



# Top Priority Chemicals in the Pacific Northwest

David Livengood

Oregon DEQ Toxics Use & Waste  
Reduction Assistance Program



# Top TRI Chemicals in the Pacific Northwest on NPEP 31 Priority List

- Lead (10.9%)
- Mercury & compounds (3.3%)
- Hexachloroethane (3.3%)
- 1,2,4-Tricholobenzene (2.7%)
- Naphthalene (0.1%)
- Polycyclic aromatic compounds or PACs (negligible)
- PCBs (none)
- Cadmium (none)



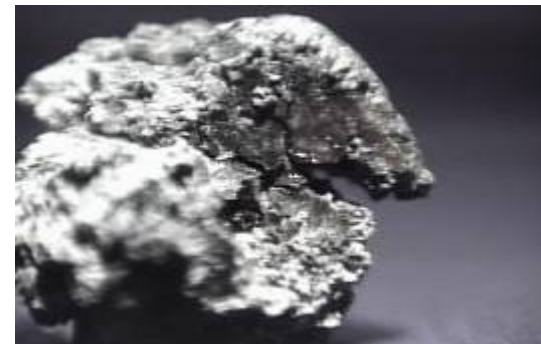
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- Naphthalene (0.1%)
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- PCBs (none)
- Cadmium (none)



# Lead: Source

- Bluish-gray metal
- Found in small amounts within the earth's crust
- Does not easily breakdown in the environment





# Lead: Uses

- Ammunition
- Soldering (e.g., electrical, electronic components)
- Batteries
- Pipes
- Shielding/aprons
- Pigments

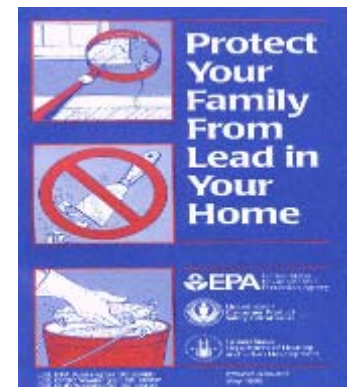
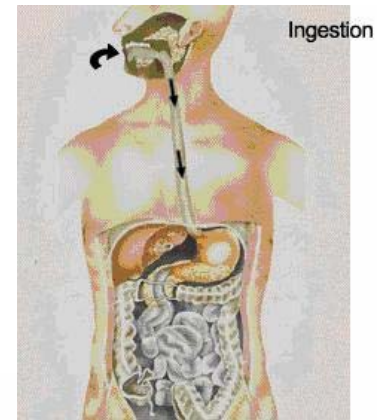


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# Lead: Hazard Pathways

- Ingestion: Most common pathway from air, food, soil, water, paint chips
- Inhalation: Fumes and dust
- Results in: Brain and kidney damage, death



[www.epa.gov/lead/pubs/leadinfo.htm](http://www.epa.gov/lead/pubs/leadinfo.htm)



# Lead: P2 Tips

- Substitute pigments and solders
- Substitute and recycle batteries, electronics, shields, weights, bullets (see fact sheets), etc.
- Recycle metals
- Modify equipment and processes
- Install a new, replacement process
- Use best practices





# Lead: Resources

- Federal Environmental Executive -  
[www.ofee.gov/wpr/chemical.htm](http://www.ofee.gov/wpr/chemical.htm)
- Letterkenny Army Depot case study -  
[www.denix.osd.mil/denix/Public/Library/PRO96/S19/note1.html](http://www.denix.osd.mil/denix/Public/Library/PRO96/S19/note1.html)
- Dept of Energy aprons case study -  
[www.eh.doe.gov/p2/p211/project.aspx?id=79](http://www.eh.doe.gov/p2/p211/project.aspx?id=79)
- Outdoor Shooting Range case study -  
[www.oshainfo.gatech.edu/lead/stewardship.pdf#search='lead%20p2](http://www.oshainfo.gatech.edu/lead/stewardship.pdf#search='lead%20p2)



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# Mercury: Source

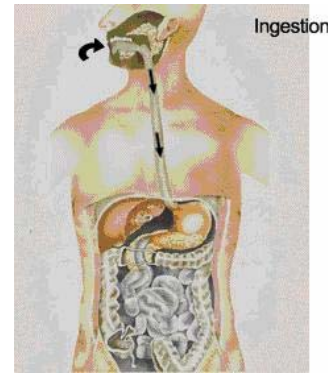
- Naturally occurring metal as cinnabar ore
- Has several forms:
  - Metallic
  - Inorganic compounds (salts)
  - Organic compounds (methyl mercury)
- From the Latin word *hydrargyrum* (liquid silver)





