Lessons Learned

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When Should We Develop a Lessons Learned?

- Following:
  - Fatality
  - Injury
  - Incident
    - Damage to facilities, equipment, instruments
    - Release to the environment
  - Near Miss
    - An unplanned event that has the potential to cause, but does not actually result in human injury, environmental or equipment damage, or an interruption to normal operation (i.e., "we dodged a bullet)

Why Develop Lessons Learned?

Avoid	Enhance	Support	Improve
Avoid having the same incident occur again	Enhance safety awareness of workers	Support the lateral thinking required to develop “what if” scenarios when planning work - “P” in R.A.M.P.	Improve emergency planning for response to events

Why Develop Lessons Learned? (Continued)

IDENTIFY SUCCESSFUL H&S PROTECTIVE MEASURES

PROVIDE STORIES THAT CAN ADD INTEREST TO SAFETY TRAINING EFFORTS

HELP SUPERVISORS AND MANAGERS CORRECTLY PRIORITIZE THEIR CONCERNS

SHARE H&S ISSUE(S) WITH OTHER DEPARTMENTS OR INSTITUTIONS

Why Aren't More Lessons Learned Reported and Published?

Lessons Learned Format

What happened?

- Summary description of circumstances surrounding the incident. Include known contributing factors to the incident. Include photos

What went right?

- Actions which were done properly (i.e., was trained, worked in pairs, etc.)

What should have been done differently?

- Actions which should have been done to possibly prevent the incident

What was the cause?

- Describe cause(s) for the incident

What corrective actions have been (or will be) taken?

- Immediate or planned corrective actions that have or will be implemented

What are the lessons learned?

- 2 to 4 Bullet points that are to be used as the preliminary learning for all

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Health and Safety Program Elements

(Incorporate into the Lessons Learned)

Inspections

- Periodic - Documented
  - Identify & correct unsafe conditions & work practices
  - Machinery
- PPE, tools, equipment
- New equipment/process
- Before beginning the job/task

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Hazard Analysis

- Job Hazard Analysis (JHA)
  - Involve affected worker in development of JHA
  - Job Safety Analysis | Office of Environment, Health & Safety (berkeley.edu)
- Standard Operating Procedures (SOPs) to address hazards
- EH&S Fact Sheets
- Hazard Analysis in Laboratories – American Chemical Society (ACS) RAMP
  - **R**ecognize hazards
  - **A**ssess the risks from the hazards
  - **M**inimize risks of the hazards
  - **P**repare for emergencies
- Lab SOPs must include how to control exposure(s)

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Training

- Initial – First assigned to task
- Supervisors - Hazards their employees may be exposed to
- Group Meetings
  - Start with Safety Moment
- Tailgate safety meetings
- Periodic (At least annually)
- New equipment, process, SOP, JHA
- Worker observed not having requisite knowledge/skill to perform the task safely
- Following an accident, incident, fatality, near miss

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Use of Equipment, Instruments, PPE

- In accordance with the manufacturer's instructions
- Follow OSHA regulations, consensus standards (ANSI, ASHRAE, UL, NEC, NFPA, etc.)

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H&S Programs

- Injury Illness Prevention Program (IIPP)
- Personal Protective Equipment
- Hazard Communication
- Respiratory Protection
- Emergency Action Plan
- Fire Prevention Plan
- Chemical Hygiene Plan
- Toxic Gas Program
- Bloodborne Pathogen Exposure Control Plan
- Confined Space
- Forklift/Elevated Work
- Carcinogens
- Lock Out Tag Out
- Hazardous Waste
- Radiation Safety

Supervisor/Management Responsibilities

- Ensure employees receive initial & ongoing training on hazards unique to the job assignment
  - Review incidents and Lessons Learned with affected employees
  - Tailgate safety meetings and/or Safety Moments
- Monitor employees regarding H&S practices
- Review & approve SOPs, JHA's, H&S policies & procedures
- Receive training on hazards their employees may be exposed to
- Ensure inspections are conducted
- Consult EH&S as needed
- Implement progressive discipline for employees not complying with H&S policies

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Institutional Changes

- Establish a Health & Safety Committee
  - Company or University
  - School or Department
- Lessons Learned issued by:
  - Upper Management
  - In Universities -Vice Chancellor for Research or Administration or Dean of the College
- Encourage or mandate implementation of the Safety Moment concept at the start of meetings

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Sample Lessons Learned

Rotovap Explosion Injures Researcher

An undergraduate student researcher was working at the laboratory bench when the apparatus she was using exploded, sending glass fragments into her face and upper torso. The researcher was using a rotary evaporator (rotovap) to remove organic solvents from an azobenzene precipitate. Unstabilized tetrahydrofuran (THF) and diethyl ether were used in the reaction. She adjusted the bottom flask which then exploded sending glass towards her face, hitting her safety goggles and forehead. She was not wearing a lab coat which required the lab personnel to take her to the safety shower for decontamination of her body and clothing. 911 was called. She was taken by ambulance to the hospital where she received stitches above her eyes and other treatment for her injuries. She was released from the hospital the same day.

- What was the cause of the incident?
- What went right?
- What should have been done differently?
- What corrective actions should be taken?
- What are the Lessons Learned?

The lower round-bottomed flask from the rotovap exploded inside the metal water bath

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Cause of the Incident?

- Peroxide crystal contaminants built up in the bottom of the flask and exploded when the researcher adjusted the flask

What went right?

- Researcher wore safety goggles
- Fellow researchers took her to the safety shower and she was decontaminated
- Researcher was taken to the hospital by the ambulance

What should have been done differently?

