

Rehab Your Lab: Improving Management of Curriculum Chemicals in Schools

Sponsored by the Ozark Rivers Solid Waste
Management District and U.S. Environmental
Protection Agency

May 2007



Background – (How we got our Bunsen burners fired up...)



- ORSWMD staff regularly received inquiries from local schools – “how do we get rid of our hazardous materials?”
- Really should not be included in HHW collections.
- Local school districts do not always have the financial resources to manage major cleanups.



Background cont'd.



- OR staff developed and submitted a grant to the Resource Challenge Grant program provided by US EPA
- Grant was approved in September 2006



We're Not Above Plagiarism...

- There are really good programs already in existence.
 - Rehab the Lab –sponsored by EMC Insurance Company and the Metro Waste Authority, Des Moines, IA
 - Klickitat County, WA
 - State of Florida
 - State of Connecticut



Overview of the Project

- Holding workshop for educators and school administrators
- Enrolling five schools for the pilot cleanups
- Bidding out labpack/disposal contractor
- Conducting pre-cleanup walk thrus





Overview cont'd...

- After the walk thrus, we coordinated appointments with the schools and the contractor
- Chemicals were labpacked, removed and disposed of





Overview cont'd...



- Evaluations were sent to schools on the cleanup process
- We will do additional followups during the upcoming school year to determine if the schools have adopted BMPs and provide additional technical assistance, if needed
- Currently working to get two more schools cleaned up



Workshop/Technical Assistance



- Provided the whys, whats, wheres and hows
 - along with a few illustrated horror stories....



Why Be Concerned About Chemical Management?



- **Health hazards:** immediate & long-term
- **Safety hazards:** stability of shelves, storage methods and incompatibility
- **Environmental harm:** groundwater, discharges to streams/rivers, air pollution
- **Hidden costs/liabilities:** lawsuits, fines, Paperwork/fees, insurance premiums, etc



What?

Types of Chemicals Posing Hazards in Schools

- Extremely flammable
- Corrosive
- Poisonous
- Carcinogenic
- Reactive: explosive, heat generating, fume/vapor generating
- Unknowns
- ANYTHING STORED IMPROPERLY



Where?

Examples : Poor Storage Practices

- Water reactives near / under sink
- Heavy containers on high shelves
- Corrosives on (corroded) metal shelves
- Flammables stored on wood
- Alphabetical storage (incompatible?)
- Unlabelled/"mystery" contents
- Chemicals next to food



Incompatible Chemical Storage



Stockpiling/Overpurchasing and Underestimating Hazards



Poor Choice of Chemicals (high flammability material)



Metal shelving deterioration



Special Case : Mercury



Special Case : Acutely Toxic



Nitric acid, oxidizer and corrosive. Fumes ate through plastic cap then oxidized cardboard box. Extreme fire risk. Six pounds of cyanide right above it. Earthquake could mean a gas chamber for 500 students!



Nitric
"Sombbrero"

or...

