Safety Basis Requirements for Nonnuclear Facilities at Lawrence Livermore National Laboratory

Site-Specific Work Smart Standard

Revision 3

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LAWRENCE LIVERMORE NATIONAL LABORATORY

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Safety Basis Requirements for Nonnuclear Facilities
at Lawrence Livermore National Laboratory
Site-Specific Work Smart Standard

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* Minor additional change made to Section 5.1.3.3, Light Science & Industry, Biological classification criteria. The Change Control Board at their 12/19/06 meeting approved this change.

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TERMS AND DEFINITIONS

Ammunition: For purposes of this standard, explosives (i.e., bullets) used in rifles, handguns, shotguns, machine guns, and similar devices designed to be carried and operated by one person. Unloaded firearms are excluded from concern in safety basis hazards identification and analysis.

Co-located workers: People outside a facility under consideration but within the LLNL fence line.

Credited Controls: Control(s), identified through Accident Analysis, that are required to reduce the residual risk acceptance level (see Figure 3).

Facility: A Laboratory building, group of buildings, building segment, or segmented operation. All buildings listed in the LLNL Facility Information Management System database are included in one or more LLNL "facilities."

Major modification: Construction that would result either in changes to the safety basis envelope, such that the facility classification would change, or in changes to the structural design basis of the facility.

Mitigated consequence: The consequence or impact of a hazardous release when all controls designed to reduce the impact are operable.

Nonnuclear facility: For the purpose of this standard, a nonnuclear facility is defined as any LLNL-operated building, group of buildings, building segment, or segmented operation that is assigned a unique facility number through the LLNL Facility Information Management System database with the following exception:

Nuclear facilities categorized as 1, 2, or 3 per 10CFR830.

Operational-use quantity: The quantity of ammunition assigned to a duly authorized worker for a daily assignment.

Operational safety requirements: Formally established controls that define limits, controls, and related actions that establish the specific parameters and required actions for safe operation of a nonnuclear facility in accordance with the safety basis.

Residual risk: The operational risk that remains when all controls are operable.

Safety Basis document (documentation): Written documents that establish the safety basis for the facility. Includes initial documentation and changes. Does not include reviews of operations that do not result in changes to the safety basis envelope.

Temporary emergency exposure limits (TEELs): Four levels (0–3) of limits as defined below. When a TEEL level is referred to in this document, it is assumed that the impacts are no greater than the maximum impact allowed for that level.

> TEEL 0: The threshold concentration below which most people would experience no appreciable risk of health effects.

TEEL 1: The maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing anything other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.

TEEL 2: The maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

TEEL 3: The maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing or developing life-threatening health effects.

1.0 Introduction

This standard establishes requirements that, when coupled with Lawrence Livermore National Laboratory's (LLNL's) Integrated Safety Management System (ISMS) methods and other Work Smart Standards for assuring worker safety, assure that the impacts of nonnuclear operations authorized in LLNL facilities are well understood and controlled in a manner that protects the health of workers, the public, and the environment.

All LLNL facilities shall be classified based on potential for adverse impact of operations to the health of co-located (i.e., nearby) workers and the public in accordance with this standard, Title 10 Code of Federal Regulations (10 CFR) 830, Subpart B, and Department of Energy Order (DOE O) 420.2A.

This standard provides information on:

- Objectives.
- Applicability.
- Safety analysis requirements.
- Control selection and maintenance.
- Documentation requirements.
- Safety basis review, approval, and renewal.
- Safety basis implementation.

This standard supercedes DOE San Francisco Operations Office Management Directive DOE SAN MD 5481.1A.

2.0 Objectives

This sets forth requirements to ensure the impacts of operations authorized in LLNL facilities are well understood and controlled in a manner that protects the health of workers and the public. This standard builds on existing Work Smart Standards associated with worker safety by ensuring that operations are examined to determine the potential impact to co-located workers and the public. This standard is intended to fill gaps identified in the previous work smart standard set with respect to authorization of facility operations.

This standard uses the terms "low," "moderate," and "high" as labels for the classifications of facilities (see Sections 5.1.3.4, 5.1.3.5, and 5.1.3.6). However, these terms may not have the same meanings as in other Work Smart Standards or other LLNL requirements.

3.0 Applicability

This standard applies to all facilities operated by LLNL for DOE and the National Nuclear Security Administration (NNSA), including:

- Facilities not located at the Livermore main site or at Site 300 but operated by LLNL.
- Onsite hazardous materials transportation that do not meet the requirements of the DOT, shall meet the requirements of this Standard. Except that onsite hazardous materials transfers that meet the DOT or LLNL approved packaging requirements shall not be subject to the hazard and accident analysis requirements of this Standard.
- Category 2 or 3 facilities or operations with nonnuclear hazards, when the nonnuclear hazard is neither the initiator nor exacerbator of the consequences of a nuclear incident.
- Any other facility or operation not specifically excluded below.

This standard does not apply to:

- Facilities located at the Nevada Test Site.
- Transportation operations meeting DOT requirements.
- Facilities located at the Livermore main site or at Site 300 but not operated by LLNL (e.g., construction office trailers).

This standard does not supercede nor alter the requirements of 10CFR830, Subpart B or DOE Order 420.2A.

4.0 Roles, Responsibilities, And Authority

The DOE and NNSA are the primary authorizing agencies for all facilities covered by this standard. This authority is executed through the NNSA Livermore Site Office (NNSA/LSO). NNSA/LSO may delegate in writing to LLNL management authority for operation of certain facilities.

