DOE-STD-1104-2009 to DOE-STD-1104-2014
Bases of Approval Crosswalk for Safety Basis Documents

Document/ Section/ Page #	Bases of Approval DOE-STD-1104-2009	Document/ Section/ Page #	Bases of Approval DOE-STD-1104-2014
DSA, 2.1 Base Information, Page 10	Determining the adequacy of base information generally entails being able to conclude that the DSA contains sufficient documentation and basis to arrive at the following conclusions: • The facility contractor development and approval processes (e.g., personnel involvement in developing the DSA, management cognizance and acceptance, internal reviews) demonstrate sufficient commitment to establish the facility safety basis. • The facility mission(s) and scope of operations (i.e., the scope of work to be performed) for which safety basis approval is being sought are clearly stated and reflected in the type and scope of operations analyzed in the DSA. For example, a DSA documenting the safety basis of a spent fuel storage facility whose mission includes size reduction of spent fuel elements would be unacceptable if the DSA omitted safety analysis of size-reduction operations. • A description of the facility's life-cycle stage, mission(s), scope of operations, and the design of safety SSCs3 is presented, including explanation of the impact on the facility safety basis. • Clear bases for and provisions of exemptions, consent agreements, and open issues are presented. • Description of the site, facility, and operational processes provide a knowledgeable reviewer sufficient background material to understand the major elements of the safety analysis.	DSA, 4.2 Base Information, Page 12	Determining the adequacy of base information rests on being able to reach the following conclusions: • The facility contractor's development and approval processes (including personnel involvement in developing the DSA, management cognizance and acceptance, internal reviews) demonstrate sufficient commitment to establish the facility safety basis. • The facility's mission and scope of operations (i.e., the scope of work to be performed) for which safety basis approval is being sought are clearly stated and reflected in the type and scope of operations analyzed in the DSA. For example, a DSA documenting the safety basis of a spent fuel storage facility whose mission includes size reduction of spent fuel elements would be unacceptable if the DSA omitted safety analysis of size-reduction operations. • A description of the facility's life-cycle stage, mission, scope of operations, and the design of safety SSCs is presented, including explanation of the impact on the facility safety basis. • The description of the site, facility, and operational processes provide a knowledgeable reviewer with sufficient background material to understand the major elements of the safety analysis.

	• Correlation is established between actual facility arrangements and operations with those stated in the DSA. This may be accomplished successfully through reference to facility walkthroughs during DSA preparation. Walkthroughs may also be warranted during DSA review to provide some level of assurance that the actual physical arrangement of a facility corresponds to that documented in the DSA. For example, a walkthrough may be considered for a facility and/or operation that was modified in the time frame between when DSA development was started and completed. This is not intended to imply the review team must perform detailed verifications of facility configuration. The objective is to allow the review team to conclude that the basic descriptions provided are fundamentally up-to-date and correct.		
DSA, 2.2 Hazard and Accident Analyses, Page 11	Determining the adequacy of hazard and accident analyses generally entails being able to conclude that the DSA contains sufficient documentation and basis to arrive at the following conclusions: • The hazard analysis includes hazard identification that specifies or estimates the hazards relevant for DSA consideration (i.e., both natural and man-made hazards associated with the work and the facility) in terms of type, quantity, and form and also includes properly performed facility hazard categorization. • The final hazard category for the facility is determined consistent with DOE-STD-1027-92, Change Notice No. 1. Any differences between the final hazard category and the initial hazard category are explained.	DSA, 4.3 Hazard and Accident Analyses, Page 13	Determining the adequacy of hazard and accident analyses rests on being able to reach the following conclusions: • The hazard analysis includes hazard identification that specifies and estimates the hazards, both man-made and natural, in terms of type, quantity, and form of radioactive and other hazardous materials. • The initial and final hazard category for the facility is determined consistent with DOE-STD-1027-92, Change Notice No. 1. Any differences between the final hazard category and the initial hazard category are explained. • The methodology used for hazard analysis is clearly identified and appropriate (e.g., techniques chosen and