# Mercury: Hazard Pathways

- Ingestion: Methyl mercury in fish or shellfish
- Inhalation: Elemental mercury vapors from spills or burning
- Results in: Neurological damage, cancer

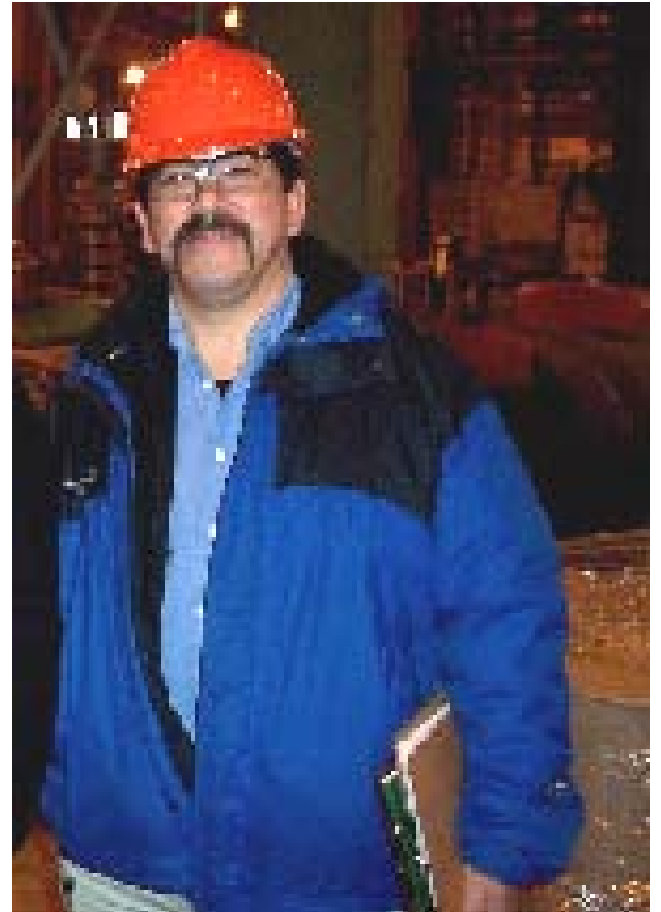


[www.epa.gov/mercury/effects.htm](http://www.epa.gov/mercury/effects.htm)



# More on Mercury Later

Presented by...





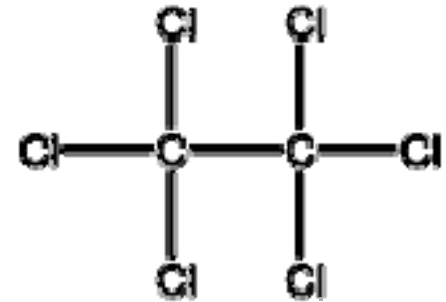
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# Hexachloroethane: Sources

- Slightly off-white crystalline
- Not naturally occurring
- By-product in production of other chemicals
- Forms when chlorinated hydrocarbons burn
- Forms when chlorine reacts with carbon compounds in water





# Hexachloroethane: Uses

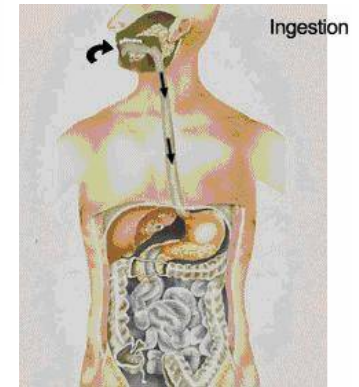
- Smoke candles or grenades
- Degassing agent in molten ore
- Pesticides – vet medicine
- Refrigerant
- Plastics
- Extreme-pressure lubricants





# Hexachloroethane: Hazard Pathways

- Inhalation most common effects central nervous system
- Ingestion: Poisoned drinking water
- Results in: Kidney and liver dysfunction





# Hexachloroethane: P2 Tips

- Substitute grenades and smoke pots
- Replace degassing agent with ultrasonic
- Substitute pesticides
- Substitute refrigerant



