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CURRENT SCIENTIFIC TOPICS FOR ATTORNEYS

***THE EXPERT APPROACH TO
EXPOSURES AND ACCIDENTS
INVOLVING HAZARDOUS MATERIALS***



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THE EXPERT APPROACH TO EXPOSURES AND ACCIDENTS INVOLVING HAZARDOUS MATERIALS

INTRODUCTION

This document was developed to provide technical information and guidance for clients about personal injuries caused by exposure to hazardous and toxic materials. Litigation involving health, safety and environmental (H, S & E) issues is highly specialized and very dynamic. Effective litigation support requires the expert scientist or engineer to possess sound knowledge that crosses the boundaries of many disciplines within Chemistry, Physics, Materials Science, chemical hazards, and federal, state and local regulations. Given the competitive forces in the legal business arena and the increasing judicial scrutiny of expert testimony (i.e., Daubert), it can be advantageous to qualify and to work with an expert early when undertaking a new matter involving hazardous materials.

Prompt investigation and documentation by an appropriate expert is especially important in litigation involving toxic or hazardous materials. An accident site, be it the burned skin of an individual or an accidental chemical spill on a roadway, is subject to rapid change: Solvents evaporate. Non-volatile liquids drain into concrete and soil. Reactive materials may decompose to become something else. Public or worker health and safety may require immediate removal of containers and site cleanup. Changes will also occur by natural environmental processes, new construction and unauthorized alteration. A site investigation documents conditions that will be used to assist in determining the nature, cause and responsibility for an excessive exposure or accident. A timely, thorough investigation defines the circumstances, secures evidence and data, and minimizes speculation.

WHAT ARE HAZARDOUS MATERIALS?

Hazardous materials are substances or mixtures of substances having characteristics that are capable of producing adverse effects on the health and safety of living organisms and the utility of buildings and structures. The word substance implies some kind of chemical. This is often true, but too restrictive. For purposes of this discussion hazardous materials include chemical and biological materials as well as electricity, magnetic fields, ionizing and non-ionizing radiation, intense and prolonged sound, and body fluid-borne pathogens.

The phrase hazardous material typically suggests such materials as asbestos, lead, radium, benzene, PCBs, methyl isocyanate, and DDT. Many lay and technical people can recite this list or a similar one because such materials are notorious and highly regulated. However, a more realistic and comprehensive list will include such materials as insecticides, herbicides, detergents, glues, caulks, varnishes, solvents, ammonia gas, swimming pool chemicals, petroleum products



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and thousands of chemical intermediates used to manufacture a twenty-first century way of life.

It can be helpful to appreciate that there is frequently a fine line between a material and a process. The following four examples help to illustrate this important point: An electrician was burned severely when he used both hands to touch a wire conductor that he thought had been de-energized by a coworker. A construction worker was asphyxiated when she became trapped in a confined space containing too much carbon dioxide and too little oxygen. A homeowner mixed two relatively safe cleaning materials and required emergency treatment for esophageal burns from the chlorine that was liberated. A phlebotomist became infected with the blood-borne pathogen Hepatitis C from a needle stick.

These examples have a common theme. The agents of injury; namely, electricity, carbon dioxide, chlorine, and diseased blood did so because of how these agents were delivered and processed by the human body. Thus, hazardous materials should be understood to include hazardous processes where the word process means the manner by which the hazardous material is brought into contact with human tissues and physiological processes.

HAZARDOUS MATERIALS LEGISLATION

There are many federal laws that identify and regulate hazardous materials. The following is a brief overview of the major pieces of legislation that comprise the federal hazardous materials management policies and programs. Many municipalities and most states and territories have their own environmental, safety and health laws and regulations. Federal regulations will not preempt state and local regulations as long as they are at least as stringent as the federal regulations.

Superfund Amendments and Reauthorization Act (SARA), 1986

In 1980, Congress passed the Comprehensive Emergency Response, Compensation, and Liability Act, known as CERCLA. The bill's purpose was to fund cleanups and emergency response actions for some of the worst inactive or abandoned hazardous waste sites scattered across the country. A billion-dollar revolving trust fund--financed primarily by a tax on certain chemical and petroleum products--was created to pay for federal and state response actions when hazardous substances pose an existing or potential threat to human health or the environment.

In 1986, this bill was revised and expanded in the Superfund Amendments and Reauthorization Act of 1986 (SARA). The third part of SARA, Title III, is known as the Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986. This portion of the legislation makes over three hundred "extremely hazardous substances" subject to routine and detailed reporting to designated local, state, and federal government agencies. It also requires local emergency planning committees (LEPC) to use this information (and other data on local hazards) to create effective plans for hazardous materials emergencies.

* Much of this discussion was abstracted from Federal Emergency Management Agency, National Fire Academy Publication IS-5 (1993), "Hazardous Materials: A Citizen's Orientation".



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The National Oil and Hazardous Substance Pollution Contingency Plan (NCP)

The National Contingency Plan is the basis for federal action to minimize pollution damage from discharges of oil or hazardous substances. In accordance with this law, federal agencies assist in the development and evaluation of national, regional, and local oil and hazardous substance pollution contingency plans. This coordinated planning enables communities to prevent or lessen the harm that could accompany a hazardous materials release.

Experts from 14 federal agencies work together as part of the National Response Team. The team publishes guidance on emergency response planning and stands ready to assist states in the event of a major chemical emergency. As co-chairs of the National Response Team, EPA and the Coast Guard play key roles in environmental protection. The two agencies share specific responsibility for waterway protection, EPA having primary responsibility for most *inland* waters and the Coast Guard having responsibility for *coastal* waters and some specifically designated federal navigable waterways such as Lake Michigan.