	• The hazard analysis includes a hazard evaluation that covers the activities for which approval is sought, is consistent in approach with safe harbor methodologies, identifies preventive and mitigative features for the spectrum of events examined, and identifies dominant accident scenarios through ranking. • The hazard analysis evaluates normal, abnormal, and accident conditions, including consideration of natural and man-made external events, identification of energy sources or processes that might contribute to the generation or uncontrolled release of radioactive and other hazardous materials, and consideration of the need for analysis of accidents that may be beyond the design basis of the facility. • The hazard analysis results are clearly characterized in terms of public safety, defense in depth, worker safety, and environmental protection as part of the safety basis of the facility. The logic behind assessing the results in terms of safety significant SSCs, SACs, and designation of TSRs is understandable and internally consistent. • Subsequent accident analysis clearly substantiates the findings and delineations of hazard analysis for the subset of events examined and confirms their potential consequences. Safety class and safety significant SSCs, SACs and associated TSRs have been identified for preventing and/or mitigating events potentially exceeding evaluation guidelines.		implemented consistent with Center for Chemical Process Safety's *Guidelines for Hazard Evaluation Procedures*), including supportable input assumptions and criteria, and correct application of analytical tools used as part of the process. • The hazard analysis evaluates all activities for which approval is sought, is consistent in approach with safe harbor methodologies or approved alternate methods, and identifies preventive and mitigative hazard controls for the spectrum of hazards evaluated. • The hazard analysis evaluates normal, abnormal, and accident conditions, including natural and man-made external events, and identifies the energy sources or processes that might contribute to the generation or uncontrolled release of radioactive and other hazardous materials. The hazard analysis results are clearly characterized in terms of public safety, defense-in-depth, co-located worker safety, facility worker safety, and environmental protection. The logic behind assessing the results in terms of safety significant SSCs, SACs, and designation of TSRs is understandable and internally consistent. • Accident analysis is performed for an adequate set of design/evaluation basis accidents (D/EBAs) having unmitigated offsite consequences that have the potential to challenge the EG. • The accident analysis methodology is clearly identified and appropriate, including identification of initial conditions and assumptions. The technical basis for source term values is provided, valid, and appropriate for the physical situation being analyzed. The completeness and level of detail in the technical basis should increase as the parameters depart from

			the default or bounding values described in Part 830's safe harbor methods. Supporting calculations and technical documents are identified, where appropriate, and reviewed for critical aspects of safety controls, where appropriate. • The modeling protocol, if used to support site/facility specific values in atmospheric dispersion modeling (see Section 3.2.4.2 of DOE-STD-3009-2014), meets the criteria and guidance provided in DOE-STD-3009-2014, and an adequate technical basis is provided for the receptor locations, meteorological data, modeling tools, and modeling parameters. • Probabilistic risk assessments, related tools, and probabilistic calculations (if used) are used in a manner consistent with the applicable provisions of DOE-STD-1628-2013, *Development of Probabilistic Risk Assessments for Nuclear Safety Applications*, and supplements the qualitative/deterministic processes for hazard assessments and hazard control development. • Accident analysis clearly substantiates the findings of hazard analysis for the design/evaluation basis events and demonstrates the effectiveness of safety class SSCs, if needed to prevent or reduce the likelihood of accidents or mitigate dose consequences below the EG. (Note: If the safety class SSCs do not reduce mitigated dose consequences below the EG, see Section 4.9 of this Standard.) • Safety class SSCs, SACs and associated TSRs have been identified for preventing and/or mitigating events that exceed the EG.

