Safety Improvement Through Lessons Learned

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Outline

SRNL Commercial

Examples of Lessons Learned Implementation

- Dimethylmercury Fatality
- CO₂ / Acetone Container Over-Pressurization
- Smoldering Trash Can
- Whip Arrester

Summary
Develop and Deploy Technology for Complex One-of-a-Kind Projects

Tritium Processing Facility

Defense Waste Processing Facility

Tritium Extraction Facility

Materials Science

FB-Line

BritePrint™
SRNL R&D Portfolio Elements

National and Homeland Security
- Tritium Technology
- Plutonium Technology
- Homeland Security Support
- Non-Proliferation Technology
- Law Enforcement

Energy Security
- Hydrogen Storage Technology
- Production of Hydrogen
- Global Nuclear Energy Partnership
- Renewable Energy Research

Environmental Management
- EM Corporate Laboratory
- Materials Stabilization and Disposition
- Cleanup Technologies
SRNL Physical Facilities

Full Range of Capabilities Supporting Varied Missions – 600,000 sq. ft. total

- **High Level Cells**
  - 10,000 sq. ft.
  - Highly Radioactive
  - Large Quantity SNM
  - High Sensitivity
  - Gaseous Tritium
  - Environmental Remediation
  - Analytical/Metallurgical Labs
  - Instruments/Mock-up Labs

- **Gloveboxes**
  - 10,000 sq. ft.

- **Nonproliferation Mass Spectrometer**
  - 20,000 sq. ft.

- **Bioremediation Labs**
  - 25,000 sq. ft.

- **Measurement Systems**
  - 35,000 sq. ft.

- **Remote Systems/Instruments**
  - 77,000 sq. ft.

- **Metal Hydride Labs**
  - 15,000 sq. ft.
Laboratories Injury Statistics - 2009

National Laboratory Injury & Illness Data
Per 200,000 Hours Worked, CY 09
Note: Data obtained from DOE Computerized Accident/Incident Reporting System (CAIRS)

National Laboratory Injury & Illness Data
Per 200,000 Hours Worked, CYs 04 Through 09
Note: Data obtained from DOE Computerized Accident/Incident Reporting System (CAIRS)

Note:
• Data displayed is for multi-program National Laboratories only
• Data not included for DOE single-program laboratories ALAB, Fermi, JLAB, PPPL, NETL & SLAC
Dimethylmercury Fatality (1997) – Dartmouth College

Highly skilled, world expert in toxic metal effects
- Followed all precautions and requirements known at the time
Spilled a few drops of dimethylmercury onto latex-gloved hand
- Died within 6 months of exposure (80X blood Hg toxic threshold)
2 previously documented deaths (1865 England, 1972 Czechoslovakia)

Worldwide reaction included extensive PPE materials testing,
MSDS revisions, recommended practices revisions, new Standards

SRNL & SRS reaction included extensive review & revision of:
- Chemical / hazardous materials work practices
- PPE recommendations
- PPE procurement, vendor qualification, testing
Chemical Hazard Gloves
Dimethylmercury - SRNL & SRS Lessons Learned Implementation

Industrial Hazard Gloves
Dimethylmercury - SRNL & SRS Lessons Learned Implementation

Anti-C Gloves & Booties

Anti-C and IH Coveralls
1.0 SCOPE

1.1 General

1.1.1 This Guide is applicable to Savannah River Site (SRS) Area Health and Safety Professionals such as Industrial Hygienists (IHs) and Safety Engineers (SEs), in the implementation of specific provisions to 82-61, "Personal Protective Equipment."

2.0 PURPOSE

2.1 General

2.1.1 This purpose of this Guide is to provide assistance to the Area Health and Safety Professional in the evaluation and selection of appropriate chemical personal protective equipment (CPPE) for the eye, foot, hand and skin. For additional arm or torso-specific guidance on use of CPPE, refer to applicable work documentation, facility procedures or laboratory Chemical Hygiene Plans using applicable input from this manual.

2.1.2 While guidance provided in this manual is considered nonmandatory in nature, any deviation from this Guide shall be properly documented in accordance with 82-122, Hazards Analysis.

