



U.S. Chemical Safety History

Persons, Events and Regulation



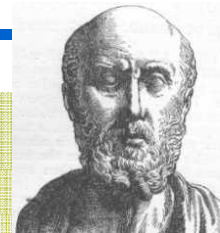
Chemical Safety History: Persons

Early Observers

400 BC

HIPPOCRATES

- FATHER OF MEDICINE
- FIRST TO WRITE OF OCCUPATIONAL DISEASE
 - LEAD POISONING IN SLAVES



Hippocrates

<http://commons.wikimedia.org/wiki/File:Hippocrates.jpg>

23-79 AD

PLINY THE ELDER

- USE OF ANIMAL BLADDERS AS MASKS
 - FOR METALWORKERS



Pliny the Elder

<http://faculty.arts.ubc.ca/sechard/344GEOFF.HTM>



1494

**GEORGIUS
AGRICOLA**

- ADVOCATED VENTILATION & MASKS
 - FOR MINERS & SMELTER WORKERS



Agricola

<http://toxsci.oxfordjournals.org/content/69/2.cover-expansion>

1529-37

PARACELSIUS

- FATHER OF TOXICOLOGY
 - FIRST BOOK ON OCCUPATIONAL DISEASE (1533: miners' disease)
 - "DOSE MAKES THE POISON" (paraphrased from "All things are poison and nothing is without poison, only the dose permits something not to be poisonous")



Paracelsus

<http://commons.wikimedia.org/wiki/File:Paracelsus-portrait.jpg>



Chemical Safety History: Persons

<http://toxipedia.org/display/toxipedia/Bernardo+Ramazzini>

Ramazzini



Later Observers

1713

BERNADINO RAMAZZINI

- FATHER OF OCCUPATIONAL MEDICINE
 - DESCRIBED PATHOLOGY OF SILICOSIS

1775

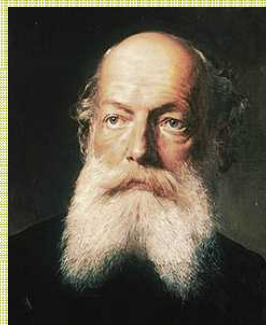
PERCIVAL POTT



Pott

http://georges.dolisi.free.fr/Biographies/Biographies_textes_p.htm

- PHYSICIAN
 - SHOWED FIRST OCCUPATIONAL LINK TO CANCER
 - AS ENVIRONMENTAL CARCINOGEN
 - » Chimney sweeps & scrotal cancer



Kekulé

http://commons.wikimedia.org/wiki/File:Heinrich_von_Angeli_-_Friedrich_August_Kekul%C3%A9_von_Stradonitz.jpg

Hamilton

http://commons.wikimedia.org/wiki/File:Alice_Hamilton.jpg



1890

AUGUST KEKULE

- THEORETICAL CHEMIST (benzene structure)
 - “IF YOU WANT TO BECOME A CHEMIST... YOU HAVE TO RUIN YOUR HEALTH. WHO DOES NOT RUIN HIS HEALTH BY HIS STUDIES, NOWADAYS WILL NOT GET ANYWHERE IN CHEMISTRY.”

1910-50

ALICE HAMILTON

- US MOTHER OF OCCUPATIONAL MEDICINE
 - DESCRIBED LEAD POISONING, AND
 - PHOSSY JAW
 - » in match workers, from white/yellow phosphorus





Chemical Safety History: Events & Regulation

1833-1901

British Factories Acts (BFA)



• BASIS OF EARLY US REGULATIONS

- CHILD AND WOMEN LABOR LAWS
- VENTILATION REQUIRED:

“to render harmless any gases, dusts...
that may be damaging to health....”

- APPOINTMENT OF INSPECTORS

mine rescue

[http://einhornpress.com/
FairmontCoal.aspx](http://einhornpress.com/FairmontCoal.aspx)



child mill worker

http://www.bbc.co.uk/history/familyhistory/bloodlines/workinglife.shtml?entry=factoryhealth_morals&theme=workinglife

1907

US Bureau of Mines created

- 3,200 KILLED IN U.S. MINING ACCIDENTS (1907)

1908

Federal Employer's Liability Act (FELA)

- IN RESPONSE TO HIGH NUMBER OF RAILROAD WORKER DEATHS IN LATE 1800s
- BOTH FCA and BFA LEGISLATED COMPENSATION TO INDUSTRIAL ACCIDENT VICTIMS



fatal rail accident

[http://upload.wikimedia.org/
wikipedia/en/5/56/Spencerport_train_accident_-_1917.jpg](http://upload.wikimedia.org/wikipedia/en/5/56/Spencerport_train_accident_-_1917.jpg)





