OAK RIDGE National Laboratory

Nuclear Criticality Safety Repository, LFE Database, and the NDA Program

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2024 NCSP Technical Program Review
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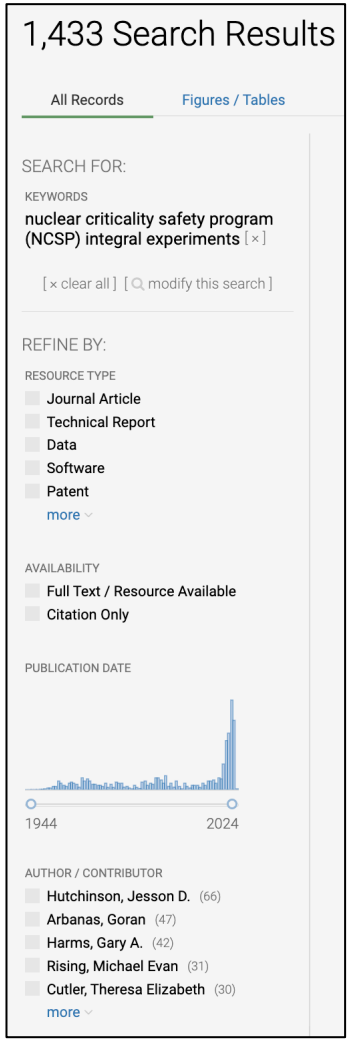
U.S. DEPARTMENT OF ENERGY

Nuclear Criticality Safety Repository (ORNL IPD3)

- This was a new task for FY2022
- Task conceived at the 2019 TPR in Santa Fe, NM
  - NCSP discussions about the difficulties of finding NCS-related documents on the NCSP website and OSTI.gov
  - NCSP website was not intended as a document repository
- OSTI is a specialized repository for this document collection.
  - All documents in the collection are meant to be unlimited in distribution and publicly releasable
  - Many sites do not send their documents to OSTI, at least right away
- Phase I
  - ORNL/OSTI are working together to ensure all products generated with NCSP funds are stored at OSTI, along with improved metadata to make the documents easier to find
  - NCSP GUI idea abandoned after a meeting with OSTI at multiple sites; some funding provided back to NNSA HQ for use elsewhere
- Phase II
  - Legacy documents from the Howard Dyer library and those listed in the LLNL Bibliography, LLNL-TR-760080 list legacy NCS documents
  - These documents will be searched for in the OSTI repository and metadata enhanced
  - Those documents that cannot be found will be considered for the OSTI repository
    - Depends upon documentation that can be found regarding approval for unlimited release

NCSP
NUCLEAR CRITICALITY SAFETY PROGRAM



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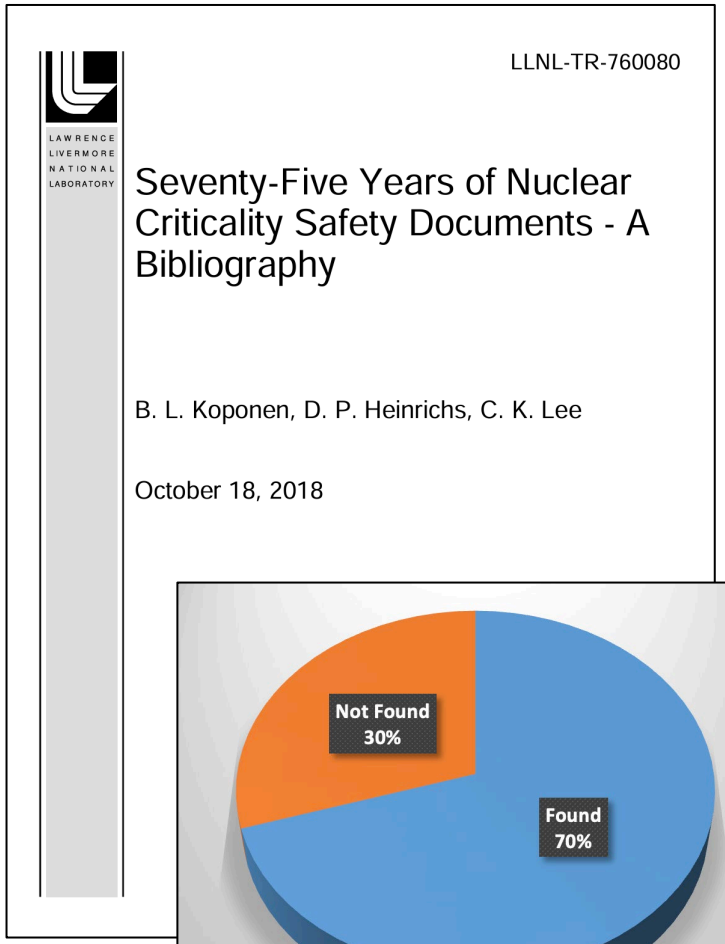
Nuclear Criticality Safety Repository (ORNL IPD3)