4.1 National Nuclear Security Administration/Livermore Site Office (NNSA/LSO)

DOE/NNSA assumes overall responsibility and authority for all risk acceptance at LLNL. This authority may be delegated to the LLNL Director.

Responsibilities of the NNSA/LSO Manager are to:

- Delegate authority for review and approval for nonnuclear facility safety basis.
- Establish a program for the technical review of safety basis documents submitted by LLNL.

- Prepare safety evaluation reports or appropriate technical evaluation documentation describing the findings of the technical review and recommendation for approval or revision.
- Approve safety basis documents required to be submitted to them and accept risk as described in Sections 5.1.6 and 5.4.

4.2 Lawrence Livermore National Laboratory

Each LLNL facility shall be assigned to a directorate or other organization that is responsible for assuring compliance with this standard.

4.2.1 Director

LLNL's Director retains overall responsibility and authority for all risk acceptance delegated to LLNL by NNSA. This authority may be delegated to LLNL Associate Directors for the facilities for which they are responsible. The Director shall concur with operations that have residual risk above that which an Associate Director may accept, as described in Sections 5.1.6 and 5.4, or may delegate this authority to the Deputy Director for Operations.

4.2.2 Associate Directors

For the facilities assigned to them, Associate Directors shall be responsible for:

- Operating facilities safely.
- Complying with this standard.
- Ensuring facilities are operated within the established safety envelope.
- Preparation of safety basis documents.
- Reviewing and approving safety bases in accordance with this standard.
- Understanding the risks accepted by approval of the safety basis.
- Establishing a system of accountability for compliance with this standard.
- Reporting noncompliances with safety basis requirements, when required.

Associate Directors may establish organizational structures and delegate authority within those structures for compliance with this standard.

4.2.3 Hazards Control Department

The Hazards Control Department shall:

- Provide institutional guidance and oversight for compliance with this standard, including internal policies and procedures that are approved through LLNL's standard mechanisms.

- Identify qualified individuals to ensure that institutional reviews of safety basis documentation take place.
- Review all safety basis documentation.

5.0 Requirements

5.1 Safety Analysis

Safety analysis shall be performed for all LLNL facilities. LLNL facilities that meet the classification criteria of being an Office (see Section 5.1.3), only need to perform element A (see below) and to document its status as an office on the official listing; no further safety analysis is required. The content of the safety analysis for all other facilities shall be commensurate with the hazards (see Figure 1), but shall include at least elements A–C of the following:

A. Identification of operations and inventories.
B. Identification of hazards.
C. Facility classification.
D. Hazard analysis.
E. Accident analysis.
F Control selection.

5.1.1 Identification of Operations and Inventories

All LLNL facilities covered by this standard must initially identify the operations within the facility and the planned maximum inventories associated with these operations, including storage.

5.1.2 Hazard Identification

Each facility, other than an office, shall be reviewed to identify the presence of the following hazards:

- Chemicals.
- Explosives.
- Biohazardous materials.
- Radiological materials and radiation-generating devices.
- Industrial hazards.