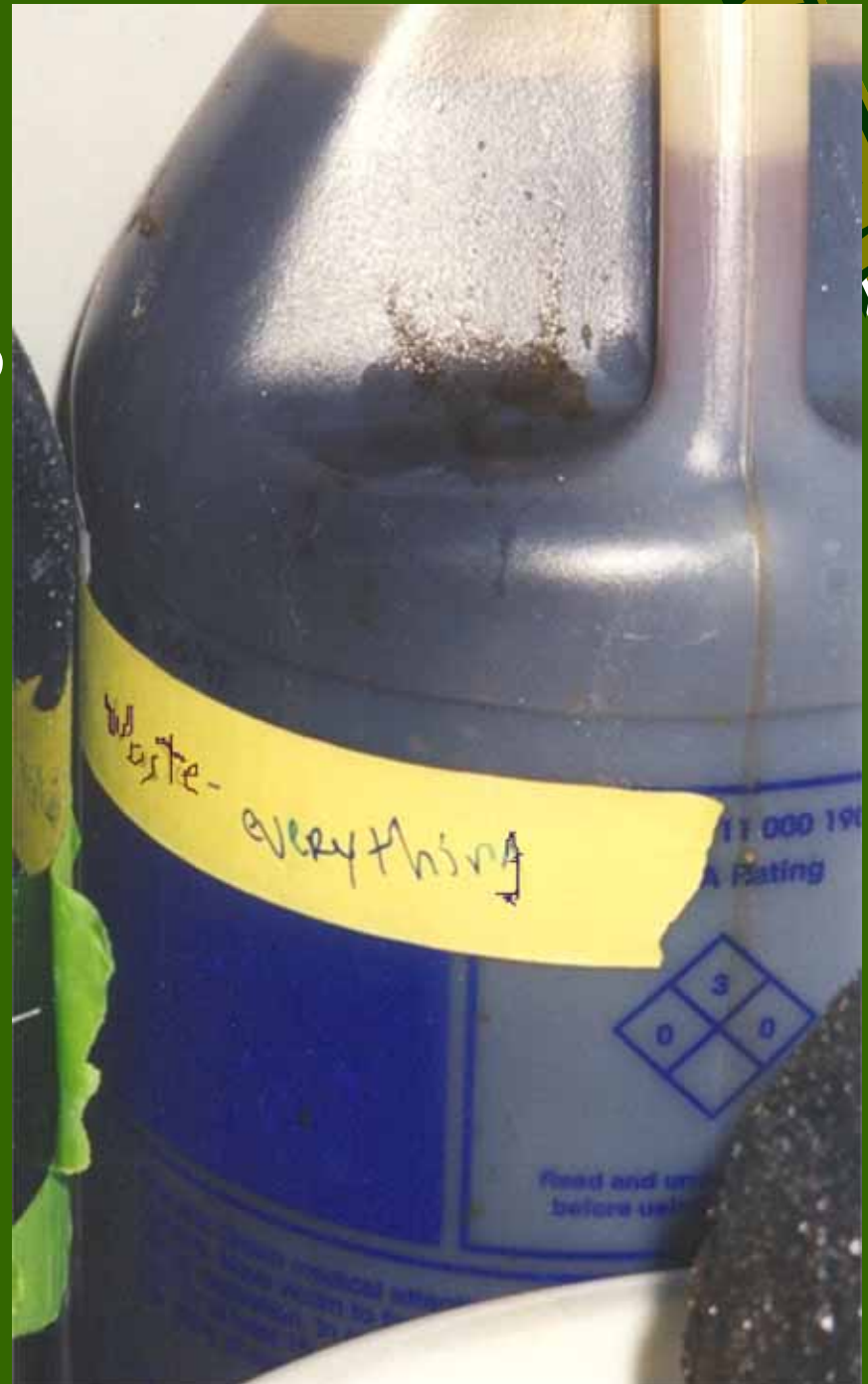
Nitric
"Gnome"



At least we know it's organic....



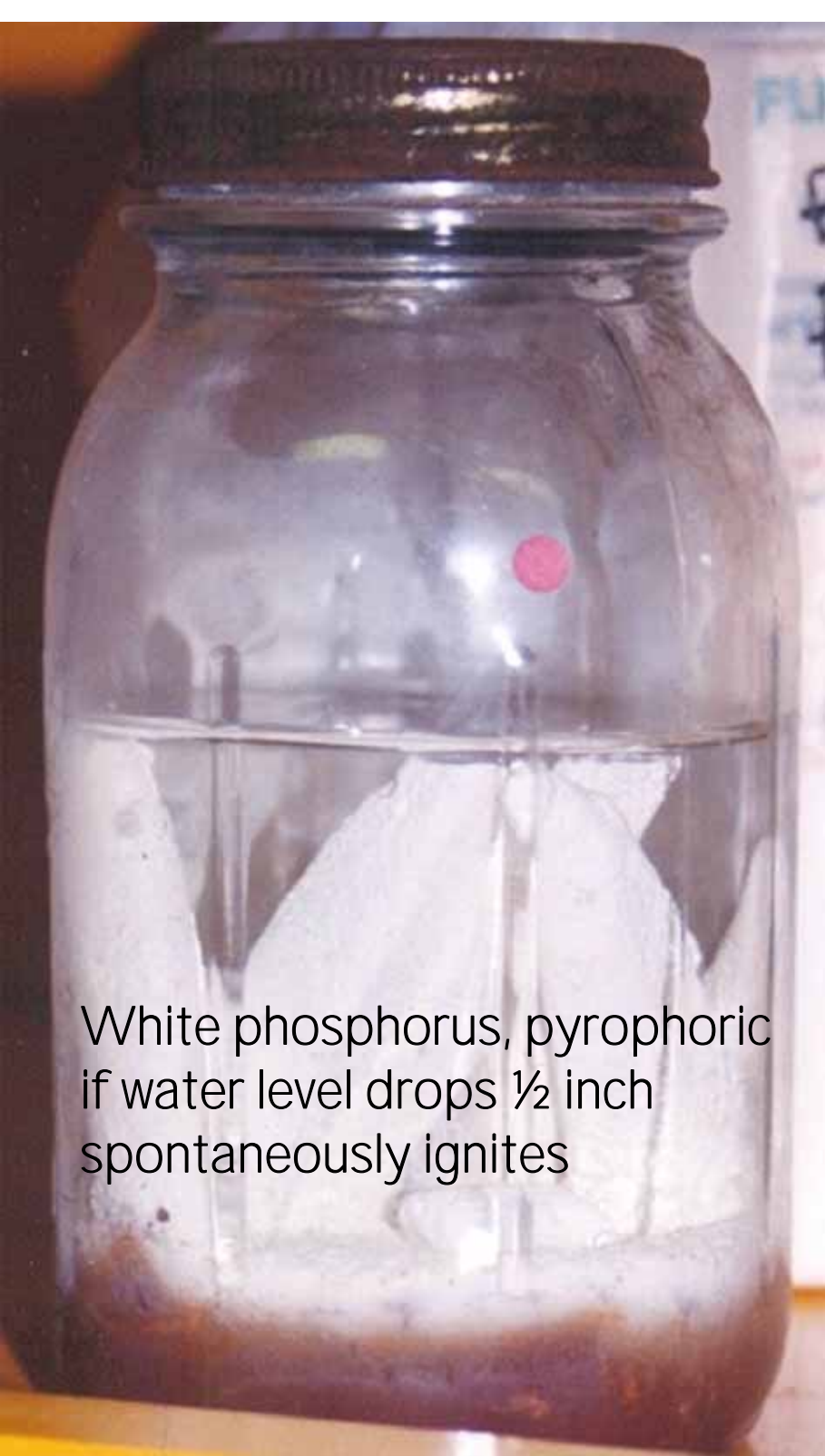
What IS it????



