Section Objectives

SAND2010-1216C

- Describe the purpose of a USQD.
- Identify lessons learned on completing the USQD worksheet by reviewing requirements question-by-question.
- Prepare a sample USQD for a facility.

Purpose of USQDs

- USQDs determine the required approval level for a change (or discovery condition).
  - If it is not a positive USQD, or a TSR change is not required, Sandia can internally approve the change.
  - **Otherwise,** DOE must approve the change before a change is made (or approve the evaluation of the safety of the situation and compensatory measures for discovery conditions).

Cover Page – USQD Worksheet (SF 2001-USQ)

SF 2001-USQ (5-2009) Supersedes (3-2003) Issue

UNREVIEWED SAFETY QUESTION DETERMINATION (USQD) WORKSHEET SUMMARY SHEET

Note: This form is associated with CPR400.1.1.14/GN470080, "Implementing the Unreviewed Safety Question (USQ) Process for Nuclear Facilities."

USQD number:	**Associated Screen Number:**	**Date: -**
Revision number:		**Date: -**
Facility name:		
Facility/Change title:		

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Cover Page – USQD Worksheet (SF 2001-USQ)

- USQD Number
  - Currently assigned by USQ Coordinator for organization
  - Will be automatically assigned by eUSQ system when released
    - Screens and associated USQDs will have the same number
- Revision Number
  - If a USQD is revised after approval, a new revision number will be assigned
  - eUSQ system will auto-assign numbers
  - Provide revision number for initial issuance
- Facility Name
  - For example, ACRR, SPR, GIF, Manzano

Cover Page – USQD Worksheet (SF 2001-USQ)

- Facility/Change Title
  - One line brief descriptor to identify change
  - Should be clear, concise, and unique
- Date
  - Date USQD worksheet was completed by preparer
  - Used to determine applicable DSA at time of preparation
  - Will be auto-assigned by eUSQ system.

Facility Change Title – Real Examples

- Poor choices of words/phrases:
  - MP-6 Revision
  - NFSC Change
  - Experiment procedure change
  - GN470072
  - Configuration management change

Facility Change Title – Real Examples

- Better choices of words/phrases
  - MP-6, *Fuel Storage Maintenance Procedure*, Revision to Incorporate SSO Independent Assessment Comments
  - Nuclear Facilities Safety Committee Charter Change
  - Experiment Procedure Change to Incorporate MSA Comments
  - GN470072 - *Nuclear Criticality Safety*, change to criticality safety index
  - OP Procedure Changes on Configuration Management

Facility Change Title – Real Examples

- Superior choice of words/phrases
  - MP-6, *Fuel Storage Maintenance Procedure*, Revision 2, Changes to Incorporate SSO Independent Assessment Comments on In-service Inspection of Fuel Storage Racks
  - Revision 6 To Nuclear Facilities Safety Committee Charter to Revise Titles and Clarify Criticality Safety Responsibility
  - Experiment Procedure Change to Incorporate June 2006 MSA Comments on Implementation
  - GN470072 - *Nuclear Criticality Safety*, Revision 4, Change to Reflect Use of New Methodology to Define Criticality Safety Index
  - Changes to OP Series of Procedures to Reflect Revision 2 to Configuration Management Procedure

Cover Page – USQD Worksheet (SF 2001-USQ)

- Summary of Outcome/Signatures

Based on the evaluation presented in this report, the change:

- ☐ **Does not involve an Unreviewed Safety Question based on a full USQD.**
- ☐ **Requests a Categorical Exclusion and NNSA/SSO approval is required prior to implementation.**

  Categorical Exclusion #_____ (assigned by SBD).
- ☐ **Involves an Unreviewed Safety Question and NNSA/SSO approval is required prior to implementation.**

- Put on first page to assist reviewers
- Filled out when USQD is complete

USQD Worksheet (SF 2001-USQ) – Change Description

SECTION 1 – Introduction

1.1 DETAILED DESCRIPTION OF CHANGE

Provide a concise but detailed description of the proposed change. Include references to specific Documented Safety Analysis (DSA) Report process descriptions, where applicable. This section should clearly explain the relationship of the change to the process (e.g., is this a component that is no longer required for the existing process, i.e., a legacy issue, or is this change in preparation for a new process to be approved in a separate USQD); discuss phases of the project including construction, start-up, normal operation, and provide line drawings, logic diagrams, and other reference drawings, as appropriate; cite material at risk (MAR) and significant chemicals (quantity, physical state, confinement, controls), energy sources and other significant hazards. Include the identification of any temporary or interim configurations that are not covered by allowable out-of-service time limits in the facility TSRs or TSR-like documents.

USQD Worksheet – Change Description

- **What makes a good USQD Worksheet description?**
  - Clear
    - Easy to understand;
    - Specifically identifies affected systems as identified in the safety basis; and
    - Identifies affected document by their official name and revision.
  - Complete discussion of the following:
    - the scope of the change;
    - background information and assumption;
    - how the change relates to the total picture ;
    - drivers for the change; and
    - any interim configurations or states.

USQD Worksheet – Change Description

- **What makes a good USQD Worksheet Description?**
  - Concise
    - focuses on the safety significance of the change relative to the facility safety basis;
    - Does not perform quantitative analysis within the description;
    - Provides enough information so that someone not familiar with the change can understand its safety significance; and
    - Establishes the facts to be evaluated

USQD Worksheet – Change Description

- **What makes a good USQD Worksheet Description?**
  - Other Factors
    - Includes references to applicable Safety Basis sections, where appropriate;
    - Explains the relationship of the change to the USQ process;
    - Explains the effects of the change on other SSCs or programs;
    - Does not answer the seven questions in this section; and
    - Clearly distinguishes whether the subject of the evaluation is a future, change, a discovery condition or a fix for a discovery condition.

Change Description

- Factors to consider
  - Who *is going to make a change?*
  - What *is the change?*
  - When *will the change be made, and for how long?*

These questions should be answered in the first few sentences. Further elaboration should be brief. Long, rambling descriptions might confuse the reviewers.

Basic Communication

- Factors to consider
  - Where *is the affected facility/operation?*
  - How *will the change be accomplished?*
    - Consider interim configuration
  - Why *is this change necessary?*

These questions should be answered in the first few sentences. Further elaboration should be brief. Long rambling, descriptions might confuse the reviewers.

USQD Worksheet – Change Description – Real Example

- *"The procedure is revised as indicated:*
  - All sections were reformatted according to ConOp recommendations:
    - Out of date references were deleted
    - Definition and acronyms were updated
    - New precautions and prerequisites were incorporated"
  - "These changes were made to ensure the procedure was updated with current information and to provide additional clarification for procedure steps."

- Is this a good description?
- Why or why not?

Change Description – Real Example

- This USQD evaluates the proposed organizational changes to TAV-AP-002, *Control of Procedures*. The following changes are associated with this procedure revision:
  - Defined acronyms throughout the document;
  - Added specific biennial review criteria to Section 5.9; and
  - Added Low Dose Rate Gamma Irradiation Facility (LDRGIF) and Radiation Metrology Laboratory (RML) check boxes to the Appendix B review form.
- This procedure was already applicable for the LDRGIF and RML, and adding the checkbox to the review form was for consistency. Defining acronyms in the procedure was also editorial in nature. The only non-editorial change was adding the specific biennial review criteria to Section 5.9. This criteria was added to ensure that regulatory and corporate requirements are reviewed periodically to check that current requirements are implemented procedurally.