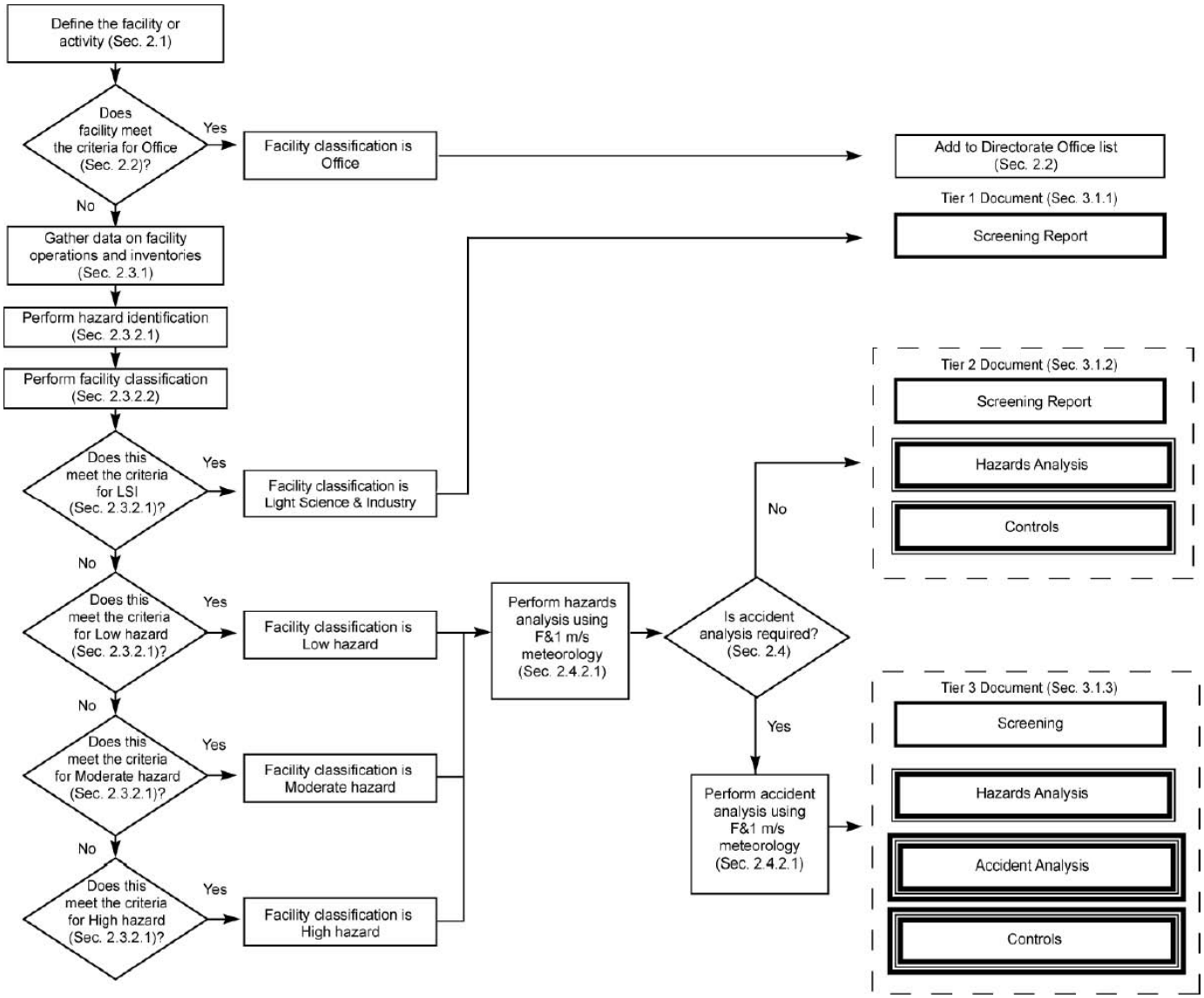

Figure 1. Safety Analysis and Documentation Process.

Specific lists of the hazards of each authorized type shall be the basis for the safety analysis. A graded approach may be used in determining the level of specificity for hazard identification. At a minimum, information adequate for proper facility classification shall be documented. The hazards of expected operations using the maximum planned quantities should be considered and listed. Hazards listed shall represent the facility safety envelope for work that may be authorized. Hazards not identified shall not be authorized without a change of the safety basis. Details regarding the location, storage, proximity to other materials and operations, frequency of use, and manner of use may be needed to perform hazard and accident analysis. Such details may not be necessary for all hazards.

5.1.2.1 De Minimus Quantities

LLNL may establish de minimus quantities of hazardous materials, i.e., quantities below which a material is not considered to be part of the facility inventory for safety basis purposes. These quantities shall be based on the potential for health impacts to co-located workers and the public and shall be identified in LLNL implementing documents, when appropriate.

Establishment of de minimus quantities shall not alter the requirement to evaluate hazards and develop controls to protect workers who work directly with hazardous materials or the requirement to track for compliance with other Work Smart Standards or other requirements.

5.1.2.2 Segmentation

In some cases, a facility may be divided into separate segments that shall be treated as separate facilities and shall meet the requirements of this standard independently. Segmentation is intended to prevent excessive requirements needed for one operation from being applied to less-hazardous operations in the same facility. However, segmentation should not be considered lightly. Clear justification shall be demonstrated and documented. Facility segments can be considered independent if facility features exist to preclude the potential impacts of hazards in one segment from affecting workers or operations in other segments. Facility features considered to justify segmentation are passive engineering features (e.g., intact firewalls). Active controls (e.g., fire suppression systems) shall not be used as justification for segmentation.

5.1.3 Facility Classification and Graded Approach

LLNL shall establish a process for classification of all LLNL facilities covered by this standard. Facility classification should be based on the potential for adverse health impacts to co-located workers and the public. Criteria shall be established for the following facility classifications:

- Office
- Light Science and Industry
- Low
- Moderate
- High

Criteria may include specific inventory thresholds for hazardous materials.

The criteria, described below, consider human health effects based upon a graded approach related to the qualitative language defining temporary emergency exposure limits (TEELs). While analysis has been performed to directly relate chemical exposure levels to these qualitative levels, as shown below, facility classifications based on other hazards have been more loosely aligned with these consequence levels. Radiological and biological hazards facility classifications are tied to existing Work Smart Standard graded approaches (e. g., 10CFR835). Facilities shall be classified according to the potential of their operations to impact nearly all co-located workers and the public as follows:

- No appreciable risk of health effects.
- No more than mild, transient adverse health effects or the perception of a clearly defined objectionable odor or sensation.
- No irreversible or other serious health effects or symptoms that could impair a person's abilities to take protective action.
- No development of life-threatening health effects.

Facility classification shall be based on the highest level of hazard determined for any of the five hazard types. For example, if a facility is classified as Low for its use of biological materials and Moderate for its use of certain chemicals, the facility itself is classified as Moderate. In this example, however, the safety analysis for the biological hazards shall be performed at the level appropriate to the risk associated with the use of biological material, whereas the analysis for those certain chemical hazards shall be performed at the moderate level, appropriate for the risk associated with the use of those certain chemicals. Note that for the determination of the Biosafety Level (BSL), the primary authority of facility classification for facilities with biological material/activities that are BSL-2 or above, is the responsibility of the Institutional Biosafety Committee (IBC). The IBC may require controls to be established in the course of establishing the Biosafety Level. Lower BSL classifications are determined by the researcher with the aid of the ES&H Team and the Biosafety Subject Matter Expert in accordance with LLNL Work Smart Standards.

5.1.3.1 Chemical Quantity Tables

LLNL shall establish chemical quantity tables to classify facilities where hazardous chemicals are used. The tables shall be based on the TEEL concentration values posted on the DOE's Chemical Safety Office website and calculated for a release of a chemical assuming a receptor located 100 and 300 meters from the release using LLNL 50th% atmospheric conditions. LLNL shall prepare a diagram that shows which tables shall be used based upon facility location. NNSA/LSO shall approve the protocols for the development of these quantity tables. For the purposes of facility classification, only individual chemicals, not combined effects, are considered. The facility shall use the LLNL tables that are current at the time of the creation of their safety basis document or additional analysis.

Similar tables may be established for hazard and accident analysis using LLNL 95th% atmospheric conditions.