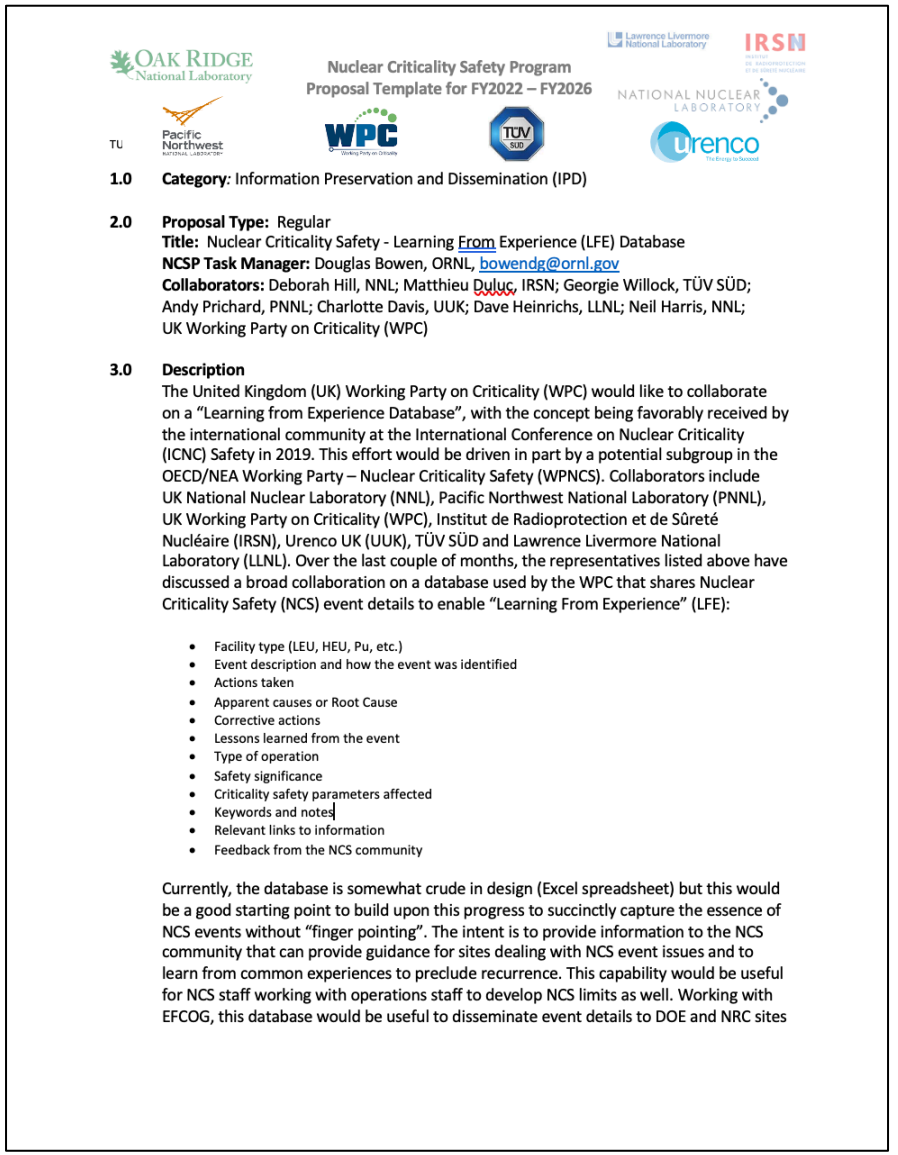
- FY2023 work focused on
  - Sending funds to OSTI via Purchase Order
  - Marsha Henley started working on providing NCSP deliverables to OSTI for FY20-FY22 provided by sites each quarter
  - LLNL Bibliography record search
    - 19,134 records examined
    - 13,432 records were found in the OSTI repository
      - Metadata enhanced for more effective search
    - 5,702 records not found in OSTI.gov
      - Most of these records were determined to be:
        - Classified documents
        - Conference proceedings
        - Critical experiment logbooks
        - Technical reports not cleared for external release
          - A review of these records resulted in the determination that the documents are of limited use to the NCS community
          - These documents could be found via request to the NCSP management team in NCSP document repositories (LLNL or ORNL)