# Hexachloroethane: Resources

- Federal facilities Air Quality case study - [www.p2pays.org/ref/04/03776.htm](http://www.p2pays.org/ref/04/03776.htm)
- EPA Action Plan - [www.chemalliance.org/News/news\\_detail.asp?StoryID=391](http://www.chemalliance.org/News/news_detail.asp?StoryID=391)
- EPA fact sheet - [www.epa.gov/epaoswer/hazwaste/minimize/factsheets/hexchlet.pdf](http://www.epa.gov/epaoswer/hazwaste/minimize/factsheets/hexchlet.pdf)
- Department of Defense - [www.denix.osd.mil/denix/Public/ES-Programs/Pollution/TRI/1996/toxic.html](http://www.denix.osd.mil/denix/Public/ES-Programs/Pollution/TRI/1996/toxic.html)



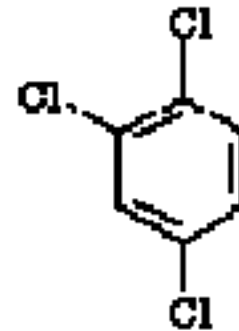
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- Naphthalene (0.1%)
- Polycyclic aromatic compounds or PACs (negligible)
- PCBs (none)
- Cadmium (none)



# 1,2,4-Trichlorobenzene: Source

- Does not occur naturally
- Colorless, non-flammable liquid created by 2 US companies



1,2,4-Trichlorobenzene



# 1,2,4-Tricholobenzene: Uses

- Cleaners/degreasers
- Solvent in dyes and other chemicals
- Transformer oils
- Lubricants





# 1,2,4-Tricholobenzene: Hazard Pathways

- Inhalation: most common
- Absorption: Eyes and skin irritant & dermatitis
- Results in: Respiratory tract, liver, kidney, central nervous system adrenal glands dysfunctions
- Chronic effects unknown





# 1,2,4-Tricholobenzene: P2 Tips

- Replace transformers or oils
- Substitute dielectric fluids
- Substitute solvents
- Substitute lubricants



# 1,2,4-Tricholobenzene: Resources

- EPA fact sheets -  
[www.epa.gov/enviro/html/emci/chemref/120821.html](http://www.epa.gov/enviro/html/emci/chemref/120821.html) and  
[www.epa.gov/epaoswer/hazwaste/minimize/factshts/trichlbe.pdf](http://www.epa.gov/epaoswer/hazwaste/minimize/factshts/trichlbe.pdf)
- Pollution Prevention Resource Center -  
[www.pprc.org/pubs/pbt.cfm#124trichlor](http://www.pprc.org/pubs/pbt.cfm#124trichlor)



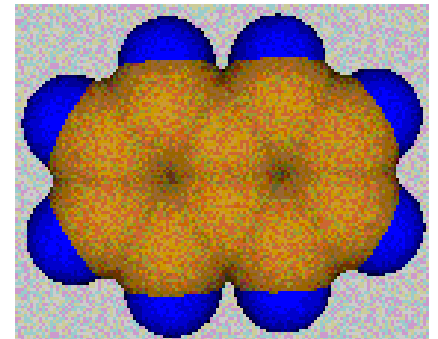
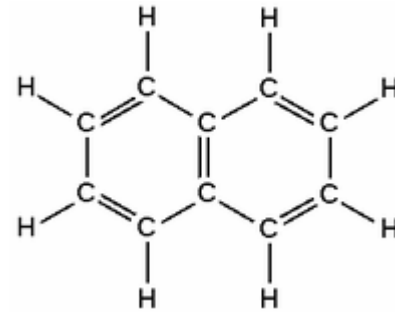
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- **Naphthalene (0.1%)**
- Polycyclic aromatic compounds or PACs (negligible)
- PCBs (none)
- Cadmium (none)



# Naphthalene: Source

- Naturally-occurring in coal and oil
- White crystalline solid or a liquid
- Produced from burning of coal, oil, tar and tobacco
- Smells like tar or mothballs





# Naphthalene: Uses

- Mothballs/pesticides
- Petroleum products
- Leather tanning
- Wood preservatives
- Ink and dye production





# Naphthalene: Hazard Pathways

- Inhalation: Most common in workplace
- Absorption: Through the eyes/membranes
- Results in: Hemolytic anemia and cataracts
- Passes through system in ~2 days





# Naphthalene: P2 Tips

- Substitute inks and dyes
- Substitute paints
- Replace paints
- Change painting process
- Substitute mothballs
- Substitute tanning solvent
- Replace cleaning process
- Substitute petroleum-based with water-based products