The NCP covers how to identify and investigate hazardous waste sites that could potentially pose such a serious threat to public health that the situation would be considered an emergency. It also specifies how to analyze costs and evaluate the best cleanup options, and details roles and responsibilities for federal, state, and local governments in carrying out these requirements.

The Resource Conservation and Recovery Act (RCRA), 1976

This law, administered by EPA, establishes a federal program to provide comprehensive regulation of hazardous waste, which includes certain materials held to pose a potential threat to public health and safety when they are discarded. RCRA regulations provide and maintain a hazardous waste management system that covers the generation, transportation, use, and disposal of such waste (regulation from "cradle to grave"). Major control mechanisms include a manifest system to track hazardous waste shipments and a permit system requiring waste site owners and operators to comply with specified safety standards. While RCRA primarily regulates safety precautions at hazardous waste facilities in operation today, it also has strong provisions potentially relevant to cleanup if any part of a facility was in operation during the 1980s.

The Hazardous Materials Transportation Act (HMTA)

The Department of Transportation (DOT) has the authority to regulate the handling and interstate transportation of hazardous materials. More specifically, DOT's Office of Hazardous Materials Transportation (OHMT) issues regulations dealing with the shipping and packaging of hazardous materials, including how they are classified and labeled (both nationally and internationally). While the law enables DOT to regulate any traffic that "affects" interstate or foreign commerce, the agency has chosen to regulate only shipments of carriers engaged in interstate commerce, leaving the states to regulate shipments by carriers that do not cross state lines.

The Occupational Safety and Health Act (OSHA), 1970

The purpose of the OSH Act is to assure, as far as possible, "safe working conditions" to "every working man in the country." This is accomplished by the issuing of basic safety and health



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standards, assigning OSHA employees to inspect workplaces, and forcing industry to reduce or eliminate job hazards by imposing fines for identified violations.

The Occupational Safety and Health Administration (OSHA) sets standards for worker exposure to hazardous substances and requires that such substances bear warning labels. It also mandates that employees be given training and other information on dangers posed by chemicals, and be given instruction as to how to use these chemicals safely. OSHA has the authority to inspect a workplace to determine whether it is in compliance with these regulations. In current practice, only an accident, a worker complaint or high worker injury rates as shown in company records will trigger an actual inspection.

Under SARA, the Secretary of Labor was directed to issue a final standard to protect the health and safety of employees engaged in hazardous waste operations. In 1989, OSHA issued this rule on Hazardous Waste Operations and Emergency Response (HAZWOPER), which represents the first comprehensive approach to protecting public and private sector employees involved in the dangerous business of handling hazardous waste materials. Many of the workers affected by this rule are employees of state and local governments. Twenty-five states and territories have their own job safety and health programs.

The Toxic Substances Control Act (TSCA), 1976

This legislation was passed to reduce the threat from *new* chemicals that "present or will present an unreasonable risk of injury to health or the environment." As a result, chemical producers and importers are required to research the effects of new chemicals and notify EPA before they are manufactured in greater than research and marketing quantities. EPA has the authority to ban or restrict chemical uses if there is sufficient evidence that a substance poses an "unreasonable risk."

Pesticides Legislation

Both the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) and the Federal Food, Drug and Cosmetic Act (FFDCA) regulate pesticides. Originally requiring mere registration of pesticides, FIFRA was amended in 1972 to require testing for short-term and long-term toxic effects prior to registration. For pesticides used on food crops, EPA establishes an upper limit on the amount of residue that can remain on food based on human tolerance levels. The FFDCA requires the Food and Drug Administration (FDA) to enforce these residue limits by monitoring and seizing foods whose residues are in excess of these standards.

The Clean Air Act (CAA), 1970

This act is the basic federal law for controlling toxic air pollution. It requires EPA to keep an up-to-date list of industrial pollutants that are hazardous to human health, and set an emission standard for each "with an ample margin of safety." Under the law, EPA prepares minimum pollution standards, and states prepare implementation plans showing how these standards will be attained. States issue permits for the release of listed pollutants into the atmosphere, and take samples to evaluate the state's air quality. Of the 320 toxic air pollutants named in the act, EPA has to date completed regulations governing only seven, in large part because industry protests have resulted in legal precedents requiring costly and lengthy scientific studies to show that a



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pollutant has harmful effects at a certain level.

In the Clean Air Act Amendments of 1990, Congress enacted Section 112(r)(1), also known as the General Duty Clause (GDC), which makes the owners and operators of facilities that have regulated and extremely hazardous substances responsible for ensuring that their chemicals are managed safely. Facilities have been required to comply with GDC since November, 1990.

According to the General Duty Clause, owners and operators of stationary sources producing, processing, handling or storing a chemical listed in 40 CFR Part 68 or any other extremely hazardous substance have a general duty to: identify hazards that may result from releases; use appropriate hazard assessment techniques; to design and maintain a safe facility taking such steps as are necessary to prevent releases; and to minimize the consequences of accidental releases that do occur.

One of the more recent regulations affecting facilities is The Risk Management Program (RMP). The Risk Management Program is also part of the EPA's 112(r) program dedicated to recognizing hazards and preventing accidents. It differs from the GDC in that it requires facilities that use listed toxic or flammable chemicals above certain threshold quantities to make their hazard assessment, emergency response and prevention program information available to the public. The deadline for businesses to provide this information in specific reporting formats was June 30, 1999. Most of the information provided under the RMP can be found on the EPA Envirofacts website.

The Clean Water Act (CWA), 1972

This act envisioned swimmable waters by 1983 and pollution discharges halted by 1985. Obviously, these goals were not accomplished. The law continues to promote clean water by supporting construction of sewage treatment facilities (which are currently bearing a heavy burden in processing pollutants); supporting the preparation of water quality plans encompassing the entire nation; and setting up a permit system restricting the amount and type of pollutants that can be discharged into the nation's waterways. Modest fines may be imposed for illegal spills. The law is primarily designed to address point sources of pollution, paying far less attention to non-point sources such as agricultural runoff (currently estimated to be responsible for 65 percent of stream pollution).