			• If required, safety significant SSCs, SACs, and associated TSRs have been identified for preventing and/or mitigating events that may cause worker fatalities or serious injuries; may potentially exceed the worker/co-located worker radiological consequence thresholds or the applicable "significant" public and co-located worker toxicological thresholds; or are determined to provide major contribution to defense-in-depth. The facility worker's mobility or ability to react to hazardous conditions is not used as the sole or primary basis for determining facility worker impacts. • Where planned operational improvements are identified in the DSA, interim controls are identified, if required to provide adequate protection, and assigned appropriate safety classification. • Beyond Design/Evaluation Basis Accidents are adequately considered in the DSA. If mitigated off-site dose estimates for postulated D/EBA accidents are close to the EG, impacts from a spectrum of accidents is presented (i.e., as opposed to only evaluating seismic hazards) along with a discussion of controls and actions available to mitigate consequences. Note: For more complex facilities, it is acceptable for these accidents to be described in a separate, controlled document that is referenced in the DSA.
Not Included As A Basis for Approval in Prior Revision	This Basis for Approval added to DOE-STD-1104-2014.	DSA, 4.4 Defense-in-Depth, Page 15	Determining the adequacy of defense-in-depth rests on being able to conclude that postulated events and accidents are controlled with appropriate levels of defense-in-depth that are applied such that several layers of protection are used to prevent the release of radiological or hazardous materials to the environment.

DSA, 2.3 Safety Structures, Systems, and Components (SSCs), Page 12	Determining the adequacy of safety SSCs generally entails being able to conclude that the DSA contains sufficient documentation and basis to arrive at the following conclusions: • The safety SSCs identified and described are consistent with the logic presented in the hazard and accident analyses. • Safety functions for safety SSCs are defined with clarity and are consistent with the bases derived in the hazard and accident analyses. • The boundaries of safety SSCs are clearly defined, including the support systems. • Functional requirements and system evaluations are derived from the safety functions and provide evidence that the safety functions can be performed when called upon. • System Evaluation is performed to assure functional requirements are met. • Control of safety SSCs relevant to TSR development is clearly defined.	DSA, 4.5 Safety Structures, Systems, and Components (SSCs), Page 15	Identification of safety SSCs is a product of the hazard and accident analyses. Determining the adequacy of safety SSCs rests on being able to reach the following conclusions: • The safety SSCs identified and described are consistent with the logic presented in the hazard and accident analyses. • Safety functions for safety SSCs are defined with clarity and are consistent with the bases derived in the hazard and accident analyses. • Safety systems are clearly described to include essential components needed to meet the safety function. The boundaries of safety SSCs and support systems are clearly defined and interfaces with other SSCs are described. • Support SSCs are clearly described and designated as safety class or safety significant for cases where their failures prevent safety SSCs or SACs from performing their safety functions. • Functional requirements and performance criteria are defined such that, when met, they ensure that the safety functions can be performed when needed. • A system evaluation demonstrates that the system can meet applicable performance criteria thereby ensuring the functional requirements are met under postulated accident conditions (e.g., elevated temperatures and pressures) and the required safety functions are fulfilled. The evaluation contains an engineering evaluation with a supportable basis such as one of the following methods:

			○ Providing a technical basis that includes an evaluation against the code of record, to the extent known, and augmented as needed with calculations, performance tests, or reliability evidence from operating history or industry databases; ○ Comparing the safety SSC design attributes to DOE O 420.1C (or applicable successor document) design requirements, and associated codes and standards that are applicable, to demonstrate compliance; or, ○ Demonstrating that the existing SSCs satisfy equivalent design requirements of current design codes and standards. • Key assumptions are identified so that appropriate TSR protection can be developed or derived (such as in limiting conditions of operations (LCOs), design features, and SACs).
DSA, 2.4 Specific Administrative Controls, Page 12	As stated in DOE-STD-1186-2004, *Specific Administrative Controls*, SACs are administrative controls that are selected to prevent and/or mitigate specific accident scenarios and which have safety importance equivalent to engineered controls that would normally be classified as safety SSCs. Engineered controls (safety SSCs) are preferred over SACs for these functions; thus, SACs should only be selected if engineered controls cannot be identified to serve these functions or are not practical. The approval basis for SACs is the same as for safety SSCs. Specific expectations for SACs are delineated in DOE-STD-1186-2004.	DSA, 4.6 Specific Administrative Controls, Page 16	Determining the adequacy of SACs rests on being able to reach the following conclusions: • The SACs identified and described are consistent with the logic presented in the hazard and accident analyses. • Safety functions for SACs are defined with clarity and are consistent with the bases derived in the hazards and accident analyses. • The SACs are readily understood and can be effectively implemented. The supporting SSCs and other administrative controls whose failure would result in an inability to complete the required SAC