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Triangle Fire protest

<http://pggibbons.blogspot.com/2009/11/triangle-fire-of-1911.html>

1911

Triangle Shirtwaist Fire

New York City; USA

- 146 GARMENT WORKER DEATHS
- RAISED AWARENESS OF SWEATSHOPS AND CHILD LABOR CONDITIONS
- LED TO WORKERS' COMPENSATION LAWS

1912

Sinking of the Titanic

- LED TO ADOPTION OF **S-O-S** AS INTERNATIONAL DISTRESS CALL

Titanic sinking

http://en.wikipedia.org/wiki/File:Titanic's_sinking_stem.jpg



1919

Molasses Disaster

Boston, MA; USA

- KILLED >20; INURED >150 PERSONS
- EXPLOSION FROM PRESSURE BUILD-UP IN STORAGE TANK



Molasses damage

http://upload.wikimedia.org/wikipedia/commons/7/71/Boston_1919_molasses_disaster_-_el_train_structure.jpg



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Hawk's Nest Tunnel

<http://www.elcosh.org/en/document/848/1232/d000803/1.html>



1936

Gauley Bridge Fayette County, WV; USA

- ~800 WORKERS DIED FROM ACUTE SILICOSIS
 - FROM BUILDING THE 4 MILE HAWKS NEST TUNNEL
 - LESSONS **NOT** LEARNED:
 - » NO PRECAUTIONS WERE TAKEN ALTHOUGH HEALTH EFFECTS OF SILICA WERE KNOWN

1936

Walsh-Healy Act

- FOR US FEDERAL CONTRACTS OVER \$10,000
 - “NO PART OF SUCH CONTRACT WILL BE PERFORMD... IN ANY PLANTS, FACTORIES, BUILDINGS, OR SURROUNDINGS OR *UNDER WORKING CONDITIONS WHICH ARE HAZARDOUS, UNSANITARY, OR DANGEROUS TO THE HEALTH AND SAFETY OF EMPLOYEES* ENGAGED IN THE PERFORMANCE OF SAID CONTRACT.”
 - START OF U.S. OCCUPATIONAL SAFETY & HEALTH ACT (OSHA)

EMPLOYEE RIGHTS ON GOVERNMENT CONTRACTS

THE UNITED STATES DEPARTMENT OF LABOR WAGE AND HOUR DIVISION

This establishment is performing Government contract work subject to (check one)

WHA Poster

<http://www.governmentposter.com/Walsh-Healey-Act-Poster-p/fed135.htm>

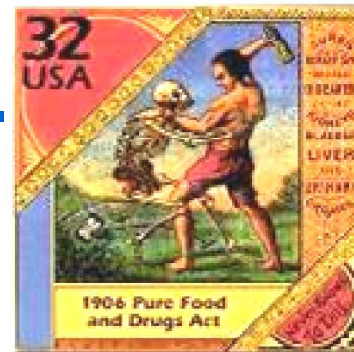




Chemical Safety History: Events & Regulation

Elixir Sulfanilamide

[http://bmartinmd.com/
2009/03/elixir-sulfanilamide-
legislation.html](http://bmartinmd.com/2009/03/elixir-sulfanilamide-legislation.html)



1937

Elixir Sulfanilamide

- STREPTOCOCCAL DRUG CAUSED >100 DEATHS IN 15 STATES
- LIQUID FORM OF SULFANILAMIDE WITH DIETHYLENE GLYCOL SOLVENT
- HASTENED ENACTMENT OF THE FOOD, DRUG, AND COSMETIC ACT
 - » SAVED U.S. FROM THE THALIDOMIDE DISASTER 25 YEARS LATER

1942

Cocoanut Grove Fire

Boston, MA; USA

- KILLED 492 PERSONS IN A NIGHTCLUB
- POOR EGRESS (ONE REVOLVING DOOR ENTRY, INWARD-SWINGING DOORS, LOCKED DOORS)
- HIGHLY FLAMMABLE MATERIALS
- REFORM OF FIRE CODES AND SAFETY STANDARDS IN U.S.
- LESSONS **NOT** LEARNED:
 - 1903 IROQUOIS THEATER FIRE IN CHICAGO
 - KILLED >600 PERSONS



Cocoanut
Grove Fire

[http://www.boston.com/
photo_gallery/
ri_fire/c2.htm](http://www.boston.com/photo_gallery/ri_fire/c2.htm)





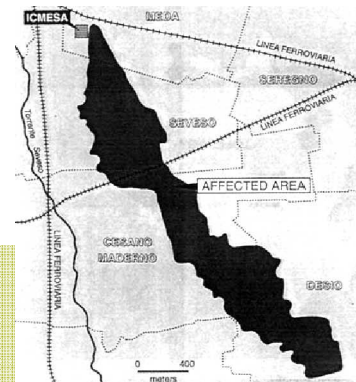
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<http://www.osha.gov/>