The Safe Drinking Water Act

This act is specifically designed to protect public water supplies from contamination by mandating water testing, denying federal funds to projects that threaten critical water supplies, and requiring states to submit plans to protect public wells from contamination. The law also has a Right to Know provision through which the public must be informed if certain contaminants are present in drinking water above specified levels.

The Federal Facilities Compliance Act of (FFCA), 1992

This act requires the federal government to hold itself to the same standards (with certain accommodations for the national defense) as the private sector with regard to RCRA. It gives



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EPA the authority to assess civil penalties against federal agencies. Federal agencies are subject to monetary penalties to the same degree as the private sector for violations of federal, state and local solid and hazardous waste laws.

Executive Order (E.O.) 12856, Federal Compliance with Right-to Know Laws and Pollution Prevention Requirements, 1993.

This Presidential order directs, among other things, all federal facilities to comply with EPCRA and PPA and, further, to publicly report toxic materials inventories and emissions.

ORIGINS OF HAZARDOUS MATERIALS

- Abatement of asbestos and PCBs
- Accidental spills
- Biological organisms
- Construction
- Cosmetics
- Demolition
- Dry cleaning
- Electric utilities releases
- Electromagnetic fields
- Food processing
- Household and commercial chemicals
- Industrial releases
- Lead from paints and batteries
- Medical activities
- Mercury from electric switches, ballasts, and batteries
- Military Activities, including ordnance
- Municipal waste water treatment
- Pesticides and herbicides
- Photographic film processing
- Radiation
- Storm water runoff
- Toys and crafts
- Underground storage tanks
- Vehicle emissions
- Wastes
- Water run-off from farms and mines
- Work places

The above is a partial listing of hazards that are attributable to our technology. Nature can toss in a few potent ones too. Some of these are toxic and caustic gases from volcanic activity, toxic gases from animal and vegetable decomposition, and ground water leaching of heavy metals.



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HAZARDOUS AND TOXIC MATERIALS ACCIDENT COMPONENTS

The conditions in a home or workplace may be factors of an accident or long-term exposure. Some of the items in the following listing should be considered for investigation and discovery materials when evaluating a hazardous condition. An investigation, with experts when warranted, should help determine the nature and cause of an accident to formulate reasonable theories of causation and liability. Details considered relevant when preliminary case theories are postulated may require modification, as information becomes available.

- | | | |
|--|--|--|
| <input type="checkbox"/> Acids | <input type="checkbox"/> Fuels | <input type="checkbox"/> Records and logs |
| <input type="checkbox"/> Adhesives | <input type="checkbox"/> Fumes | <input type="checkbox"/> Regulated Chemicals |
| <input type="checkbox"/> Alarms | <input type="checkbox"/> Gloves | <input type="checkbox"/> Residues |
| <input type="checkbox"/> Air flow | <input type="checkbox"/> Hazard Communication | <input type="checkbox"/> Respirators |
| <input type="checkbox"/> Attitudes | <input type="checkbox"/> Headgear | <input type="checkbox"/> Restricted Areas |
| <input type="checkbox"/> Biohazards | <input type="checkbox"/> Heat | <input type="checkbox"/> Risk Management Plan |
| <input type="checkbox"/> Bottles | <input type="checkbox"/> Housekeeping | <input type="checkbox"/> Safety Showers |
| <input type="checkbox"/> Capacities | <input type="checkbox"/> Humidity | <input type="checkbox"/> Sampling |
| <input type="checkbox"/> Caustics | <input type="checkbox"/> Illumination | <input type="checkbox"/> Sealants |
| <input type="checkbox"/> Change Rooms | <input type="checkbox"/> Incompatible Materials | <input type="checkbox"/> Shipping |
| <input type="checkbox"/> Charring | <input type="checkbox"/> Industrial Hygiene Surveys | <input type="checkbox"/> Shipping Papers |
| <input type="checkbox"/> Chemical Hygiene Plan | <input type="checkbox"/> Inspections | <input type="checkbox"/> Signs |
| <input type="checkbox"/> Chemicals Inventory | <input type="checkbox"/> Instructions | <input type="checkbox"/> Size Reduction |
| <input type="checkbox"/> Citations | <input type="checkbox"/> Labels | <input type="checkbox"/> Slippery Surfaces |
| <input type="checkbox"/> Combustible Materials | <input type="checkbox"/> Layout/Floor plans | <input type="checkbox"/> Solvents |
| <input type="checkbox"/> Compressed Gases | <input type="checkbox"/> Leaks | <input type="checkbox"/> Sound Level |
| <input type="checkbox"/> Containers | <input type="checkbox"/> Listed Chemicals | <input type="checkbox"/> Specifications |
| <input type="checkbox"/> Confined Spaces | <input type="checkbox"/> Lockout/Tagout | <input type="checkbox"/> Speed Settings |
| <input type="checkbox"/> Contingency Plans | <input type="checkbox"/> Lubricants | <input type="checkbox"/> Spill |
| <input type="checkbox"/> Conveyors | <input type="checkbox"/> Machine Guards | <input type="checkbox"/> Spray Booths |
| <input type="checkbox"/> Corrosion | <input type="checkbox"/> Management Practices | <input type="checkbox"/> Stain |
| <input type="checkbox"/> Cryogenics | <input type="checkbox"/> Material Safety Data Sheets | <input type="checkbox"/> Storage locations |
| <input type="checkbox"/> Damaged Equipment | <input type="checkbox"/> Materials Handling | <input type="checkbox"/> Storage Tanks |
| <input type="checkbox"/> Dikes | <input type="checkbox"/> Medical Surveillance | <input type="checkbox"/> Supervision |
| <input type="checkbox"/> Disabled Devices | <input type="checkbox"/> Mists | <input type="checkbox"/> Tags |
| <input type="checkbox"/> Discolored Vegetation | <input type="checkbox"/> Mixed Waste | <input type="checkbox"/> Temperature |
| <input type="checkbox"/> Disposal | <input type="checkbox"/> Mixing and Blending | <input type="checkbox"/> Toxic Materials |
| <input type="checkbox"/> Drawings | <input type="checkbox"/> Noise | <input type="checkbox"/> Training of Personnel |
| <input type="checkbox"/> Drums | <input type="checkbox"/> Operating Manuals | <input type="checkbox"/> Trash |
| <input type="checkbox"/> Dusts | <input type="checkbox"/> Oxidizers | <input type="checkbox"/> Ventilation |
| <input type="checkbox"/> Electrical grounding | <input type="checkbox"/> Paints | <input type="checkbox"/> Warnings |
| <input type="checkbox"/> Exhaust Hoods | <input type="checkbox"/> Particles | <input type="checkbox"/> Waste |
| <input type="checkbox"/> Explosives | <input type="checkbox"/> Permits | <input type="checkbox"/> Working Surfaces |
| <input type="checkbox"/> Exposure Monitoring | <input type="checkbox"/> Placards | |
| <input type="checkbox"/> Eye Wash Stations | <input type="checkbox"/> Ponds | |
| <input type="checkbox"/> Eyewear | <input type="checkbox"/> Power Settings | |
| <input type="checkbox"/> Fire Extinguishers | <input type="checkbox"/> Pressure | |
| <input type="checkbox"/> Flammable Materials | <input type="checkbox"/> Process Description | |
| <input type="checkbox"/> Footwear | <input type="checkbox"/> Protective Clothing | |
| <input type="checkbox"/> Friction | <input type="checkbox"/> Qualifications | |