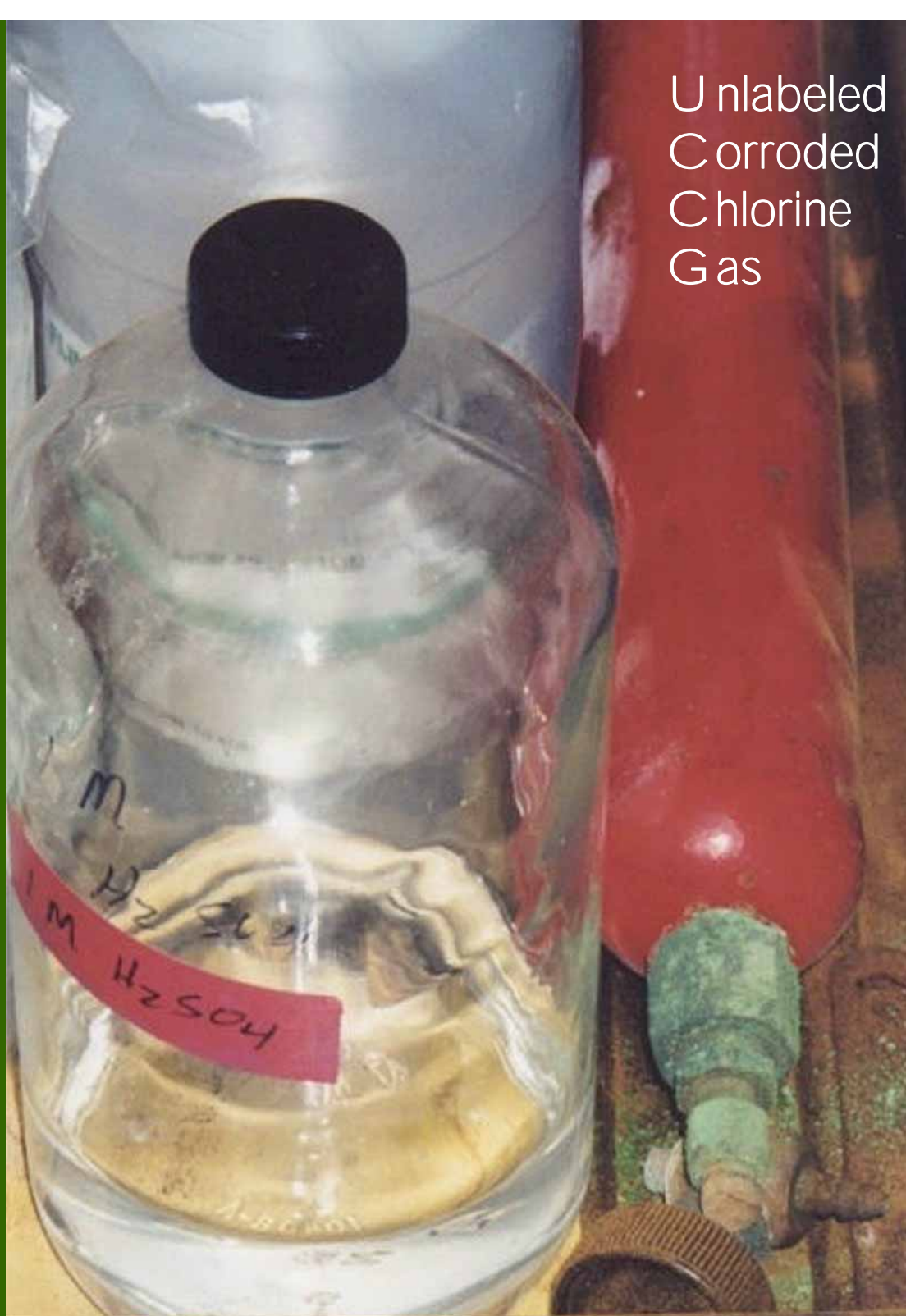
Hydrofluoric Acid

- Anesthetic: acid doesn't burn on contact
- Deep tissue and bone disintegration
- Extreme pain, can cause gangrene, amputation
- Highly corrosive, dissolves glass
- Used in Art & Chem classes for glass etching





