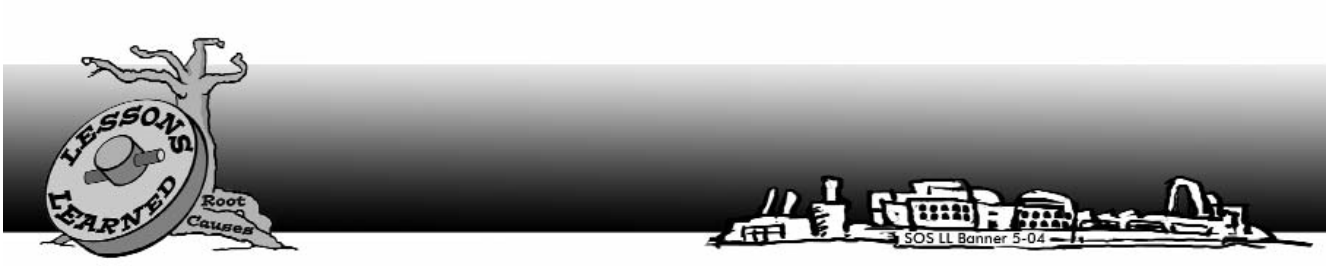

Workers Exposed to Uranium

Purpose

To share "lessons learned" gained from incident investigations through a small group discussion method format.

To understand "lessons learned" through a Systems of Safety viewpoint.

TONY MAZZOCCHI CENTER
FOR HEALTH, SAFETY AND ENVIRONMENTAL EDUCATION
A PROJECT OF THE UNITED STEELWORKERS AND THE LABOR INSTITUTE

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Lessons Learned

Volume 08, Issue 47

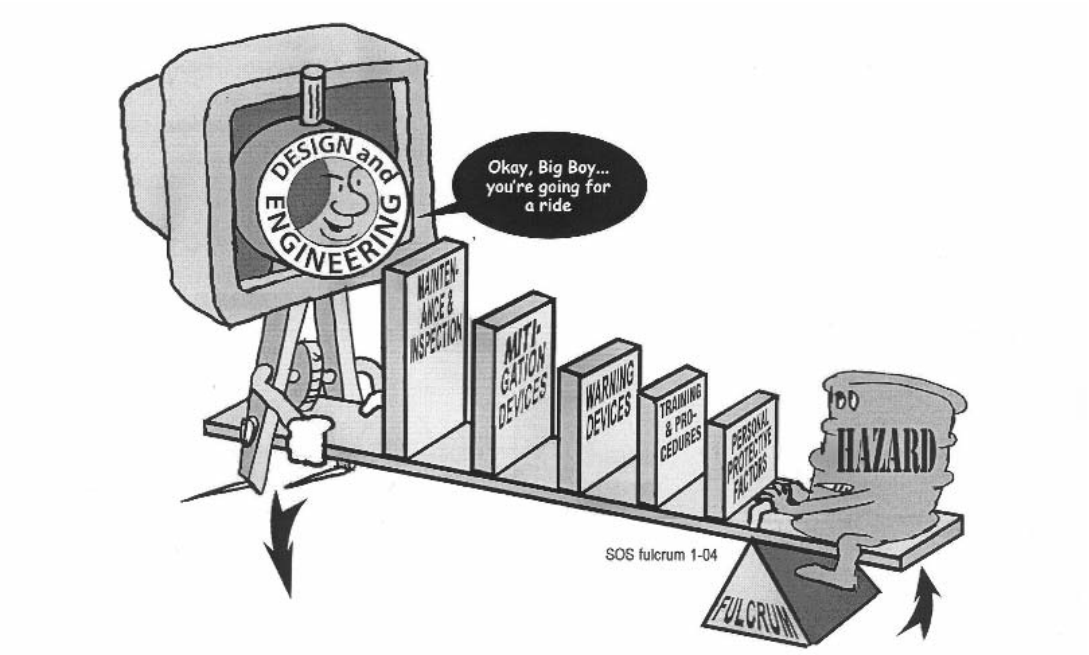
Background Information

Before beginning this Lessons Learned, please review this and the next page which contain information that will introduce the concepts of Lessons Learned and Systems of Safety.

Creating a safe and healthy workplace requires a never ending search for hazards that sometimes are not obvious to us. These hazards exist in every workplace and can be found by using various methods. Lessons Learned are just as the name suggests: learning from incidents to prevent the same or similar incidents from happening again.