5.1.3.2 Office Facilities

Office facilities are workplaces for managerial, administrative, professional, and technical staff. The primary work that takes place in an office facility is the preparation, reading, communication, and storage of documents and data and the interaction between personnel through meetings, telephone conversations, and e-mail. Extensive use of office-related equipment is expected in office facilities.

Office facilities are constructed and maintained in accordance with LLNL's Work Smart Standards and other applicable requirements. Repair and maintenance operations shall be those normally associated with such a facility and with the equipment contained therein and shall be performed in accordance with LLNL's ISMS. Significant repair or maintenance operations that could have adverse health impacts to co-located workers or the public should be evaluated to determine the hazards and any appropriate controls using the ISM work control processes. Such operations shall not alter the classification of the facility unless they become a standard part of daily operations.

Office facilities shall not be used for storing hazardous material (e. g., cleaning supplies) for other facilities or for long-term storage of hazardous materials for its own use. The quantity of these materials contained in an office facility should be commensurate with LLNL's procurement and supplies practices. An office facility shall not be used for planned transition or storage of hazardous materials to or from an experimental laboratory.

Radioactive materials, explosives, unknown samples, lab wastes, and reagents in general should not be brought into office facilities. Radioactive materials shall be limited to those that are considered "generally licensed items and articles," qualified sealed sources containing less than the 10 CFR 835, Appendix E thresholds (e.g., Class I and II sources), or general materials that contain less than the 10 CFR 835, Appendix E, threshold quantities.

Ammunition for operational use by duly authorized individuals may be present in office facilities in accordance with Section 5.4.3.4 of DOE Standard (STD) 1091-96. Ammunition beyond that assigned for daily operational use shall not be stored in office facilities.

No safety basis documentation is required for office facilities.

5.1.3.3 Light Science and Industry

Facilities classified as Light Science and Industry have the potential for unmitigated release of hazards with impacts to co-located workers that are believed to cause no more than mild, transient adverse health effects or the perception of an objectionable odor or sensation (e.g., TEEL 1) for nearly all individuals and with impacts to the public that are believed to present no appreciable risk of health effects (e.g., TEEL 0) for nearly all individuals. The following are typical examples or thresholds for each hazard type:

- Industrial—Plumbing, carpentry, and machine shops using steel, aluminum, copper, plastic, wood, or other common materials; electronics shops; laser laboratories; and experimental equipment design and testing laboratories.

- Chemical—Small-scale chemical laboratories, dye laser laboratories, small-quantity chemical storage, and facility chemical inventories less than the low classification threshold as defined by the LLNL chemical quantity tables for classification.
- Biological—Biosafety Level (BSL) 1 and 2 operations or facilities that fall under 29 CFR 1910.1030, OSHA Bloodborne Pathogens Standards.
- Radiological—Radiation-generating devices not covered by DOE O 420.2A, radioactive material inventories less than the reportable quantities listed in 40 CFR 302.4, Appendix B.
- Explosive—Commonly available powder-actuated tools, total room inventories involving secondary explosives with a mass of 10 mg or less or primary explosives with a mass of 1 mg or less, and storage (in greater than operational-use quantities) of ammunition classified as 1.4 S in accordance with Section 5.4.3.4 of DOE-STD-1091-96. Ammunition that is not classified as 1.4 S is not permitted.

5.1.3.4 Low

Facilities classified as Low have the potential for unmitigated release of hazards with impacts to co-located workers that are believed to include no irreversible or other serious health effects or symptoms that could impair their abilities to take protective action (e.g., TEEL 2) for nearly all individuals and whose impacts to the public are believed to be no more than mild, transient adverse health effects or the perception of an objectionable odor or sensation (e.g., TEEL 1) for nearly all individuals. The following are typical examples or thresholds for each hazard type:

- Industrial— If a facility has an industrial hazard that could meet the above conditions.
- Chemical—Facility inventory levels kept within the Low range as defined in the LLNL chemical quantity tables for classification.
- Biological—BSL 3 operations.
- Radiological—Radioactive material inventories greater than the reportable quantities listed in 40 CFR 302.4, Appendix B, but less than the Category 3 threshold of DOE-STD-1027-92 and qualified sealed sources exceeding the Category 3 threshold but exempted from inventory under DOE-STD-1027-92. If through analysis under 10CFR830, Subpart B, the facility is determined to be below Category 3, it shall be classified as Low.
- Explosive—The maximum credible event used to meet the Level of Protection and Quantity-Distance requirements of the DOE Explosives Safety Manual does not exceed 10 grams for United Nations Organization (UNO) Hazard Class 1.1, 1.2, 1.4 (except as stated for 1.4S for LSI facilities above) 1.5 or 1.6 explosives or 200 grams for UNO Hazard Class 1.3 explosives.

5.1.3.5 Moderate

Facilities classified as Moderate have the potential for unmitigated release of hazards with impacts to co-located workers that are believed to include no life-threatening health effects (e.g., TEEL 3) for nearly all individuals and whose impacts to the public are believed to include no irreversible or other serious health effects or symptoms that could impair their abilities to take protective action (e.g., TEEL 2) for nearly all individuals. The following are typical examples or thresholds for each hazard type:

- Industrial—If a facility has an industrial hazard that could meet the above conditions.
- Chemical—Facility inventory levels kept within the Moderate range as defined in the LLNL chemical quantity tables.
- Biological—Not Applicable.
- Radiological—Radioactive material inventories that exceed the threshold of DOE-STD-1027-92 shall be managed as a nuclear facility in accordance with 10 CFR 830, Subpart B, instead of this standard for nonnuclear facilities.
- Explosive—All activities or materials that are not allowed in light science and industry or Low facilities but that meet the quantity–distance requirements specified in DOE Manual 440.1-1 and transportation of explosive material on site that does not meet DOT requirements.