# Naphthalene: Resources

- State fleet management -  
[www.dep.state.fl.us/waste/categories/p2/pages/TallyFleetMgt.htm](http://www.dep.state.fl.us/waste/categories/p2/pages/TallyFleetMgt.htm)
- US EPA case study: Materials Sciences  
[www.epa.gov/reg3wcmd/wmmembers.htm#material](http://www.epa.gov/reg3wcmd/wmmembers.htm#material)
- OSTI aromatic reduction case study -  
[www.osti.gov/energycitations/product.biblio.jsp?osti\\_id=183061](http://www.osti.gov/energycitations/product biblio.jsp?osti_id=183061)



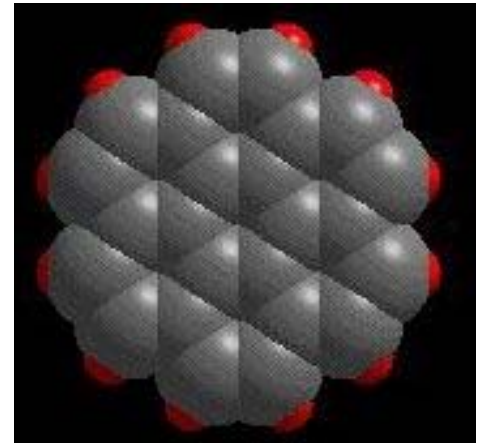
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- **Polycyclic aromatic compounds or PACs (negligible)**
- PCBs (none)
- Cadmium (none)



# Polycyclic aromatic compounds: Source

- aka Polycyclic aromatic hydrocarbons (PAHs)
- Solid form; colorless to white to pale yellow-green
- Family of organic chemicals based on the chemical structure of benzene
- Found in groups of two or more
- Naturally occurring and human made





# Polycyclic aromatic compounds: 17 out of hundreds

- acenaphthene
- acenaphthylene
- anthracene
- benz(a)anthracene
- benzo(a)pyrene
- benzo[e]pyrene
- benzo(b)fluoranthene
- benzo(ghi)perylene
- benzo[j]fluoranthene
- benzo(k)fluoranthene
- chrysene
- dibenz(a,h)anthracene
- fluoranthene
- fluorene
- indeno(1,2,3-cd) pyrene
- **naphthalene**
- phenanthrene
- pyrene



# Polycyclic aromatic compounds: Uses

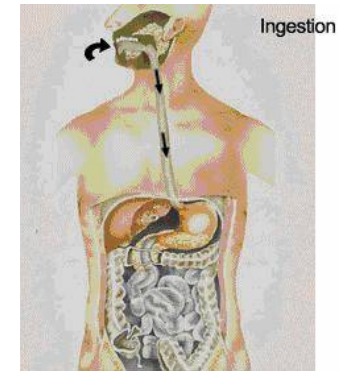
- Incomplete combustion of gas, coal, oil and garbage
- Dyes
- Paving asphalt
- Plastics
- Pesticides
- Medicines





# Polycyclic aromatic compounds: Hazard Pathways

- Inhalation: Most common
- Ingestion: contaminated water, food & soil
- Absorption: Used oils
- Results in: Reproductive problems, tumors, and cancer in some cases
- Passes through system in ~3 days





# Polycyclic aromatic compounds: P2 Tips

- Substitute petroleum-based products and ingredients
- Substitute petroleum-based combustion units
- Eliminate petroleum-based cleaners
- Non-P2: Install emission controls, use bioremediation





# Polycyclic aromatic compounds: Resources

- EPA fact sheet - [www.epa.gov/epaoswer/hazwaste/minimize/factsheets/pahs.pdf](http://www.epa.gov/epaoswer/hazwaste/minimize/factsheets/pahs.pdf)
- EPA Air Toxics - [www.epa.gov/ttn/atw/hlthef/polycycl.html](http://www.epa.gov/ttn/atw/hlthef/polycycl.html)
- US DHHS fact sheet - [www.atsdr.cdc.gov/toxprofiles/phs69.html](http://www.atsdr.cdc.gov/toxprofiles/phs69.html)
- Intern'l Society for PACs - [www.ispac.org/](http://www.ispac.org/)



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- **PCBs (none)**
- Cadmium (none)



# Polychlorinated biphenyl: Source

- Human made with over 200 PCB isomers and compounds
- Varies from mobile, oily liquids to white, crystalline solids and hard resins
- Resist decomposition by natural processes
- Stopped manuf. in 1977





