



Phenol Chloroform Exposure- December 2017

What happened?

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 fume hood 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 Bioagent) 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 (**123, 773.702.8181**) who notified ORS via the on-call pager. ORS confirmed the spill had been cleaned up and performed a final decontamination on Tuesday, January 2, 2018.

What was the cause?

The researcher acknowledged that they were taking short cuts and in a rush. Normal procedures, including working inside a fume hood and buttoning of the lab coat were ignored for the sake of a couple minutes at most. They also reported that this was a procedure that they have completed over a dozen times before and had become complacent of the risk even though the hazards were well understood. Finally the bottle (see picture below) is very tall and narrow thus easy to tip over. The use of a pipettor increases the likelihood of tipping the bottle if the pipettor is not carefully inserted and removed. After having a few days to think about the incident and talk with the Principal Investigator and other collaborators the researcher also learned that other labs use secondary containers when pipetting phenol chloroform. Even something as simple as a pipette tip box could help prevent a tipped bottle from spilling its contents onto the fume hood and researcher.

What were some of the things done well?

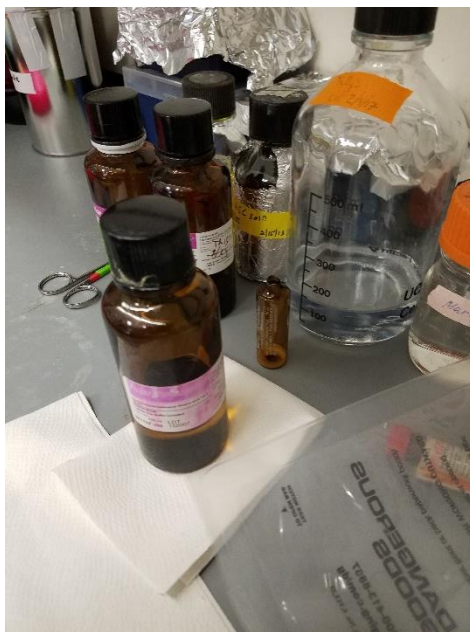
The person’s injuries were relatively minor and the lab was able to clean up the spill quickly because they acted quickly and correctly. Such actions taken include:

- Research personnel were trained, knew the hazards, and were aware of the emergency equipment location

- The researcher quickly removed the contaminated clothes, immediately reducing the amount of chemical and contact time of the exposure
- The researcher was not alone and the other lab members came to the injured party's assistance
- The lab indicates that personnel are trained on lab-specific practices including phenol/chloroform extractions

What are some lessons learned from the incident?

- Personal protective equipment should be worn properly when working with hazardous chemicals, this includes eye protection (safety glasses at minimum), body protection (lab coat), and gloves
- Take your time when working with hazardous chemicals. A couple extra seconds of preparation and thinking through a procedure could save hours of medical treatment and spill clean up
- Hazardous chemicals should be used inside a chemical fume hood
- Secondary containers, even an old pipette tip box, can be used stabilize the smaller bottles and contain a spill
- Always accompany injured individuals to the medical treatment facility
- Use of DNA extraction kits instead of phenol chloroform, if possible
- Labs should call **123** or **773.702.8181** in case of an emergency



References and Resources

1. University of Chicago's Chemical Hygiene Plan template <https://researchsafetyuchicago.edu/page/policies-and-safety-manuals>
2. National Research Council. 2011. Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards, Updated Version. Washington, DC: The National Academies Press. <https://doi.org/10.17226/12654>.