U.S. DEPARTMENT of ENERGY | Office of Worker Protection & Nuclear Safety

Frequently Asked Questions (FAQs) for DOE-STD-3009-2014, *Preparation of Nonreactor Nuclear Facility Documented Safety Analysis*

Updated June 2026

Q1: Why was DOE-STD-3009 revised?

A1: The goal of this revised Standard is to provide clearer criteria and guidance to support effective and consistent Documented Safety Analyses (DSAs) based upon lessons learned in implementing DOE-STD-3009-94. DOE has gained over 20 years of experience and lessons learned in implementing DOE-STD-3009-94. DOE also committed to revise DOE-STD-3009 in response to DNFSB Recommendation 2010-1.

Q2: What are the major changes in DOE-STD-3009-2014?

A2: This revision:

- Clarifies use of the Evaluation Guideline;
- Clarifies use of bounding parameters;
- Clarifies unmitigated and mitigated hazard evaluations to protect the workers, public, and environment;
- Clarifies standard industrial hazards and chemical hazards screening or further hazard evaluation;
- Establishes a clear criterion for use of the hierarchy of controls and requires documentation of the rationale;
- Clarifies major contributors to defense-in-depth for selection of safety significant controls;
- Incorporates methodologies for co-located workers and chemical hazard evaluations;
- Refines methods for air dispersion calculations;
- Provides specific criteria for determining the functional adequacy of safety class and safety significant structures, systems, and components; and
- Reduces the level of description required in DSAs for safety management programs.

Q3: Does 10 C.F.R. Part 830 require use of DOE-STD-3009-2014 for existing DOE nuclear facilities?

A3: No. 10 C.F.R. Part 830 requires contractors for DOE nuclear facilities to use a safe harbor standard for preparing DSAs, or to obtain approval of an alternate methodology. DOE-STD-3009 is the most-used safe harbor standard, and many existing DOE nuclear facilities use DOE-STD-3009-94. The 10 Code of Federal Regulations (C.F.R.) 830 safe harbor table requires use of "DOE-STD-3009-94, Change Notice No. 1 … or successor document." However, in an October 18, 2014 letter, the Secretary of Energy reiterated the following commitment for an evaluation of existing defense nuclear facilities relative to the new revision of DOE-STD-3009:

> *"In addition, as stated in Section 6.2 of the Department's 2010-1 IP, the evaluation of DSAs for existing defense nuclear facilities relative to the new revision of DOE-STD-3009*

will be performed consistent with the current regulatory process for developing and maintaining DSA updates. This evaluation will look for and implement enhancements that can be made based upon lessons learned and best practices that have been incorporated in the revised DOE-STD-3009, related to protection of the public from nuclear hazards. The Department is in the process of developing its approach for this evaluation."

Q4: In what circumstances should major modifications to existing DOE nuclear facilities use the new DOE-STD-3009-2014?

A4: DOE O 420.1C Page Change 1 (approved February 27, 2015) requires use of DOE-STD-3009-2014 for preparing documented safety analyses for major modifications to existing nuclear facilities, when the DOE-STD-3009 method is used as the safe harbor method to satisfy 10 C.F.R. Part 830, *Nuclear Safety Management*, requirements. For such major modifications to existing non-reactor nuclear facilities, DOE O 420.1C Page Change 1 also allows the appropriate Secretarial Officers, with concurrence by the applicable Central Technical Authority, to approve use of DOE-STD-3009-94. This PSO-approved exception is expected to be used for relatively smaller modifications, particularly those that do not add major new types of equipment or major new accidents. This PSO-approved exception is not expected to be used when major new structures or major new accident scenarios are added to existing facilities.

Q5: When a major modification to an existing facility uses the new DOE-STD-3009-2014, does the whole DSA have to be upgraded to the new STD-3009?

A5: No, not necessarily. Existing nuclear facilities undergoing a major modification are allowed to continue to use existing DOE-STD-3009-94, with approval by the appropriate Secretarial Officer and concurrence by the applicable Central Technical Authority. As described in A5, the approach should be based on the relative size and significance of the modification. It may be possible to use the requirements of the new DOE-STD-3009-2014 for design of the major modification, but not upgrade the overall DSA to the new standard.

Q6: What does STD-3009 say about "Equipment Important to Safety"?

A6: DOE-STD-3009-2014 says nothing about "Equipment Important to Safety." The Standard only recognizes three classifications of hazard controls: (1) Safety Class, (2) Safety Significant, and (3) Other Hazard Controls. 10 C.F.R. 830 does not use the term "Equipment Important to Safety" in reference to DSA preparation. This is a consideration for unreviewed safety question determinations, as described in the DOE Guide G 424.1-1B, and additional clarifications are being considered for the next revision to that Guide.

Q7: When using Option 1, is it acceptable to use either the 95^{th} percentile directionally independent or the 99.5^{th} percentile directionally dependent X/Q, even though this is not consistent with NRC Reg. Guide 1.145?

