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Criticality Safety Process Improvement at LLNL

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Criticality Safety Process Improvement at LLNL

- Process
- Recommendations
- Results

The Process

- In 2007 a formal Process Improvement (PI) effort was initiated for the Lawrence Livermore National Laboratory (LLNL) Criticality Safety (CS) Program.
- This PI initiative was one of many such initiatives commenced to consider a wide range of processes important to the Nuclear Materials Technology Program (NMTP) at LLNL.

CS Program PI followed a standard methodology

- NMTP management established a PI Leadership Team to oversee the process for all initiatives.
- Consultants from outside NMTP provided expertise and guidance.
- An individual PI Team was then chosen for each initiative area.
- The PI Team for the CS Program consisted of eight members including criticality safety engineers (two), fissile material handlers (three), facility managers (two) and a site regulator (one).

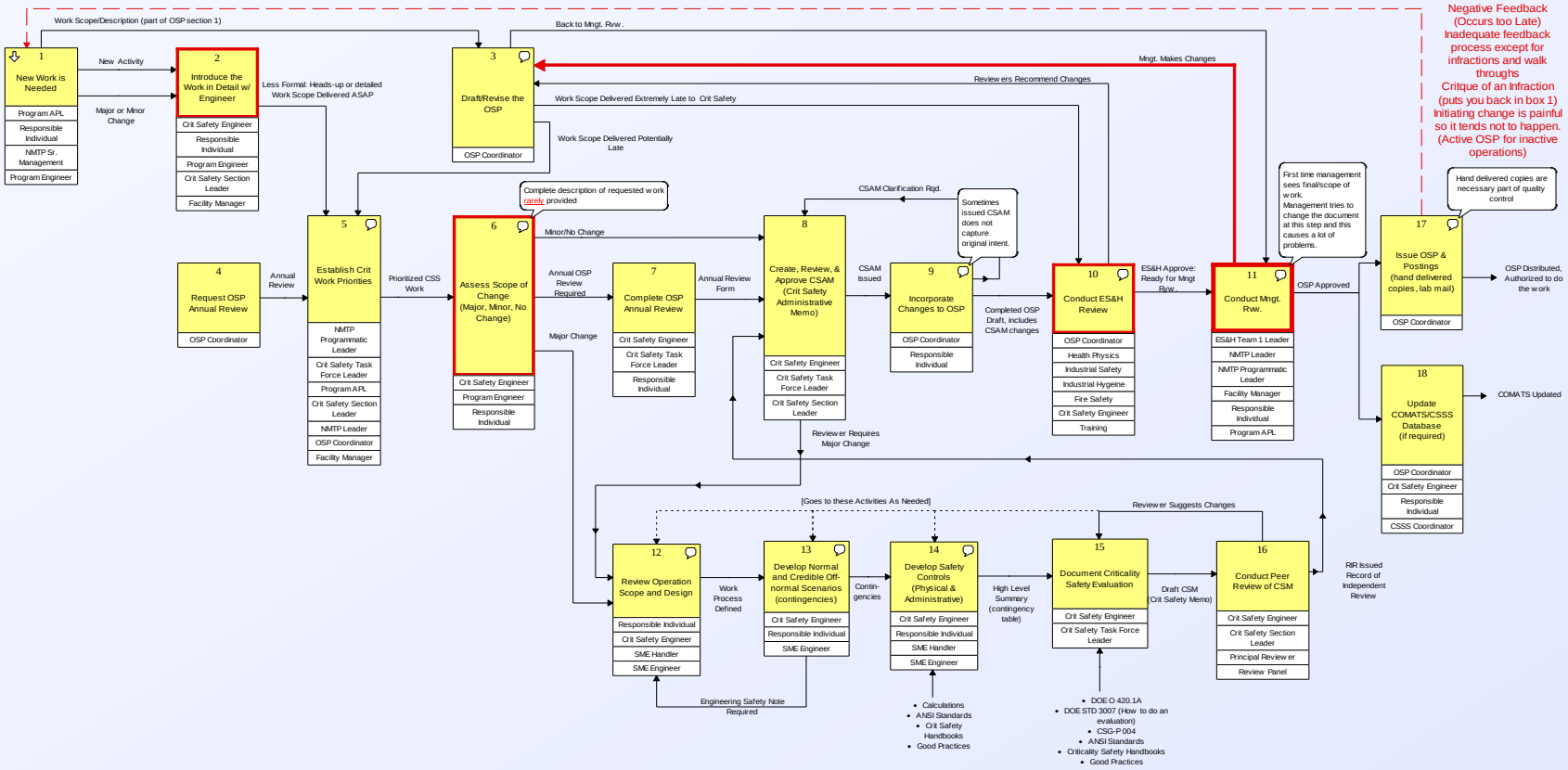
CS Program PI followed a standard methodology (cont.)