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HAZARDOUS MATERIALS EXPERT ASSISTANCE FOR INVESTIGATIONS

An attorney often encounters technical documents or engineering reports that provide information that is difficult to understand and interpret. The technical expert can provide timely interpretation and perspective in performing tasks that include the following:

- Arrange or conduct chemical and physical testing
- Code enforcement file review
- Code requirements, code changes and standards review
- Collaborate with other consultants
- Compliance review
- Deposition notes
- Drawings, contracts and design documents review
- Engineering and construction general practice criteria
- Evidence collection and packaging
- Evidence storage
- Examination of accident scene
- Exhibit preparation
- Governmental department file review
- Identify useful information
- Instruct attorney on technical issues
- Interface and coordinate to obtain the available information.
- Interview witnesses
- Obtain and review records
- Photograph evidence
- Predict opposing expert's arguments
- Prepare a report, if warranted
- Questions and technical wording for discovery requests
- Regulatory requirements review
- Research publications
- Review technical documents
- Test accident conditions and evidence
- Testify, if warranted
- Translate technical language into common terms
- Trial cross-examination question suggestions
- Trial monitoring
- Trial preparation



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HEALTH, SAFETY & ENVIRONMENTAL GLOSSARY

<	A symbol meaning "less than".
>	A symbol meaning "greater than".
Acid	A chemical that neutralizes alkalis forming salts. Acids have low pHs (< 7).
Acute	Having a rapid onset and progression.
Aerosol	Particles dispersed in a gas (usually air). Examples are fog (liquid particles) and smoke (solid particles).
ALARA	As low as reasonably achievable.
Alkali	A chemical that neutralizes acids forming salts. Alkalis have high pHs (> 7). Alkalis are corrosive.
Anhydrous	Containing no water.
Asphyxiation	Injury or death caused by the replacement of oxygen in the environment by another gas or vapor.
Asym-	An abbreviation for asymmetrical. Refers to a particular arrangement of chemical groups in a molecule (isomer).
Base	See alkali
BART	Best available retrofit technology
Basic Life Support (CPR)	First aid measures done to assist a victim's breathing and heart action such as cardiopulmonary resuscitation.
BDAT	Best demonstrated available technology.
BLEVE	Boiling Liquid Expanding Vapor Explosion. Materials which BLEVE may cause storage containers and parts of containers to rocket great distances, in many directions. Any liquid may cause a BLEVE.
BOD	Biochemical oxygen demand.
Boil	To change from a liquid state to a gaseous state at a stated pressure.
BTEX	Benzene, toluene, ethyl benzene and xylene.
BTZ	Below the treated zone.
CAA	Clean Air Act (1970, 1977, and 1990).
Cameo	Computer Aided Management of Emergency Operations developed by the National Oceanic and Atmospheric Administration.
CAS Identification Number	A number assigned to each unique chemical entity by the Chemical Abstract Service of the American Chemical Society.
Catalyst	A substance which, when present in a very small amount, increases the rate at which two or more chemicals react together.
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act.
CFC	Chlorofluorocarbon.
CFR	Code of Federal Regulations.
Chemical Protective Clothing	Chemically resistant apparel designed to protect the wearer from specific hazardous materials.
CHEMTREC	The CHEMical TRansportation Emergency Center, a public service of the Chemical Manufacturers Association. Located in Washington DC Available 24 hours a day.
CHRIS	The Chemical Hazard Response Information System. Written and maintained by the U. S. Coast Guard.
Chronic	Occurring over a long time - many days or longer.