5.1.3.6 High

Facilities classified as High have the potential for unmitigated release of hazards with impacts to co-located workers that are believed to include life-threatening health effects (e.g., >TEEL 3) and whose impacts to the public are believed to include irreversible or other serious health effects, symptoms that could impair their abilities to take protective action, or possible life-threatening health effects (e.g., >TEEL 2). The following are typical examples or thresholds for each hazard type:

- Industrial— If a facility has an industrial hazard that could meet the above conditions.
- Chemical—Facility inventory levels exceeding the Moderate range as defined in the LLNL chemical quantity tables.
- Biological—BSL 4 operations.
- Radiological—Radioactive materials inventories that exceed the Category 3 threshold of DOE-STD-1027-92 shall be managed as a nuclear facility in accordance with 10 CFR 830, Subpart B, instead of this standard for nonnuclear facilities.
- Explosive—Any activities or materials necessitating an exemption from the quantity–distance requirements specified in DOE Manual 440.1-1.

5.1.4 Hazard Analysis

Hazard Analysis shall be performed for all hazards classified as Low, Moderate, or High. The hazard level for each type of hazard (i.e., industrial, chemical, biological, radiological, and explosive) shall be determined, and the hazard analysis performed should be commensurate with the hazard level. Hazard analysis is primarily focused on understanding the behavior of the hazard in generic accident scenarios (e.g., spills, fire, etc…). Hazard Analyses should consider the following items:

- The way(s) in which the known hazards could manifest into undesirable consequences.
- The frequency of hazardous events based on operating history, analyst judgment, and industry data (note that this estimate is not specific to the facility, controls, or management for the specific hazard being analyzed but based on broad information about the frequency for similar operations and facilities through their life cycle).
- The unmitigated consequences of an event (the consequences of a release of dispersible material shall be estimated for 95th% atmospheric conditions).
- The assumptions regarding parameters to the analysis that must be controlled.
- The available preventative and mitigative controls applicable to the known hazards.

Hazard Analysis shall be used to determine what hazards and hazardous events require accident analysis. This determination shall be made by using estimated frequencies and unmitigated consequences, in conjunction with the matrix in Figure 2.

Hazard Analysis is an iterative process. Suggestions for improving safety that arise from the preliminary iterations should be factored into subsequent iterations. If Accident Analysis is required, less iteration on the Hazard Analysis should be necessary. The following actions are necessary to meet requirements in other parts of this standard with respect to Hazard Analysis if Accident Analysis is not required:

- Checking the Residual Risk Matrix (Figure 3) to determine the acceptability of the risk.
- Identifying controls per Section 5.1.7.1 of this standard.

5.1.5 Determination of Need for Accident Analysis

Hazard analysis information shall be binned per the Analysis Level Matrix in Figure 2. The results of the binning shall determine whether Accident Analysis shall be performed.

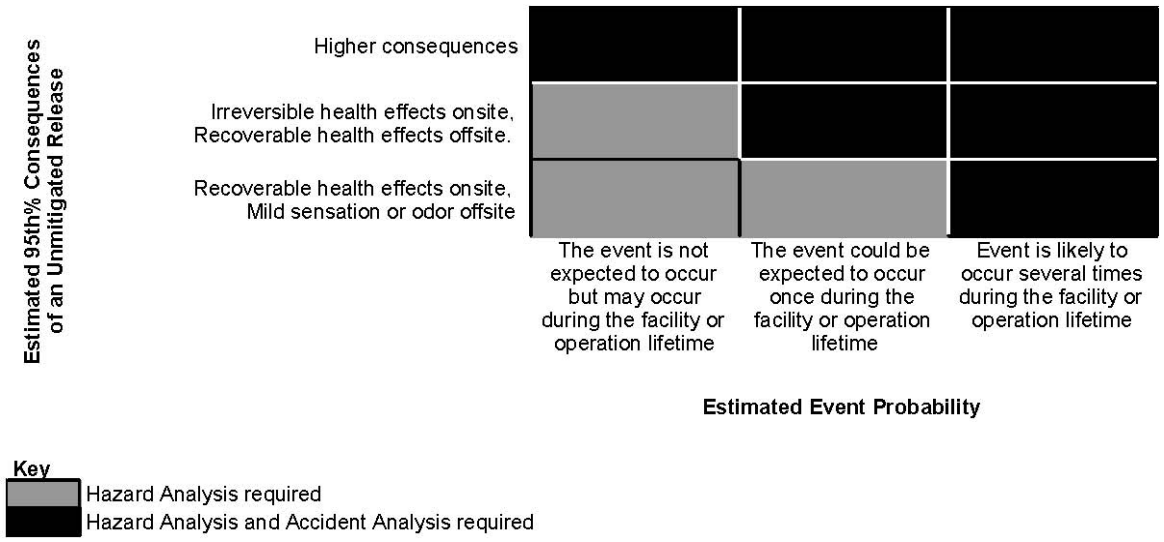

Figure 2. Analysis Level Matrix.

5.1.6 Accident Analysis

Accident Analysis differs from Hazard Analysis primarily by evaluating specific accident scenarios that are associated with hazards and studying the component parts of a scenario in further detail to understand how each of these parts contributes to the overall risk of the accident scenario. Accident Analyses should:

- State what specific accidents can occur.
- Identify hazardous event initiators present in the facility and processes.
- State potential scenarios in narrative or illustrative form.
- Identify what specific events within a scenario contribute to the frequency of the accident.
- Determine the likelihood of the overall scenario.
- Determine the mitigated consequences of an event.
- Determine those elements that are the major contributors to the risk from this hazard.
- State preventive and mitigative controls.
- Evaluate options and effectiveness of the controls.
- Identify credited controls.
- Identify uncertainties and sensitivities in the analysis.