White phosphorus, pyrophoric
if water level drops ½ inch
spontaneously ignites



Unlabeled
Corroded
Chlorine
Gas

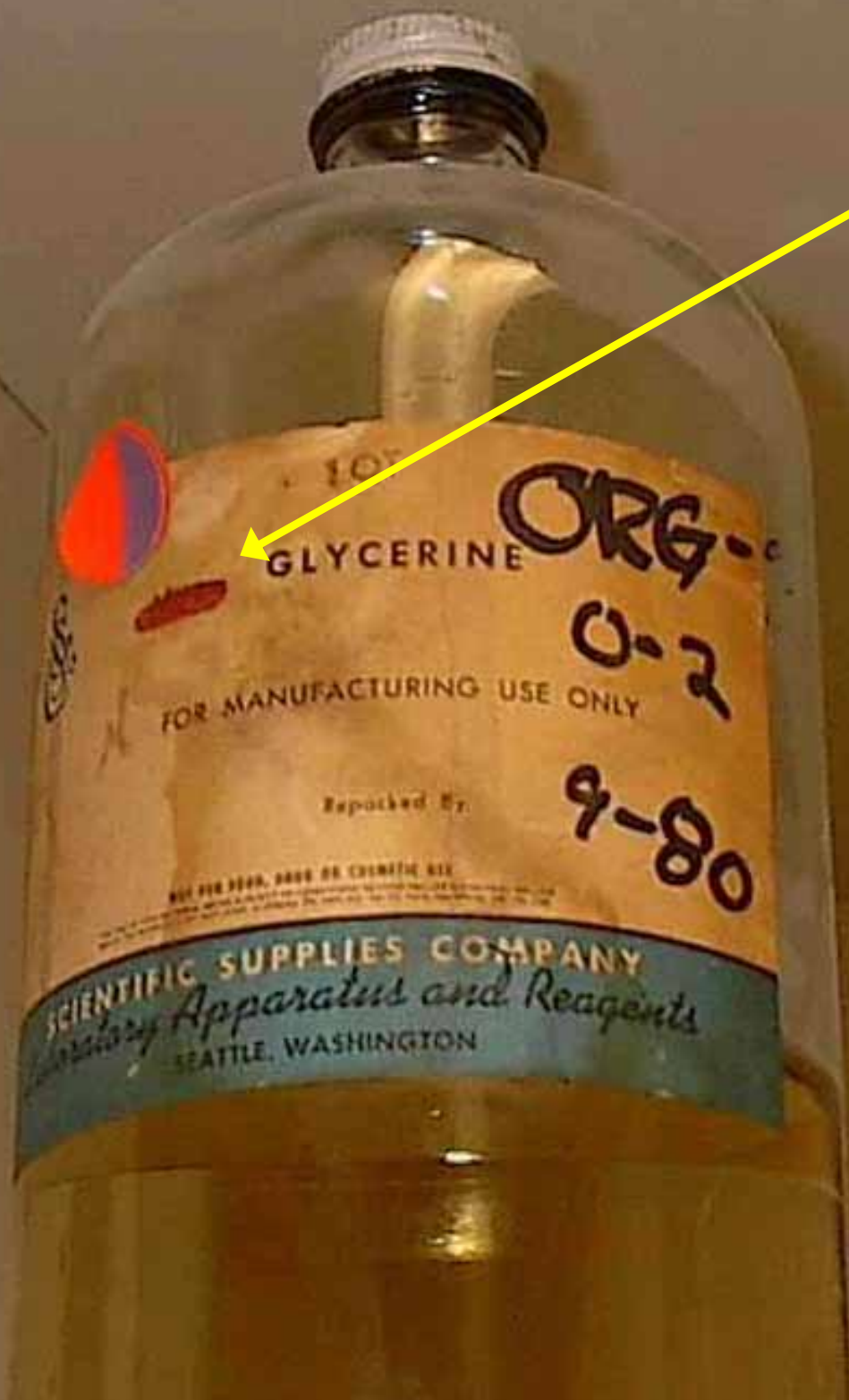


Chlorine
(corrosive poison)

Ammonia
(corrosive poison)

The "Box O Gases"

Hand-written word "Nitro"
in middle school lab.
Tested and found to be
nitroglycerine



Why are there problems with chemical management in schools?

- Lack of awareness
- Lack of environmental management system
- Lack of "somebody in charge" (add-on duty)
- Discount warehouse store effect
- Spend it or lose it monies



Why are there chemical management problems in schools? (cont'd.)

- Stockpiles from the 1950's – era of Sputnik and technology race