Howard Dyer Library @ ORNL

Learning from Experience Database (LFE) (ORNL IPD4)

- The LFE was favorably received by the international community at the International Conference on Nuclear Criticality (ICNC) Safety in 2019
- The Nuclear Criticality Safety Program (NCSP) has funded a task in collaboration with multiple domestic and international partners
- Collaborators include:
  - Oak Ridge National Laboratory (ORNL) and Lawrence Livermore National Laboratory (LLNL) (Nuclear Criticality Safety Program)
  - UK National Nuclear Laboratory (NNL)
  - UK Working Party on Criticality (WPC)
  - Institut de Radioprotection et de Sûreté Nucléaire (IRSN)
  - Urenco UK (UUK)
  - TÜV SÜD



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Nuclear Criticality Safety Program
Proposal Template for FY2022 – FY2026

TU | Pacific Northwest NATIONAL LABORATORY | WPC Working Party on Criticality | TÜV SÜD | urenco The Energy to Succeed

1.0 **Category**: Information Preservation and Dissemination (IPD)

2.0 **Proposal Type:** Regular
Title: Nuclear Criticality Safety - Learning From Experience (LFE) Database
NCSP Task Manager: Douglas Bowen, ORNL, bowendg@ornl.gov
Collaborators: Deborah Hill, NNL; Matthieu Duluc, IRSN; Georgie Willock, TÜV SÜD; Andy Prichard, PNNL; Charlotte Davis, UUK; Dave Heinrichs, LLNL; Neil Harris, NNL; UK Working Party on Criticality (WPC)

3.0 **Description**
The United Kingdom (UK) Working Party on Criticality (WPC) would like to collaborate on a "Learning from Experience Database", with the concept being favorably received by the international community at the International Conference on Nuclear Criticality (ICNC) Safety in 2019. This effort would be driven in part by a potential subgroup in the OECD/NEA Working Party – Nuclear Criticality Safety (WPNCS). Collaborators include UK National Nuclear Laboratory (NNL), Pacific Northwest National Laboratory (PNNL), UK Working Party on Criticality (WPC), Institut de Radioprotection et de Sûreté Nucléaire (IRSN), Urenco UK (UUK), TÜV SÜD and Lawrence Livermore National Laboratory (LLNL). Over the last couple of months, the representatives listed above have discussed a broad collaboration on a database used by the WPC that shares Nuclear Criticality Safety (NCS) event details to enable "Learning From Experience" (LFE):

- Facility type (LEU, HEU, Pu, etc.)
- Event description and how the event was identified
- Actions taken
- Apparent causes or Root Cause
- Corrective actions
- Lessons learned from the event
- Type of operation
- Safety significance
- Criticality safety parameters affected
- Keywords and notes
- Relevant links to information
- Feedback from the NCS community