  - Is this a good answer?
  - Why or why not?

Change Description – Real Example

"The charter for the Nuclear Facilities Safety Committee (NFSC) has been revised. The revision has the NFSC performing approximately quarterly reviews of nuclear facilities (so that each facility is reviewed at least once per year) versus meeting on an as-needed basis to review documents or experiments. The new review cycle approach will keep the NFSC apprised of planned facility activities and experiments, facility issues and assessments, safety basis document changes, etc. Since the NFSC will now be conducting periodic facility reviews, there is no longer a need for a separate audit and review staff for the NFSC. The NSFS will continue to review experiments in accordance with the existing experiment class structure, but it will no longer review DSA changes for review and recommendation for approval (although these changes will be addressed during facility reviews. However, the NFSC will continue to review changes to the TSRs. The four tier experiment class structure now applies to all subordinate committees. The minimum membership now requires two non-SNL members versus just one."

- Is this a good description?
- Why or why not?

Change Description – Real Example

- *"SNL Facilities Maintenance and Operations Center is restoring the Lightning Protection System (LPS) on the roofs of buildings ABCD, DEFG, and GHIJ (which houses Facility X). The system was largely removed and not replaced during roofing work a number of years ago. Restoration work will include cleaning existing air terminals and copper conductors and installation of new copper conductors and air terminals in areas where they are missing. Upon completion, the LPS will be in compliance with NFPA 780."*

- Is this a good description?
- Why or why not?

References and Supporting Documentation

1.2 REFERENCES AND SUPPORTING DOCUMENTATION

a. Identify all Safety Basis documents, procedures, tests, and experiments that may be affected by this change (e.g., SAR, TSRs, procedures, etc.).

b. Identify design/evaluation basis accidents evaluated in the facility Safety Basis that may be affected by this change.

c. Identify all safety systems, structures, and components (SSCs) described in the current Documented Safety Analysis that may be affected by this change.

d. Identify all equipment important to safety other than safety SSCs (equipment whose function can affect safety either directly or indirectly, e.g.: systems that perform an important defense-in-depth function, equipment relied on for safe shutdown, and in some cases, process equipment) that may be impacted by this change.

e. Identify failure modes, process parameters, and malfunctions associated with this change that can be an initiating event.

f. List hazard analyses/safety analyses that support the conclusions reached in this worksheet.

References and Supporting Documentation

a. Identify all facility safety basis documents, procedures, tests, and experiments that may be affected by this change

- List all approved safety basis documentation here.
  - Documents identified should be the most recent approved version of the document.
  - List should also include approved but not implemented Safety Basis Documents.
  - If not providing all the above, include an explanation for the limited list.
  - Draft documents should not be referenced.

- Documents referenced should be obtainable in record management system.

What are Facility Safety Basis (SB) Documents?

- Safety basis documents includes the whole safety basis documentation for the nuclear facility such as
  - the DSA;
  - supporting analyses and calculations;
  - the Technical Safety Requirements (TSRs) and their Bases;
  - the Safety Evaluation Report (SER);
  - any existing NNSA/SSO-approved DSA that may not have been implemented; and
  - any other documents that may be associated with the acceptable methodologies for preparing a DSA as described in 10 CFR 830.

USQD Worksheet – References and Supporting Documentation – Six Questions

b. Identify design/evaluation basis accidents evaluated in the facility Safety Basis that may be affected by this change.

- Consider both accident and hazard scenarios
- Chapter 3, Hazard Tables and accident analyses or Chapter 15, Accident Analyses (for reactors) of the DSA
- List only scenarios that are potentially affected by the change being analyzed
- Accidents could be identified by accident family (i.e., fires, spills, explosions, criticality, etc.)

c. Identify all safety systems, structures, and components (SSCs) described in the current Documented Safety Analysis that may be affected by this change.

- Safety class or safety significant SSCs or design features
- List only those SSCs that are potentially affected by the change being analyzed

USQD Worksheet – References and Supporting Documentation – Six Questions

d. Identify all equipment important to safety other than safety SSCs that may be impacted by this change.

- List only those SSCs that are potentially affected by the change being analyzed
- Consider support systems (e.g., utilities, alarms, instrumentation)
- Includes any equipment whose function can affect safety, either directly or indirectly
- Includes other systems that perform important defense-in-depth safety function, equipment relied on for safe shut-down, and in some cases process equipment

USQD Worksheet – References and Supporting Documentation – Six Questions

e. Identify failure modes, process parameters, and malfunctions associated with this change that can be an initiating event.

- Include any potential failure modes and malfunctions associated with the change including both equipment malfunctions and human error

f. List hazard analyses/safety analyses that support the conclusions reached in this worksheet.

- List supplemental analyses used to substantiate conclusions reached in the USQD evaluation
- Not necessary to reiterate safety basis document listing provided in Question 1.

USQD Worksheet (SF 2001-USQ) – Section 2 - Seven Questions

1. Could the proposed change increase the probability of an accident previously evaluated in the facility's existing safety analyses? Explain your answer below.	Yes	☐	No	☐
2. Could the proposed change increase the consequences to workers or the public of an accident previously evaluated in the facility's existing safety analyses? Explain your answer below.	Yes	☐	No	☐
3. Could the proposed change increase the probability of a malfunction of equipment important to safety previously evaluated in the facility's existing safety analyses? Explain your answer below.	Yes	☐	No	☐
4. Could the proposed change increase the consequences of a malfunction of equipment important to safety previously evaluated in the facility's existing analysis? Explain your answer below.	Yes	☐	No	☐

USQD Worksheet (SF 2001-USQ) – Section 2 - Seven Questions

5. Could the proposed change create the possibility of an accident of a different type than any previously evaluated in the facility's existing safety analyses? Explain your answer below. Yes ☐ No ☐

6. Could the proposed change create the possibility of a malfunction of equipment important to safety of a different type than any previously evaluated in the facility's existing safety analyses? Explain your answer below. Yes ☐ No ☐

7. Could the proposed change reduce a margin of safety? Explain your answer below. Yes ☐ No ☐

USQ Determination Summary:

If the answer to any question in Section 2, "*Unreviewed Safety Question Determination*" is YES, the proposed change involves an Unreviewed Safety Question. **Based on the evaluation above:**

☐ **This change does not involve an un-reviewed safety question.**

☐ **This change requests a Categorical Exclusion and NNSA/SSO approval is required** prior to implementation.

☐ **This change requests does involve an un-reviewed safety question (NNSA/SSO approval is required prior to implementation).**

Complete the cover sheet summary and sign completed worksheet.

USQD Worksheet - Seven Questions – General Guidance

- A common mistake is to try to answer most of the seven questions in one write-up rather than slanting each answer to the question it asks.
- The word “accident” in these questions should be interpreted to mean “hazard or accident” scenario.
- Enough information should be provided in the justification of each question being answered so that someone not familiar with the change can understand the safety significance of the change/discovery and the technical basis for why the questions were answered the way they were.

