Pete Reinhardt

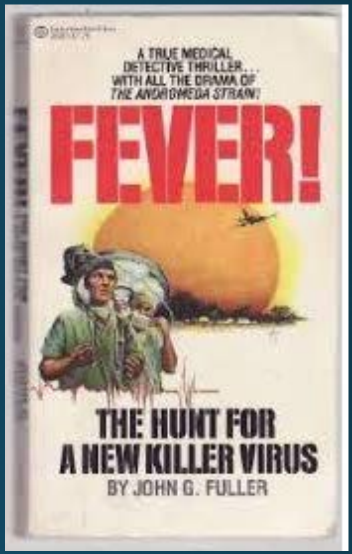
21 August 2018

# Preserving Institutional History of Chemical Incidents

## Yale Environmental Health & Safety

In June 1969, Dr. Jordi Casals-Ariet, a virologist at the Yale Arbovirus Research Unit, contracted Lassa fever from his research. He recovered, but in November Juan Roman, a laboratory technician, contracted the disease and died.

This event spurred CDC's development of microbiological risk groups and the use of control banding to set standards for BSL-4 laboratories (then called P-4 labs).




This incident is detailed in the 1975 book, "Fever" by John G. Fuller.

On 8 August 1994 a Yale researcher became infected with Sabiá virus, with which he was working, as a result of a cracked centrifuge bottle. The researcher noticed the crack and release, but did not sufficiently recognize the incident's risk to himself or others.

As a result, Yale developed a formal program for the management of its BSL-3 laboratories.

*History doesn't repeat itself but it often rhymes.*

In 1989 a researcher in Dr. Cole's laboratory accidentally and unknowingly was exposed to I 125, which resulted in a 178 rem fingertip dose. (This is referred to as "the Cole-Kardana incident.") The U.S. Nuclear Regulatory Commission's (NRC) subsequent inspection resulted in a $12,000 fine, numerous Notices of Violation and a "show cause" order.

As a result, Yale greatly expanded the radiation safety program in 1990-1. From 1991-7 Yale was intensely inspected by the NRC and received nine additional Notices of Violation.

In 3-4 May 1994 five inspectors from Region I of the U.S. Environmental Protection Agency (EPA) conducted a RCRA (hazardous waste) inspection of the University and found numerous violations. Yale later agreed to a $69,570 civil penalty and $279,205 in supplemental environmental projects.

# What Stories Shall We Tell?

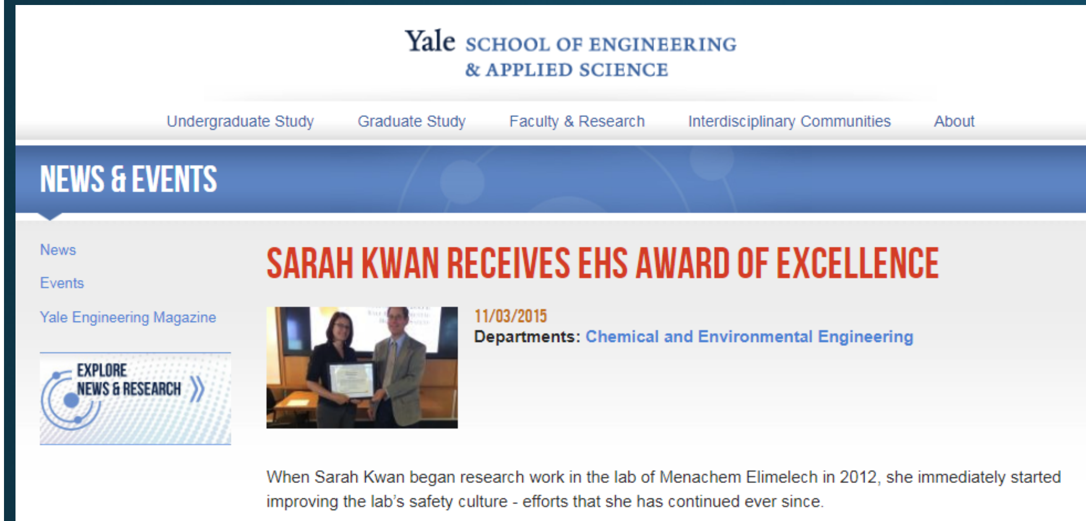
*Good news or bad news?*

*Trumpet our successes?*

*Warn others of possible hazards?*

*Encourage good behavior?*

*Frighten (or dare) those who might find themselves in a similar situation?*



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# SARAH KWAN RECEIVES EHS AWARD OF EXCELLENCE

11/03/2015

**Departments:** Chemical and Environmental Engineering

When Sarah Kwan began research work in the lab of Menachem Elimelech in 2012, she immediately started improving the lab's safety culture - efforts that she has continued ever since.