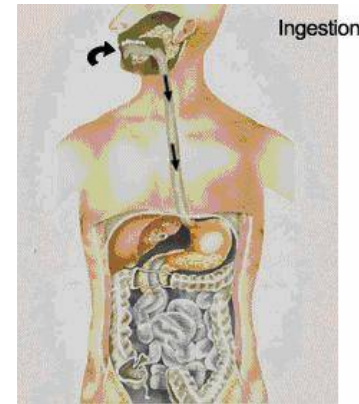
# Polychlorinated biphenyl: Uses

- Adhesives
- Transformers
- Large, high- and low-voltage capacitors
- Liquid-cooled electric motors
- Hydraulic systems
- Heat-transfer systems
- Fluorescent light ballasts
- Electromagnets
- Liquid-filled cable
- Gasketing and dampening felt
- Microscopy mounting media and immersion oil
- Switches
- Voltage regulators
- Vacuum pumps
- Microwave ovens
- Electronic equipment



# Polychlorinated biphenyl: Hazard Pathways

- Ingestion: Most common overall
- Inhalation: Most common in workplace
- Absorption: Contact with contaminated soil
- Results in: Acne, rashes, liver damage, and reproductive and behavioral problems





# Polychlorinated biphenyl: P2 Tips

- Substitute PCB-contaminated oils
- Replace PCB-containing equipment





# Polychlorinated biphenyl: Resources

- US EPA PCB sites - [www.epa.gov/pcb/](http://www.epa.gov/pcb/) and <http://yosemite.epa.gov/r10/owcm.nsf/pcb/pcb>
- US EPA fact sheets - [www.epa.gov/epaoswer/hazwaste/minimize/factsheets/pcb-fs.pdf](http://www.epa.gov/epaoswer/hazwaste/minimize/factsheets/pcb-fs.pdf) and [www.epa.gov/safewater/dwh/c-soc/pcbs.html](http://www.epa.gov/safewater/dwh/c-soc/pcbs.html)
- US EPA Substance Registry - [http://oaspub.epa.gov/srs/srs\\_proc\\_qry.navigate?P\\_SUB\\_ID=85878](http://oaspub.epa.gov/srs/srs_proc_qry.navigate?P_SUB_ID=85878)
- Environmental Health & Safety Online - [www.ehso.com/PCBregs.htm](http://www.ehso.com/PCBregs.htm)



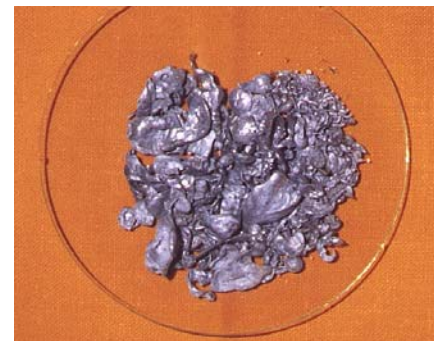
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- PCBs (none)
- **Cadmium (none)**



# Cadmium: Sources

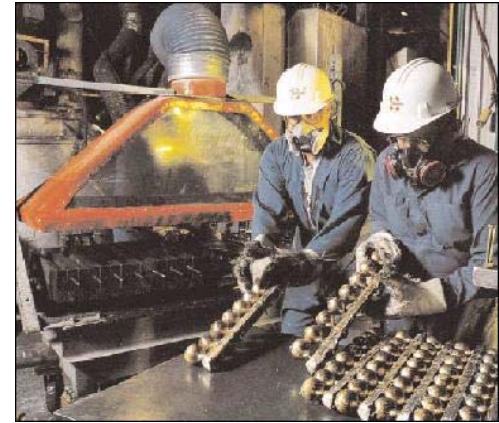
- Latin *cadmia* for being found with calamine in zinc ore
- Naturally occurring soft, bluish-white
- Found primarily in zinc, copper and lead ores
- Volcanic eruptions & forest fires





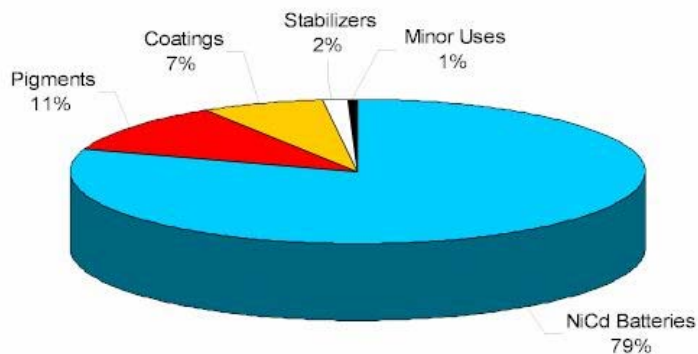
# Cadmium: Uses

- Coated-ferrous and nonferrous products
- Pigmented plastics, ceramics, glasses, paints and enamels
- Batteries
- Stabilized polyvinylchloride (PVC) products
- Alloys
- Electronic compounds