			safety actions(s) are identified at the same level of safety significance as the SAC, or justification provided if not so designated.
DSA, 2.5 Derivation of Technical Safety Requirements, Pages 12-13	Determining the adequacy of the derivation of TSRs generally entails being able to conclude that the DSA contains sufficient documentation and bases to arrive at the following conclusions: • TSRs are identified to ensure adequate protection of workers, the public, and the environment. • The bases for deriving TSRs are identified and described in the hazard and accident analyses, safety SSC, and SAC chapters and are consistent with the logic and assumptions presented in the analyses. • The bases for deriving safety limits, limiting control settings, limiting conditions for operation, surveillance requirements, and administrative controls are provided as appropriate. • The process for maintaining the TSRs current at all times and for controlling their use is defined.	DSA, 4.7 Derivation of Technical Safety Requirements, Page 17	Determining the adequacy of the derivation of TSRs rests on being able to reach the following conclusions: • TSRs are identified to ensure adequate protection of workers, the public, and the environment. • The bases for deriving TSRs are identified and described in the hazard and accident analyses and safety SSC chapters (which include SACs) and are consistent with the logic and assumptions presented in the analyses. • The bases for deriving safety limits, limiting control settings, LCOs, surveillance requirements, and administrative controls are provided as appropriate. • The facility modes, if applicable, are defined and those associated with TSRs are consistent with the hazard analysis and accident analysis. • The process for maintaining the TSRs current at all times and for controlling changes is defined.
DSA, 2.6 Safety Management Programs, Page 13	Determining the adequacy of safety management program characteristics generally entails being able to conclude that the DSA contains sufficient documentation and basis to arrive at the following conclusions: • The major programs needed to provide programmatic safety management are identified.	DSA, 4.8 Safety Management Programs, Page 17	Determining the adequacy of safety management program characteristics rests on being able to reach the following conclusions: • The major programs needed to provide programmatic safety management are identified.

	• Basic provisions of identified programs are noted, and references to facility or site program documentation are provided.		• Basic provisions of identified programs are noted, and references to facility or site program documentation are provided. • Key characteristics of programs that are identified in the hazard analysis are identified in safety management program descriptions. Such key characteristics are important to safe operation of the facility, but not at a level that requires safety significant classification.
Not Included As A Basis for Approval in Prior Revision	This Basis for Approval added to DOE-STD-1104-2014.	DSA, 4.9 Existing Facilities with Mitigated Offsite Consequence Estimates over the EG, Page 18	The following criteria should be used to judge technical adequacy of DSA information: • Accidents that cannot be mitigated below the EG or prevented, are explicitly identified, including the likelihood of the event(s) and the mitigated consequences associated with the event(s). • Accidents likelihood and consequences are determined in accordance with the DSA safe harbor methodology (e.g., Section 3.2 of DOE-STD-3009-2014). This includes source term estimates, dispersion analysis methodology, and dose consequence assumptions. • Mean or best estimate values used for source-term and dispersion input parameters that are part of comparative analyses (e.g., as described in DOE-STD-3009-2014, Section 3.3.1, bullet #2) have a valid technical basis that includes logical assumptions that are based on experiments, tests, or sound engineering judgment. The analysis describes the significant contributors to uncertainties in both the likelihood and consequence evaluations. The mean or best estimate calculation is used to provide perspective regarding the degree of conservatism that is imbedded in the consequence calculation.