As a researcher at UC Riverside, Sara Kwan experienced the importance of having a strong safety culture in a laboratory. Sara entered the UC lab environment in the aftermath of a horrific lab accident that resulted in the death of a young researcher. UC Riverside soon implemented rigid safety policies in step with changes required by the UC system. Sara recalls a very low tolerance for infractions in laboratory safety and gives credit to her strong safety acumen, to the training and experience at UC Riverside. When Sara arrived at Yale, she partnered with her then Principal Investigator, Professor Menachem Elimelich, to develop a core safety culture for all researchers in their laboratory.

Sara first observed a few challenges unique to her laboratory as they performed a variety of research experiments, with the variance most prominent in their biological research. She noted inconsistencies with the interpretation of EHS lab safety guidelines by her co-workers, so she worked to simplify the safety protocols for her lab. In addition, Sara also worked to improve the safety culture in the following ways.

- Sara first volunteered to serve as co-lab safety manager.
- She created posters for biomedical waste disposal that relied heavily on images over words to simplify their unique lab waste streams.
- She developed a lab safety checklist to onboard new researchers in her lab (to make sure that all relevant EHS training was completed before starting work and to review lab specific protocols for biomedical waste).
- Sara implemented a 5 minute safety briefing at every lab meeting where she reviewed a basic but related lab safety element pertinent to their laboratory.

An associate professor of pediatrics in emergency medicine, Dr. Kirsten Bechtel will go that extra mile to make sure that New Haven roads are safe for its residents and visitors. Kirsten co-authored an extensive report showing the infrastructure, education, and enforcement gaps that were making the campus and city less safe from a traffic safety perspective. This study helped leaders from across Yale and the City of New Haven to collaborate to address these gaps.


She works tirelessly to advance issues — always responding to emails, showing up to testify, meeting with critical players, and studying issues so that she can speak intelligently about them. One program encouraged improved pedestrian behavior by stenciling safety messages around the streets of New Haven.

# Ways That We Tell Stories

- EHS newsletters and internal Yale communications
- Papers and presentations
- Every safety committee meeting includes a review of recent incidents
- Incident reviews in the EHS newsletter
- "Lessons Learned" fact sheets
- Metrics: numbers tell stories
- "Yale EHS' Most Significant Modern Risk History"

# Safety Bulletin

November 2013
*Environmental Health & Safety*

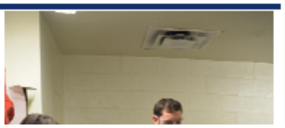
## What's Inside



## Glove Etiquette

Gloves are an important piece of personal protective equipment (PPE) in laboratories and clinics. Along with lab coats and safety glasses, gloves complete the triad of basic safety equipment in most laboratories. As important as gloves are, they are not meant to be worn in hallways or throughout buildings in common access spaces. Gloves and other PPE that you believe could be contaminated need to be removed *before* leaving the lab and collected for disposal along with other waste materials. While it is one thing to keep non-contaminated gloves on when traveling to an adjacent laboratory or support room, wearing gloves in wider public areas (especially hallways, stairways, and elevators) is unacceptable. Even if you know the gloves are not contaminated and you are only wearing them to protect your research materials from the enzymes on your hands, it gives the appearance to others that you are handling hazardous materials and potentially spreading contamination throughout the University. If you need to transport any potentially hazardous research materials beyond your laboratory room, please ensure that they are properly packaged and contained before leaving the laboratory. For more information about gloves, other personal protective equipment, or proper containment and packaging for hazardous materials, please visit our website (ehs.yale.edu) or contact your Safety Advisor.