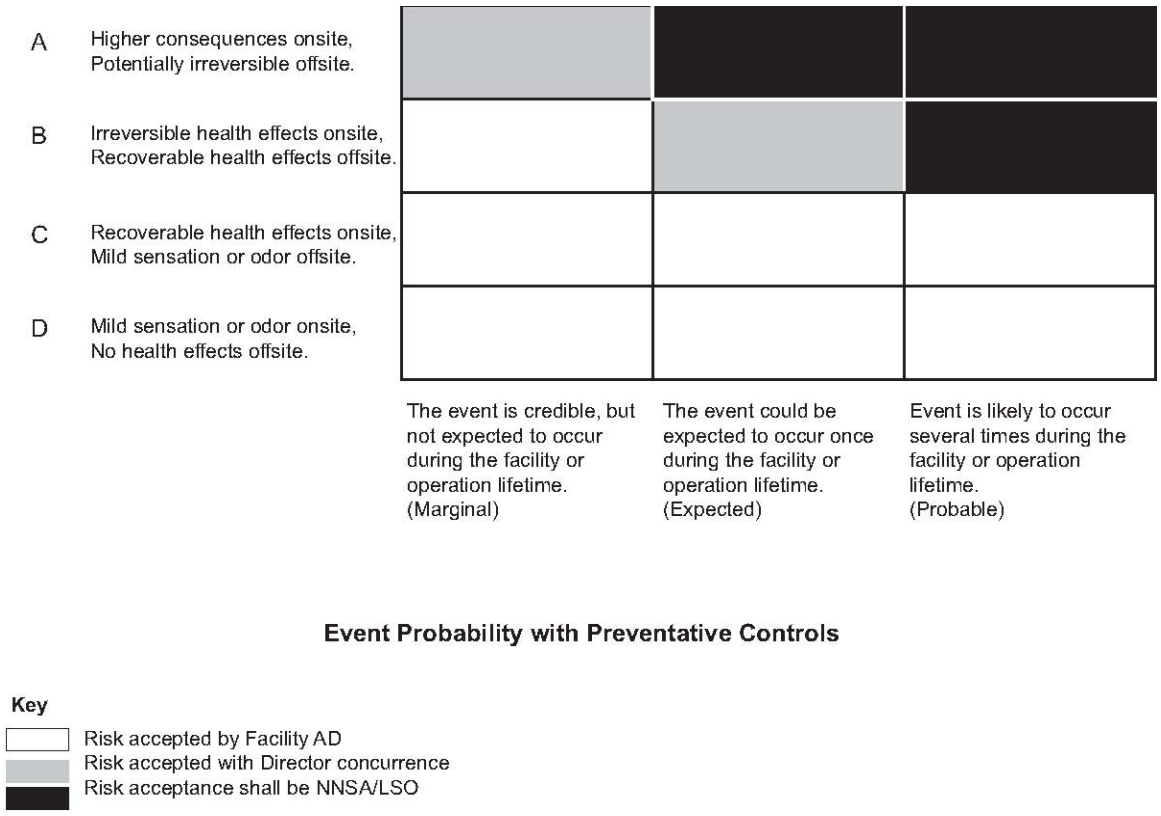

Figure 3. Residual Risk Matrix.

Like Hazard Analysis, Accident Analysis is an iterative process. The final results of Accident Analyses shall be checked against the Residual Risk Matrix, Figure 3, to determine risk acceptance levels. The unmitigated impacts of releasing the hazard of concern, i.e., a parking lot scenario, shall be considered to initiate the control selection process. Preventive and/or mitigative controls shall be applied to the scenario to reduce the residual risk, see Figure 3.

Accident analysis shall address the probability of release, event consequences, accident sequence, and selection of controls. Analysis may be qualitative in off-site individuals.

5.1.7 Controls

Controls are used to reduce the likelihood of accidents or mitigate their consequences. The process for control selection is described in this section. All facilities shall develop and implement controls necessary to meet requirements in the LLNL Work Smart Standards set, including those established by the IBC during the determination of Biosafety Levels.

5.1.7.1 Controls Identified through Hazard Analysis

When performing Hazard Analysis, controls may have been identified in addition to those required by LLNL's Work Smart Standards and ES&H Manual. The facility management should identify which of these controls provide additional protection to co-located workers and the public or assure operability of other controls. If the facility management commits to

implementation of these controls, they shall be listed in the control section of the safety basis document (see Figure 1).

5.1.7.2 Selection of Credited Controls

Controls identified through Accident Analysis, as required by this standard, shall be evaluated to determine credited controls. A control or collection of controls required to reduce the residual risk acceptance level (see Figure 3) shall be credited controls.

Many types of controls mechanisms are available; however, the selection of controls should be based on the following hierarchy whenever possible.

- Passive over Active
- Preventive over Mitigative
- Engineered over Administrative

A control(s) identified through Accident Analysis that is necessary to reduce the risk (either the probability or consequence or both) to co-located workers or the public to accepted levels is called a Credited Control. There may be a number of combinations of controls necessary to reduce the residual risk. Typically, the minimal set is chosen as the set of credited controls. If several scenarios require accident analysis, different credited controls may be derived from each. Alternatively, a common control may be effective at reducing the risk of more than one scenario. The necessary degree of risk reduction is determined from the Residual Risk Matrix shown in Figure 3.