A7: Yes. In Section 3.2.4.2, under the heading "Determination of the Offsite χ/Q," the Standard states: "While the three options allow for alternative methods to calculate the χ/Q values, all three options shall evaluate the dose at the MOI using either a 95th percentile for a directionally independent method or a 99.5th percentile for a directionally dependent method. Option 1 is based on Reg. Guide 1.145; it is not a verbatim compliance to Reg. Guide 1.145.

Q8: Can the directionally independent 95th percentile X/Q credit irregular site boundary distances?

A8: Yes. The analysis is intended to be consistent with the NRC Regulatory Guide 1.145 determination of the "5 percent overall site" X/Q (i.e., 95th percentile) considering variable site boundaries as defined by Regulatory Position 3. The term "directionally independent" as used in STD-3009-2014 means that the determination of the overall site 95th percentile χ/Q is calculated by creating a cumulative probability distribution for all sectors combined based on all the meteorological annual data and using the actual site boundary distance for each sector. See also Q&A 11 below.

Q9: Regarding the Option 2 X/Q method, can the DOE Toolbox version of MACCS2 be applied, since it is not fully compliant with the NRC Regulatory Guide 1.145 methodology?

A9: Yes. Historically, MACCS2 has been used to calculate the offsite 95th percentile X/Q for DOE facilities despite the fact that the methodology used does not take into account variations in site boundary distances. As stated in DOE-EH-4.2.1.4-MACCS2-Code Guidance (June 2004), *MACCS2 Computer Code Application Guidance for Documented Safety Analysis*:

> "MACCS2 and MACCS do not comply fully with … (NRC Regulatory Guide 1.145 Position 3) methodology for determination of direction-independent 95th percentile dose to the offsite individual. It may be used to conservatively evaluate the 95th percentile direction-independent dose to receptors equidistant to the source."
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> "Given site-specific data, the 95th percentile consequence is determined from the distribution of meteorologically-based doses calculated for a postulated release to downwind receptors at the site boundary that would result in a dose that is exceeded 5% of the time. [DOE-STD-3009] allows for variations in distance to the site boundary as a function of distance to be taken into consideration. Assuming the minimum distance to the site boundary applies in all directions is a conservative implementation that is easily supported by MACCS2 and that essentially makes the calculations sector independent."

Q10: In Section 3.2.4.2 of DOE-STD-3009-2014, what is intended by the term "recent" in relationship to meteorological data? Does this imply some expected periodicity?

A10: In this context, "recent" means within ten years. Regarding the implied periodicity in the term "recent," with respect to meteorological data and analysis for X/Q, the forthcoming Accident Analysis Handbook will recommend a reanalysis of X/Q every ten years. The fiveyears average is expected to change slowly over time and there is no need for more frequent reanalysis.

Q11: *(Added March 2015)* In Section 3.3.1 of DOE-STD-3009-2014, what is intended by the following sentence: "Further, it is DOE's goal that the combined effectiveness of the suite of SC and/or SS controls will be such that accident consequences would be well below the EG"? Does DOE expect this goal to be demonstrated in the DSA?

A11: The cited sentence is merely a description of DOE's goal; it does not contain or imply any requirements. The primary requirement in this Section is that the DSA demonstrate how SC SSCs or SACs mitigate consequences of anticipated accidents below the EG, when preventive controls do not terminate the scenario or eliminate the hazard. Beyond that, the cited sentence permits consideration of other SS controls (i.e., entire suite of SC and SS) to achieve the goal of consequence reduction "well below the EG."

Q12: *(Added March 2015)* In Section 3.3.1 of DOE-STD-3009-2014, what is intended by the following sentence: "If unmitigated off-site doses between 5 rem and 25 rem are calculated (i.e., challenging the EG), SC controls should be considered, and the rationale should be described for decisions on whether or not to classify controls as SC"? Does this sentence describe a requirement? Will DOE reviewers of DSAs turn this sentence into a requirement?

A12: The cited sentence is a recommendation, not a requirement. The standard clearly defines the use of "shall" for requirements and "should" for recommendations. The phrasing of this sentence is also consistent with that in DOE-STD-1189-2008 for new facilities and major modifications. The intent is to consider SC controls or provide DOE with the rationale when not establishing SC controls for accidents with consequences between 5 and 25 rem. This is to help in establishing a basis for risk acceptance (e.g., consequence calculations have multiple conservatisms that don't warrant SC controls, etc.) In general, DOE expects that DOE-STD-3009-2014 will provide for more consistent and conservative consequence calculations based on clear requirements, and therefore the EG of 25 rem serves as the appropriate "bright line" criterion for determining SC categorization for hazard controls.

Q13: *(Added March 2015)* Section 3.3.1 of DOE-STD-3009-2014 provides a requirement for new nuclear facilities that SC controls shall be applied to prevent identified accidents or mitigate consequences to below the EG of 25 rem. DOE-STD-5506-2007 (Section 6.3) states that doses greater than 10 rem should be considered sufficient to challenge the EG. How do these compare and which takes precedence?