USQD Worksheet - Seven Questions – General Guidance

- Echoing back the question is not sufficient. Explanations should be provided that provide a sufficient basis for the answer provide consistent with the accidents and SSCs identified in Section 1.2.
  - i.e. in answering the questions, the set of safety basis documents, hazard scenarios and accidents, and SSCs should be a subset of what was described in Section 1.2.
    - Do not introduce new safety basis documents, hazard scenarios or accidents, or SSCs that were not described in Section 1.2.
- Questions overlap so do not be surprised if a “yes” for one question, triggers a “yes” for other similar questions.
- Explanations must consider the interim state as well as the end state.

USQD Worksheet - Seven Questions – General Guidance

- An affirmative answer to any of these questions may not mean there is a negative impact on safety.
- It would, however, indicate the existence of a USQ and the need for further analyses.

Write with the Reviewer in Mind

- Describe the change such that others reviewing the document as part of their oversight function can understand the intent and goal of the change.
- Present the change so that an engineer working at the site (not necessarily a co-worker) can understand the change and it's impact on the safety bases.
- The entire USQD should tell the story and be consistent from section to section.

Write with the Reviewer in Mind

- Avoid jargon.
- Explain terms when first presented.
- Spell out acronyms and abbreviations if to be used more than once. Include a separate, alphabetical listing if lengthy.
- Write in the active voice, not the passive.
- Use short sentences.

USQD Question 1- Increase in Accident Probability

1. Could the proposed change increase the probability of an accident previously evaluated in the facility's existing safety analyses?

Increase in probability of occurrence expressed as an increase in frequency (per year), or qualitatively.

USQD Question 1- Increase in Accident Probability

- Determine if the hazard or accident scenarios contained in the approved safety basis may be affected by the proposed change.

- Probability change estimates need only be as detailed as the original safety basis. If the DSA estimate was largely qualitative, the impact estimate should also be qualitative.

- Hazard scenarios and accidents discussed for this question should be consistent with Section 1.2.

USQD Question 1- Increase in Accident Probability

- By focusing on the accident initiators and credit taken for preventive controls, a determination is made as to whether there is an increased likelihood that a given hazard or accident scenario would occur.

- The following questions may provide a useful approach in making this determination.

USQD Question 1- Increase in Accident Probability

- Could the proposed change affect overall structures, systems, or components (SSC) performance in a manner that could increase the probability of a previously analyzed accident?
  - Could the proposed change employ instrumentation with accuracies or response characteristics that are different from those of existing instrumentation such that an accident is more likely to occur?
    - Change from a digital instrument with an accuracy range of ± 1% to one with an accuracy range of ± 10%.
    - Replacement of a check valve with a manually operated gate valve
    - Changing from instrumentation with a 1 second response time to instrumentation with a 10 second response time.
    - Changes to software associated with safety systems that changes the response characteristics of the system.

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USQD Question 1- Increase in Accident Probability

- Could the proposed change cause an SSC to be operated outside their design or testing limits, by any of the following?
  - Overloading an electrical system;
  - Over pressurizing a piping system;
  - Operating a motor outside its rated voltage and amperage;
  - Exceeding the weight limit on floor grating; and/or
  - Compromising the structural integrity of a design feature.

USQD Question 1- Increase in Accident Probability

- Could the proposed change cause system vibration, water hammer, fatigue, corrosion, thermal cycling, or degradation of the environment for SSC that would exceed the design limits? Examples include the following:
  - Changing pump size could cause system cavitation ;
  - Changing part material could cause corrosion or performance degradation; and/or
  - Changing system chemistry could lead to corrosion.

USQD Question 1- Increase in Accident Probability

- Could the proposed change cause a change to any SSC interface in a way that could increase the likelihood of an accident?
  - Would the change require more human intervention?
    - Change from an automatic valve to a manually operated valve
  - Would the change put more stress on supporting systems?
    - Increased cooling or electrical loads
  - Would the change make an interface work in a way different from its design?
    - Change from a passive design feature to an active SSC that requires support systems

USQD Question 1- Increase in Accident Probability

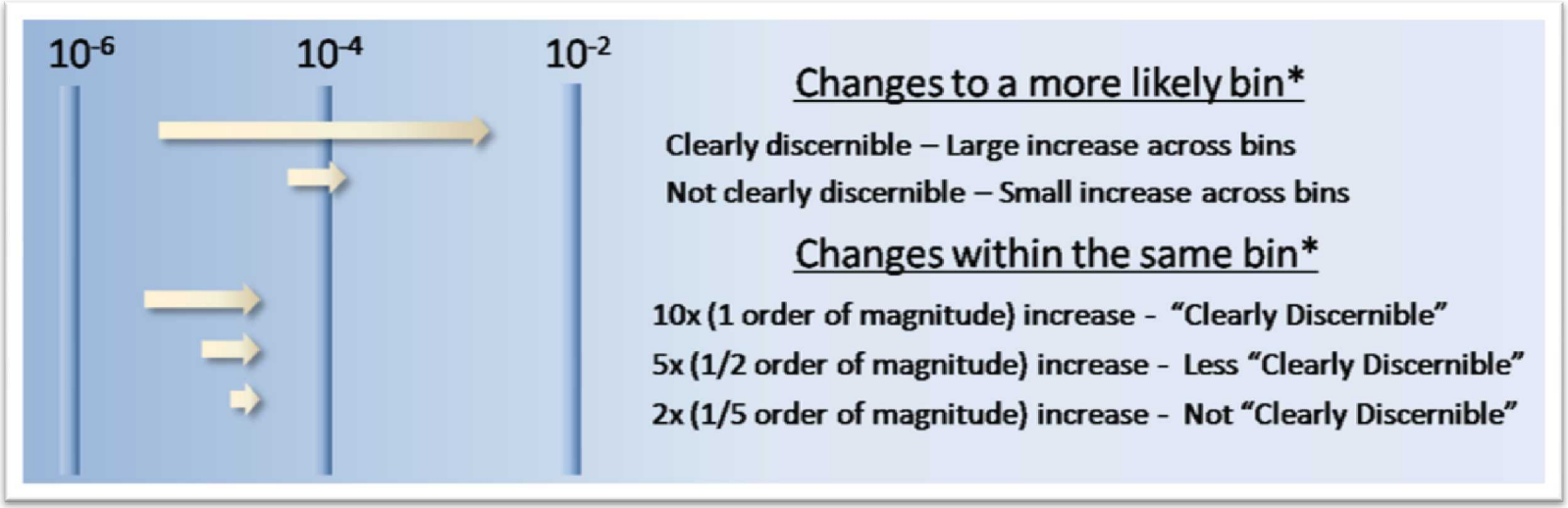
- The increase in probability may be expressed as a discernible, qualitative increase.
  - It is inappropriate to set a numerical margin for increases in probability within which a positive Unreviewed Safety Question Determination (USQD) would not be triggered.
  - Each situation must be evaluated on a case-by-case basis.