Currently, the database is somewhat crude in design (Excel spreadsheet) but this would be a good starting point to build upon this progress to succinctly capture the essence of NCS events without "finger pointing". The intent is to provide information to the NCS community that can provide guidance for sites dealing with NCS event issues and to learn from common experiences to preclude recurrence. This capability would be useful for NCS staff working with operations staff to develop NCS limits as well. Working with EFCOG, this database would be useful to disseminate event details to DOE and NRC sites

Learning from Experience Database (LFE)

- We proposed a broad collaboration on a database used by the WPC that shares Nuclear Criticality Safety (NCS) event details to enable "Learning From Experience" (LFE):
  - Facility type (LEU, HEU, Pu, etc.)
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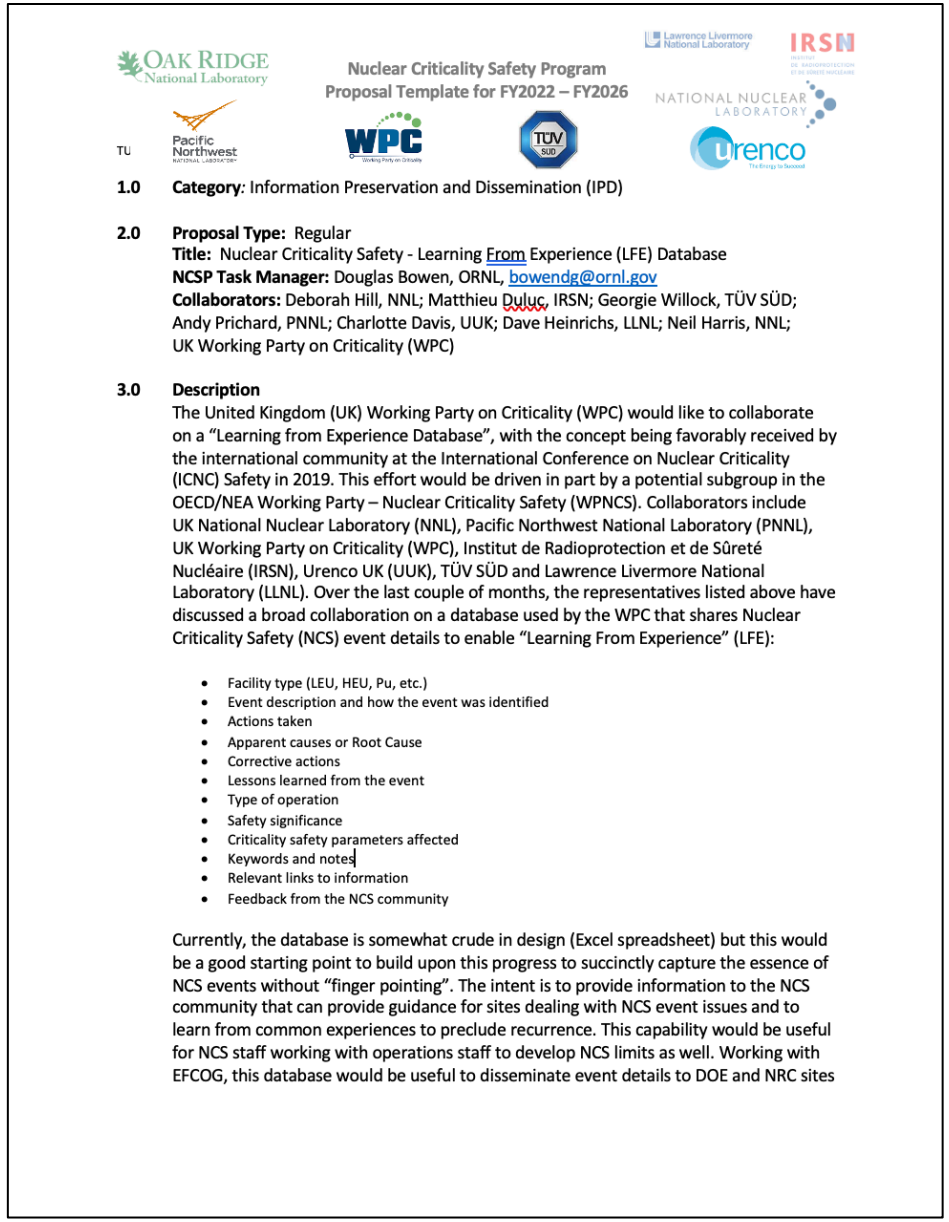
  - Keywords and notes
  - Relevant links to information
  - Feedback from the NCS community
- Task is to take an Excel spreadsheet with this info and share with the NCS community
  - NCSP Website was chosen as a possibility
  - Site ambiguous, i.e., no finger pointing