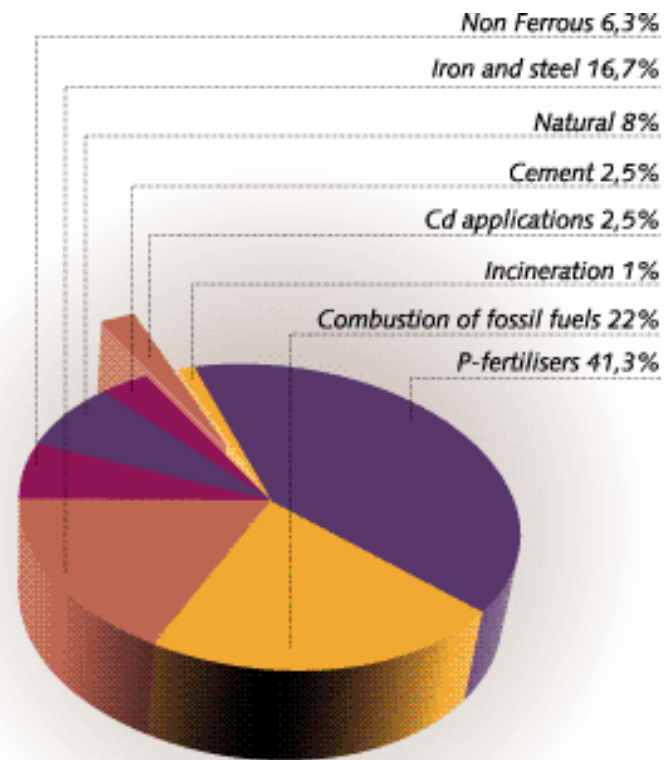




# Cadmium: Uses (cont.)



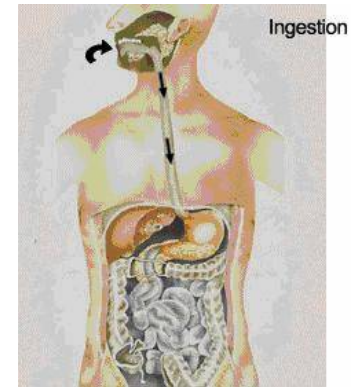
■ NiCd Batteries ■ Pigments ■ Coatings ■ Stabilizers ■ Minor Us





# Cadmium: Hazard Pathways

- Ingestion: Most common pathway
- Inhalation: In dust and fumes
- Results in: Kidney, liver, and respiratory tract complications





# Cadmium: P2 Tips

- Substitute pigments
- Substitute and recycle batteries
- Substitute fertilizers
- Replace plating solution
- Modify equipment and processes
- Install a new, replacement process
- Use best practices



# Cadmium: Resources

- Cadmium consortium - [www.cadmium.org](http://www.cadmium.org)
- Federal Environmental Executive - [www.ofee.gov/wpr/chemical.htm](http://www.ofee.gov/wpr/chemical.htm)
- Corpus Cristi Army Depot case study - [www.zerowastenetwork.org/success/story.cfm?StoryID=47&RegionalCenter](http://www.zerowastenetwork.org/success/story.cfm?StoryID=47&RegionalCenter)
- Tinker AFB case study [www.p2pays.org/ref/07/06008.htm](http://www.p2pays.org/ref/07/06008.htm)



# General Resources

- US EPA Federal Facilities -  
[www.epa.gov/epaoswer/hazwaste/minimize/fedfac.htm](http://www.epa.gov/epaoswer/hazwaste/minimize/fedfac.htm)  
and  
[www.epa.gov/epaoswer/hazwaste/minimize/trend05/fedfac.htm](http://www.epa.gov/epaoswer/hazwaste/minimize/trend05/fedfac.htm)
- US EPA Priority Chemicals and fact sheets -  
[www.epa.gov/epaoswer/hazwaste/minimize/chemlist.htm](http://www.epa.gov/epaoswer/hazwaste/minimize/chemlist.htm)
- Federal Environmental Executive -  
[www.ofee.gov/wpr/chemical.htm](http://www.ofee.gov/wpr/chemical.htm)
- US Dept of Energy - [www.eh.doe.gov/p2/resources.html](http://www.eh.doe.gov/p2/resources.html)
- State technical assistance programs



# Contact Information

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