- Often little communication across Academic, Administrative, & Facilities departments

Facilities often not built for handling chemicals (ventilation, storage problems)



Storage in Labs



Bottles as structural support for shelf above them
Need disposal but can't move them



Goals of the Program...

Not only to eliminate the existing problem chemicals, but to change mindsets and establish policies in order to eliminate future problems.



Creating Continual Improvement



Types of Improvements Desired

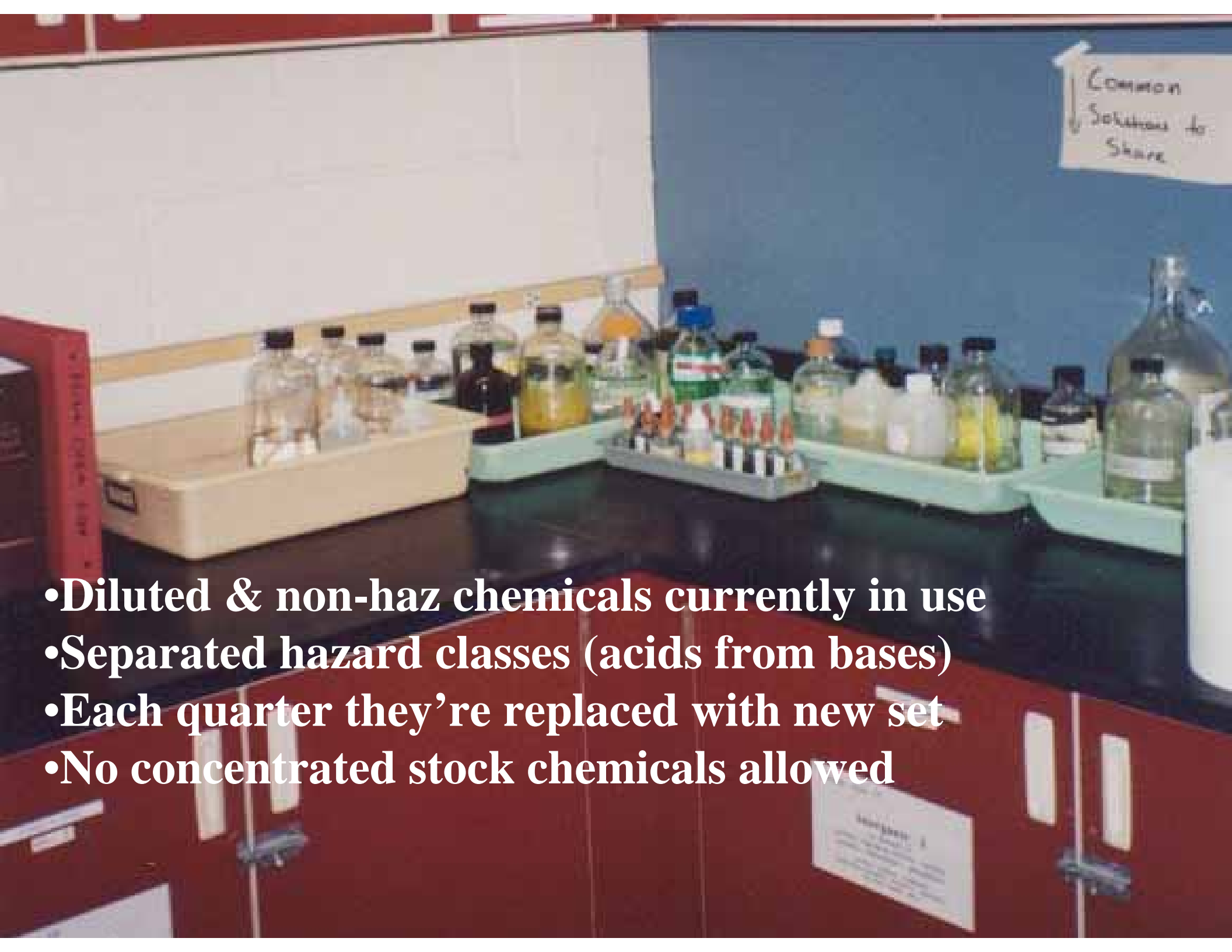
- Infrastructural changes
 - Facility design and materials
- Institutional changes
 - Purchasing practices
 - Storage practices
- Process changes
 - Chemical use
 - Waste disposal