			• The reliability and adequacy of credited controls is addressed (e.g., consistent with DOE-STD-3009-2014 system evaluation requirements for safety class SSCs, as applicable). • Controls considered (SSCs and SACs) but not identified as safety class that could further reduce the likelihood and/or consequences of the associated accident(s) are described in the DSA. The impact of these controls on accident mitigation, as well as the rationale for not classifying these controls as safety class should be presented. Discussions of potential failure modes of SSCs and any relevant cost/benefit results are included. • Planned operational or safety improvements are presented and include potential facility modifications, removal of MAR, packaging of MAR into containers, operational restrictions, and/or additional compensatory measures, and associated schedules, to further reduce the likelihood and/or mitigate consequences of an accident. • A qualitative or semi-quantitative comparison of the facility risk from identified scenarios and cumulative facility risk (for all facility operations) estimate for facility accidents (including the results in response to the second bullet) is presented along with a comparison to the quantitative safety objectives provided in DOE Policy 420.1. A discussion of the level of risk and the basis why this risk is acceptable is provided, taking into account an evaluation of available alternatives, the benefits to the public of the alternatives, and the costs to the public of the alternatives.

TSR, 3.2 Approval Bases, Page 16	Determining the adequacy of the TSR provisions generally entails being able to conclude that: • Hazard controls discussed in the DSA are faithfully translated into TSR provisions; and • TSR provisions are appropriate and consistent with the DSA.	TSR 5.3, TSR Consistency with the DSA, Page 22	Review criteria to assess consistency are provided below: • TSR requirements are based on functional requirements described in the DSA. • Safety SSCs are addressed specifically in TSR provisions. Active, safety class SSCs may have a safety limit and a limiting control setting associated with them, and will usually have a LCO and a surveillance requirement. An active safety significant SSC may have a LCO and surveillance requirement and/or specific provisions of a maintenance management program associated with its Technical bases for limiting control settings, LCO, and surveillance requirements in the Bases appendix of the TSR should be reviewed for adequacy. All of these provisions are directed at ensuring that the safety function of the SSC will be protected. • Passive features are designated as “Design Features” in the TSR. A crosscheck between DSA-identified important design features and the Design Features section of the TSR should be conducted to ensure consistency. Passive design features may also require surveillance and maintenance provisions to ensure they continue to meet designated safety functions (e.g., erosion of overburden for Pantex Cells). • When SACs are used, they are controlled through the TSR. DOE-STD-1186 specifies the TSR provisions that are acceptable to use for SACs. The first involves using the conventions for LCO and associated surveillance requirements (e.g., material-at-risk limits). The second method available to incorporate SACs into a TSR document is to identify the specific requirement/action in a special section in

			the Administrative Control section of the TSR. This format may be appropriate when it is essential that the SAC be performed every time and without any delay when called upon (e.g., hoisting limits for nuclear explosives) or when definitive program requirements for specific activities can be established. • The administrative controls section of the TSR addresses commitments to implement safety management programs identified in the DSA as important to the facility safety basis. Hazards analyses may invoke particular provisions of safety management programs, such as emergency preparedness, criticality safety, procedures, and training. • If DOE conditions of approval are identified for the DSA, the review team ensures that TSR provisions have been developed, as appropriate, to provide assurance of the identified safety functions.
Not Included As A Basis for Approval in Prior Revision	This Basis for Approval added to DOE-STD-1104-2014.	TSR 5.4, TSR Consistency with DOE G 423.1-1, Page 23	The second aspect of adequate TSRs is consistency with guidance provided in DOE G 423.1-1 (or successor document in site contract). Review criteria from this Guide needed to reach this conclusion are provided below for various sections of the TSR. The criteria should be followed to the extent they are applicable to the TSR being reviewed. • Section 1, Use and Application. Terms that operators and other facility staff need to understand the TSRs are defined. Definitions should be clear and concise. Operational modes are clearly demarcated. Frequency notations used in surveillances or elsewhere follow standard definitions and usages given in DOE G 423.1-1.