A13: First, DOE-STD-5506 is a supplemental standard to the safe-harbors of 10 C.F.R. 830. It is expected that the standard will be revised in the future to reflect lessons learned captured in DOE-STD-3009-2014. As it is the primary safe harbor, DOE-STD-3009-2014 takes precedence. The two standards differ only slightly regarding thresholds for "challenging" the EG. DOE-STD-3009-2014 indicates that 5 to 25 rem is the range for "challenging the EG," whereas STD-

5506 identifies a 10 rem threshold. However, and more important, DOE-STD-3009-2014 clearly establishes the SC control threshold at the EG of 25 rem. See also Q&A 14 above.

Q14: *(Added March 2015)* DOE-STD-3009-2014 states that hazard evaluation data are part of the DSA, whether included directly or by reference. The standard further states that "For each hazard scenario, hazard evaluation tables or data sheets document the following; … Available preventive and mitigative controls." If "available preventive and mitigative controls" are identified in the hazard evaluation tables or data sheets, and these are considered part of the DSA, does DOE expect that all "available" controls identified in these tables will be controlled, managed, and updated using the USQ process, even where such controls do not rise to the level of SC or SS?

A14: Yes, to the degree that one of the controls is involved with a "proposed change" as described in 10 C.F.R. Part 830 and DOE G 424.1-1B, or is somehow related to a discovery of a Potential Inadequacy in the Safety Analysis (PISA). While major contributors to defense-in-depth are identified as SS, other hazard controls that are not identified as either SC or SS are also important as they contribute to the overall defense-in-depth approach that is required for DOE nuclear facilities.

Q15: *(Added August 2016)* In performing the mitigated analysis to determine effectiveness of safety-significant co-located worker safety controls, as required by Section 3.2.3 of DOE-STD-3009-2014, are quantitative calculations required for each hazard scenario to report mitigated dose estimates?

A15: No. Footnote 4 of Table 1 in Section 3.1.3.1 states: "Although quantitative thresholds are provided for the MOI and co-located worker consequences, the consequences may be estimated using qualitative and/or semi-quantitative techniques." As an example, an acceptable approach would be to perform a quantitative calculation for worst case scenarios, and then demonstrate qualitatively how these results are bounding for other scenarios. For example, the analysis would quantitatively calculate the unmitigated consequences to the MOI and co-located worker and then could semi-quantitatively or qualitatively state that an installed, credited 99.9% efficient HEPA filter system that provides a 1E-3 reduction in consequences would clearly reduce consequences to less than the EG. Results of the hazard evaluation, and the effectiveness of hazard controls as used in specific hazard scenarios may be shown qualitatively in the hazard evaluation tables. Alternately, the quantitative estimates of mitigated dose when crediting mitigative controls may be shown on the hazard evaluation tables and/or hazard evaluation summary of results.

Q16: *(Added August 2016)* If a facility DSA uses quantitative calculations to assign qualitative likelihood estimates during hazard evaluation, does application of the revised DOE-STD-3009-2014 require application of DOE-STD-1628-2013, *Development of Probabilistic Risk Assessments for Nuclear Safety Applications*?

A16: No, not necessarily. The standard (Section 3.1.3.1) does require selection and justification of appropriate hazard evaluation techniques, including Fault Tree Analysis and Event Tree Analysis. Use of these techniques typically involves quantitative calculations. Section 3.1.3.1 specifically allows use of "quantitative calculations" appropriate to assign qualitative likelihood estimates. The conditional requirement in DOE-STD-3009-2014 requiring application of DOE-STD-1628-2013 is applicable only if the facility elects to use of a complete probabilistic risk assessment (PRA) as described in DOE-STD-1628-2013. DOE-STD-1628-2013 states that "it is not intended for analysis that simply employs a subset of PRA techniques, such as event-tree or fault-tree analysis." PRAs are defined in DOE-STD-1628-2013 as an "assessment of the risk associated with plant or facility operation and maintenance that is measured in terms of frequency of occurrence of risk metrics, such as release category frequency and its effects on the health of the public [also referred to as a probabilistic safety assessment (PSA) or quantitative risk assessment (QRA)]." If this full PRA technique is used to support DOE safety analysis, then the provisions of DOE-STD-1628-2013 would apply.

Q17: *(Added August 2016)* In Section 3.1.3.1, 1st paragraph below Table 2 states "Risk ranking/binning may be used to support the selection of Design Basis Accidents (DBAs)/ Evaluation Basis Accidents (EBAs) and hazard controls (See Appendix A, Section A.4 for information on risk ranking/ binning)." However, Section A.4 does not provide guidance on the use of risk ranking for hazard controls. Will there be guidance provided in the near future?