USQD Question 1- Increase in Accident Probability

- The Rule does not permit a numerical margin before which an increase constitutes a USQ, i.e., a "discernable increase."
  - The rationales for the USQ answers should be convincing to an independent reviewer that the change could result (or not result) in an increase.
    - DOE feels that with numerical margins a contractor could make many changes that individually would not violate the margins, but taken together over years could result in a massive increase in operational risk that DOE did not consciously accept and which was never documented in the safety basis.
    - Site-specific quantitative guidance that allows for a numerical margin are implicitly acknowledging that they have a USQ, when that margin is used to dismiss the question.
    - Finally, it would seem that if a contractor were to go to the extent of quantifying an increase in consequences or frequency, the contractor would have done all that would be required to prepare a USQD, and more.

From DOE G 424.1-1A, "Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements"

USQD Question 1- Increase in Accident Probability



* **These examples are used for illustrative purposes since use of a specific numerical margin is inappropriate. Engineering judgment should be used to consider the following factors on a case-by-case basis:**
  - **Frequency bin – An equivalent magnitude increase in a higher frequency bin is more clearly discernible**
  - **Conservatism used in the analysis – An equivalent magnitude increase for a less conservative analysis is more clearly discernible**
  - **Analysis uncertainty – An equivalent magnitude increase for an analysis with lower uncertainty is more clearly discernible**

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USQD Question 1- Increase in Accident Probability

- Question 1 is a probability question and is also targeted towards preventive controls.
- Method:
  - Identify the preventive controls (as identified in Section 1.2.c and 1.2.d) that were credited in the existing safety analysis that could potentially be impacted by the proposed change.
  - Determine if the proposed change would affect performance of control(s) in a way that might influence (increase) the probability of a previously analyzed accident.

USQD Question 1- Increase in Accident Probability – Special Case - HC3T (Barrier Analysis)

- Special consideration for barrier analyses (e.g. HC3T)
  - –Identify the hazard scenarios (as identified in Section 1.2.b) that might be impacted by the proposed change;
  - –Identify preventive barriers (as identified in Sections 1.2.c and 1.2.d) credited in the hazard scenarios;
  - –Evaluate impacts of the proposed change on the credited preventive barriers; and
  - –If proposed change removes or degrades a credited preventive barrier, the probability is considered to increase.

Question 1 - Example 1

- The proposed change being evaluated is to correct the radiological material content of one of the packages described in the DSA. The correction would result in an increase to the quantity identified in the hazard identification table.
  - How would you answer Question 1?

Question 1 - Example 2

- The proposed change is to reduce the surveillance frequency for a safety-significant SSC from “prior to each use” to “annually.”
  - How would you answer Question 1?

USQD Question 1 – Real Example 3

- "The procedures being modified are associated with updating information and providing additional clarification for operating procedures, and therefore, have the potential to affect unplanned operational transient scenarios.

However, the changes are limited to updating information and providing additional clarification. The proposed change does not alter or affect any accident initiators in the DSA by introducing or discontinuing practices which may increase the likelihood of an accident initiator or affect accident progression. The proposed change does not involve changing from automatic, equipment-initiated actions to manual operator actions. Therefore, the proposed change does not increase the probability of an accident previously evaluated in the DSA."

  - **Is this a good answer?**
  - **Why or why not?**

USQD Question 1 – Real Example 4

- "Facility X's DSA analyzes the following accident types: unplanned/excessive reactivity insertion, experiment malfunction. Loss of containment or confinement, inadvertent radiological exposure, inadvertent criticality, explosion, fire, and flood.

The DSA does not take credit for the cavity purge system for any analyzed accident or hazard scenario. The proposed change (relating to removal of a valve that is no longer in service) does not alter or affect any accident initiators in the DSA by introducing or discontinuing practices which may increase the likelihood of any accident initiators or accident progression. Therefore, the proposed change does not increase the probability of an accident previously evaluated in the DSA."

  - **Is this a good answer?**
  - **Why or why not?**

USQD Question 2 – Increase in Accident Consequences

- Could the proposed change increase the consequences of an accident previously evaluated in the facility's existing safety analyses?

consequences = exposure of people to hazardous materials, energy, or both

(includes both onsite and offsite personnel)

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Affecting Any Element of the Five Factor Formula Affects Consequences

Source Term = MAR x DR x ARF x RF x LPF

MAR = Material-at-Risk
DR = Damage Ratio
ARF = Airborne Release Fraction
RF = Respirable Fraction
LPF = Leak path Factor

IF the release mechanism is changed the

ARFs and RFs may increase;

- Fire to explosion

OR **the amount or type of material that can be released increases (MAR) ;**

OR **the amount of material actually impacted by the accident increases (DR) ;**

OR **a mitigative barrier is degraded or introduces a new leak path (LPF); then**

consequences could be increased.

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Equation from DOE-HDBK-3010-94

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USQD Question 2- Increase in Accident Consequence

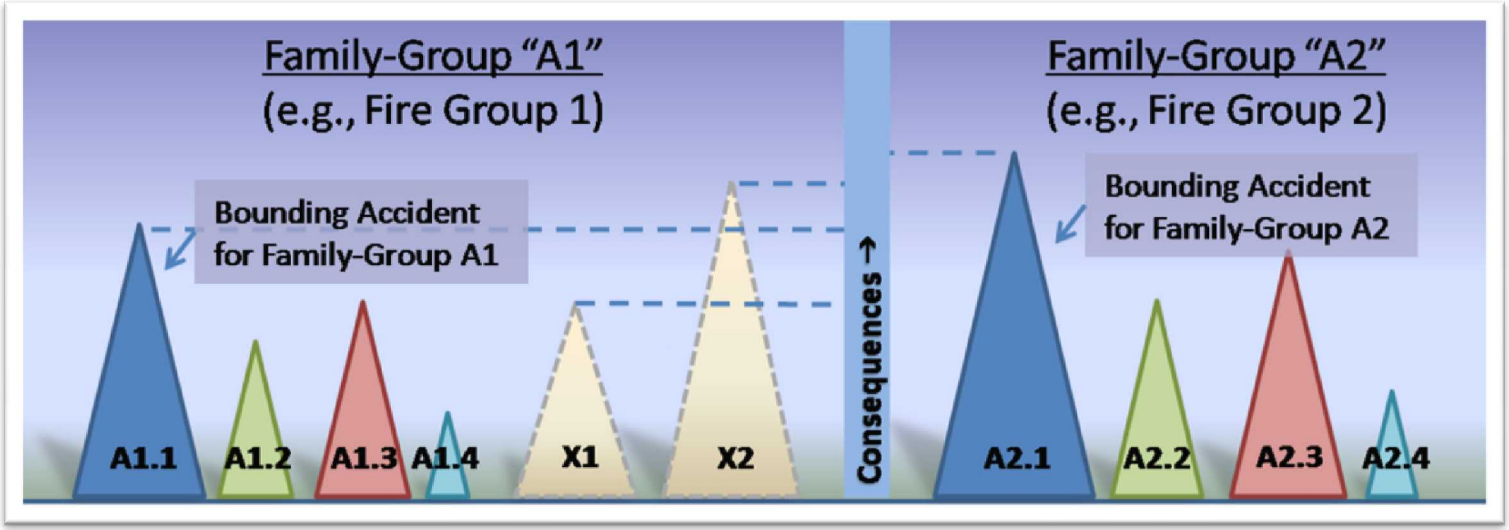
- The increase in consequence may be expressed as a discernible qualitative increase of the accident family
  - It is inappropriate to set a numerical margin for increases in consequence within which a positive Unreviewed Safety Question Determination (USQD) would not be triggered.
  - It is important that the family of accidents be related (the same type, fires, for example) and uses the same set of preventative measures and mitigation.
  - Each situation must be evaluated on a case-by-case basis.