- One of the fissile material handlers was designated as the PI team leader.
- Consulting experts provided guidance and facilitation to the team, including initial training in the PI methodology.

The PI Team developed a detailed "map" of the criticality safety process support "as is"

- The initial map provided a detailed description of the existing steps required to provide criticality safety support for a programmatic activity.
- It started from a perceived need by the Program and ended with an approved safety document (Operational Safety Plan) including criticality safety controls.
- This map provided insight into how criticality safety support was provided and where the process was either efficient or inefficient.
- The PI team identified several problems (inefficiencies) and recommended potential solutions.

The PI Team developed a detailed "map" of the criticality safety process support "as is"



Recommendations

- The PI team for the CS Program identified several problems (inefficiencies) and recommended potential solutions.
- NMTP management assigned responsibilities for addressing these recommendations.
- Actions were taken and the recommendations were resolved.
- In response to changes in mission, some recommendations were modified and additional recommendations were identified and addressed.
- Thus, PI became an on-going process rather than a one-time effort.

Problem # 1

- Several inefficiencies were noted stemming from the lack of formality for initially requesting criticality safety support by Program staff.
  - Informality at this stage sometimes allowed incomplete or misunderstood input and resulted in later rework.
  - Program staff sometimes initiated a request for CS support without their management approval and support.
  - Sometimes management first saw a statement of work during the review phase, late in the support process, which then required rework.

Proposed Solution

- All of these inefficiencies would be improved by establishing a formal CS support request form which requires early management approval.

Results

- A formal CS Support Request Form was developed and implemented
- The form requires early management review and approval before criticality safety resources are assigned.
- The form guides the requester through a series of questions to provide initial information needed for the CS evaluation.
- This helps jump-start further discussions between Program staff and the assigned CS evaluator.

Results (cont.)

- The form is logged into a CS tracking system.
- The tracking system helps ensure that assigned work is completed according to priorities set by Program management.
  - Work status and priorities are formally reviewed weekly with Program management
- The tracking system also provides useful information for evaluating metrics on how well the process is working.

A formal CS support request form was implemented

Criticality Safety Evaluation Request Form

Directions for completing the Criticality Safety Evaluation Request:

1. **Complete the requester information on this form.**
2. **Attach the completed "Criticality Safety Evaluation Input Checklist" form.**
3. **Obtain the Associate Program Leader signature, signifying APL support and priority level for the request.**
4. **Give the completed form and checklist to the Criticality Safety Task Force Leader (CSTFL).**

To be completed by Requester

Facility_____ Project Title_____
Technical Contact _____ Phone # _____ Pager_____

Brief Description of Request:

Attachments:

Additional Information (i.e., due dates):

To be completed by responsible Associate Program Leader (APL) or designee

Requested CS Priority: A B C (High, normal, low priority)

Approval: _____ _____
Associate Program Leader or designee *Date*

To be completed by NMTP Criticality Safety Task Force Leader (CSTFL) or designee

Type of action requested:
□ Basic Annual Review □ Minor Change □ Major Change □ New Operation
□ Approved Item

(Request form and checklist are complete from Program & accepted by NCSD with approval below)

Request Approval: _____ _____
NMTP CSTFL or designee *Date*

CS Review is assigned as follows:

Tracking Number CSR-10-_____ CS Analyst _____ Date assigned _____
Notes:

CS_Evaluation_Request_Form_Version_1c Page 1

Guidance for Completing the
Criticality Safety Evaluation Input Checklist

The purpose of the criticality safety evaluation is to review an existing operation, a change to an existing operation, or a proposed new operation to ensure that adequate controls are in place to provide nuclear criticality safety.