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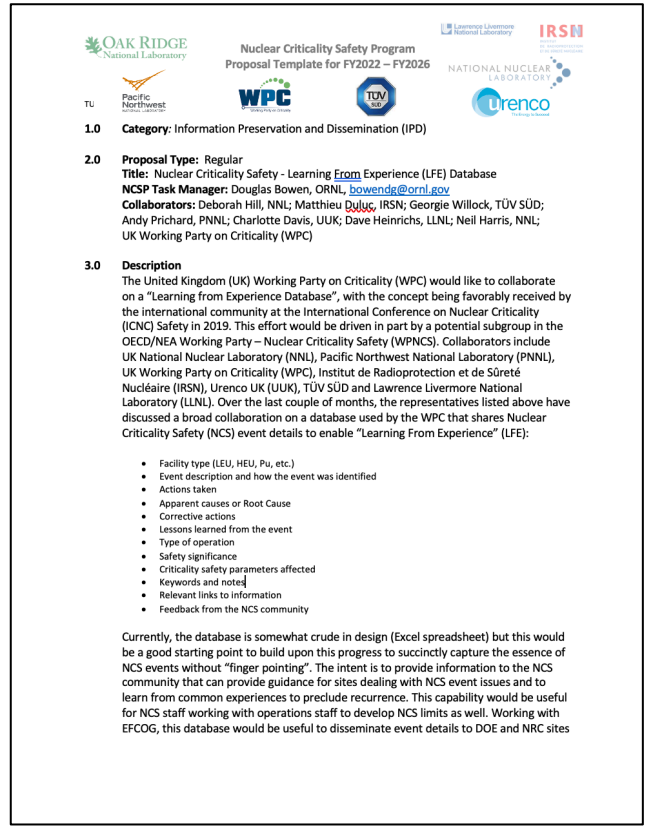
Learning from Experience Database (LFE)

- The intent is to provide information to the NCS community that can provide guidance for sites dealing with NCS event issues and to learn from common experiences to preclude recurrence
  - ANSI/ANS-8.1-2014, Section 4.1.5, ANSI/ANS-8.19-2014, Section 8.7, ISO 14943-2004, Section 3 and ISO 1709-2018, Section 4.7, require NCS staff, operations staff, and institutional management to research event deviations and to take actions to prevent their recurrence. In the words of ISO 1709-2018, Section 4.7 "Processing Violations"
- The NCSP program and website are very stable to allow for sharing this information with the NCS community
- Information is to provided to ORNL for review prior to requesting that LLNL update the LFE database on the NCSP website
  - Efforts will be taken to ensure event details are publicly releasable before being added to the database and information added to the database will be promulgated via EFCOG during monthly phone calls

"Processing violations and unusual occurrences shall be reported, analyzed, and considered for possible improvements in nuclear criticality safety practices"



OAK RIDGE National Laboratory

Nuclear Criticality Safety Program
Proposal Template for FY2022 – FY2026

Lawrence Livermore National Laboratory · IRSN · NATIONAL NUCLEAR LABORATORY · Pacific Northwest NATIONAL LABORATORY · WPC · TÜV SÜD · urenco

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Learning From Experience (LFE) Database

Information Preservation

- ICSBEP History
- **Learning From Experience (LFE) Database**
- LFE Database
- NCSP OSTI Search Instructions
- Request ICSBEP Handbook

Introduction

This database is for the recording of Learning from Experience (LFE) relevant to the activities of members of the UK Working Party on Criticality (WPC).