USQD Question 2 – Increase in Accident Consequence

- The Rule does not permit a numerical margin before which an increase constitutes a USQ, i.e., a "discernable increase."
  - The rationales for the USQ answers should be convincing to an independent reviewer that the change could result (or not result) in an increase.
    - DOE feels that with numerical margins a contractor could make many changes that individually would not violate the margins, but taken together over years could result in a massive increase in operational risk that DOE did not consciously accept and which never got documented in the safety basis.
    - Site-specific quantitative guidance that allows for a numerical margin are implicitly acknowledging that they have a USQ, when that margin is used to dismiss the question.
    - Finally, it would seem that if a contractor were to go to the extent of quantifying an increase in consequences or frequency, the contractor would have done all that would be required to prepare a USQD, and more.

From DOE G 424.1-1A, "Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements"

USQD Question 2 – Increase in Accident Consequence



- If new consequences of proposed change are represented by X1, consequences are bounded by the bounding accident (i.e., A1.1 > X1)
- If new consequences of proposed change are represented by X2, consequences are not bounded by the bounding accident (i.e., X2 > A1.1)
- The fact that a different Family-Group may contain an accident of greater consequences (i.e., A2.1) is not relevant. This is also the case for groups from any other accident family (e.g., explosion, spill, criticality)

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USQD Question 2 – Increase in Accident Consequences

- Question 2 is a “consequence” question, targeting mitigative controls and controls to protect assumptions.
- Consequence change estimates only need be as detailed as the original safety basis. If the DSA estimate was largely qualitative, the impact estimate should also be qualitative.

USQD Question 2 – Increase in Accident Consequences - Method

- Determine which accidents evaluated in the safety analyses may have their radiological or hazardous material consequences altered as a direct result of the change.
- Consider consequences to Members of the Workforce (in-facility and outside, or collocated) as well as to the public.
  - Also consider unique and bounded hazard scenarios.
- Hazard scenarios and accidents discussed for this question should be consistent with Section 1.2.

USQD Question 2 – Increase in Accident Consequences - Method

- Questions that assist in this determination include:
  - Could the proposed change degrade or prevent safety functions described or assumed in the existing safety analyses?
    - Reduced HEPA filter efficiency
    - Hole(s)
    - ventilation system function
    - Reduced shielding capability
    - Affected confinement barrier

USQD Question 2 – Increase in Accident Consequences - Method

- Questions that assist in this determination include:
  - Could the proposed change alter any assumptions previously made in evaluating the radiological or hazardous material consequences in the existing safety analyses?
    - No explosives present
    - No fire potential
    - Tritium in non-oxidized form
    - Solid material versus powder
    - Temperature or duration of fire
    - Pressurized vs. non-pressurized releases

USQD Question 2 – Increase in Accident Consequences - Method

- Questions that assist in this determination include:
  - Could the proposed change affect the integrity or function of any fission product barrier or any radioactive or hazardous material barriers?
    - Degraded fuel cladding
    - Reduced shielding capability
    - Drum integrity
    - Others?

USQD Question 2 – Increase in Accident Consequences – Special Case HC3T (Barrier Analysis)

- Special considerations for barrier analyses (e.g., HC3T)
  - –Identify the hazard scenarios (as identified in Section 1.2.b) potentially impacted by the proposed change.
  - –Identify mitigative barriers (as identified in Sections 1.2.c and 1.2.d) credited in the hazard scenarios.
  - –Evaluate impacts of the proposed change on the credited mitigative barriers.
  - –Identify whether the changes increases the amount or type of hazardous materials present.
  - –Determine whether the change affects a release mechanism.
  - –If a proposed change removes or degrades a credited mitigative barrier, increases the amount of hazardous material, or causes a more severe release mechanism, the consequence could increase.

Question 2 - Example 1

- The proposed change being evaluated is to correct the radiological material content of one of the packages described in the DSA. The correction would result in an increase to the quantity identified in the hazard identification table.
  - How would you answer Question 2?

Question 2 - Example 2

- The proposed change being evaluated is to correct the analysis, reflecting the fact that stored drums contain material that has the potential to generate hydrogen.
  - How would you answer Question 2?

Question 2 - Example 3

- The proposed change is to reduce the surveillance frequency for a safety significant SSC from “prior to each use” to “annually”.
  - How would you answer Question 2?

Question 2 - Example 4

- The proposed change is to move ten (10) packages containing radiological material at a time. The accident analysis assumed that three (3) packages would be moved simultaneously.
  - How would you answer Question 2?

USQD Question 2 – Real Example 5

- "Facility X's DSA analyzes the following accident types: unplanned/excessive reactivity insertion, experiment malfunction. Loss of containment or confinement, inadvertent radiological exposure, inadvertent criticality, explosion, fire, and flood."

  "The DSA does not take credit for the cavity purge system for any analyzed accident or hazard scenario. The proposed change (relating to removal of a valve that is no longer in service) does not introduce any new material-at-risk to the facility. The proposed change does not alter any assumed damage ratios, pool release fractions, or leak path factors in the accident analyses. Therefore, the proposed change does not increase the consequence of an accident previously evaluated in the DSA."

  - **Is this a good answer?**
  - **Why or why not?**

USQD Question 2 – Real Example 6

- "The proposed change is limited to restructuring the Nuclear Facilities Safety Committee's (NFSC) charter and does not eliminate any of the NFSC's core responsibilities. The proposed change (related to the NFSC structure and procedures) does not introduce any new material-at risk to the facility and does not alter any assumed damage ratios, pool release fractions, or leak path factors in the accident analyses. Therefore, the change does not increase the consequences of an accident previously evaluated in the DSA."
  - Is this a good answer?
  - Why or why not?

USQD Question 3 – Probability of Equipment Malfunction

- Could the proposed change increase the probability of a malfunction of equipment important to safety previously evaluated in the facility's existing safety analyses?

ITS equipment = components directly or indirectly relied upon to reduce likelihood or consequence of an accident or to protect assumptions in the analysis.

ITS equipment may not be explicitly identified - Study the DSA and be aware of different ways in which existing equipment may be credited.

What is Equipment Important to Safety (ITS) ?

1. Equipment that acts to prevent or mitigate an accident discussed in the DSA.
2. Equipment that monitors or detects accident consequences discussed in the DSA.
3. Equipment, which if it malfunctions, adversely impacts either of the above.

Includes any equipment whose function can affect safety either directly or indirectly. This includes Safety Class and Safety Significant SSCs, and other systems that perform an important defense in depth safety function, equipment relied on for safe shutdown, and in some cases, process equipment.

From DOE G 424.1-1, "Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements"

USQD Question 3 – Probability of Equipment Malfunction

- The safety analysis for the facility assumes the proper functioning of ITS equipment in demonstrating the adequacy of design.
  - The proper functioning of other systems, including support systems, is generally assumed.
  - The scope of the USQ determination should include these systems.
  - If the change could potentially affect the functionality of ITS equipment, this information should be addressed.
- ITS equipment discussed for this question should be consistent with Section 1.2.