Improved Chemical Storage

- Cupboards bolted to wall with lockable doors.
- Each door labeled with its contents and the chemical storage category

Common
Solutions to
Store



Common Solutions to Share

- Diluted & non-haz chemicals currently in use
- Separated hazard classes (acids from bases)
- Each quarter they're replaced with new set
- No concentrated stock chemicals allowed



Non-metallic acid cabinets

- Don't corrode
- Provide secondary containment

Recommended Short-Term Action Items

- Learn about chemical hazards
- Learn about requirements for storage and disposal
 - Federal (e.g. OSHA, EPA, DHS)
 - State (Dept. of Natural Resources)
 - Local (e.g. building or fire code)
 - District



Short-Term Action Items

Cont'd...

- Build awareness in
 - Administration
 - Business Officials
 - Purchasing
 - Facilities / Maintenance
- Elements to build awareness of
 - Issue is important
 - It needs attention
 - It needs funding



Short-Term Action Items

cont'd...

- Work with professionals to identify hazards
- Get rid of the Stockpiles
 - Prescreen
 - Inventory
 - Remove chemicals
 - Hazardous
 - Outdated
 - No longer needed



Short-Term Action Items Cont'd...

- For inventory remaining
 - Obtain and Maintain Material Safety Data Sheets
 - Keep 1 set in lab
 - Keep 1 set in office



Short-Term Action Items Cont'd...

- Learn how to handle spills
- Have a chemical spill kit on hand to take care of minor spills
- Use and keep personal protective gear on hand at all times
- A mercury spill of more than a fever thermometer is a large spill - anything larger than 2 T. must be reported to the National Response Center!



Recommended Long-Term Goals



- Develop a chemical management system that includes policies on:
 - Purchasing
 - Storage, including labeling
 - Use, including labeling
 - Disposal
 - Emergency Plan for spills, explosions, accidents



Long-Term Goals Cont'd...

- Use safer chemicals & less too
 - Order min. quantities, consistent with use
 - Try to keep only 1 year's worth in stock
- Prohibit certain chemicals period
(hazard potential outweighs educational potential)



The "Dirty Dozen"

- Barium chloride
- Benzene
- Carbon disulfide
- Carbon tetrachloride
- Cyanide compounds
- Formaldehyde
- Hydrofluoric acid
- Mercury & compounds
- Picric acid
- Potassium metal
- Sodium metal
- Thermite





Long-Term Goals Cont'd...

- Order "safer" alternatives, packaging, dilutions, kits
 - Green chemistry
 - Microscale approaches (e.g. spot plates instead of test tubes)
- Centralize inventory/purchasing



Long-Term Goals Cont'd...



- Develop and maintain chemical hygiene plan for lab chemicals (*at least*)
- Chemical Hygiene Plan identifies
 - Responsibilities
 - Administration
 - Teachers
 - Students
 - Basic rules and procedures
 - Safety
 - Handling of hazardous materials
 - Spill procedures
 - Waste procedures
 - Training



Long-Term Goals Cont'd...