- Experiment should be done behind a safety sash if working with potentially explosive chemicals
- Researcher should have worn a lab coat and face shield
- Use peroxide-forming chemicals with a stabilizer added
- Should this experiment be done by an undergraduate student?
- Peroxide forming chemicals need to be:
  - Dated when first received, first opened, and assigned an expiration date;
  - Periodically tested for peroxide contamination; and
  - Disposed of after the expiration date

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What corrective actions should or will be taken?

- **Meet** with lab group to discuss the accident
- **Train** lab group on SOP for peroxide-forming chemicals
- **Check chemical inventory** for the presence of peroxide-forming chemicals & remove old, undated containers and peroxide-forming chemicals which do not have a stabilizer added
- **Implement a peroxide-forming** chemical dating, testing, disposal, and proper storage **program**
- **Limit the volume** of peroxide-forming chemicals which are purchased

Lessons Learned

- Training for lab workers
  - On unique hazards
  - Requirement to wear proper PPE for the anticipated hazards
- Limit types of experiments for undergraduate students
- Potentially explosive experiments should be done behind a safety sash or in a fume hood equipped with a safety sash
- Establish a peroxide-forming chemical safety program which addresses: Purchase quantity; storage; labeling; dating; testing; and disposal

Lessons Learned Scenarios

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Fall from Fixed Ladder with Grab Bars Results in Injury

A campus employee was holding onto the grab bars at the top of a fixed vertical ladder and was beginning to descend when one of the grab bars broke off, causing the employee to fall about 13 feet. The employee sustained significant injuries to several toes. The incident occurred on a roof mounted cooling tower. The employee was working with another employee at the time.

- What was the cause of the incident?
- What went right?
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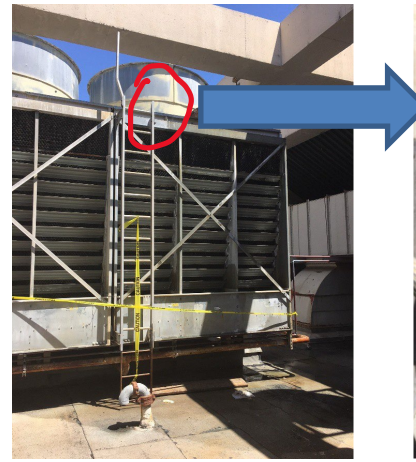
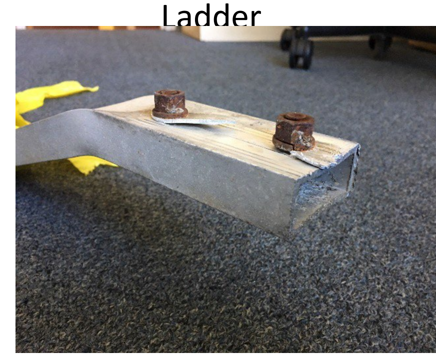


Broken Ladder

Sheared Metal Ladder



Grab Bar at the Connection Point

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Phenyl Chloroform Exposure

Phenol:chloroform:isoamyl alcohol also known as Trizol, and various names in other DNA/RNA extraction kits, is a common molecular biology reagent for extracting nucleic acids. The mixture is approximately 50-70% phenol, 30-50% chloroform, and 1-5% isoamyl alcohol. Phenol is corrosive to skin tissue and is moderately toxic by ingestion, absorption, and inhalation. Chloroform is “possibly carcinogenic to humans” (IARC Group 2B). This mixture was being used for a DNA extraction on Friday, December 29, 2017 at around 3pm. The experienced graduate student would typically conduct the extraction inside a fumehood while wearing a lab coat and nitrile gloves. However, this time the researcher felt that since they were only using a few milliliters for a couple of missed samples it was quicker to work outside of the fume hood, while also failing to button their lab coat. While attempting to retrieve the mixture from the manufacturer’s bottle (100mL bottle from Fischer Bioreagent) the bottle tipped and spilled onto the bench, floor, and researcher. It got onto their arm and thigh and the researcher noticed an immediate skin burning sensation.

The researcher removed their contaminated clothes, proceeded to the sink, and alerted nearby lab members. The researcher proceeded to wash with soap and water for around 5 minutes until the burning sensation had ceased. The researcher then went to the University of Chicago’s Emergency Department unaccompanied while the remaining lab member cleaned the spill. The lab members then reported the spill to the Office of Research Safety, but ORS had just closed for the holiday weekend. The PI was notified and contacted ORS via email. The lab eventually called UCPD who notified ORS via the on-call pager. ORS confirmed the spill had been cleaned up and performed a final decontamination.

- What was the cause of the incident?
- What went right?
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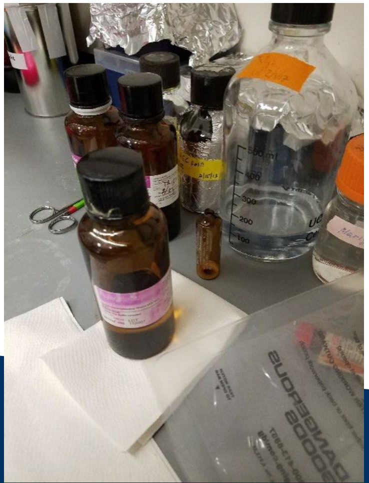

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Nitric Acid Over-Pressurization Event

A graduate student was consolidating aqueous nitric acid solutions into a 4L bottle marked as hazardous waste. The bottle was stored inside a fume hood along with other waste bottles, organic reagent bottles, a hotplate and an oil bath. The fume hood sash was left open when all researchers left at the end of the day.

Several hours later, a custodian entered the lab and saw broken glass and brown liquid on the floor. It appears that the nitric acid waste was stored in a bottle that contained residual organic compounds, the combination which generated sufficient pressure to shatter the holding vessel and the surrounding glassware.

- What was the cause of the incident?
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