USQD Question 3 – Probability of Equipment Malfunction

- A change that does either of the following is a change that increases the probability of occurrence of a malfunction of equipment important to safety:
  - If it degrades the performance of a equipment important to safety assumed to function in the accident analysis to below the performance level assumed in the existing safety analyses. Examples are:
    - Reduced coolant flow
    - Reduced ventilation flow
  - If it increases the challenge to equipment important to safety assumed to function in the accident analysis such that performance is degraded below that assumed in the existing safety analyses. Examples are:
    - Overloading an electrical system
    - Over pressurizing a piping system
    - Operating a motor outside its rated voltage and amperage
    - Exceeding the weight limit on floor grating

USQD Question 3 – Probability of Equipment Malfunction - Method

- Determine which SSCs might be impacted by the proposed change. SSCs are identified in Sections 1.2.c and 1.2.d.
- Evaluate the direct and indirect effects of this change on ITS equipment.
  - Direct effects are those in which the change effects the equipment
    - a motor change on a pump
    - instrument inaccuracy causing equipment to shut off at a less conservative point
  - Indirect effects are those in which the change impacts one piece of equipment, which in turn can effect equipment important to safety.
    - One piece of equipment falling on an SSC.
    - Failure of a non-SSC causing a power failure to an SSC

USQD Question 3 – Probability of Equipment Malfunction

- Will the proposed change degrade ITS equipment reliability by any of the following?
  - Imposing additional loads not analyzed in the design
    - Exceeding the load capacity of an electrical power grid.
    - Exceeding the weight capacity of a grating.
  - Deleting or reducing system/equipment protection features
    - Disabling an automatic circuit breaker.
    - Disabling an overheat alarm .

USQD Question 3 – Probability of Equipment Malfunction

- Will the proposed change degrade ITS equipment reliability by any of the following?
  - Downgrading the support system performance necessary for reliable operation of the equipment
    - Reducing the capacity of a fire suppression system water supply
  - Reducing safety system/equipment redundancy or independence
    - Connecting two independent instruments to a common power supply

USQD Question 3 – Probability of Equipment Malfunction

- Will the proposed change degrade ITS equipment reliability by:
  - Increasing the frequency of operation of safety systems/equipment?
    - Changing a support system from on-demand to continuous operation.
  - Imposing increased or more severe testing requirements on safety systems/equipment?
    - Load testing a hoist to a level above design capacity.
  - Failing to meet the original design specifications for materials and construction practices?
    - Use of counterfeit bolts
    - Evidence of voiding in a shielding wall

USQD Question 3 – Probability of Equipment Malfunction – Special Case - HC3T (Barrier Analysis)

- Special considerations for barrier analyses (e.g., HC3T)
  - –Identify ITS equipment (barriers, as identified in Sections 1.2.c and 1.2.d).
  - –Evaluate impacts of the proposed change on equipment important to safety.
  - –If proposed change imposes conditions that prevent the equipment from meeting a safety aspect of its original design specification, or introduces unanalyzed stress or use conditions, the probability of a malfunction could increase.

USQD Question 3 – Example 1

- A trailer is pulled into the limited area to house a group of contractors who will be supporting a major modification to an adjacent facility. Power to this trailer is hooked into the main power grid for the facility.
  - How would you answer question 3?

USQD Question 3 – Example 2

- A process ventilation fan is changed from operating “on demand” to “continuous operation” during normal working hours.
  - How would you answer Question 3?

USQD Question 3 – Example 3

- A coolant line is re-routed to pass through a support equipment room instead of along the exterior of the building to prevent a freezing problem during winter.
  - How would you answer Question 3?

USQD Question 3 – Real Example 4

- "Facility X's DSA analyzes the following accident types: unplanned/excessive reactivity insertion, experiment malfunction. Loss of containment or confinement, inadvertent radiological exposure, inadvertent criticality, explosion, fire, and flood."

"The DSA does not take credit for the cavity purge system for any analyzed accident or hazard scenario. The proposed change (relating to removal of a valve that is no longer in service) does not introduce any new material-at-risk to the facility. The proposed change does not alter the fundamental operation of any important to safety SSC. The change is reducing the probability of malfunction by removing the active valve and making the passive ducting more rigid and sealed."

- **Is this a good answer?**
- **Why or why not?**

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USQD Question 3 – Real Example 5

- "The USQD was performed on a discovery condition that the recorded container sizes for a Hazard Category 2 facility did not match the actual container sizes in at least two cases. The original container sizes were derived from the Nuclear Materials Control and Accountability database associated with these containers. Because of the discrepancy between the DSA and the actual container size, a Potentially Inadequate Safety Analysis (PISA) was declared."

"The material content of the containers was correct. The container is a passive component and its size does not involve or impact any safety SSCs, equipment important to safety, or an interfacing and support system to the above mentioned SSCs. A container specific CSI is also a calculated index which does not have any interaction or impact on any equipment. Hence, this change does not change the probability of malfunction for any SSC."

  - **Is this a good answer?**
  - **Why or why not?**

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USQD Question 4 – Consequence of Equipment Malfunction

- Could the proposed change increase the consequences of a malfunction of equipment important to safety previously evaluated in the facility's existing safety analyses?

USQD Question 4 – Consequence of Equipment Malfunction

- Assume a malfunction of equipment important to safety - would the malfunction result in increased radiological or hazardous material consequences?
- For example:
  - An error is identified in the shielding calculation for a hot cell wall;
    - The wall is credited to protect the worker while material is being handled in the hot cell; and
    - The calculation error results in a higher radiation dose at a point 12 feet above the floor.

USQD Question 4 –Consequence of Equipment Malfunction - Method

- The first step is to determine which SSC could be potentially impacted by the proposed change. These SSCs are identified in Section 1.2(c) and 1.2(d).
- Next, the direct and indirect effects of this change on equipment important to safety are evaluated.
- Consider consequences to Members of the Workforce (in-facility and outside, or collocated) as well as to the public.

USQD Question 4 - Consequence of Equipment Malfunction - Method

- Examples of questions that assist in this determination:
  - Could the proposed change affect the amount of material available for release due to any malfunction of important to safety equipment?
  - Could the proposed change affect the integrity or function of any fission product barrier or any radioactive or hazardous material barriers mitigative barrier or control described or assumed in the existing safety analyses?
    - Container integrity is compromised creating the potential for more material to be present
  - Could the proposed change affect the form of any radiological or hazardous material assumed in the existing safety analyses?
    - Container integrity is compromised creating the potential for oxidized material

USQD Question 4 - Consequence of Equipment Malfunction – Special Case – HC3T (Barrier Analysis)

- Special considerations for barrier analyses (e.g., HC3T)
  - Identify equipment important to safety (barriers, as identified in Sections 1.2.c and 1.2.d).
  - Evaluate impacts of the proposed change on equipment important to safety.
  - If proposed change imposes conditions that prevent the equipment from meeting its original design specification, or introduces un-analyzed stress or use conditions, the consequence of malfunction could **increase**.
  - Additional items of concern: increased MAR, change in release mechanism

USQD Question 4 – Example 1

- A secondary ventilation line is connected into a cavity purge system vent conduit. Because of this connection, the air flow for the ventilation system is reduced by 15%.
  - How would you answer question 4?