A17: Section A.4 provides additional guidance on a risk ranking methodology but does not further elaborate on the use for selection of hazard controls as described in Section 3.1.3.1. Additional guidance on the use of risk ranking for control selections will be included in the draft Accident Analysis Handbook, based on methodologies similar to those presented in the DOE-STD-5506-2007, *Preparation of Safety Basis Documents for Transuranic (TRU) Waste Facilities*, and DOE-STD-1120-2005, *Integration of Environment, Safety, and Health into Facility Disposition Activities*. Both of these standards are based on using qualitative unmitigated risk estimates as another input to the process to determine when to select safety significant SSCs or SACs. The intent is to provide a qualitative tool to facilitate discussion between cognizant subject matter experts, including facility and operational staff, and the DOE to enhance the judgment process inherent to selection of hazard controls.

Q18: *(Added October 2018)* DOE-STD-3009-2014, Appendix A.2 provides a list of examples of chemicals that may be excluded from DSA hazard evaluations. Is it allowable that chemicals that exceed these screening criteria may be excluded from further qualitative or quantitative hazard evaluation?

A18: Yes, chemicals that exceed the Appendix A.2 screening criteria may be screened out as discussed below.

Table 9-1 of Section 9.3, Chemical Screening Criteria, of DOE-HDBK-1224-2018, *Hazard and Accident Analysis Handbook*, presents additional considerations regarding screening criteria. The use of these screening criteria may be an initial step in the screening process. Chemicals that do not meet those screening criteria thresholds may be screened against the discussion in the introduction of DOE-STD-3009-2014 Section A.2, which states:

> The DSA is not intended to deal extensively with chemicals that can be safely handled by implementation of a hazardous material protection program. Therefore, a screening process is established to select for DSA evaluation only those chemicals of concern (i.e., type and quantity that have the potential for significant health effect on the facility worker, co-located worker, or public) that are present in the facility or activity and present hazard potentials outside the routine scope of the hazardous material protection program.

Therefore, if the chemical hazard potential is adequately evaluated and controlled by the routine scope of the hazardous material protection program, meeting the requirements of 10 CFR Part 851, *Worker Safety and Health Program*, the chemical may be screened out from further hazard evaluation in the DSA.

However, there still may be other considerations that warrant further evaluation of the chemical in the DSA hazard evaluation. DOE-HDBK-1224-2018 Section 2.2.4, Exclusion of Standard Industrial Hazards and Other Hazardous Materials, provides these additional clarifications. This statement is reproduced, in part, as follows:

> The DSA hazard evaluation scope covers analysis of: (a) hazardous chemicals affecting nuclear safety; and, (b) in some cases, chemical hazards that are outside the scope of the facility's hazardous material protection program. The intent of DOE-STD-3009-2014 is to cover:
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> - Radiation-related hazardous chemical events (examples: chemicals comingled with radiological waste, chemicals generated through radiological processes, and chemicals generated or released through processing of radioactive materials);
> - Nuclear safety-related hazardous chemical events (examples: events that affect a worker relied upon for a credited action, events that affect safety-related SSCs through corrosion, fire, or explosion); or
> - Unique hazardous chemical events, not addressed by 10 CFR Part 851, that could cause harm to workers, the public or the environment.

Section 2.2.4 of DOE-HDBK-1224-2018 also includes additional guidance regarding screening chemicals out, and evaluating chemicals further in the hazard evaluation. This includes a screening example of a large outside storage tank, guidance for unmitigated consequence assessment for the facility worker, and the need to address the unique hazard of asphyxiation as discussed in DOE-STD-3009-2014 Section A.1. In addition, per DOE-STD-3009-2014 Section A.2, chemicals "that could otherwise be screened out, but have the potential to be an accident initiator involving radioactive or hazardous material releases, or could compromise the ability of the facility operators to safely manage the facility, are retained as part of the DSA hazard evaluation."

Lastly, DOE-HDBK-1224-2018 Section 2.3.3, Chemical Hazard Evaluation, provides additional guidance to the discussion in DOE-STD-3009-2014 Section 3.1.3.4, Chemical Hazards, regarding further qualitative hazard evaluation. That Handbook section also references other sections regarding a quantitative assessment as discussed in the DOE-STD-3009-2014 Section 3.2.3.4, Chemical Source Term and Consequence, and Appendix A.2 method to estimate exposure concentration for comparison to safety significant thresholds for control selection.

Q19: *(Added July 2019)* If Option 3 is being used for DSA scoping calculations supporting the qualitative DSA Section [3.3] Hazard Evaluation to estimate the radiological consequences to the Maximally-exposed Offsite Individual (MOI), does a MOI Modeling Protocol for atmospheric dispersion need to be developed and submitted for approval by the DOE Safety Basis Approval Authority (SBAA)?

A19: No, an atmospheric dispersion modeling protocol does not need to be developed or approved by the DOE SBAA on the basis that DOE-STD-3009-2014 Section 3.2.4.2 only requires DOE approval of a MOI modeling protocol for the DSA Section [3.4] Accident Analysis for the selection of Safety Class controls.