## Chemical Clean Out Day



Yale Environmental Health and Safety (EHS) organized a Chemical Clean Out Day for the Anlyan Center laboratories on Thursday, Oct 31, 2013. All labs were

## Incident Report

**Description: Fishy Chemical Odor in Lab**
EHS received a report of a fish-like odor in a lab where there is research using amine based chemicals, which have a fishy odor. Researchers confirmed this work is done only inside a chemical fume hood. Investigation revealed that there was a low level of amines in the air in the lab.

**Resolution**:
There had been a very small amount of amine solution spilled in the hood earlier. The researcher cleaned up the spill appropriately, leaving the spill cleanup material in the hood, but disposed of his gloves in the regular trash. The amine odor was coming from the contaminated gloves in the trash. The trash bag was sealed and disposed of as hazardous waste.

**Lessons Learned:**
EHS met with the lab group to discuss fume hood safety and safe handling of amines. The importance of keeping the fume hood sash lowered and working at least 6" in from the face of the hood was discussed, as well as keeping the fume hood clear from clutter to allow it to function as designed. Spill cleanup procedures, including disposal of contaminated material and gloves, were also discussed.

FEATURE

# Managing laboratory biomedical waste using a large on-site autoclave–shredder

In 2002 Yale University purchased, installed, and began operating an on-site biomedical waste treatment system at its School of Medicine campus consisting of a large autoclave and shredder. The system is currently operating, and has served the University well. In this paper we describe how biomedical waste is identified, separated at the source, collected, and managed at Yale. We explain the rationale for using this system, as well as its operation, costs, and benefits to the University.

**By Brenda A. Armstrong, Peter A. Reinhardt**

## INTRODUCTION

In this paper, the term *biomedical waste* includes infectious waste, waste sharps, waste that may contain bloodborne pathogens, animal tissue and bedding that may contain infectious agents, and laboratory waste that may contain microbiological agents. Colleges and and at medical clinics operated by the Yale Medical Group. Yale has a Central Campus and Medical School Campus located in New Haven, Connecticut, and a West Campus located in West Haven, CT; these clinics are in New Haven and other locations in south-central Connecticut. Located adjacent to the medical school campus is Yale-New Haven Hospital, a separate entity that also generates biomedical waste; Yale University does not manage this hospital

medical waste washing up on their beaches in 1988. As a result, the federal government passed the Medical Waste Tracking Act in 1989, which established a limited demonstration biomedical waste tracking program that ran from June 1989 to June 1991. At the same time, many states began or expanded their own regulation of biomedical waste. Connecticut promulgated extensive biomedical waste regulations in 1990.[2]

As shown in Table 1, Connecticut

Yale *Environmental Health & Safety*

# *Lessons Learned*

*Please report all accidents and near misses. Things happen and it is important to learn from others. Environmental Health and Safety and your colleagues appreciate hearing about incidents, reviewing their causes and learning from them.*

## LIQUID NITROGEN DEWAR VALVE FAILURE


Liquid nitrogen is a cryogen that is commonly used in laboratories. Like all cryogenic liquids, it can be extremely hazardous if not handled properly. Cryogens rapidly expand when converted from a liquid to a gas as they warm. Due to this rapid expansion, if an uncontrolled release of liquid nitrogen were to occur, even in a well-ventilated space, it is possible that enough oxygen would be displaced for asphyxiation to occur. As a note, levels ≤19.5 percent are considered oxygen deficient.

### What Happened?

In February 2018, a Yale researcher contacted EHS because they were unable to close the valve on one of the liquid nitrogen dewars in the laboratory. The personal oxygen monitor in the lab indicated that oxygen levels were lower than normal. Upon arrival, EHS found that the researcher was able to shut the valve, however the oxygen levels at the entryway to the laboratory were 18 percent, indicating an oxygen deficient atmosphere. With the dewar valve closed, the oxygen levels quickly rose back to normal.

### What Went Right?

- The dewar was placed next to the fume hood to help quickly exhaust the gas from the laboratory.
- The laboratory had a personal oxygen monitor because of the large amount of cryogen in the room.
- The researcher contacted EHS for assistance when they noticed that the oxygen levels were low.