In order for a criticality safety engineer to perform a criticality safety evaluation, appropriate information must be provided by the requesting program. The information required depends upon the nature and scope of the request. This checklist is intended to provide guidance to personnel who request a criticality safety evaluation. Fill out the checklist and provide the appropriate information according to the guidance, below. Criticality safety staff are available to help answer any questions concerning this process. Then, give the completed checklist and attachments to the Criticality Safety Task Force Leader.

For a new operation/OSP, please provide the following information:

- Room, Work-stations (if known), Responsible Program, OSP title & number (if known), Responsible individual/POC
- Description of workstation(s). Drawings of the glove box(es) are preferred.
- Description of the operations (e.g. "Scope of Work" for OSP).
- Description of approved items (if appropriate)
- Description of equipment, including drawings of equipment to be used for processing fissionable materials.
- Description of processing containers.
- Are other fissionable material operations conducted in this area? If so, explain.
- Potential sources of neutron moderator/reflector materials (e.g. water lines, closed-loop cooling system, hydraulic fluids, other liquids, molds/crucibles, close-fitting materials, etc.).
- Requested criticality safety controls (e.g. SCCCs)
- What could go wrong? (i.e. credible upset situations which could affect criticality safety)

For an annual review of an approved operation/OSP, please provide the following information:

- Provide the OSP, including any proposed changes
- Provide any information listed in the previous section ("For a new operation/OSP"), which applies to the proposed changes

For changes to an existing operation/OSP (including requests to add an approved item), please provide the following information:

- Provide requested changes to the operation/OSP
- Provide any information listed in the previous section ("For a new operation/OSP"), which applies to the proposed changes

Page 2

A formal CS support request form was implemented

Criticality Safety Evaluation Input Checklist

Fill out the checklist and provide the appropriate information according to the guidance on the previous page. (The checklist is provided for guidance and may not encompass every issue applicable to the criticality safety review.)

Attach additional information, documents, drawings, etc., as appropriate.

Do not include classified information on (or attached to) this form. Reference appropriate classified documents and provide them, if necessary, separately per LLNL rules.

Facility_ _ _____ Project Title_ _____
Technical Contact _ _ _____ Phone # _ _____ Pager_____

Check the box if information is provided or attached. Attach to this form any additional unclassified information, documents, drawings, etc., as appropriate.

☐ **Provide the following Basic information**
Building:
Room:
Work-stations (if known):
Responsible Program:
OSP title & number (if known):

☐ **Description of workstation(s). (Drawings of the glove box(es) are preferred.)**

☐ **Description of the operations (e.g. "Scope of Work" for OSP) including;**
- Form, quantity and enrichment of fissionable materials. (What comes in, how does it change, and what goes out as product)
- Form and quantity of liquids or other moderators. To what extent are fissionable materials mixed with other materials, including moderators?
- Flow of the material through the process. What is done to the material including changes to the material.
- What are the wastes/residues of the process?
- Where does fissionable material go after this operation? (e.g. OSP or workstation)
- How is it packaged?

Page 3

Check the box if information is provided or attached. Attach to this form any additional unclassified information, documents, drawings, etc., as appropriate.

☐ Description of approved item(s), if appropriate. Material composition and geometry, including dimensions, is required. (Drawings are preferred. Do not include classified information on (or attached to) this form.)

☐ Description of equipment, including drawings/sketches/photos of equipment to be used for processing fissionable materials. What equipment or fixtures may provide neutron reflection? (e.g. molds, crucibles, specialized containers, shielding, nearby walls, etc.)