Systems Are Not Created Equal: Not equal in protection and not equal in prevention.

Using our Systems Focus to uncover system flaws or root causes is only one part of controlling hazards. We also need to look at the systems involved to decide on the best way to deal with the problem. The most effective way to control a hazard is close to its source. The least effective is usually at the level of the person being exposed. The system of safety in which the flaw is identified is not necessarily the system in which you would attempt to correct the flaw.



Major Safety System	Design & Engineering	Maintenance & Inspection	Mitigation Devices	Warning Devices	Training & Procedures	Personal Protective Factors
Level of Prevention	**Highest—the first line of defense**	**Middle—the second line of defense**				**Lowest—the last line of defense**
Effectiveness	**Most Effective**	←	→			**Least Effective**
Goal	*To eliminate hazards*	*To further minimize and control hazards*				*To protect when higher level systems fail*
EXAMPLES OF SAFETY SUB-SYSTEMS**	**Technical** Design and Engineering of Equipment, Processes and Software Management of Change (MOC)** Chemical Selection and Substitution Safe Siting Work Environment HF **Organizational *(must address a root cause)*** Staffing HF Skills and Qualifications HF Management of Personnel Change (MOPC) Work Organization and Scheduling HF Work Load Allocation of Resources Buddy System Codes, Standards, and Policies**	Inspection and Testing Maintenance Quality Control Turnarounds and Overhauls Mechanical Integrity	Enclosures, Barriers Dikes and Containment Relief and Check Valves Shutdown and Isolation Devices Fire and Chemical Suppression Devices Machine Guarding	Monitors Process Alarms Facility Alarms Community Alarms Emergency Notification Systems	Operating Manuals and Procedures Process Safety Information Process, Job and Other Types of Hazard Assessment and Analysis Permit Programs Emergency Preparedness and Response Training Refresher Training Information Resources Communications Investigations and Lessons Learned Maintenance Procedures Pre-Startup Safety Review	Personal Decision-making and Actions HF Personal Protective Equipment and Devices HF Stop Work Authority

HF - Indicates that this subsystem is often included in a category called Human Factors.
* There may be additional subsystems that are not included in this chart. Also, in the workplace many subsystems are interrelated. It may not always be clear that an issue belongs to one subsystem rather than another.
** The Codes, Standards and Policies and Management of Change subsystems listed here are related to Design and Engineering. These subsystems may also be relevant to other systems; for example, Mitigation Devices. When these subsystems relate to systems other than Design and Engineering, they should be considered as part of those other systems, not Design and Engineering.

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Title: Workers Exposed to Uranium

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Lessons Learned Statement:
The lack of a clear job plan, the design of a fume hood and the poor training of waste handlers led to the exposure of workers to Uranium. This type of incident can be avoided through a ***Systems of Safety*** approach.

Through proper design of equipment, **Design and Engineering** ***System of Safety*** incidents like this can be eliminated. A fume hood with open hand holes was used and fumes were able to escape the hood and expose workers. If a properly-designed, encapsulated fume hood is used for this job, workers will not be subjected to the potential exposure of the sample bottles being opened in the hood.

Through the **Training and Procedures** ***System of Safety,*** workers are educated and trained to be aware of potential dangers of a job and the proper steps to do a job task safely. Because of improper training and experience, a sample bottle was opened with the lid facing a fume hood curtain, allowing fumes to escape through hand holes in the curtain of the hood. A good training program would have taught waste handlers to open bottles pointing the lid away from themselves and the curtain.

Discussion:

Workers were processing fissile legacy waste that required down blending with DUF_4[1]. Prior to the start of the work, a HEPA–fitted air mover had been started and airflow into the hood was confirmed.

While removing a 100 ml. sample bottle lid inside the fume hood, a waste handler felt an unexpected pressure release as the lid was removed. The waste handler witnessed black fumes coming out of the sample bottle for approximately three to five seconds. The bottle contained U-235[2], nitric acid[3], DUF_4 and Arsenazo III. Two workers were standing at the curtain of the fume hood and a third was in the contamination area. Each worker was wearing their specified PPE, including respirators.

The waste handler had difficulty removing the lid, so he brought it closer to his chest (and the hood curtain) in order to improve his leverage on the lid. He indicated that the lid was facing the hood curtain. When the jar was opened, pressure was released and a puff of black fumes was dispersed into the fume hood with some escaping through the hand hole in the plastic curtain.