For many existing HC-2 facilities in the DOE Complex, especially those with large site boundary distances, a demonstration that the MOI dose is < 5 rem for the bounding hazard events/ hazardous conditions can be prepared to conclude that no Evaluation Basis Accidents (EBAs) need to be selected for Accident Analysis to determine the need for Safety Class controls. This same consideration may arise during development of a DSA per DOE-STD-1228-2019 guidance for an HC-3 nuclear facility.

DOE-STD-3009-2014 Section 3.2 acknowledges that scoping calculations performed during hazard evaluation may be used to show that an accident analysis is not needed. While modeling may be used for scoping calculations to evaluate the dose to the MOI, there is no specific requirement that a modeling protocol be submitted to the DOE SBAA for approval prior to its use. However, scoping calculations should be supported by an adequate technical basis document to determine the appropriateness of the selected model and assumptions. Unless a site-specific Option 3 approach has been previously approved by DOE for existing facility DSAs, development of a new dispersion analysis for scoping calculations using the Option 1 or Option 2 approaches is encouraged. As with any technical basis demonstration, it is always a good practice to engage DOE in discussions early on since DOE will ultimately review the atmospheric dispersion assumptions used and their technical basis as part of the safety basis review. Waiting to obtain DOE buy-in until the full safety basis review may ultimately lead to costly rework.

The technical basis supporting scoping calculations should demonstrate that the site-specific and facility-specific atmospheric dispersion modeling for the scoping calculations are appropriately conservative consistent with the DOE-STD-3009-2014 Section 3.2.4 approach for assuring an overall conservative analysis. If there is no demonstration that the site-specific dispersion methodology is equivalent to the DOE-STD-3009-2014 requirements and guidance, this could affect the conclusion that no DSA DBA/EBAs warrant evaluation.

Q20: *(Added September 2022)* Section 4 states "Criteria and guidance for the format and content of each of the chapters in the DSA are provided in this section. Each subsection begins with a brief introduction regarding the purpose of the chapter. The DSA shall address applicable DSA sections described below, consistent with the format and content described below." How should the one "shall" statement be interpreted in light of the 36 "should" statements in the remainder of the chapter?

A20: The "shall" statement requires that the DSA include and address each of the applicable topics covered in the DSA Format and Content Section, including those in relevant subsections (X.1, X.2, X.3, etc.). Organization of the DSA in the same 7-chapter format with the same numbering of subsections is a good practice to demonstrate that relevant topics are addressed; otherwise, a cross-walk may be necessary to demonstrate where the relevant topics are addressed. The numbering itself may also be adjusted for situations where a DSA includes content in addition to that covered by Section 4 or for situations in which DSA content described in Section 4 is not applicable. Declarative statements are included in Section 4 to describe the content that is expected to be included within each subsection. The "should" statements provided within the subsections are recommendations, not requirements, for meeting the content expectations.

Q21: *(Added January 2024)* Section 3.3.2 states "For existing facilities, a situation could occur where no viable control strategy exists that could either prevent or mitigate one or more of the hazard/accident scenarios from exceeding the above onsite radiological or chemical consequence thresholds [i.e. Table 1 "High" consequences]. In such a case, the DSA may determine co-located worker (CW) consequences at receptor distances further than 100 meters, if it consistent with the actual location of adjacent facilities." What is considered "viable," and in what cases may this allowance be used?

A21: The section cited in the question begins with "For existing facilities, a situation could occur …." This specifies that the allowance in question is applicable to existing facilities only, not to new facilities or major modifications. The term "viable" used in DOE-STD-3009-2014 follows the dictionary term. This could include situations where a control is not available or feasible to implement (e.g. considerable investment that is not commensurate with the risk). When no safety significant (SS) controls are deemed "viable" resulting in no controls being selected/credited to reduce consequences below "High" to the CW, the situation must be adequately described in the DSA as part of the technical basis for the mitigated analysis results. DOE evaluates the contractor's DSA submittal containing the technical basis for why there are no viable controls and describes in the Safety Evaluation Report (SER) the basis for acceptance/rejection of the risk.

The requirement in Section 3.3.2 of DOE-STD-3009-2014 for determining SS control designation states that “a conservatively calculated unmitigated dose of 100 rem TED to a receptor located at 100 meters from the point of release shall be used as the threshold for designation of SS controls.” Evaluating at the actual CW location is not meant to be an option of convenience and its use in the unmitigated analysis is inconsistent with the above requirement. Changing the receptor distance to greater than 100 meters was included in DOE-STD-3009-2014 as an option for analysis that could be used in the mitigated case to support the technical basis described above. Again, this mitigated analysis is performed after the unmitigated 100 meter analysis has been performed, SS controls are determined to be necessary, but no SS controls are deemed viable for reducing the dose to the CW below “High” consequence.