USQD Question 4 – Example 2

- A shielding wall is identified as providing less effective protection than originally designed.
  - How would you answer Question 4?

USQD Question 4 – Example 3

- A coolant line is rerouted to pass through a support equipment room rather than running along the exterior of the building to prevent a freezing problem during winter.
  - How would you answer Question 4?

USQD Question 4 – Real Example 4

- The proposed change does not introduce any new material at risk to the facility, nor does it alter any assumed damage ratios, release fractions, or leak path factors in the accident analysis. Likewise, it does not impact the function or operation of any equipment ITS. Therefore, the change does not increase the consequence of a malfunction of equipment important to safety previously evaluated in the DSA.

  – Is this a good answer?
  – Why or why not?

USQD Question 5 – Accident of a Different Type

- Could the proposed change create the possibility of an accident of a different type than any previously evaluated in the facility's existing safety analyses?

Must involve a failure or initiator not considered in the DSA.

USQD Question 5 – Accident of a Different Type

- An accident or malfunction that involves an initiator or failure not considered in the nuclear facility's existing safety analyses is potentially an accident or malfunction of a different type.
  - Is a new accident family created? (i.e., explosions, pressurized releases, radiation exposures)

- Examples:
  - Explosive material is discovered to be present creating the potential for an explosive accident which was previously considered incredible.
  - A mass of fissile material exists that was not previously considered creating the potential for a criticality accident which was previously considered incredible.

USQD Question 5 – Accident of a Different Type

Certain accidents or malfunctions are not addressed in the nuclear facility's existing safety analyses because their effects are bounded by similar events with the same control sets that are analyzed. Bounding accidents are not a new type.

- DSA analyzes fire in room A
- Change results in a fire in room B becoming possible and as likely as fire in room A.
- Not a new type of accident
- Types of accidents are fire, explosion, spill, inadvertent criticality, etc.

USQD Question 5 – Accident of a Different Type - Method

- Identify and list the types (i.e., families) of accidents (as identified in Section 1.2.b) evaluated in the existing safety analyses.
- The types of credible accidents that the change could create can then be identified and listed.
- Evaluating the differences between the existing list of types of accidents with the newly generated list will determine the answer to the question.
- The accidents evaluated in the existing safety analyses are generally chosen to be bounding for a broad class of credible accidents. Thus, comparison of a new accident to the existing analyses may require referral to the underlying hazard analyses and associated control sets.

Question 5 – Example 1

- A mathematical error was discovered in the way that the amount of fissile material in a Hazard Category 3 facility was calculated. As a result, the quantity of fissile material present has the potential to form a critical mass.
  - How would you answer Question 5?

Question 5 – Example 2

- A radiological waste storage facility wishes to store additional containers of mixed waste material that were discovered in an outlying facility. The contents of the mixed waste containers are not fully characterized but have the potential to include volatile chemicals and small amounts of explosive materials.
  - How would you answer Question 5?

USQD Question 5 – Real Example 4

The USQD was to evaluate the effect of removing all packages at once from a facility rather than moving the facility inventory in multiple moves. Packages are moved onsite using approved transportation vehicles. Once the vehicles leave the facility, they are covered by a DOT analysis.

The Facility DSA analyzes fires and crushes. The proposed change does not introduce any factors (for example significant process changes in the packages being moved, etc.) that would introduce a new hazard or create an accident of a different type than those previously evaluated in the facility's safety analysis. The change only affects how many of the packages are being moved at one time.

- **Is this a good answer?**
- **Why or why not?**

USQD Question 6 – Malfunction of Equipment of a Different Type

- Could the proposed change create the possibility of a malfunction of equipment important to safety of a different type than any previously evaluated in the facility's existing safety analyses?

Could the change or as-found condition result in a failure mode of a different type?

USQD Question 6 – Malfunction of Equipment of a Different Type - Method

- Identify the types of failure modes (as identified in Section 1.2.e) of equipment important to safety that have been previously evaluated in the existing safety analyses and that would be affected by the change. These are identified in Section 1.2(e).

- Identify the types of failure modes that the change could create. These are also identified in Section 1.2(e).

- Comparing the existing list of types of failure modes with the newly generated list of the same can provide an answer to the question.

USQD Question 6 – Malfunction of Equipment of a Different Type - Examples

- Examples:
  - Relocating ITS equipment to a location where it could be flooded
  - Replacing mechanical control system for ITS equipment with an electronic control system
  - Replacing a centrifugal pump with an air driven diaphragm pump which can fail in a way that will atomize the pumped liquid through the pump's exhaust
  - Replacing a gauge used for a safety setting with a digital readout
- Note: You must address both existing equipment and equipment that might be present as a result of the change being evaluated.

Question 6 – Real Examples

1. The proposed change does not alter or impact the facility ITS equipment such that new failure modes are introduced. The proposed change does not add any new equipment. Therefore, there is no potential for a malfunction of a different type.

2. The proposed change relates to an administrative change to procedures and does not affect any equipment. Therefore, there is no potential for a malfunction of a different type.

3. The proposed change does not change how existing equipment is being used. Therefore, there are no new stresses on existing equipment introduced that might cause a malfunction of a different type. One new piece of equipment is introduced (document stand). However, the characteristics of this stand (metal, less than 60 pounds) are already considered in the existing analysis.

4. The change relates to allowing the use of two trucks instead of one. Both trucks are consistent with what was analyzed in the DSA. There is no new equipment introduced, other than that found in the original analysis.

- Are these good answers to Question 6?

USQD Question 7 – Margin of Safety

- Could the proposed change reduce a margin of safety?

This question deals with applicable margins of safety related to Department of Energy (DOE) approved DSA/safety analysis report (SAR) and/or technical safety requirement (TSR) documents.

