CUSTODIAL RISKS THE INVISIBLE PROBLEM

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FIRST EXPERIENCE AS A CUSTODIAN

Federal Land Bank

- Given Keys
- Shown the custodial closet
- The extent of training and job duties

THREE REASONS RISKS ARE INVISIBLE

- Simplicity
- Complexity
- Complacency

SIMPLICITY

- "Everyone knows"
- Example – Incident involving bleach (sodium hypochlorite) and toilet bowl cleaner (hydrochloric acid)

$HCl + NaClO > H^+ + Cl^- + Na^+ + ClO^- > HClO > H2O + Cl_2$

QUESTION

- How many times has this reaction happened in the cleaning industry?

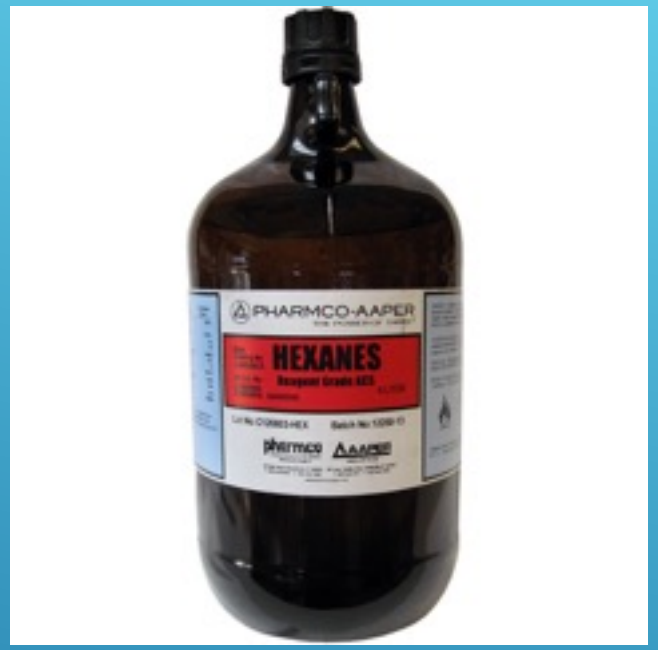
SIMPLICITY

- Basically all hydrophobic hydrocarbon based solvents are CNS toxins
- "The acute health effects of organic solvents reflect their central nervous system effects and include headache, dizziness, and light–headedness progressing to unconsciousness, seizures, and death". Occupational & Envrionmental Medicine, March 2006

HEXANE

Not all solvents are created equal

- Forms 2, 5 Hexanedione Cytochrome P450
- C-C=O-C-C-C=O-C
- Damages neurons



HYDROFLUORIC ACID

Not all acids are created equal

- Fluoride ion binds calcium
  - Causing – tetany, decreased myocardial contractility and possible cardiovascular collapse.
  - Also hyperkalemia associated with ventricular fibrillation - death

- **Fatality due to acute HF exposure**
- A fatal accident occurred in a palynological laboratory in Australia, resulting in the death of a technician. This article looks at the factors that may have contributed to its occurrence.
- A standard geology technique, which involved the dissolving of sedimentary rock with mineral acids (hydrochloric and hydrofluoric acid), was being undertaken in a fume cupboard. The technician involved was believed to be seated when he knocked over a small quantity (between 100 - 230ml) of hydrofluoric acid (HF) onto his lap, splashing both thighs. The only personal protective equipment worn was two pairs of wrist length rubber gloves and a pair of polyvinyl chloride sleeve protectors. As a result of the fact that the technician was working alone, it is unclear whether the spill was from the digestion cup or the 2-1 bulk acid container. The technician sustained burns to 9% of his body surface area, despite washing his legs with water from a makeshift plumbing arrangement that supplied water at 6 litres/min. No calcium gluconate gel was applied to the affected area and contaminated clothing was not removed during the flushing with water. Following flushing, the technician, who appeared to be in severe pain and shock, immersed himself in a chlorinated swimming pool at the rear of the workplace, where he remained for approximately 35-40 minutes before ambulance help arrived.
- The injured man was hypothermic and hypocalcaemic on admission to an intensive care unit at a nearby hospital, and soon became unconscious. His condition continued to deteriorate despite, subcutaneous injections of calcium gluconate and administration of intravenous calcium and magnesium. His right leg was amputated 7 days after the incident.
- He subsequently died from multi-organ failure 15 days after the hydrofluoric acid spill. *Ann.Occup.Hygiene, Vol. 40, No. 6, pp 705-710, 1996*

COMPLEXITY

- Mark Twain urged people to use direct, clear, concise language

COMPLEXITY

- Hazard Communication Standard
- I created a 29 page Written Hazard Communication Program
- Student Custodian reaction to the program

HOW HELPFUL WAS MY HAZCOM PROGRAM?

COMPLEXITY

- Full model describing variable response and interaction
- The response of four variables A, B, C, D could be written as follows
- $A + B + C + D = b_1A + b_2B + C + D + AB + AC + AD + BC + BD + CD + ABC + ACD + BCD + ABCD$

- Disinfectants
- Interaction between detergents and quats
- Interaction between ions in water and phenols
- pH interaction
- Temperature

COMPLEXITY

COMPLACENCY

"Burns Happen"

- My question "what happened"
- Response "this is a kitchen, burns happen"
- Implication – this injury is beyond our control

- Typical corrective actions:
  - Do it better
  - We won't do that again

- SMART – Specific, Measurable, Attainable, Realistic, Timely

COMPLACENCY
ACCIDENT EVALUATIONS AND RESPONSE

Reduce Complexity

- Intel created a system called “copy exactly”
- Extremely complex system across multiple fabrication facilities
- Allows each fab to share knowledge and techniques

Intel Fab Arizona

HOW DO WE BALANCE THE NEED FOR SIMPLICITY AND NECESSARY COMPLEXITY?

SHARED LEARNED EXPERIENCES

- The best way to reach the correct balance between simplicity and complexity.
- Also gives us a better opportunity to avoid complacency.
-

STANDARDS

- Give us an opportunity to measure our programs
- Provides better opportunity for shared learning experiences

NUCLEAR POWER INDUSTRY

LOCA Three Mile Island March 28,1979

- The worst nuclear power accident in US history.
- Almost killed the nuclear power industry in the US
- Both human and mechanical errors

Three Mile Island