It is not required that the technical basis for the acceptance of the “High” mitigated dose results include an evaluation at a distance further than 100 meters. However, this analysis may demonstrate that assuming the actual distance to the nearest facility or operation (i.e., not related to the DSA authorized activities) results in a dose less than 100 rem. The technical basis, in this case, would need to demonstrate that the alternate location (i.e., greater than 100 meters) is fixed or is maintained such that the DSA assumptions are not violated (e.g. a Technical Safety Requirement (TSR) control that ensures there are no CW workers present in the area).

Q22: *(Added November 2025)* Section 3.2.4.2 of DOE-STD-3009-2014 states the following requirement: "Dose coefficients ***consistent with*** International Commission on Radiological Protection Publication 68, Dose Coefficients for Intakes of Radionuclides by Workers, and Publication 72, Age-dependent Doses to Members of the Public from Intake of Radionuclides,[10] for adults ***shall be used***." Are newer, approved versions of the International Commission on Radiological Protection (ICRP) adult dose coefficients (such as ICRP 103) considered consistent and appropriate for use? May the ICRP dose coefficients be supplemented with dose coefficients for isotopes not included in the ICRP? May other reference standards be used for groundshine dose calculations (such as Federal Guidance Report (FGR)-15, *External Exposure to Radionuclides in Air, Water, and Soil*, 2019) where they provide more appropriate values?

A22: Yes, adult dose coefficients, from the ICRP 103 system of radiation protection may be used. If updating to a newer version, it is a best practice to use the newer standard in whole rather than selectively picking and choosing dose coefficients from different ICRP systems. Although not discussed in DOE-STD-3009-2014, if certain isotopes are not identified in the ICRP publications, then yes, ICRP dose coefficients may be supplemented with other reference standards (such as FGR-15 for groundshine dose calculations) where appropriate. In general, where any dose coefficients are used beyond ICRP 68 and 72, their source should be identified and a technical basis provided for their use.

Footnote 10 on page 25 of DOE-STD-3009-2014 references DOE-STD-1196-2011, *Derived Concentration Technical Standard.* DOE-STD-1196-2011 has been revised, and DOE-STD-1196-2022, *Derived Concentration Technical Standard,* may be used in place of the 2011 version, as appropriate, in DOE-STD-3009-2014 radiation dose estimates.

Q23: *(Added April 2026)* DOE-STD-3009-2014 appears to give a mixed message on the use of administrative controls for preventing or mitigating consequences from hazard scenarios. How are administrative controls to be considered in selecting hazard controls?

A23: Administrative controls may be considered and selected while still following the hierarchy of controls established in DOE-STD-3009-2014 and DOE-STD-1189-2016.

DOE-STD-3009-2014, Section 3.3, describes the hierarchy of controls process: "Preventive or mitigative controls are selected using a ***judgment-based process considering a hierarchy of controls that gives preference to passive engineered safety features over active ones; engineered safety features over ACs or SACs; and preventive over mitigative controls.*** When the hierarchy of controls is not used for situations requiring SC/SS controls (e.g., a SAC is selected over an available SSC), the DSA shall provide a technical basis that supports the controls selected. This is included as part of the mitigated analysis discussed in Section 3.2.3." [emphasis added] This judgment-based process allows for the selection of an administrative control over an engineered control when a sufficient technical basis is provided.

Further, regarding the hierarchy of controls used in the design of a facility, DOE-STD-3009-2014, Section A.8, states in part, "Minimization of hazardous materials is the first priority."

Administrative controls that remove or reduce the amount of radioactive or hazardous material available during an accident are consistent with this tenet and may preclude the need for additional hazard controls. An example is limiting the amount of MAR in a facility, because a postulated accident has the potential for unmitigated high consequences to the public (exceeding 25 Rem or PAC-2). Other examples of administrative controls to limit hazardous material MAR include: (a) hazardous material not allowed on site, (b) certain packaging materials prohibited from waste drums, (c) maximum drum stacking limits, and (d) prescribed maximum concentrations of hazardous materials (if previously applied and verified).

DOE-STD-1189-2016, Section 4.1.4, describes that after hazardous material minimization/elimination, a control strategy is employed in an order of preference: (a) engineered controls are preferred over administrative controls, (b) passive controls are preferred over active controls, and (c) preventive controls are preferred over mitigative controls. Under this control strategy, a preventive administrative control may be justified over a mitigative engineered control if the administrative control is effective in eliminating a release of hazardous material. Another example is a situation where an existing facility may need to justify a preventive AC over a preventive engineered control which would require facility redesign that is not feasible.

Q24: *(Added April 2026)* May administrative controls serve as initial conditions (ICs)? If an administrative control is used as an IC, must it be justified and protected by a SAC?

A24: In some limited cases, administrative controls may be used as ICs and their function should be designated as either SC or SS and protected by the appropriate TSR operating limits, design features, or SACs.