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cis-	A prefix meaning on the same side. Refers to a particular arrangement of chemical groups in a molecule (isomer).
Combustion	The process of burning.
Compressed Gas	A gas which exerts a pressure of at least 41 psi in the container in which it is stored.
Concentration	The amount of one substance mixed or dissolved in a specified amount of a second substance.
Confined Space	A space that has limited openings for entry and exit and has poor natural ventilation.
Container	Anything that holds material, including storage tanks, pipelines and packaging (bottles, bags, drums, carboys, etc.).
Contaminated	Containing potentially harmful material.
Contamination	A release of hazardous material from its source to people, animals, the environment or equipment.
Corrosive	Any material that causes visible damage or irreversible alteration of human tissue (skin, eyes, etc.) at the site of contact or causes metals to corrode at a rapid rate.
CPR	Cardio Pulmonary Resuscitation, an emergency procedure used to maintain and restore breathing and blood circulation.
Cryogenic	A material at a very low temperature.
CWA	Clean Water Act; federal law regulating pollutant discharges into surface water or to POTWs.
Decompose	Breaking apart into smaller, different chemicals.
Decontamination	The removal of a hazardous material from a victim or equipment.
Decontamination Area	Area located on the upwind edge of the Hot Zone used to decontaminate personnel and equipment. All personnel coming out of the Hot Zone must pass through the Decontamination Area for decontamination.
Deluge	A flooding quantity of water.
Detonate	The rapid decomposition of an explosive material leading to a rapidly moving wave of high temperature and high pressure. May be started by impact, friction or heat.
Dike	Barrier constructed to hold back a spill or leak.
Disperse	To scatter in different directions.
DOT	US Department of Transportation.
EA	Endangered Assessment, Enforcement Agreement, Environmental Action, Environmental Assessment, Environmental Audit. All are correct.
EPCRA	Emergency Planning and Community Right-to-Know Act; see SARA Title III.
ERP	Enforcement response policy.
Ex situ	Treatment of contaminated materials offsite or away from their point of generation.
Explode	The rapid expansion of a material or container with the release of energy.
Explosive	Any substance designed to produce an explosion (i.e. an extremely rapid release of gas and heat) or capable of producing an explosion by reacting with itself.
FEMA	US Federal Emergency Management Agency.
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act (1972, 1988).
FINDS	Facility Index Systems.
Fire Fighting Gear	Turnout gear including footwear, trousers, coat, gloves, helmet, and respiratory protection (NFPA 472).
First Responder	The individual who arrives first at the scene of a Hazmat incident with the responsibility to act.
Flashpoint	The lowest temperature at which the vapor of a substance will ignite and burn. It will not continue to burn without the addition of more heat. The flashpoint is lower than the ignition temperature.
Fog	Liquid particles dispersed in air.



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Freeze	To change from a liquid state to a solid state.
Frostbite	Injury caused to skin or other tissue by very cold materials. The medical consequences are similar to those caused by burns.
Fume	A general term for vapors, gases, or smoke.
Gas	A state of matter in which the material can expand and contract in response to pressure or temperature.
GPR	Ground penetrating radar.
HAP	Hazardous air pollutant; any of 189 air toxics.
Hazard	A potential risk or danger.
Hazardous Material	Any substance capable of causing harm to people, animals, property or the environment.
Hazardous Waste	Under RCRA, any solid, liquid, gas or combination of wastes, which, because of their physical, chemical or toxic characteristics, may pose a hazard when, managed improperly.
Hazmat Incident	Actual or potential unplanned release of a hazardous material.
HAZWOPER	Name given to the 29CFR 1910.120 regulation entitled Hazardous Waste Operation and Emergency Response.
HCFC	Hydrochlorofluorocarbon.
HON	Hazardous organic NESHAP; MACT standard for the organic chemical manufacturing industry
Hot Zone	The area immediately around the incident site. Appropriate protective clothing and equipment <i>must</i> be worn by all personnel in the Hot Zone. Awareness Level and Operational Level trained personnel are not permitted in the Hot Zone.
HVAC	Heating, Ventilating, and Air Conditioning systems.
HWSA	Hazardous and Solid Waste Amendments (1984); amendments to RCRA.
Ignition Temperature	The minimum temperature to which a material must be raised before it will burn. The ignition temperature is higher than the flashpoint.
In situ	Treatment of contaminated areas without excavation or other removal.
Inhalation	Breathing a chemical into the lung.
Inhibited	Containing a small amount of another substance included to prevent the host material from reacting with itself or other things in its environment.
Insoluble	Not able to be dissolved in a particular substance.
Isomer	A material with the same chemical composition (i.e. kind and number of elements) as another material but with a different arrangement of those elements. For example, n-butyl alcohol and t-butyl alcohol are isomers of one another, but behave differently.
Land bans	RCRA provisions prohibiting disposal of specific toxic materials in landfills.
LDAR	Leak detection and repair programs.
LEPC	Local Emergency Planning Committee.
LTU	Land treatment unit.
m-	An abbreviation for the prefix meta. Refers to a particular arrangement of chemical groups in a molecule (isomer).
MACT	Maximum achievable control technology.
Methemoglobin	An abnormal form of hemoglobin which will not carry oxygen in the blood.
MGD	Million gallons per day.
MSDS	Material Safety Data Sheet. Information provided by the manufacturer of a material about its physical and chemical properties as well as the hazards associated with its use.
n-	An abbreviation for normal. Refers to a particular arrangement of chemical groups in a molecule (isomer).