### What Should Have Been Done Differently?

- There was a note in the laboratory indicating that the valve was not working properly. The laboratory should have contacted their supplier for a replacement tank immediately upon noticing a problem.
- Immediate evacuation from the laboratory should have taken place since oxygen levels were below 19.5 percent. Oxygen monitors are set to alarm at this level.

| | FY12 | FY17 | 5 Year Increase |
|---|---|---|---|
| Net Assignable Square Feet (NASF)-Research | 2,078,839 | 2,386,609 | 15% |
| Yale employees and faculty | 13,136 | 14,159 | 8% |
| Research material shipments reviewed by EHS | 7,904 | 13,252 | 68% |
| Principal Investigators using human pathogens | 93 | 109 | 17% |
| Principal Investigators using recombinant DNA | 269 | 376 | 40% |
| Principal Investigators using controlled substances | 183 | 218 | 19% |
| Minors participating in research or clinical activities | 155 | 205 | 32% |
| Visiting undergraduates participating in research or clinical activities | 41 | 530 | 1,193% |
| Water samples required by environmental permits | 889 | 1,843 | 107% |
| Automatic External Defibrillators (AEDs) | 37 | 157 | 324% |
| Class 3b and 4 lasers | 195 | 248 | 27% |
| Emergency eyewashes | 971 | 2,231 | 130% |
| Laboratory hoods | 1,124 | 1,408 | 25% |
| Trainees completing EHS courses | 23,820 | 41,921 | 76% |

In 1985 a container of iso-pentane, improperly stored in a non-fire rated refrigerator in the Sterling Hall of Medicine's C-Wing, exploded in the middle of the night.

As a result, EHS and the YFM began to label lab cold storage units according to their use and ended the retrofitting of non-rated units by the Science Hill machine shop.

In 1988 a contractor found phenobarbital in a vacated laboratory in undergoing renovation in the Osborne Memorial Laboratory building. He brought the substance home and consumed it, resulting in a fatal overdose.

Following this incident, EHS instituted a decommissioning program for vacating laboratories.

# Visual vs. Descriptive Reality

In Spring of 1997 a major fire occurred in Dr. Turekian's environmental counting (radiological) laboratory in the Kline Geology Building. The fire was caused by an unattended hot plate being left on.

In the ‘90s a major laboratory fire occurred on the second floor of the Sterling Hall of Medicine’s I Wing, which began when an unattended gel electrophoresis apparatus ran dry. The fire involved chemicals stored nearby.

On 21 October 2000 a laboratory fire occurred in the Kline Chemistry Building when an unattended gel electrophoresis apparatus (with a timer) malfunctioned. A student discovered the fire when they returned to the lab in the evening. No one was injured.

In December 1976 a violent explosion shattered windows and lights in Dr. Wasserman's laboratory in the Kline Chemistry Building, probably caused by a shock-sensitive azide residue from distillation—no more than 25 mL. The explosion injured the ear drums of two graduate students, one of whom was hospitalized for ten days.

On 19 October1997, a graduate student in chemistry severely injured their hand when handling a flask containing an azide compound exploded.

# Yale School Of Medicine Members Likely Sickened By Chemical, University Says

Yale University. (Getty Images)

By **Rebecca Lurye** · **Contact Reporter**

MARCH 7, 2017, 8:56 PM | NEW HAVEN

Four members of the Yale School of Medicine who became ill at a campus building last month had likely ingested sodium azide, a substance commonly found in laboratories and used as a preservative, according to the university.

Sodium azide can cause dizziness, headache, nausea and vomiting, rapid breathing and rapid heart rate, the university said in a news release Tuesday.