5.1.7.3 Operational Safety Requirements

Credited controls shall be documented, described, and maintained through Operational Safety Requirements (OSRs). OSRs may include safety limits, operating limits, surveillance requirements, administrative and management controls, use and application provisions, and design features. OSRs shall be established for High facilities for credited controls. OSRs may be required for Moderate and Low facilities if credited controls are identified. In addition, a control that is relied upon to maintain the facility's classification may be an OSR for Low, Moderate, or High facilities. If reporting of information from OSRs is necessary to ascertain operational status of the facility, a section of the safety basis document should specify the information to be reported, the frequency of reporting, and who is to receive the information. If reporting is not expected on a given frequency, the driver for reporting should be clarified.

5.2 Facility Safety Basis Documentation

With the exception of office facilities, all facilities shall have a safety basis document. Safety basis documentation shall be developed using a graded approach. This section specifies requirements for the contents of facility safety basis documentation. A separate document is not required if the requirements of this standard can be met by a document produced in accordance with 10CFR830, Subpart B or DOE Order 420.2A for those hazards covered by this standard.

5.2.1 Minimum Requirements

The minimum requirements for a safety basis document shall be:

- Facility identification.
- Identification of the organization responsible for the facility.
- Facility classification and information supporting the decision.
- Hazard identification.
- Controls to assure that facility operations do not exceed the facility classification.

In addition, the following information may be required for facilities with classifications of Low, Moderate, or High:

- Facility description or layout to aid understanding of potential hazardous events.
- Hazard Analysis.
- Accident Analysis.
- Control selection and credited controls.
- OSRs.
- Change control.
- Reporting requirements.

Safety basis documentation should be developed by providing the minimum documentation for all hazards, then adding the information needed for those hazards requiring Hazard or Accident Analysis, as well as information for credited controls and OSR.

5.2.2 Hazard Identification

A listing of hazards associated with operation of a facility shall be included in all safety basis documentation. For hazardous materials, the maximum quantity that may be authorized shall be specified. The magnitude of the potential impact from nonmaterial (industrial) hazards shall be specified. The presence or absence of hazards shall be noted for the five hazard types: industrial, chemical, biological, radiological, and explosive.

If it is not practical to list all chemicals authorized for use in a facility, a general description of the types of chemicals and their physical state (i.e., gas, liquid, or solid) should be given. If it is not practical to list all radioactive isotopes authorized for use in a facility, a general description of the types of isotopes and their form should be given. Radiation-generating devices may be grouped in a listing by class. If it is not practical to list all biological materials authorized for use in the facility, the basis for BSL determination for biological materials shall be given. Explosives hazard identification shall include information regarding the types of material. At a minimum, information adequate for proper facility classification shall be documented. Hazards not identified shall not be authorized without a change to the safety basis.

If Hazard or Accident Analysis is performed on any of the hazards identified, further information regarding the hazard and any assumptions may be listed in the hazard identification section of the document. However, limitations as to the form of the hazard may be considered controls and would imply that other forms of the hazard shall not be authorized without a change to the safety basis.

5.2.3 Facility Classification

Safety basis documentation shall contain sufficient information for a reviewer to independently determine the facility classification. The minimum information required is the limits on inventory and operations from which the facility classification is determined. If the graded approach is to be applied to certain hazards in a facility (i.e., in Hazard Analysis, Accident Analysis, and the selection and documentation of controls), the limits on inventory and operations for each type of hazard present in the facility shall be identified and a classification for that hazard determined.

5.2.4 Hazard Analysis

Hazard Analysis is required for facilities classified as Low, Moderate, and High, and shall be discussed in the safety basis documentation. This discussion shall include the estimated consequences of an accident based on LLNL inventory tables for risk assessment and the estimated probability of the accident and the bases for those estimates. This section shall also document the application of the information derived from the Hazard Analysis for each potential accident scenario to the Analysis Level Matrix (Figure 2) and shall list those hazards and scenarios for which more detailed analysis is required.

5.2.5 Accident Analysis

If required to have an Accident Analysis by the Analysis Level Matrix (Figure 2), the safety basis documentation shall include a discussion of the initial conditions, the initiating events, the methodology, the effect of any controls, and the results of any calculations for each hazard and scenario that is determined by Hazard Analysis to require Accident Analysis. Accident Analysis is an iterative process in which the residual risk of a scenario is determined in the absence of any preventive or mitigative controls, and then controls are added until the residual risk has been reduced to the lowest reasonable level. The final analysis, including any calculation, must be documented and referenced, showing the residual risk with all controls operable.

5.2.6 Controls Documentation

As noted in Section 5.1.7, there is a hierarchy of preference that should be used when selecting the credited controls from the list of identified controls. The analyst must provide a justification of all controls selected (i.e., meets needed safety function). This justification must be documented, and if the hierarchy in Section 5.1.7 cannot be followed, a defensible position must also be documented. Control selection also should be evaluated for efficiency.

5.3 Change Control

LLNL shall establish a mechanism for controlling change in nonnuclear facility safety bases. LLNL's ISMS work planning and control process shall be used for all facilities. In addition, a formal change control process shall be implemented for nonnuclear facilities classified other than "Office". The formal change control process shall be initiated by:

- A proposed change in inventory or operations that would exceed that currently analyzed or bounded by the safety basis envelope.
- Previous analyses discovered to be inadequate (e.g., a potential hazard was discovered but not identified or was incorrectly analyzed in the SBE document).
- Modification to facility, equipment, or controls that alters the safety basis or initial assumptions of the safety basis.