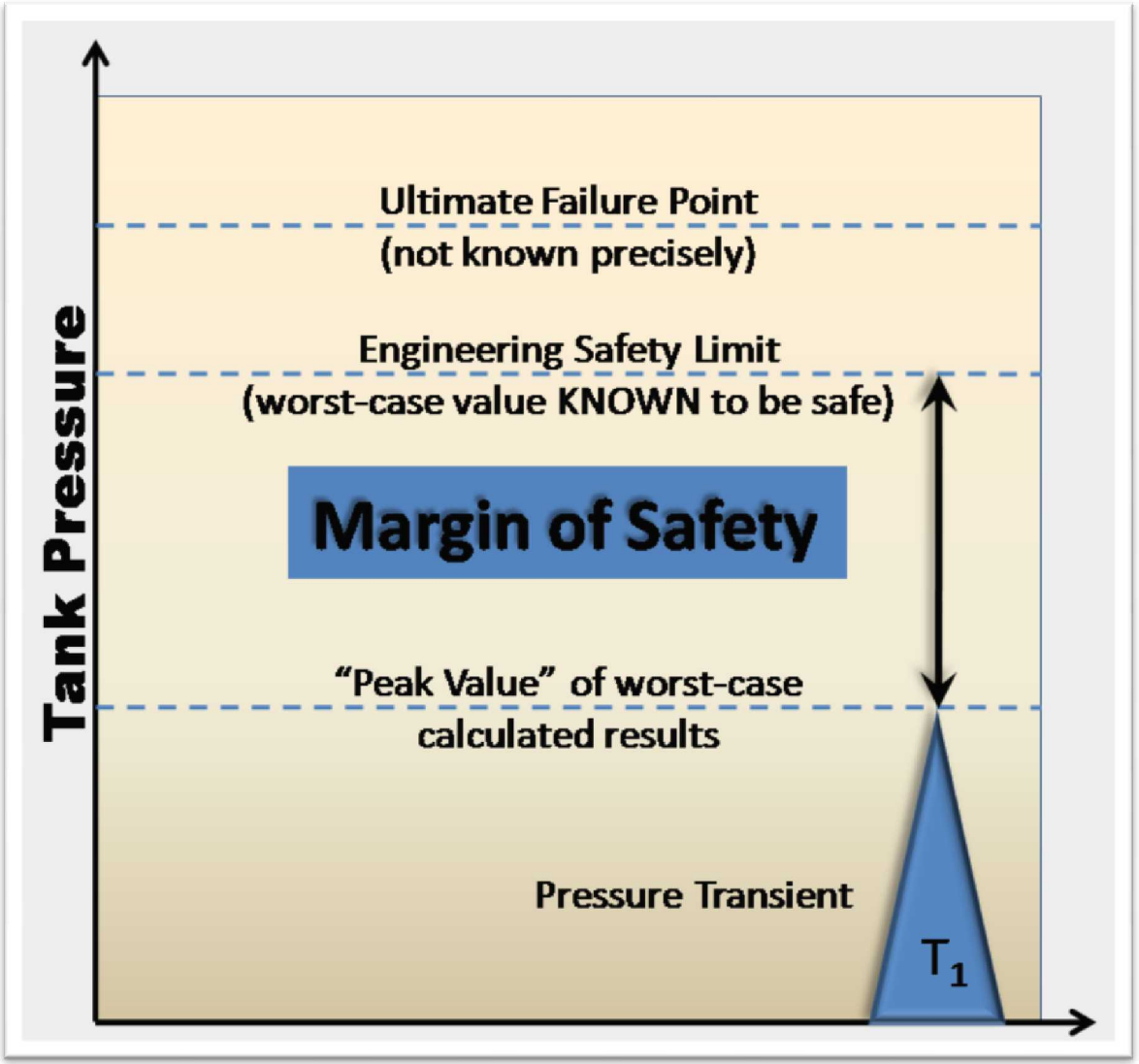
USQD Question 7 – Margin of Safety

- A margin of safety is defined by the range between two conditions:
  - The first is the most adverse condition estimated or calculated in the safety analyses to occur from an operational upset or family of related upsets.
  - The second condition is the worst-case value known to be safe, from an engineering perspective. This value would be expected to be related to the condition at which some accident prevention or mitigation action must be taken in response to the upset or accident, rather than the actual predicted failure point of some component.
- If an explicit bounding limit can not be determined from the DSA, it may be assumed to be the point at which the consequences in question are realized (the failure point).

USQD Question 7 – Margin of Safety

- The DSA and other appropriate safety basis documents should be reviewed to determine whether the proposed change, test or experiment, or new information has or would result in a reduction in a margin of safety.
  - The judgment on whether the margin is reduced should be based on physical parameters or conditions that can be observed or calculated.

USQD Question 7 – Margin of Safety



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USQD Question 7 – Margin of Safety

- When a change in margin is so small or the uncertainties are such that it cannot be reasonably concluded that the margin has changed (i.e., no clear trend toward reducing the margin) it is not considered a reduction in margin.

USQD Question 7 – Margin of Safety

- Compare the difference between the established acceptance limit and the bounding acceptance limit, as established by the DSA for the parameter in question.

What are Established Acceptance Limits?

SSC designated as Safety Class (necessary to protect public or environment) are to have associated TSRs to ensure operability. In accordance with DOE-STD-3009-94, safety class items may require the assignment of Safety Limits. As a minimum, safety class items should receive operational limits and administrative control coverage.

SSC designated as Safety Significant (worker protection or defense-in- depth) items do not require the assignment of Safety Limits, but may require the assignment of operational limits. As a minimum, safety significant items should receive administrative control coverage.

When the operational limits have been approved and put into the DSA, they become "established acceptance limits". Note that they may take the form of SLs, LCSs, LCOs, or certain ACs.

USQD Question 7 – Margin of Safety Example

- Piping system has a design pressure of 100 psig.
- Maximum pressure resulting from an accident is 93 psig.
- A change results in the peak pressure increasing to 97 psig.
- Is this a reduction in the margin of safety? It depends:
  - If DSA says all accidents will have a peak pressure less than or equal to 98 psig – “No” on question 7.
  - If DSA says maximum system pressure from an accident is 93 psig – “Yes” on question 7.

USQD Question 7 – Real Example 1

The margin of safety is defined by the range between two conditions. The first is the most adverse condition estimated or calculated in the safety analyses to occur from an operational upset or family or upsets. In this case, this is 10,000 ppb of ozone. The second is the worst case known value to be safe from an engineering perspective. The TSRs establish this value as 500 ppb. The facility procedurally controls the ozone concentration to less than 100 ppb. The introduction of an error of 23-50% in the reading of the ozone monitor could have resulted in a maximum concentration of 150 ppb, which is well below the lower limit of 500 ppb. This margin of safety was not affected by the potential mis-calibration.

- **Is this a good answer?**
- **Why or why not?**

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Question 7 – Real Example 2

- The proposed change does not alter any acceptance limits established in the safety analysis, and no new Material at Risk was added to the facility. Therefore, there is no reduction in the margin of safety.
  - Is this a good answer?
  - Why or why not?

Evaluation of Results

- If any of the seven questions is answered "yes," a positive USQD exists (a USQ exists).

- The existence of a positive USQD does not mean that the change is unsafe, only that DOE must take the final approval action.

From DOE G 424.1-1A, "Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements"

USQD Practice

- The dose to the public and the workers in the current DSA for Facility X was determined based on movement of the worst case package type. We now want to remove the entire remaining inventory in a single move. The amount of radioactive material to be moved in the single movement is 15% greater than the radioactive material evaluated in the HA for material movements. However, once this final move is accomplished, these hazards will be totally removed from the facility.

- The design basis accidents analyzed in the DSA include burning dispersal due to fire and radiological material release due to crush. There are no explosives present. A criticality accident was included in the analysis.

- The only equipment controlled by Sandia that performs a ITS function for this facility are an electric forklift, carts, hand trucks, and the containers themselves. There are no changes to this equipment.

- Prepare a USQD worksheet.

Lessons Learned on Preparing USQDs

- Incorrectly prepared USQDs could potentially allow changes to be made to the facility safety basis without the proper level of approval.
- Lessons learned address USQD worksheet requirements line-by-line.

Section Summary

- Describe the purpose of a USQD. ☑
- Identify lessons learned on completing the USQD worksheet by reviewing requirements question-by-question. ☑
- Prepare a sample USQD for a facility. ☑