- Chemical hygiene plans intended for the protection of EMPLOYEES
- Inform school or district of chemical hygiene plan
- Model plan (IL) at http://www.isbe.net/ils/science/pdf/science_safety.pdf



Long-Term Goals Cont'd...



- Regularly budget for removals (Cradle to grave)
- Address chemical issues in context with other environmental concerns



In Summary: Need To Help Schools See "The Big Picture"

- Chemical management can affect
 - Safety
 - Health
 - Indoor Air Quality
- Chemical mismanagement can affect
 - Drinking Water Quality
 - Stormwater Quality
- Environmental stewardship



"The Big Picture" Cont'd...



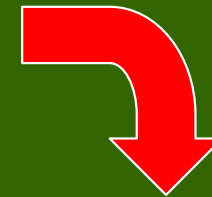
- Help schools look at Chemical Management as part of bigger set of EHS Issues (e.g.)
 - Poor IAQ
 - Pests /pesticide use
 - Mold
 - Deferral of maintenance
 - Funding
- Environmental Management Systems (EMS)
 - puts issues in context & addresses continuous improvement



Environmental Management System Approach



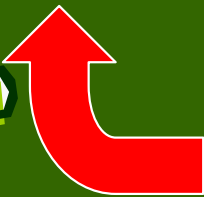
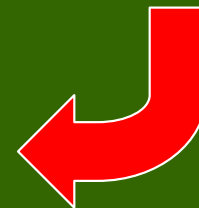
PLAN



ACT

DO

CHECK



Resources Available

There are plenty of tools available to assist schools directly, and to assist you in establishing lab cleanup programs in your areas.



A large, stylized illustration of a brown crayon with a white eraser and a white tip, positioned as if it has just finished drawing a white, wavy line on a light green background.

HealthySEAT

The Healthy School Environments Assessment Tool





Healthy School Environments Assessment Tool



- Voluntary self-audit software tool
- Fully customizable
- Intended for school district and state use
- Based on:
 - LAUSD facility assessment tool
 - EPA guidance and regulations
 - Existing State and district checklists
- No reporting requirements
- Cover many environmental topics (including chemical management)



Innovative Curricula



National Small-Scale Chemistry Center



Colorado State University

Knowledge to Go Places

Department of Chemistry
Center for Science, Math,
and Technology Education



What is Small Scale Chemistry?

Why Small Scale Chemistry?

Benefits of Small Scale Chemistry

How to use Small Scale Chemistry

Small Scale Chemistry Equipment

**"The molecule is the medium
and the message."**

Dr. Stephen Thompson



Resources

Videos:

—Order (FREE)

—Feedback

Technical Manual:

—Laboratory Manual for
CHEMTREK

—Regional Centers

Publications:

—Sample Experiments

www.smallscalechemistry.colostate.edu/



Rehab
the LAB

Safe Labs That Don't Pollute

<http://www.govlink.org/hazwaste/schoolyouth/rehab/labs.htm>



Determination of the Charge on an Electron

Topical Unit of Instruction: Atomic Structure

Teacher's Edition

Rehab
the LAB

Introduction

There are no chemical consumables in this lab. The ZnSO_4 can be reused from year to year indefinitely. After several years, it may no longer appear very pure, but it will still yield excellent results. The electrodes are also good for many years. To prolong battery life up to several years, they can be kept in the refrigerator or freezer. Recharging or recycling batteries will help keep batteries out of the landfills.

Materials

(For a class of 32 students working in pairs)

- 32 zinc electrodes (~3 X 10 cm)
- 1 package steel wool (from hardware store)
- balances (sensitive to 0.01 g)

More Resources

- School Chemistry Laboratory Safety Guide, Consumer Product Safety Commission, www.cpsc.gov, *due out by end of 2005*
- Material Safety Data Sheets
<http://www.siri.org/>
- Flinn Scientific
<http://www.flinnsci.com/>



Still More Resources



- Council of State Science Supervisors
 - Making the Connection
 - Science Safety: It's Elementary
 - <http://www.csss-science.org/safety.htm>
- Rehab the Lab, Safe labs that don't pollute
<http://www.govlink.org/hazwaste/schoolyouth/rehab/>



Even More Resources

- EPA's School Chemical Cleanout Campaign
www.epa.gov/sc3
- EPA's Healthy School Web Portal
www.epa.gov/schools
- EPA's Mercury Web Site
www.epa.gov/mercury

• Mercury in Schools Project

<http://www.mercuryinschools.uwex.edu/>



Can You Believe All The Available Resources?!