User Guide

Populate a new row with the LFE Entry. For a number of fields, entries can be selected from a drop down list; manual entry can also be used on these fields. For cells where a drop down can be used and an option is not present, you can add an option in the categories tab. Please inform the LFE Coordinator of any changes.

Guidance on individual fields:

- **ID**: Insert next sequential number; this must be unique.
- **Facility Type**: Select type of facility from drop down menu or manual entry e.g. Reactor, Fuel Cycle Facility, Storage/Waste/Repository or 'Office' based.
- **Description of Event**: Summary of the event.
- **Actions Taken**: Describe initial and subsequent actions taken following event.
- **Apparent Cause(s)**: Select cause from drop down menu or manual entry e.g. Human Error, Maintenance, Equipment Failure or Incorrect Assumption.
- **Root Cause**: Description of identified root cause.
- **Lessons Learnt**: Description of lessons learnt from event.
- **Type of Operation**: Select type of operation from drop down menu or manual entry e.g. Test/Trial/Experiment, Commissioning, Operations, Maintenance/Shutdown, Decommissioning or Emergency Planning/Recovery.
- **Safety Significance**: Select safety significance from drop-down menu e.g. Near Miss, Criticality, Technical Breach, Degradation in Defence in Depth, Insignificant or Rework.
- **Criticality Safety Parameters Affected**: Select criticality safety parameter from drop down menu or free text for multiple parameters e.g. Mass, Absorption, Geometry, Interaction/ Spacing, Concentration/ Density, Moderator, Enrichment, Reflection, Volume, Temperature, CWS/CASS or other.
- **Keywords**: Enter any relevant keywords to assist in searching for events.
- **Notes**: Free text to add any additional, useful information.
- **Links**: Insert any relevant file links.
- **WPC Member Feedback**: Free text.

LFE Coordinator Role

The role of the WPC LFE Coordinator (i.e. a WPC development role) is to:

- Sanity check entries in the WPC LFE database to correct / prompt the update of any issues with entries on the database (such as classification)
- Disseminate key learning which arises on the database to the WPC Membership in a timely fashion (checking with the Vice-Chair first)
- Prompt members to populate the database if entries are not forth coming (asking for the support of Vice-Chair if requests go unanswered)
- Ensure key international learning events disseminated to the WPC membership are added to the database
- Determine the most appropriate metrics to by which to assess WPC LFE data
- Perform a yearly review of the entries and undertake a trending analysis which best showcases the content of the data
- As part of this yearly review, the workability of the database's infrastructure should also be examined (e.g. the spreadsheet and associated guidance) to identify any potential improvements.

The role of the WPC Vice-Chair vis-à-vis the WPC LFE Coordinator is to:

- Provide support in the form of advice as requested by the WPC LFE Coordinator
- Provide guidance WPC LFE Coordinator on which events are worthy of being classed as Key Learning for immediate dissemination.
- Help encourage action from WPC membership as required
- Review trending analysis drafted by the WPC LFE Coordinator, provide guidance and report back to the WPC if the WPC LFE Coordinator is unavailable to do so
- Maintain a high-level overview of the LFE work and conduct regular "health checks" of how the process is going

Database

Developed by: M. Savage, G. Willock, B. Philpotts, D.A.Hill, M. Erlund, A. Till, A. Brown.