The waste handler then set the jar down in the hood and it continued to release fumes for approximately three to five seconds. After the fumes had stopped, the waste handler resumed the job by pouring the sample into the batching container and the lid was replaced on the container. No additional fumes were observed coming from the batching container.

A compatibility study was performed on each container to assure the down-blending could safely be performed. No immediate physical reaction was discovered during this study.

Closure and labeling of the drum occurred approximately one hour later with no further incident.

continued

Discussion ***(continued)***

Further investigation of the incident revealed the following facts:

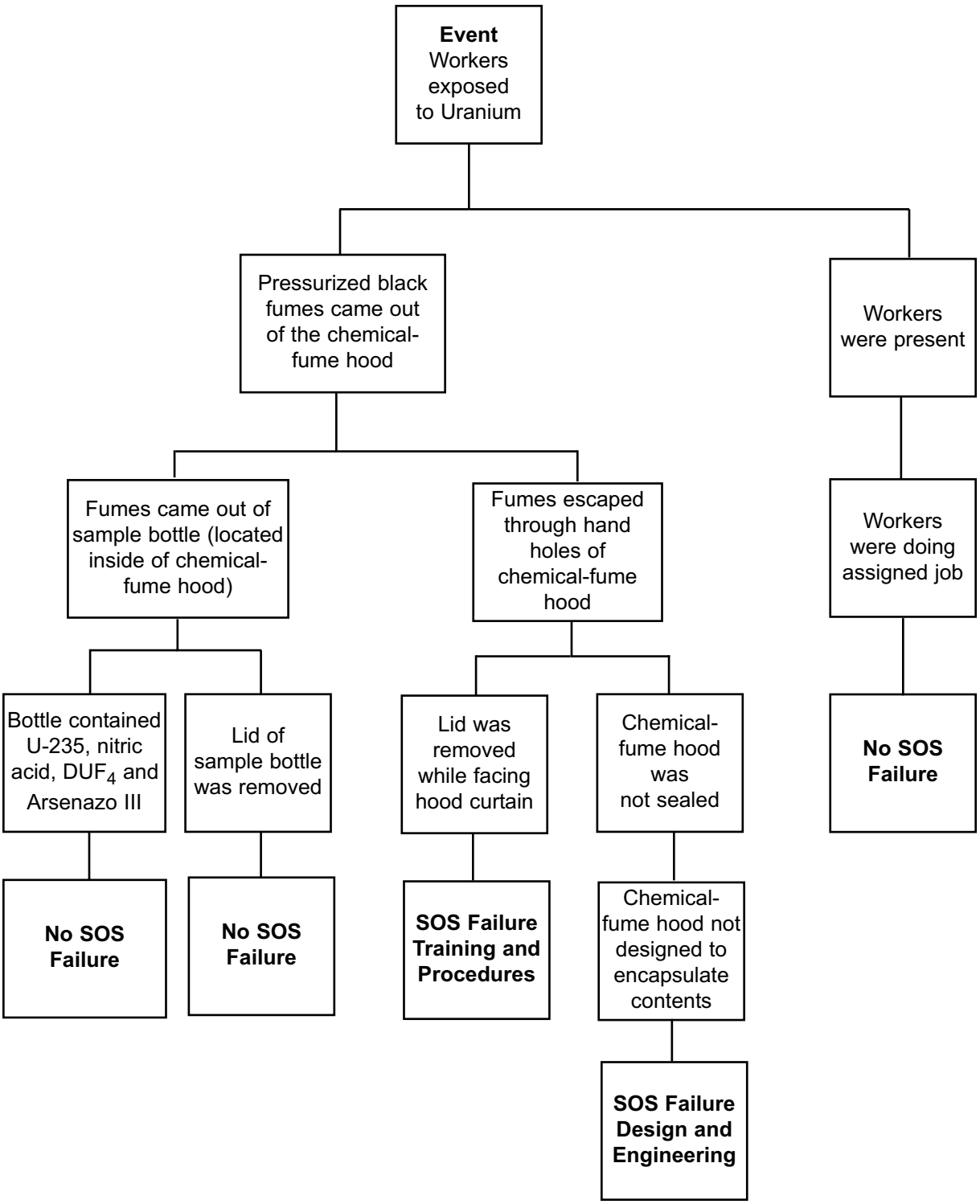
- There was no clear plan for project completion.
- Equipment was re-engineered (deviating from the original "game plan") after the start of the project, due to operational limitations encountered with the initial set-up of the Hepa-filter air mover.
- Waste handlers stated that fumes had been observed on previous occasions.
- A compatibility study was done, but focused on possible adverse reactions occurring within a few minutes of mixing materials. Long-term reactions were not considered.
- The effects of seasonal changes in ambient temperature were not considered for long-term storage.