☐ Description of processing containers. (Drawings and/or pictures, if available.)

☐ Are other fissionable material operations conducted in this area? (e.g. adjacent workstations) If so, explain.

☐ Potential sources of neutron moderator/reflector materials (e.g. water lines, closed-loop cooling system, hydraulic fluids, other liquids, molds/crucibles, close-fitting materials, etc.).What volumes or masses are involved?

☐ Requested criticality safety controls (e.g. SCCCs)

☐ What could go wrong? (i.e. credible upset situations which could affect criticality safety such as credible over-mass upsets, moderator upsets, interactions with other materials, equipment or piping failures, etc.)

☐ Other useful information.

☐ Attach any necessary unclassified documents, drawings, etc.

Page 4

Problem # 2

- Facility procedures in some cases (especially Hazard Category 3 Facilities) required new criticality safety documentation even for cases which had been previously reviewed and approved.
  - This rework was very inefficient.

Proposed Solution

- Change the Facility procedures to recognize and allow previously approved work packages, as appropriate.
  - This would greatly reduce the amount of rework by criticality safety and facility staff in those facilities.

Results

- The CS requirements in Hazard Category 3 facility procedures were changed to recognize and allow continuing use of previously approved work packages, as appropriate.
  - This change greatly reduced the amount of rework by criticality safety staff and facility staff in those facilities.

Problem # 3

- A perception existed among Program staff and management that the number of different criticality safety controls, including standard criticality control conditions (SCCCs) and other workstation specific controls, had grown too large.

CRITICALITY SAFETY LIMITS

Workstation XXXX	CONDITION D
1. MATERIAL & FORM	
Pu any form	**2500 g**
or	
^{235}U any form	**3600 g**
2. MODERATORS	
Liquids and solids intermixed with fissionable material	**1 liter**
Liquids and solids not mixed with fissionable material	**2 liters**
3. REFLECTORS	
Cladding	**≤ 0.25 inches**
4. SHAPE	**Uncontrolled**

This is an aid for Fissile Material Handlers.
Complete controls are found in OSP 332.XXX

Proposed Solution

- Reduce the number of different controls in use to simplify work requirements and reduce the chance of errors by the fissile material handlers.
- A new set of SCCCs was proposed to replace the existing SCCCs currently in use in the Plutonium Facility.

Results

- Soon after the PI Team completed its work and issued its recommendations, LLNL began an inventory reduction program which will greatly reduce the total mass of fissile material at LLNL and change the mission of several facilities.
- The inventory reduction program impacted implementation of some of the PI recommendations.
- In particular, specific changes recommended to simplify the criticality safety controls became moot.
- Inventory reduction would remove the need for many of the recommended new controls, as well as many existing controls.

Modifying the PI Recommendations

- Criticality Safety staff worked with the Process Improvement Leadership Team to modify the original recommendations.
- Rather than adopt the proposed changes to the SCCCs, which would require significant effort with little long-term benefit, specific CS controls were identified and adjusted providing short-term improvements during the inventory reduction program.
- In the spirit of process improvement, new recommendations have been and continue to be identified in support of the changing LLNL mission, including:
  - Consolidating safety procedures in the Hazard Category 3 facilities into fewer, simplified procedures.
  - Greatly reducing the number of “approved items” by grouping them within bounding cases, and removing those no longer needed.
  - Identifying appropriate CS controls as the new facility missions are determined.

Summary

- Facility, Program and Criticality Safety management and staff continue looking for opportunities to improve the criticality safety program at LLNL.
- A recent “process improvement” team identified several potential improvements to better formalize the work request process, standardize identified operations, and simplify controls,.
- The PI team was composed of representative criticality safety engineers, program fissile material handlers , facility managers and a site regulator.
- Implementing recommendations from the PI team has improved the efficiency of the criticality safety program and simplified the criticality safety support process.
- Process Improvement has become an on-going process as part of the Criticality Safety Program.