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N-	A symbol used in some chemical names indicating that the next section of the name refers to a chemical group attached to a nitrogen atom. Also refers to Normality (the strength of a solution expressed as equivalents per liter).
NA Identification Number	North America. A four-digit number assigned to some chemicals found in transport in North America.
NAAQS	National Ambient Air Quality Standards.
NESHAP	National Emission Standards for Hazardous Air Pollutants.
NFPA	National Fire Protection Association, Inc.
NIOSH	National Institute of Occupational Safety and Health.
NO_x	Nitrogen oxides.
Non-flammable	Not capable of being burned under normal conditions.
NPDES	National Pollutant Discharge Elimination System.
NPL	National Priorities List
o-	Refers to a particular arrangement of chemical groups in a molecule (isomer).
ODS	Ozone-depleting substance.
OSHA	Occupational Safety and Health Administration.
Oxidizer	A chemical that when mixed with combustible or flammable material may start a fire or make an existing fire worse.
p-	An abbreviation for the prefix para. Refers to a particular arrangement of chemical groups in a molecule (isomer).
PAH	Polyaromatic hydrocarbons.
PCB	Polychlorinated biphenyl.
PEL	Permissible exposure limit.
Peroxide	Chemicals that contain two oxygen atoms bound together. Often explosive.
pH	The relative strength designation for acids and bases
Placard	A sign or symbol designed to be hung on a wall, container or vehicle containing warning information to convey the level of hazard.
POTW	Publicly owned treatment works; municipal wastewater treatment facility.
PPA	Pollution Prevention Act (1990).
PPB	Parts per billion.
PPE	Personal protective equipment.
PPM	Parts per million.
PPTH	Parts per thousand.
PRP	Potentially responsible party.
Pungent	Sharp or irritating odor.
RAC	Environmental Restoration or Response Action Contractors.
RACT	Reasonably available control technology.
RCRA	Resource Conservation and Recovery Act.
RCRIS	RCRA Information System; EPA database of hazardous waste generators.
Response	That portion of incident management in which personnel are involved in controlling a hazardous materials incident. (ANSI/NFPA 471)
RIFS	Remedial investigation and feasibility study.
Risk	A measure of the probability that damage to life, property, or the environment will occur if a hazard occurs. Risk includes consideration of the severity of the damage.
ROD	Record of decision; EPA's statement of remedy.
SARA	Superfund Amendments and Reauthorization Act.
SARA Title III	Title III of SARA is the Emergency Planning and Community Right-to-Know Act of 1986 and includes detailed provisions for community planning.



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SCBA	Self-Contained Breathing Apparatus. SCBA includes a seal tested mask, positive pressure regulator and a pressurized air supply.
Sec-	An abbreviation for the prefix secondary. Refers to a particular arrangement of chemical groups in a molecule (isomer).
Shelter in Place	Protect people without evacuating by keeping them inside a building with windows and doors closed and external ventilation systems shut off until a hazardous situation has resolved.
SIP	State implementation plan.
SIPCC	Spill prevention, control and countermeasures.
SITE	Superfund Innovative Technology Evaluation.
Solid Waste	Any garbage, refuse or sludge, including solid, liquid, semisolid or contained gaseous material resulting from industrial, commercial, agricultural and mining operations, and community activities.
Solubility	The degree to which one material may be completely dissolved in another material.
Source	A geographic area, facility or portion of a facility.
SO₂	Sulfur dioxide.
Stabilized	Containing a small amount of another substance included to keep the first material from changing form.
STCC Identification Numbers	Standard Transportation Commodity Code. A seven-digit identification number commonly used for materials shipped by rail. Numbers beginning with 49- are hazardous materials.
Sublime	To change from a solid state to a gaseous state without becoming a liquid.
sym-	An abbreviation for the prefix symmetrical. Refers to a particular arrangement of chemical groups in a molecule (isomer).
TC	Toxicity characteristic.
TCLP	Toxicity characteristic leaching procedure.
tert-	An abbreviation for the prefix tertiary. Refers to a particular arrangement of chemical groups in a molecule (isomer).
THC	Total hydrocarbons.
Thio-	Containing a sulfur atom.
Toxic	Capable of causing human injury. A poison.
Trans-	An abbreviation for the prefix meaning across from in a chemical isomer.
TRI	Toxics Release Inventory.
TSCA	Toxic Substances Control Act (1976).
TSDF	Treatment, storage or disposal facility.
TTO	Total toxic organics.
UN Identification Number	An international four-digit number assigned to all hazardous materials regulated by the United Nations.
UST	Underground storage tank.
VOC	Volatile organic compound.
Volatile	Easily changes from a liquid to a vapor.
WAP	Waste analysis plan.



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SOURCES OF INFORMATION ON THE INTERNET

Citizen Organizations

Citizens for a Better Environment	http://www.cbemw.org
Environmental Defense Fund (EDF)	http://www.edf.org
Environmental Organization Web Directory	http://www.webdirectory.com
Environmental Working Group	http://www.ewg.org
Essential Information	http://essential.org
Greenpeace International	http://www.greenpeace.meer.net/ (U.S.)
Health Effects Institute (HEI)	http://www.healtheffects.org
Information Center for the Environment	http://ice.ucdavis.edu
Natural Resources Defense Council (NRDC)	http://www.nrdc.org
Right-to-Know Network	http://www.rtknet.org
Sierra Club	http://www.sierraclub.org
World Wildlife Fund	http://www.wwf.org

Government Agencies

Agency for Toxic Substances and Disease Registry (ATSDR)	http://atsdr1.atsdr.cdc.gov
Bureau of Labor Statistics: Census of Fatal Occupational Injuries (USA)	http://www.stats.bls.gov/oshcftab.htm
Centers for Disease Control and Prevention (CDC)	http://www.cdc.gov
Code of federal Regulations Search	http://www.access.gpo.gov/nara/cfr/cfr-table-search.html
Consumer Products Safety Commission (CPSC)	http://www.cpsc.gov
Department of Energy	http://www.doe.gov
Department of Transportation	http://www.dot.gov
Enviro\$en\$e	http://www.epa.gov/envirosense/index.html
Environmental Protection Agency (US-EPA)	http://www.epa.gov
EPA Envirofacts	http://www.epa.gov/enviro/html/ef_overview.html
EPA Office of Solid Waste	http://yosemite.epa.gov/osw/rcra.nsf
EPA Standard Analytical and Test Methods	http://www.epa.gov/SW-846
EPA Summaries of various acts	http://www.epa.gov/region5/defs/html/caa.htm
Food and Drug Administration (FDA)	http://www.fda.gov
Hazardous Materials Safety - U.S. DOT Research and Special Projects Administration	http://www.hazmat.gov
International Agency for Research on Cancer (IARC)	http://www.iarc.fr
National Institute for Occupational Safety and Health (NIOSH)	http://www.cdc.gov/niosh/