Definitions:

1. **DUF_4:** Depleted Uranium Tetraflourine is a green, crystalline, solid compound of depleted uranium with an insignificant vapor pressure and very slight solubility in water. In the uranium refining industry it is know as green salt.
2. **U-235:** Uranium-235 is an isotope of uranium that differs from the element's other common isotope, Uranium-238, by its ability to cause a rapidly expanding fission chain reaction.
3. **Nitric Acid:** A transparent, colorless-to-yellowish, fuming, corrosive liquid, HNO_3; a highly reactive oxidizing agent used in the production of fertilizers, explosives and rocket fuels and in a wide variety of industrial metallurgical processes.
4. **Arsenazo III:** Metallochrome indicator that changes color when complexed to the calcium ion under physiological conditions. It is used to measure local calcium concentrations in vivo. In this instance it was used as a cleaning additive used with nitric acid.

Analysis

The Logic Tree is a pictorial representation of a logical process that maps an incident from its occurrence, "the event," to facts of the incident and the incident's root causes.



Recommended Actions

1. Design chemical-fume hood that will encapsulate the contents.
2. Train all workers on safe lid removal.

Education Exercise

Working in your groups and using the Lessons Learned Statement, Discussion, Analysis and Recommended Actions, answer the two questions below. Your facilitator will give each group an opportunity to share answers with the large group.

1. Give examples of ways to apply the Lessons Learned Statement at your workplace.

2. Of the examples you generated from Question 1, which will you pursue in your workplace? (**Note:** When we say something you may pursue, we mean a joint labor-management activity or a union activity rather than an activity carried out by you as an individual.)

Trainer's Lessons Learned Success Inventory

Following a Lessons Learned (LL) session, **the trainer who led the LL** should complete this form. This information will: 1) Help you reflect on the successes and challenges of the session; 2) Help USW with new curriculum development; and 3) Help USW as a whole better understand how the LL Program is supporting their workers.

By reviewing LL from different sites or from other areas of their workplaces, workers are able to analyze the information and apply these lessons to their own workplaces in order to make their workplaces healthier and safer.

1. Site name (if there are participants from more than one site, please list all).

_____

2. Date of LL training _____
3. LL number used in today's Training_____
4. Your name_____
5. **Summary of Education Question 1:** Please summarize participants' examples of ways to apply this LL Statement to their workplace.

6. **Summary of Education Question 2:** Please summarize actions or recommendations participants discussed pursuing at their workplace(s).

Thank you for completing this form.

EVALUATION

Lessons Learned: Workers Exposed to Uranium

Please answer the two questions below:

1. **How important is this lessons learned to you and your workplace? (Circle one.) Rate on a scale of 1 to 5, with 5 being the most important.**

1	2	3	4	5

2. **What suggestions would you make to improve this Lessons Learned?**

End of Training Trainer's Instructions

Please complete the information below.

Trainer's Name _____

(Please Print)

Date of training: _____

No. of Participants: Total _____ Hourly _____ Management _____

Location of Training: _____

USW Local # _____

Send:

1. This page;
2. The Education Exercise (page 9);
3. The Trainer's LL Success Inventory form (pages 10 and 11);
4. The evaluation for each participant (page 12); and
5. The Sign-in sheet (page 14) to:

If you are a TOP Site (excluding DOE TOP Sites)	**Send to: Steve Cable 2915 Gradient Drive St. Louis, MO 63125**
All other sites (including DOE TOP Sites)	**Send to: Doug Stephens United Steelworkers 3340 Perimeter Hill Drive Nashville, TN 37211**

Thank you for facilitating the sharing of this Lesson Learned with your coworkers.

Sign-in Sheet

Name of Class_____ Date of Class_____

Instructors: _____

Please Check One* H	M	Print Name	Signature

***H = Hourly Worker**
M = Management or Salaried Worker