			• Section 2, Safety Limits. Safety Limits are consistent with the DSA accident analysis and describe the parameters being limited. Limits are stated in measurable terms and have a defined facility mode or other conditions under which they are applicable. Actions required to be taken if a Safety Limit is exceeded are described and, if taken, will achieve a safe and stable state. • Section 3/4, Limiting Control Settings, Limiting Conditions for Operations, and Surveillance Requirements. Operability requirements for active safety SSCs, or operator actions for SACs (i.e., where specified in LCO format), are unambiguous and concise. LCO statements are precise and state the lowest functional capability or performance level required for safe operation. Instrument setpoints/values properly account for uncertainties (e.g., derivation is consistent with ANSI/ISA 67.04.01, *Setpoints for Nuclear Safety Related Instrumentation*). Facility modes and process areas are specified and ensure applicability of LCOs during operations in which accidents for which they are credited in the DSA are possible. Actions are clear and simple, ensure a safer condition upon implementation, and specify a completion time that allows for safe and timely implementation. Surveillance requirements are established for SSC operability that specifies the requirements necessary to ensure compliance with the LCO (e.g., specific values, limits, etc., should be stated in the Surveillance Requirements). A frequency of performance is established for each Surveillance Requirement with a sound technical basis (e.g., vendor information, past performance history, and consistent with supporting uncertainty analysis).

			• Section 5, Administrative Controls. Administrative provisions and commitments are provided related to organization and management, procedures, qualifications and training, record keeping, review and assessments, reporting, safety management programs, and actions relevant to deviations from TSRs. Facility management responsibilities should be clear and encompass actions necessary to ensure safe operation. Minimum staffing requirements are specified where required based on the safety analysis. Safety management programs include commitments to important attributes emphasized in the DSA (e.g., In-Service Surveillance and Maintenance for design features). SACs having directed actions are identified and meet the general expectations of DOE-STD-1186-2004. • Section 6, Design Features. Features that must be protected based on the safety analysis are included. The description of design features provides sufficient detail related to materials of construction, important dimensions, configuration, and physical arrangement such that important attributes needed to meet safety functional requirements are protected in the TSR. • Bases Appendix. Bases are provided for Safety Limits, Limiting Control Settings, LCOs, and associated Surveillance Requirements. The bases provide supportable statements and reasoning. This includes references back to safety analyses to support selected operating limits and numeric values, conditions, surveillances, and LCO response actions.

Not Included As A Basis for Approval in Prior Revision	This Basis for Approval added to DOE-STD-1104-2014.	6.1, USQ Process Procedure, Page 25	The basis for approval of the USQ procedure shall address the expectations from the DOE G 424.1-1B, Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements (or successor document in the site contract).
Not Included As A Basis for Approval in Prior Revision	This Basis for Approval added to DOE-STD-1104-2014.	6.2.2, Justification for Continued Operation	The DOE reviewer should ensure that the applicable information described in chapter 7 of this Standard is presented in the JCO using a graded approach.
Not Included As A Basis for Approval in Prior Revision	This Basis for Approval added to DOE-STD-1104-2014.	6.3, Downgrades in Facility Hazard Categorization to "Below Hazard Category 3" Status	[Note: Only applicable when facility is categorized as a HC-2 or -3 facility based on DOE-STD-1027-92, but subsequently, based on facility-specific hazard analysis and final categorization, the contractor determines a facility to be a "Below HC-3" nuclear facility.] The following review criteria should be used in judging adequacy of such final hazard categorization downgrades below Hazard Category 3: • Base information is sufficient to understand and analyze the facility and its proposed operations; • Final hazard categorization of the facility is based on analyses of "unmitigated release" of available radioactive and materials; • The hazard analysis is comprehensive in identifying the hazards of the facility and applies appropriate hazard analysis techniques used to support final hazard categorizations; • Radioactive material inventory data is bounding;

			• Radioactive material physical form and dispersibility are considered under the full range of potential unmitigated accident conditions that would be expected to occur within the facility; • Bounding airborne release fractions and respirable fractions are used from DOE-HDBK-3010-94, Change Notice 1, unless a different value is provided in an applicable standard or is otherwise technically justified, to compare against base assumptions of DOE-STD-1027-92; and • Assumptions used to reduce the inventory at risk, such as facility segmentation, are technically justified.