DOE-STD-3009-2014, Section 3.2.2, describes the unmitigated analysis, which uses ICs to protect ***assumptions*** in the unmitigated analysis and to maintain the validity of the evaluation. In addition to characterizing the unmitigated source term, some additional assumptions regarding a facility and its operations may be necessary in order to define a meaningful accident scenario, and such assumptions can also affect the magnitude of the resultant consequences. This would be in contrast to a "parking lot scenario" where all the MAR in the facility is available to be acted upon. There is engineering judgement in performing this analysis, and therefore, assumptions need to be described in the DSA. Section 3.2.2 requires that these assumptions be "documented and evaluated to determine if controls are needed to maintain the validity of the evaluation."

Although DOE-STD-3009-2014, Section 3.2.2, prohibits the assumption that administrative controls or safety management programs are available in the unmitigated analysis, it does provide an exception for MAR values and other process physical attributes:

> ***"Material at risk (MAR) values, and other process physical attributes such as waste acceptance criteria*** on radiological or fissile concentrations that establish inventory limits, are considered an exception to not crediting ACs for the unmitigated analysis, because they are considered initial conditions if addressed by a SAC (see Appendix A,

> Section A.3). MAR limits are a special case and have historically been allowed for the unmitigated analysis since these limits define the initial conditions for the hazard evaluation and accident analysis. Examples include limiting the inventory in a HC-3 facility or limiting the inventory to low-level waste based on Waste Acceptance Criteria that prohibits transuranic wastes or higher fissile concentrations." [emphasis added]

DOE-STD-3009-2014, Section A.3, states, "It is important to define and document ICs carefully to ensure they are appropriately controlled, classified as SC or SS and preserved via TSR operating limits, design features or SACs as appropriate." Section A.3 also provides examples of process physical attributes and passive characteristics (i.e., no active mechanical or human involvement) of the facility that may be credited as initial conditions:

- "A vault or building can withstand natural phenomena hazard (NPH) events according to its NPH Design Category;
- Facility geometry or layout affects accident progression or release;
- Solid transuranic waste is contained in a certified Department of Transportation (DOT) Type-A drum;
- A certain material is present only within a certified Type B shipping container;
- Facility and process inventories are limited to those identified; and
- A passive SSC prevents significant consequences."

Other ICs may be related to the facility construction, assumptions made regarding waste container types and configurations, inventory restrictions, facility configuration commitments, waste acceptance criteria requirements, and operational process specific commitments. Examples of process physical attributes that may be credited as initial conditions include: (a) description of facility operations that inherently prevent activities and/or operations (e.g. storage only; discussion of allowed activities), (b) locations of electrical substations such that they are not capable of initiating a release of material, and (c) waste streams excluded from shipment to a facility. Each IC is required to be evaluated to determine if controls are needed to maintain the validity of the hazard evaluation.

DOE-STD-3009-2014, Section 3.2.2, explicitly prohibits combustible loading limits as initial conditions: "Other ACs, such as combustible controls, that are elevated to a SAC as an initial condition for the unmitigated analysis would circumvent the control selection process considering the hierarchy of preferences, and place greater reliance on ACs over available engineered controls." While crediting a limitation on combustibles as an IC is prohibited because it is not inherent to the characteristics of the facility and may skew the results of the unmitigated analysis, it is permissible to credit passive characteristics (e.g., non-combustible construction) of a facility or room as an IC. Combustible loading limits, which can provide both preventive and mitigative functions, remain available as a possible control for consideration in the control selection strategy and mitigated analysis.

Q25: *(Added June 2026)* Is it acceptable to exclude Material at Risk (MAR) from accident analysis in a documented safety analysis (DSA) because the MAR is excluded in hazard categorization based on DOE-STD-1027?

A25: DOE-STD-1027-2018, *Hazard Categorization of DOE Nuclear Facilities*, states that the purpose of this document is "for determining if a Department of Energy (DOE) nuclear facility is a Hazard Category (HC) 1, 2, 3, or Below HC-3 nuclear facility, as required by Title 10 of the Code of Federal Regulations (CFR) Part 830, Nuclear Safety Management." The standard discusses how to categorize a facility and the criteria for when MAR may be excluded from the categorization process. DOE-STD-1027-2018 includes the following cautionary statement for exclusion of sealed sources and Type B packages:

> [§3.1.2] *Sealed sources/Type B packages are designed for multiple accident scenarios; however, DOE facilities may present hazards not compatible with design of sealed sources/Type B Packages. In such a case, the radioactive material should not be excluded as part of the initial hazard categorization SOR and hazard analysis necessary to demonstrate the integrity of the sealed source/Type B package should be supported in final hazard categorization.*

However, the purpose of the standard is purely to determine the specific categorization of a nuclear facility. The discussion in DOE-STD-1027-2018 does not state or imply that the DSA may exclude nuclear material from the hazard and accident analysis. DOE-STD-3009-2014 provides a discussion on excluding MAR:

> [§3.2.4.1] *While DOE-STD-1027-92 excludes material in Department of Transportation Type B containers from consideration for the purposes of hazard categorization, the existence of such material shall be acknowledged in the DSA and the material excluded from the source term for a particular accident scenario only if the containers can be shown to perform their safety functions under accident conditions.*