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National Institute of Occupational Health	http://www.cdc.gov/niosh/npg/npgd0000.html
National Institute of Standards and Technology	http://www.nist.gov
National Institutes of Health (NIH)	http://www.nih.gov
National Response Center (NRC)	http://www.nrc.uscg.mil/
National Technical Information Services (NTIS)	http://www.ntis.gov
National Toxicology Program (NTP)	http://ntp-server.niehs.nih.gov
National Transportation Safety Board	http://www.nts.gov
Occupational Safety and Health Administration (OSHA)	http://www.osha.gov
OSHA Statistics & Data	http://www.osha.gov/oshstats/
Risk Management Plans On-Line Data Base	http://www.epa.gov/ceppo/rmp-dev.html
Toxic Release Inventory	http://www.epa.gov/opptintr/tri/index.html
U.S. Chemical Safety and Hazard Investigation Board (CAB)	http://www.chemsafety.gov
U.S. Consumer Gateway, Pueblo, CO	http://www.pueblo.gsa.gov
Unified Air Toxics Website (UATW)	http://www.epa.gov/ttn/uatw/

Public Health Organizations

American Association for Cancer Education	http://www.social.com/health/nhic/
American Brain Tumor Association (ABTA)	http://www.abta.org
American Cancer Society (ACS)	http://www.cancer.org
American Heart Association	http://www.amhrt.org
American Institute for Cancer Research (AICR)	http://www.aicr.org
American Lung Association (ALA)	http://www.lungusa.org
Aplastic Anemia Foundation of America, Inc.	http://www.teleport.com/nonprofit/aafa/
Asthma and Allergy Foundation of America	http://www.social.com/health/nhic/data/
Cancer Care Counseling Line	http://www.cancercareinc.org
Cancer Legal Resource Center (CLRC)	bschweri@lmulaw.lmu.edu
Center for Health Effects of Environmental Contamination	http://tango.cheec.uiowa.edu
Center for the Study of Environmental Endocrine Effects	http://www.endocrine.org
International Myeloma Foundation (IMF)	http://myeloma.orgimf.html
Leukemia Society of America	http://www.leukemia.org

Legal Organizations and Research Tools

American Bar Association (ABA)	http://www.abanet.org
American Trial Lawyers Association (ATLA)	http://www.atlanet.org
Find Law Links to state and Municipal Government Websites	http://www.findlaw.com/11stategov/index.html
Hieros Gamos (Legal search tool)	http://www.hg.org



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LII-Virtual Law Library at Cornell University

<http://www.law.cornell.edu:80/topics/environmental.html>

Martindale Hubbel Attorney Directory

<http://lawyers.martindale.com/marhub/form/by.html>

Toxic Torts Attorney Resources

<http://www.toxlaw.com>

Trial Lawyers for Public Justice (TLPJ)

<http://www.tlpj.org>

Professional and Standards Organizations

Academy of Certified Hazardous Materials Managers (ACHMM)

<http://www.achmm.orgmain.shtml>

American Chemical Society (ACS)

<http://www.acs.org>

American Conference of Governmental Industrial Hygienists (ACGIH)

<http://acgih.org>

American Industrial Hygiene Association (AIHA)

<http://www.aiha.org>

American National Standards Institute (ANSI)

<http://www.ansi.org>

American Public Works Association (APWA)

<http://www.pubworks.org>

American Society for Testing and Materials (ASTM)

<http://www.astm.org>

American Society of Mechanical Engineers (ASME)

<http://www.asme.org>

American Society of Safety Engineers (ASSE)

<http://www.asse.orghome.htm>

Building Officials & Code Administrators (BOCA)

<http://www.bocai.org>

Chemical Industry Institute of Toxicology (CIIT)

<http://www.ciit.org>

Chemical Transportation Emergency Center (CHEMTREC)

<http://www.cmahq.com/cmaweb site.nsf/pages/chemtrec>

Compressed Gas Association (CGA)

<http://www.cganet.com>

Desert Research Institute (DRI)

<http://www.dri.edu>

Environmental Industry Web Site

<http://www.enviroindustry.com>

Extension Toxicology Network (EXTOXNET)

<http://ace.orst.edu/info/extoxnet/>

National Fire Protection Association Codes and Standards (NFPA)

<http://www.nfpa.org/codehome.htm>

National Health Information Center (NHIC)

<http://nhic-nt.health.org>

National Institute for Environmental Health Sciences (NIEHS)

<http://www.niehs.nih.gov>

National Safety Council (NSC)

<http://www.nsc.org>

OSH Web Index of OSH Resources

<http://oshweb.me.tut.fi/cgi-bin/oshweb.pl>

Society of Automotive Engineers (SAE)

<http://www.sae.org>

Society of Petroleum Engineers (SPE)

<http://www.spe.org>

Underwriters Laboratories, Inc. (UL)

<http://www.ul.com>

Union of Concerned Scientists

<http://www.ucsusa.org>



CONSULTING ENGINEERS & SCIENTISTS, INC.