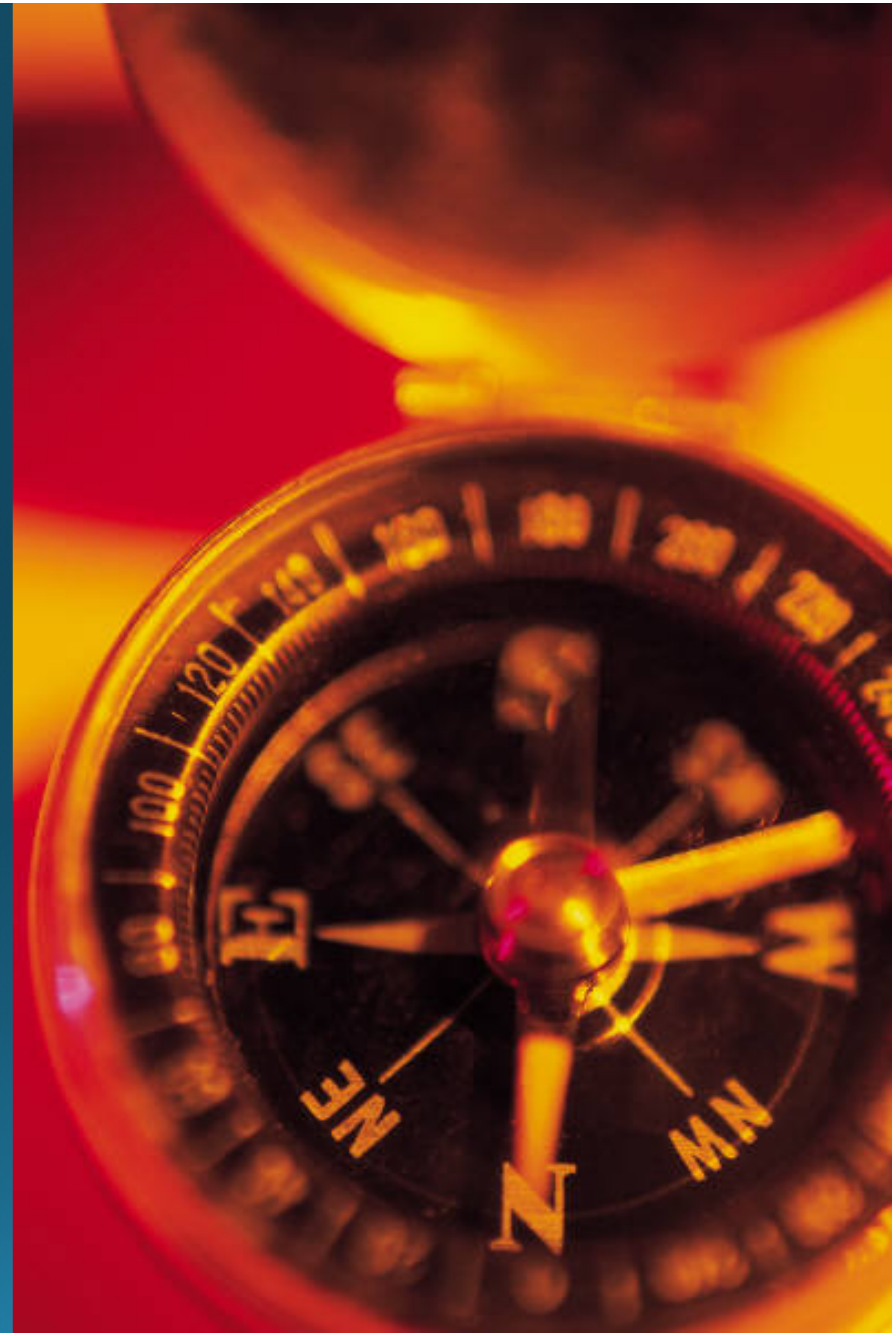
Four people became sick at 333 Cedar St. on Feb. 28 after drinking from a single-serve, pod-style coffee machine, the release said. That prompted the involvement of the State Department of Energy & Environmental Protection, which handles hazardous materials.

While independent testing of items removed from the area indicated the presence of sodium azide, Yale Police Department is continuing its investigation in collaboration with local, state and federal law enforcement.

On 28 February 2017 four medical school researchers became seriously ill after drinking beverages from the same coffee machine. The police discovered that sodium azide had been added to the machine. All of the researchers recovered. No arrest was made.

# Why Should We Tell Stories?

- Remember the past
- Acknowledge the limits (or limitlessness) of humans and systems
- Learn to expect the unexpected
- Reinforce our values
- Understand what has shaped the present
- Use them to create our future



Predictions are hard to make,
especially about the future.

—Nobel physicist Niels Bohr