Therefore, the hazard categorization might be used as starting point to identify potential MAR for exclusion, however, further analysis would be necessary as required in DOE-STD-3009-2014. Various other DOE documents also discuss specific limited cases for excluding MAR from accident analysis, such as:

> DOE-STD-3014-2006, states:
>
> [§7.2.2] *Well-confined material may be excluded from the hazardous materials inventory, but such exclusions should be justified based on the robustness of the material containment in a postulated aircraft impact environment (i.e., such assumptions should be shown to be valid for the class of accidents being evaluated).*

> DOE-HDBK-3010-94, states:
>
> [§1.2] *The damage ratio is the fraction of the MAR actually impacted by the accident-generated conditions. A degree of interdependence exists between the definitions of MAR and*

DR. If it is predetermined that certain types of material would not be affected by a given accident, some analysts will exclude this material from the MAR.

These DOE documents provide specific criteria, an accepted analytical methodology, and detailed technical guidance, which support the development of a technical basis in the DSA to justify the exclusion of nuclear material from the MAR in a postulated accident.

Q26: *(Added June 2026)* Are safety significant (SS) controls required when estimated accident doses for co-located worker (CW) are ≥25 rem and <100 rem at 100 meters?

A26: No. SS controls are not required. DOE-STD-3009-2014, Section 3.3.2, *Safety Significant Controls*, states: "For radiation hazards, a conservatively calculated unmitigated dose of 100 rem TED to a receptor located at 100 meters from the point of release shall be used as the threshold for designation of SS controls. The methodology used to determine consequences shall be consistent with that described in Section 3.2."

The threshold for CW protection from radiation hazards is 100 rem at 100 meters. Although the 100 rem threshold is definitive for the designation of SS controls, the principles of defense-in-depth and a robust Integrated Safety Management System (ISMS) support conducting a further evaluation for scenarios where unmitigated CW doses approach this threshold. This evaluation should consider magnitude of dose consequences, probability, uncertainties, and margins of conservatism to confirm that the overall risk is acceptable and that sufficient layers of protection are in place, even if no single control meets the formal SS designation criteria. The hazard evaluation (and resulting hazard evaluation tables) would identify controls for these situations but they typically would not rise to the level of SS, unless they were further evaluated as providing a major contribution to defense-in-depth. (Section 3.3.2 gives criteria for this evaluation.)

Another way to answer this question is from the risk perspective. As described in DOE-STD-3009-2014, Section 3.1.3, *Hazard Evaluation*, risk ranking/binning may be used, but is not required; however, if used, the consequence and likelihood thresholds in DOE-STD-3009-2014 are required. When using risk binning, a dose consequence between 25-99 rem would result in a Risk Bin II, III, or IV, depending on the probability. The threshold for requiring controls for CWs remains at 100 rem at 100 meters. Risk ranking/binning is a useful tool for demonstrating the effectiveness of controls. As stated above, it is the principles of defense-in-depth and a robust ISMS that form the foundational basis for evaluating scenarios approaching the 100 rem threshold, and this foundational basis applies regardless of whether risk ranking/binning is the specific tool used in the evaluation.

Both DOE-STD-3009-2014 and DOE-HDBK-1224-2024 describe that "risk ranking serves the broader purpose of confirming for the DOE approval authority that the overall mitigated risk of facility operation is low. Risk ranking can also highlight a given scenario whose mitigated risk remains significant." In context, this text is highlighting DOE's role as the "risk accepting" organization in evaluating the overall risk of the facility.

FAQ 21 of this document provides further discussion regarding situations where estimated consequences to the CW are ≥100 rem.

U.S. DEPARTMENT of ENERGY | Office of Worker Protection & Nuclear Safety

DOE-STD-3009-2014 FAQ Revision History

Date of Revision	Section(s) Affected	Description of Change
June 2026	**Q25 and Q26**	**Added Q25 and Q26 regarding the exclusion of MAR from accident analysis and the need for SS controls for the CW for situations less than 100 rem.**
March 2026	Q23 and Q24	Added Q23 and Q24 regarding the hierarchy of controls and the use of initial conditions.
November 2025	Q22	Added Q22 regarding the use of newer ICRP dose coefficients
January 2024	Q21	Added Q21 regarding viable control strategies for the CW
September 2022	Q20	Added Q20 regarding the DSA format and content
July 2019	Q19	Added Q19 regarding approval of the modeling protocol
October 2018	Q18	Added Q18 regarding chemicals in DSA hazard evaluations
August 2016	Q15-Q17	Deleted original Q4 and Q7 regarding DSA evaluations for upgrades to STD-3009-2014, and remaining FAQs renumbered. Added new Q15 though Q17 regarding mitigated analysis for CW, use of STD-1628-2013, and risk binning
March 2015	Q13-Q16	Added Q13 through Q16 to address demonstrating safety SSC effectiveness, challenging the EG, and hazard evaluation data,
February 2015	Q1-Q12	Initial release of the FAQ document and issuance of Q&As for Q1 through Q12