- The National Response Center – for hazardous materials spills - the hotline operates 24 hours a day, 7 days a week. Call (800) 424-8802.

- Info on mercury spills:

<http://www.epa.gov/epaoswer/hazwaste/mercury/spills.htm#cleanmercuryspills>

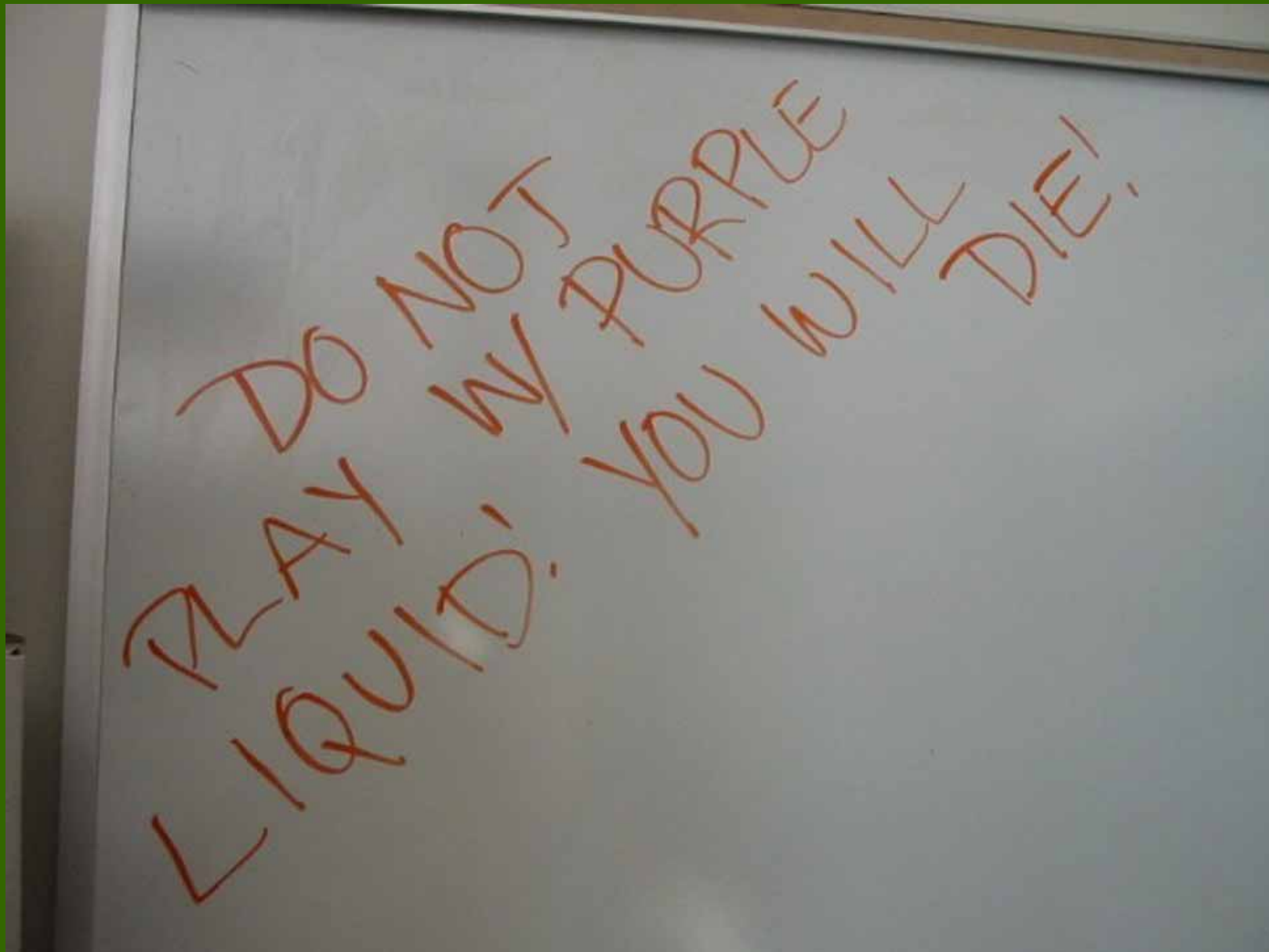


Potentially, the last
available resource that
we know about....



- King County, Seattle, WA, list of Excessive Risk Chemicals: <http://www.govlink.org/hazwaste/publications/highrisktable.pdf>





Note to students from teacher!

THE END

Questions?