Disclaimer

The statements, views and opinions presented in this document are those of the authors and do not necessarily reflect the view of the WPC. The WPC does not guarantee the accuracy of the information provided or its fitness for any purpose. **Use of the information is strictly at the user's own risk. Any commercial markings must be respected.**

Show 10 entries

Search:

LFE ID	Facility Type	Description of Event	Immediate Actions Taken	Method of Resolution	Apparent Cause(s)	Root Cause	Lessons Learnt	Type of Operation	Criticality Safety Parameters Affected	Keyword(s)	Further Information	Links	Member Feedback #1	Member Feedback #2	Member Feedback #3
1	Fuel Cycle Facility	EFCOG:Uranium Accumulation in Casting Furnace	Material was cleaned out & whole set of Corrective Actions (see ORPS report)		Natural build-up over time	Assumptions about uranium accumulations in the casting process did not align with operations in the field	Need to understand process you are assessing - view it in action	Operations	Mass	Furnace, accumulation, hidden		08-03-18_Notification_ORPS.pdf			
2	Storage/ Waste/ Repository	EFCOG:Storage of Materials Above Height of CAAS Analysis Assumptions (On Top of a Cabinet)	Material immediately relocated		Human Error	Unknown - possibly lack of awareness of CAAS assumptions ?	None given - but presumably lessons for (i) training / briefing, and (ii) investigate whether height restriction is required	Emergency Planning/ Recovery	CWS/ CAAS	Storage, CAAS, stacking		08-21-18_Notification_ORPS.pdf			
3	Fuel Cycle Facility	EFCOG:Accumulation of fissile material in sand separator	Operations stopped following NDA determination of non-trivial fissile quantities in sand separator		Hydraulic line leak	Design flaw which enabled oil leaks to the non-safe geometry sand separator	None given - but presumably lessons for (i) design, and (ii) hazard identification.	Operations	Mass ; Geometry	Hydraulic, NDA, Glovebox		06-02-17_Notification_ORPS.pdf			
4	Fuel Cycle Facility	EFCOG:Samples inputted on the wrong inventory system	Operations stopped to rectify issue		Human Error	Unknown - but believed to be different parts of the same Inventory sheet	Unknown	Operations	Mass	Inventory, software		06-09-17_Notification_ORPS.pdf			
5	Fuel Cycle Facility	EFCOG:Over pressurisation of domestic water supply resulting in multiple facility leaks	Unknown		Human Error	Isolation activities in a different facility knocked onto main facility	Many creative ways that water can leak from systems	Operations	Moderator	Water, leak, over pressurisation		08-10-17_Notification_ORPS.pdf			
6	Storage/ Waste/ Repository	EFCOG:Non-conservative assumption about concentration of product solution entering steam condensate isolation unit	Unit taken out of service & will not be operated until issue has been resolved		Incorrect assumption	Lack of understanding of process	None given - but presume lessons regarding a full understanding of the process	Operations	Concentration/ Density	Response, steam, dissolver		04-25-19_Notification_ORPS.pdf	Very useful and applicable learning		

NCSP NDA Program (ORNL TS13)

- NDA program is a continuation of the DNFSB 2007-1 Recommendation
- FY2023 funding – $80k
- Mission and Vision document published in FY2021
  - ORNL/TM-2021/2009 "Nondestructive Assay Technical Infrastructure Program Mission and Vision"
  - https://nda.llnl.gov/sites/nda/files/2022-07/ORNL_TM-2021_2009_NDA_Mission_and_Vision-FINAL.pdf
- Due to limited funding in FY23, the following task were supported
  - ORNL Nonproliferation Division successfully executed a Uranium Holdup Measurements Course at ORNL September 11-14, 2023
    - 17 students completed the course
    - Significant modifications were made to the course materials to prepare for the course - mostly NCS information about SNM holdup in processes
  - Bowen supported the revision of the ANSI/ANS-8.28 standard for NDA administrative requirements in NCS programs
    - Should be published by the end of March 2024

Course photo from Sept. 2023

Information about DNFSB 2007-1 Recommendation:
https://www.dnfsb.gov/board-activities/recommendations/safety-related-situ-nondestructive-assay-radioactive-materials

Information about SNAPSHOT:
https://www.ornl.gov/technology/80000049

Discussion & Feedback On the LFE Concept