DIRECTORY OF AGENCIES

U.S. Department of Transportation
400 7th Street, S.W.
Washington, DC 20590
(202) 366-4000

Department of Justice
Environmental Enforcement Section, Room 7313
10th and Constitution, N.W.
Washington, DC 20530
(202) 633-3646

Department of the Interior
18th and C Streets, N.W.
Washington, DC 20240
(202) 343-3891

Department of Commerce
NOAA-Superfund Program Coordinator
11400 Rockville Pike
Rockville, MD 20852
(301) 443-8465

Department of Defense
The Pentagon, Room 3D 833
Washington, DC 20301-8000
(202) 695-7820

Office of Oceans and Polar Affairs
2201 C St., N.W. Room 5801
Washington, DC 20520
(202) 647-3263

Nuclear Regulatory Commission
Washington, DC 20555
(301) 492-7000

American Association of State Highway
Transportation Officials (AASHTO)
444 North Capitol Street, N.W.
Washington, DC 20001
(202) 624-5800

Center for Emergency Response Planning (CERP)
Workplace Health Fund
815 16th Street, N.W.
Washington, DC 20006
(202) 842-7834

Federal Emergency Management Agency
Technological Hazards Division
Federal Center Plaza
500 C Street, S.W.
Washington, DC 20472
(202) 646-2861

U.S. Environmental Protection Agency
OSWER Preparedness Staff
401 M Street, S.W.
Washington, DC 20460
(202) 475-8600
(479-2449 in Washington, DC area)

U.S. Environmental Protection Agency
OERR Emergency Response Division
401 U Street, S.W.
Washington, DC 20460
(202) 475-8720

Agency for Toxic Substances
and Disease Registry Department of Health
and Human Services
Chamblee Building 30S
Atlanta, GA 30333
(404) 639-0615

U.S. Department of Energy
1000 Independence Avenue S.W.
Washington, DC 20585
(202) 252-5000

Forest Service
Department of Agriculture
P.O. Box 96090
Washington, DC 20013-6090
(703) 235-8019

Department of Labor
Occupational Safety and Health Administration
Directorate of Field Operations
200 Constitution Avenue, N.W.
Washington, DC 20210
(202) 523-7741



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U.S. Coast Guard (G-MER)
Marine Environmental Response Division
2100 2nd Street, S.W.
Washington, DC 20593
(202) 267-2010

Chemical Manufacturers Association
2501 M Street, S.W.
Washington, DC 20590
(202) 887-1255

Hazardous Materials Transportation Bureau
Information Services Division
400 7th Street, S.W.
Washington, DC 20590
(202) 426-2301

Division of Respiratory Disease Studies
National Institute for Occupational Safety & Health
944 Chestnut Ridge Road
Morgantown, WV 26505

Environmental Policy Institute
218 D Street, S.E.
Washington, DC 20003
(202) 544-2600

Federal Emergency Management Agency
Public Information Office
Box 70274
Washington, DC 20024
(202) 646-4600

Library Programs Service
Office of the Assistant Public Printer
U.S. Government Printing Office
Washington, DC 20401
(202) 275-1114

National Technical Information Service
5285 Port Royal Road
Springfield, VA 22161
(703) 487-4650

Working Group on Community Right-to-Know
218 D Street, S.E.
Washington, DC 20003
(202) 544-2600
Occupational Safety and Health Administration

Directorate of Technical Support
Technical Data Center, Room N-2634
200 Constitution Avenue, N.W.
Washington, DC 20210
(202) 523-9700 or (202) 523-7894

Public Information Center
U.S. Environmental Protection Agency
Mail Code PM-21 1 B
401 M Street, S.W.
Washington, DC 20460

Sierra Club
530 Bush Street
San Francisco, CA 94108
(415) 981.8634

U.S. Environmental Protection Agency (EPA)
Public Information Center
401 M Street, S.W., Mail Code PM-21 1 B
Washington, DC 20460

EPA Regional Offices

<u>Region I</u>	-	(617) 565-3698
CT, ME, MA, NH, RI, VT		
<u>Region II</u>	-	(212) 264-0504
NJ, NY, PR, VI		
<u>Region III</u>	-	(215) 597-0980
DE, DC, MD, PA, VA, WV		
<u>Region IV</u>	-	(404) 347-3454
AL, FL, GA, KY, MS, NC, SC, TN		
<u>Region V</u>	-	(312) 886-7579
IL, IN, MI, MN, OH, WI		
<u>Region VI</u>	-	(214) 655-6760
AR, LA, NM, OK, TX		
<u>Region VII</u>	-	(913) 236-2850
IA, KS, MO, NE		
<u>Region VIII</u>	-	(303) 293-1720
CO, MT, ND, SD, UT, WY		
<u>Region IX</u>	-	(415) 774-7460
AM, Samoa, AZ, CA, GU, HI, NV, Trust Terr. The Pacific Isl., Marshall Isl., Palau, Po		
<u>Region X</u>	-	(206) 442-2782
AK, ID, OR, WA		



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About the author

Melvin R. Kantz, Ph.D., CHMM is a member of the professional staff of Consulting Engineers & Scientists, Inc. He manages the Long Beach CA office of this forensic consulting firm, which was established in 1969. Dr. Kantz is both a chemist and materials engineer with over thirty years of industrial product and process development and failure analysis experience with Monsanto, Shell, Congoleum and Ferro.

He consults with clients in matters involving workplace and consumer exposures to chemical and physical hazards, regulatory compliance, labels and warnings, slip, trip, and fall accidents, product liability, intellectual property and failure of non-metallic materials. Dr. Kantz holds positions as Adjunct Professor of Chemistry at El Camino College in Torrance, CA and at Los Angeles Harbor College in Wilmington, CA, and Adjunct Professor of Engineering at Mt. San Antonio College in Walnut, CA.

Dr. Kantz' additional credentials include Master level certification in Hazardous Materials Management (CHMM). He is a member of the American Chemical Society, the American Society of Safety Engineers, the Materials Research Society, and the Academy of Certified Hazardous Materials Managers. He co-founded and is the past president of the Southern California Chapter of the Academy of Certified Hazardous Materials Managers and he is also a member of the American Society for Testing and Materials (ASTM) Committee F13 on Safety and Traction of Footwear.