Seveso area
contamination

[http://www.unu.edu/unupress/
unupbooks/uu211e/uu211e09.htm](http://www.unu.edu/unupress/unupbooks/uu211e/uu211e09.htm)



1970 **Occupational Safety and Health Act (OSHA)**

- MAIN GOAL:
“SEND EVERY WORKER HOME,
WHOLE & HEALTHY EVERY DAY”

1976 **TCDD (dioxin) exposure**
Seveso, Italy

- RECOGNITION OF DIOXIN COMPOUND PROPERTIES
– PERSISTENCE AND ACCUMULATION IN FATTY TISSUE

1976 **Toxic Substances Control Act (TSCA, EPA)**

- ADDRESSES THE PRODUCTION, IMPORT, USE AND DISPOSAL OF SPECIFIC CHEMICALS INCLUDING PCBs, ASBESTOS, RADON AND LEAD-BASED PAINT.

1976 **Resources Conservation and Control Act (RCRA, EPA)**

- THREE MAIN PROGRAMS:
– UNDERGROUND STORAGE TANKS
– SOLID WASTE
– HAZARDOUS WASTE



TSCA Lead-Safe label

<http://n8jackson.com/aboutus.aspx>



Hazardous Waste Resource Locator

<http://www.envcap.org/hwrl/>



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Industrial discharge to river

http://www.cleanupamericaofny.com/clean_water_act.html



CH&S
CONNECTING CHEMISTRY
AND SAFETY

ACS-CH&S

<http://www.dchas.org/>

1977

Clean Water Act (CWA, EPA)
American Chemical Society (ACS) founds Division of Chemical Health and Safety

1977

1978

Love Canal toxic dumping
Niagara Falls, NY; USA

1978

Ward Transformer dumping
North Carolina; USA

1979

Valley of the Drums
near Louisville, KY; USA



Valley of Drums

<http://en.wikipedia.org/wiki/File:Valleyofdrums.jpg>

- 950 FAMILIES EVACUATED
- LED TO CERCLA
- IMPROPER DUMPING OF PCBs
- PERSISTENT CONTAMINATION
- EMERGENCY CLEANUP STARTED
- 23-ACRE TOXIC WASTE SITE
- CAUGHT FIRE AND BURNED FOR > A WEEK IN 1966
- LED TO CERCLA
- CLEANUP FOR >7 YEARS

Love Canal waste

<http://confluenceculture.wordpress.com/2009/09/30/superfund-365/>



Ward Transformer Site

http://www.cci-env.com/remediation_projects.htm

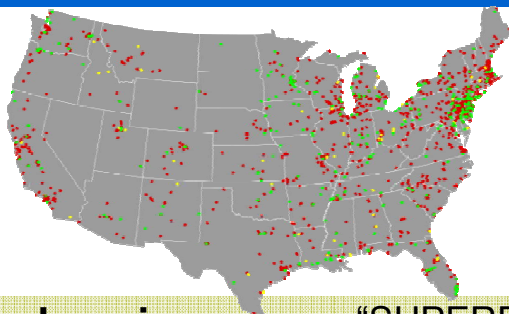




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Superfund Sites
(March 2010)

http://en.wikipedia.org/wiki/File:Superfund_sites.svg



Tylenol removal

<http://www.time.com/time/nation/article/0,8599,1878063,00.html>



1980

**Comprehensive
Environmental Response,
Compensation & Liability Act
(CERCLA, EPA)**

- “SUPERFUND” TO CLEAN UP SITES CONTAMINATED WITH HAZARDOUS SUBSTANCES
- CREATED THE AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY (ATSDR)

1982

Tylenol tampering –
Chicago, IL; USA

- CRIMINAL ACT OF LACING TYLENOL WITH CYANIDE
 - 7 PERSONS KILLED
 - RESULTED IN TAMPER-PROOF PACKAGING

1983

Dioxin contamination
Times Beach, MO; USA

- LARGEST CIVILIAN EXPOSURE TO DIOXINS IN U.S.
 - TOXIC WASTE MIXED WITH OIL
 - USED TO COAT RURAL TOWN ROADS
 - SOIL & WATER CONTAMINATED WITH DIOXIN & PCBs
 - TOWN FLOODED IN 1982, SPREADING CONTAMINATION
 - ILLNESSES, MISCARRIAGES & ANIMAL DEATHS
- TOWN FULLY EVACUATED 1982-85
 - FULLY DEMOLISHED BY 1992



Times Beach dioxin

<http://www.asmalldoseof.org/historyoftox/1970-2006.htox.php>



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Bhopal 25-yr vigil

[http://beta.thehindu.com/
opinion/columns/sainath/
article456495.ece?homepage=true](http://beta.thehindu.com/opinion/columns/sainath/article456495.ece?homepage=true)