3.0 TABLE OF CONTENTS

3.1 Manual Content

3.1.1 The subjects addressed within this technical guide are as follows:

a. Section 4.0 - Background
b. Section 5.0 - Hand Protective Equipment (Gloves)
c. Section 6.0 - Eye and Face Protective Equipment
d. Section 7.0 - Body Protective Equipment (Suits and Aprons)
e. Section 8.0 - Foot Protective Equipment (Boots, Shoe Covers)
f. Section 9.0 - Donning and Doffing of Protective Equipment
g. Section 10.0 - Chemical Splash Protection
h. Section 11.0 - Chemical Spill Emergencies
i. Section 12.0 - Decontamination of CPPE
j. Section 13.0 - List of Attachments
k. Section 14.0 - List of Figures
l. Section 15.0 - References

4.0 BACKGROUND

4.1 Overview of CPPE Selection

4.1.1 The purpose of CPPE is to shield or isolate the worker from chemical hazards. No single combination of CPPE is capable of providing against all chemicals hazards. Thus a careful,
CO\textsubscript{2} / Acetone Mixture – Container Over-Pressurization

CO\textsubscript{2} / acetone mixture used as cooling bath (-20 to -50 °C) for distillation of toluene / tetrahydrafuran with aluminum hydride

Excess acetone re-bottled after use, placed in NFPA Flammables Cabinet

- Acetone not returned to room temperature, bottle was capped, work completed late in the day

Next morning, Cabinet doors found open, broken glass on floor, broken bottles in Cabinet
CO₂ / Acetone Mixture – Container Over-Pressurization

Event Scene – Inside NFPA Flammable Liquids Storage Cabinet
CO₂ / Acetone Mixture – Container Over-Pressurization

SRNL published Lessons Learned in Journal of Failure Analysis & Prevention, June 2010:

- Allow organic liquids to return to room temperature before re-bottling
- Use self-venting containers
- Remember your Chemistry 101 - CO₂ solubility at -70°C is 70 X its solubility at 34°C
Smoldering Trash Can

Researcher washed hands at lab sink, discarded wet paper towels into trash can behind him

- Air and water reactive materials routinely handled in this lab

After a few minutes, researcher noticed smoke from trash can, Lab Custodian placed can into adjacent fume hood, evacuated Lab

- Smoke activated fire detection and alarm system, Community and SRS Fire Departments responded, no smoke being generated when they arrived
Smoldering Trash Can
Smoldering Trash Can

SRNL Lessons Learned:

- Consider all materials for treatment as potential Job Control Waste, which requires special handling, due to potential chemical or biological contamination.

- All items with potential to contact reactive materials should be passivated prior to disposal.

- Don’t handle objects that are smoking or on fire, especially if it appears safe to do so.
Whip Arrester – Implementing Lessons Learned

October 13, 2009 Daily ORPS Summary:

National Nuclear Security Administration

7) Sandia National Laboratories - SS, Tech Area I
NA--SS-SNL-1000-2009-0014 - Unexpected Disconnect of Liquid Nitrogen Fill Line Outside Bldg. 701 – (Significance Category 3)
On October 8, 2009, a technologist was in the process of filling a 240-liter liquid nitrogen dewar at an outside fill station located by the southwest corner of building 701 when the six-foot metal fill hose blew off and away from the dewar causing it to whip around. The technologist did not feel safe trying to turn off the liquid nitrogen fill valve so the technologist got assistance from a second technologist. The technologists attempted to restrain the whipping fill hose with heavy rubber pads but this failed. They then used a broom to restrain the hose to approach close enough to the fill unit to shut the valve and turn off the liquid nitrogen. No injuries occurred during this event. The filling activity was halted, the ES&H coordinator reviewed the scene, and the damaged hardware was removed and replaced. The ES&H coordinator recommended that a whip arrester be used during filling operations.
Whip Arrester - HTRL Liquid Nitrogen Setup
Whip Arrester – Dewar Filling Station
Whip Arrester - Filling Dewar with Liquid Nitrogen
Summary

One Can Always Get Better
  • AKA, Continuous Improvement

Sometimes Improvement is (Institutionally) Painful
  • Extensive Glove & PPE Program Overhaul

Sometimes Improvement is Fun
  • Whip Arrestor

Improvement is Always Necessary
  • Complacency Breeds More Events