitative risk assessments.

*Safety Analysis,* which provides clear direction on the analyses that are required to support safety basis decisions. The standard indicates that the Department's approach does not require or expect the additional detail and technically disciplined analysis necessary for a quantitative or probabilistic risk assessment. Nor does the standard provide a basis for using probabilistic risk assessment in place of the hazard analyses prescribed. Although the process is risk informed and risk considerations are integrated in the approach, such considerations are for the most part, qualitative or semi-quantitative.

Nevertheless, to better inform decision-makers, DOE's nuclear safety decision-making processes can be supplemented and strengthened through application of quantitative (including probabilistic) risk assessment methodologies; such risk assessments may be useful in aiding the evaluation of alternatives that comply with DOE nuclear safety requirements and supporting unreviewed safety question determinations for plant modifications or when a potential inadequacy of the safety basis is identified.

Secretary of Energy Notice (SEN)-35-91, *Nuclear Safety Policy,* identified risk-based safety goals but stressed that their adoption was not a requirement for the use of probabilistic risk assessments and they "are not substitutes for compliance with DOE directives and nuclear safety-related rules."

DOE's *Nuclear Safety Policy* directs DOE line managers to provide guidance to their contractors, including the need for line management to maintain a proper balance of safety, production goals, and cost considerations so as to ensure that safety is fully integrated into every level of activity. In this regard, risk assessment (discussed above) can be useful to inform management decisions by providing additional insights to:

- Augment use of traditional safety assessment methods prescribed in DOE Directives and Technical Standards and currently used in the development of safety basis for nuclear facilities and operations, by:
  - prioritizing safety challenges on the basis of risk significance,
  - assessing uncertainties in quantitative analyses, and
  - testing the sensitivity of the results to key assumptions.
- Evaluate changes to safety requirements; and
- Enhance the quality, transparency and credibility of the results and decisions.

When using such risk assessment tools to support nuclear safety decisions, the application of risk assessment is subject to: 1) DOE quality assurance requirements set forth in 10 CFR Part 830 and DOE O 414.1C, *Quality Assurance;* 2) DOE line management (including the Central Technical Authorities and their respective Chief of Nuclear Safety and Chief of Defense Nuclear Safety) review; and 3) Office of Health, Safety and Security independent oversight. Although quantitative risk assessments may be used to better inform nuclear safety decisions, DOE does not support the application of quantitative risk assessments in a manner that is contrary to the established safe harbor methodologies of 10 CFR Part 830. If quantitative or probabilistic risk assessments are used in an alternative approach instead of safe harbor methods, they are subject to review and approval as an equivalent method or in some cases may require evaluation under DOE's exemption process.

The primary safety analysis methodologies that are pre-approved by the Department conservatively identify and analyze potential accident scenarios to support the development of subsequent controls to prevent the accident or mitigate the consequences. This approach provides assurance that the public, workers and environment are protected.

The Department does not endorse any pre-approved quantitative risk acceptance criteria. Although quantitative risk assessment results are sometimes evaluated against metrics to support relative comparisons of alternative approaches or assess the effectiveness of the approach, quantitative risk assessments demonstrating conformance with, for example, the SEN-35-91 risk goals, or evaluation criteria (contained in DOE standards) do not necessarily indicate whether the associated risks are acceptable or unacceptable. Such decisions must consider many factors and in most situations, the risk information cannot be the sole basis for a decision to proceed with (or not proceed with) an activity; it is only one element of a fully informed decision. As noted previously, the Department does not support the use of quantitative risk assessment in place of the approved methodology for developing Documented Safety Analysis.

DOE has established a risk assessment technical expert working group to provide DOE line elements assistance in determining when and how risk assessment can be used effectively to better inform nuclear safety decisions.

## TECHNICAL EXPERT WORKING GROUP:

In the past, DOE has employed risk assessment tools in a variety of activities. Although application of risk assessments may be appropriate for these areas, the formality and quality of the assessments performed varied considerably. Furthermore, as observed in DNFSB Recommendation 2009-1, no consistent framework was used to employ risk assessment results in the decision-making process.

In order to support programs and field organizations, DOE has established a Risk Assessment Technical Experts Working Group (RWG). The purpose of the Group is to support effective and appropriate utilization of risk assessment tools in nuclear safety applications at defense nuclear facilities. The RWG includes a

DOE Steering Group composed of DOE nuclear safety managers and experts supported by review teams of technical experts. The RWG is available to provide advice on the use, and to assist in the planning and in the peer review of nuclear safety-related risk assessments. DOE site offices or program offices may obtain access to the group's planning or peer review services by contacting the appropriate RWG Steering Group member (i.e., the program office representative or the CDNS for NNSA activities, or the CNS for other DOE activities). Questions related to the application of nuclear safety related risk assessment at DOE can be asked through the RWG Web site forum page or by contacting program office RWG members. The RWG charter, its members and other data are available on the Web. When fully operational, the RWG Web Site will list tools and documents (and DOE lessons learned) that may be useful to those wishing to employ risk assessment to better inform decisions. The RWG Steering Group members are listed below.

## RWG STEERING GROUP MEMBERS:

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## REFERENCES:

DOE Directives and Standards discussed which are the basis for this information notice are available at:

- DOE Directives - http://www.directives.doe.gov/
- DOE Technical Standards - http://www.hss.energy.gov/nuclearsafety/ns/techstds/

Correspondence related to and the Implementation plan for the DNFSB Recommendation 2009-1, *Risk Assessment Methodologies*, - http://www.hss.energy.gov/deprep/archive/rec/2009-1.asp

RWG Web Site – http://www.hss.energy.gov/nuclearsafety/sbfd/rawg/

Other useful risk assessment and risk management resources will be posted at the RWG Web Site.

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