1984

Bhopal accident

Bhopal, India

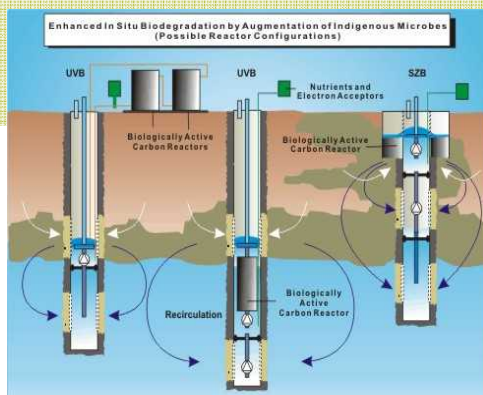
1985

Hazard Communication Standard

1986

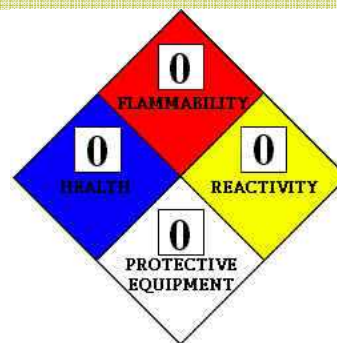
Superfund Amendments and Reauthorization Act (SARA, EPA)

- EMPLOYERS TO NOTIFY, TRAIN AND INFORM WORKERS ABOUT POTENTIALLY HAZARDOUS CHEMICALS AND PROVIDE MSDS
- STRESSED PERMANENT REMEDIES AND NEW TREATMENT TECHNOLOGIES
- REVISED HAZARD RANKING SYSTEM (HRS) TO ACCURATELY ASSESS RISKS TO HUMAN HEALTH AND THE ENVIRONMENT FROM UNCONTROLLED HAZARDOUS WASTE SITES



Bioremediation system

[http://www.iegtechnologies.co.uk/knowledge/
groundwatercirculation.shtml](http://www.iegtechnologies.co.uk/knowledge/groundwatercirculation.shtml)



MSDS/NFPA
Hazard Ratings
<http://skyproducts.com/msds.html>



Chemical Safety History: Events & Regulation

1988	PEPCON disaster – Henderson, NV; USA	• WELDING TORCH TO FIBERGLASS TO HDPE STORAGE DRUMS • AMMONIUM PERCHLORATE EXPLOSIONS – 7 EXPLOSIONS & NATURAL GAS LINE BENEATH FACILITY – 2 DEATHS, 372 INJURED – BLAST DAMAGE >10 MILES FROM EXPLOSIONS – DISASTER PLANS ACTIVATED
1990	Occupational Exposure to Hazardous Chemicals in Laboratories (Lab Standard, OSHA)	• REQUIRES CHEMICAL HYGIENE PLANS – “WRITTEN PROGRAM STATING THE POLICIES, PROCEDURES, AND RESPONSIBILITIES THAT SERVE TO PROTECT EMPLOYEES FROM THE HEALTH HAZARDS ASSOCIATED WITH THE HAZARDOUS CHEMICALS USED IN THAT PARTICULAR WORKPLACE”

PEPCON
explosion #2
<http://ahistoryofmayhem.com/?cat=11>



OSHA Lab Standard
[http://www.osha.gov/OshDoc/
data_General_Facts/hazardous
chemicalsinlabs-factsheet.pdf](http://www.osha.gov/OshDoc/data_General_Facts/hazardouschemicalsinlabs-factsheet.pdf)





Chemical Safety History: Events & Regulation

CSB Inspectors

<http://pubs.acs.org/cen/news/87/i11/8711news6.html>



1990

Clean Air Act Amendments

- ESTABLISHED CHEMICAL SAFETY BOARD
 - “TO INVESTIGATE ACCIDENTS TO DETERMINE THE CONDITIONS AND CIRCUMSTANCES WHICH LED UP TO THE EVENT AND TO IDENTIFY THE CAUSE OR CAUSES SO THAT SIMILAR EVENTS MIGHT BE PREVENTED”

1991

Imperial Foods fire Hamlet, NC; USA

- 25 workers killed
 - doors locked, no egress
 - owner jail sentence of 20 years

Imperial Foods door

<http://http://endeavors.unc.edu/fall2005/naumoff.php>



2003

House Appropriations Subcommittee on workforce protections

- TESTIMONY:
“FROM 1972 TO 2001, THERE HAVE BEEN AT LEAST 200,000 ON-THE-JOB DEATHS, 151 REFERRALS FOR CRIMINAL INVESTIGATION, AND 8 CASES RESULTING IN JAIL TIME.”



<http://www.twodaymag.com/live/view/are-toxic-chemicals-harming-our-reproductive-health>