LLNL's configuration management program and the change control mechanism shall be used to assure that all operations are maintained within the defined and approved safety envelope for the facility.

5.4 Review, Approval, and Renewal of Safety Basis Documents

Safety basis documents shall receive appropriate review to assure the accuracy and quality of the contents, as well as compliance with this standard and other applicable requirements, such as the *LLNL Environment, Safety, and Health (ES&H) Manual*. A signature on the document denotes review and concurrence. At a minimum, review and concurrence shall include representatives from the facility, the cognizant ES&H Team, and the Authorization Basis Section. For facilities for which NNSA/LSO has risk acceptance, LLNL review shall include the Associate Director responsible for that facility, and NNSA/LSO shall establish a process for review and approval.

Approval of the safety basis serves as authorization for the facility to operate in a manner consistent with the safety basis document. Approval is acceptance of the risk of the operations within the facility. NNSA/LSO shall identify, in writing, which facilities may be operated under LLNL approval and which require NNSA/LSO approval.

Approval of the safety basis shall be in writing. The Associate Director responsible for the facility shall approve, for LLNL, all safety basis documents for Low, Moderate, or High facilities. The Associate Director may delegate approval authority for a Light Science and Industry facility to the facility manager. Justification and approval by the Associate Director shall be required for any facility where the analyzed residual risk after controls have been selected remains in the RISK ACCEPTED WITH DIRECTOR CONCURRENCE area of the Risk Matrix, Figure 3. Concurrence of the Director is required for safety basis documents when residual risk exists in the areas noted. Justification provided by LLNL shall be required for any facility where the analyzed residual risk after controls have been selected remains in the RISK ACCEPTANCE SHALL BE BY NNSA/LSO. Approval by NNSA/LSO is required for safety basis documents when residual risk exists in the area noted above.

Safety basis documents shall be kept current. Change control mechanisms may be used to modify an existing document. A facility's safety basis shall be renewed at intervals of no more than three years. Minor changes may be made through simple review and approval of the document and the change control process, rather than by a complete reissue of the safety basis document. The review and approval process for changes in a facility safety basis shall be developed by LLNL. All changes to safety basis envelope shall be reviewed by NNSA/LSO if they had final authorization for the existing safety basis.

5.5 Training

Staff responsible for ensuring a facility operates within and maintains its safety basis shall be trained, as appropriate. Training shall be facility-specific and shall include, as applicable:

- Roles, responsibilities, and authority.
- Facility operation limits, including inventory management.
- Credited controls, including OSRs.
- Reporting requirements.
- Change control processes.
- Configuration management requirements.

5.6 Communication

This section specifies communication-related requirements.

5.6.1 Facility Workers

Facility workers shall receive appropriate information regarding the safety basis envelope of the facility's operations and controls as defined in the safety basis documentation to assure safe operation of the facility and compliance with the safety basis requirements. Workers' level of knowledge shall be commensurate with their roles, responsibilities, and authority.

5.6.2 Co-located Workers and Nearby Facilities

Safety analysis shall evaluate impacts to co-located workers. This shall include communication to the facility management any potential for impacts to nearby facilities, within a 100-meter radius. When the mitigated consequence of an event has the potential for impact such that nearly all workers in a nearby facility could experience or develop irreversible or other serious health effects or symptoms that could impair their abilities to take protective action (e.g., ≥TEEL 2), this potential impact shall be communicated to the management of the nearby facility.

If Accident Analysis shows that the mitigated consequence of events could result in physical phenomena that could render equipment inoperative in a nearby facility, this possible consequence shall be communicated to the facility management of the nearby facility. The management of the nearby facility shall then be able to consider such external events in their safety analysis or emergency planning.

5.7 Preliminary Safety Basis Documents

Preliminary safety analysis and safety basis documentation shall be prepared for the construction of any new facility and for a major modification to an existing facility. The level of analysis and documentation shall be consistent with the appropriate classification for the planned work.

The preliminary safety analysis and safety basis documentation should follow the requirements of this standard. Negotiations between NNSA/LSO and LLNL are permitted to narrow the scope, allow analysis and documentation to be performed in phases, and allow partial submittal of analysis before approval. It is recommended that NNSA/LSO and LLNL document agreements on specific requirements for each new facility or major modification during the negotiations. Preliminary safety basis documentation shall be approved before funds are committed to initiate construction or modification.

5.8 Discovery of Noncompliances or Inadequacies

Upon discovery of any noncompliance with, or inadequacy in, a safety basis document, the first responsibility is to assure that the facility is in a safe condition. Noncompliances with the safety basis envelope or the credited controls established for a facility shall be documented and investigated. Discovery that an analysis was not performed or was performed inadequately shall be documented, and the analysis shall be performed.

When discovery of a noncompliance or inadequacy results in a change to the facility operations or safety basis, the formal change control process shall be followed. For noncompliances that are the result of transient situations, an alternative documentation and investigation process is allowed. NNSA/LSO and LLNL shall establish reporting requirements for noncompliances and inadequacies.

5.9 Quality Assurance

LLNL shall develop and implement processes that assure the accuracy of safety analyses and the conditions upon which analyses are based. At a minimum, the processes shall assure that:

- The safety analysis meets LLNL quality assurance standards.
- Information input (e.g., hazards identification, material inventory, and references) is accurate, complete, correctly cited, and retrievable.
- Qualitative assessments are based on sound technical justification.
- Quantitative calculations and analyses are peer reviewed.
- Documentation is properly reviewed for completeness and accuracy.

LLNL shall be able to demonstrate, upon request, how the above quality assurance elements are met for any particular safety basis document.