United States
Environmental Protection
Agency

Office of Solid Waste
and Emergency Response
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EPA

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FIRE HAZARD FROM CARBON ADSORPTION DEODORIZING SYSTEMS

The Environmental Protection Agency (EPA) is issuing this *Alert* as part of its ongoing effort to protect human health and the environment by preventing chemical accidents. Under CERCLA, section 104(e) and Clean Air Act (CAA), EPA has authority to conduct chemical accident investigations. Additionally, in January 1995, the Administration asked the Occupational Safety and Health Administration (OSHA) and EPA to jointly undertake investigations to determine the root cause(s) of chemical accidents and to issue public reports containing recommendations to prevent similar accidents. EPA has created a chemical accident investigation team to work jointly with OSHA in these efforts. Prior to the release of a full report, EPA intends to publish *Alerts* as promptly as possible to increase awareness of possible hazards. *Alerts* may also be issued when EPA becomes aware of a significant hazard. It is important that facilities, SERCs, LEPCs, emergency responders and others review this information and take appropriate steps to minimize risk.

CHEMICAL SAFETY ALERT

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PROBLEM

Activated carbon systems used to adsorb vapors for control of offensive odors may pose a fire hazard when used for certain types of substances, if proper procedures are not followed. In particular, crude sulfate turpentine, commonly produced in the pulp and paper industry, can pose a fire hazard if the adsorption system is not properly designed and proper procedures are not implemented. Facilities should take precautions to avoid or mitigate these fire hazards.

ACCIDENTS

In a 1995 accident at a chemical terminal facility, a fire and explosion occurred involving three tanks of crude sulfate turpentine. The tanks were connected to drums of activated carbon for deodorizing. The fire and explosion damaged other storage tanks, resulting in the release of toxic gases and forcing a large-scale evacuation of area residents.

Fires have occurred in the past in activated carbon systems used for deodorizing crude sulfate turpentine. In general, such fires have not had effects as serious as those reported in the 1995 fire. Serious effects would not be expected if fires are confined to the activated carbon containers and do not spread to tanks containing flammable or combustible substances.

HAZARD AWARENESS

Activated carbon is widely used to adsorb vapors to prevent their release to the air. For certain classes of chemicals, reaction or adsorption on the carbon surface is accompanied by release of a large amount of heat that may cause hot spots in the carbon bed. Such chemicals include organic sulfur compounds (e.g., mercaptans), which may be found as impurities in crude sulfate turpentine and other materials. Other classes of chemicals that may cause large thermal releases are ketones, aldehydes, and some organic acids. Adsorption of high vapor concentrations of organic compounds also can create hot spots. If flammable vapors are present, the heat released by adsorption or reaction on the surface of the carbon may create a fire hazard (e.g., a fire may start if the temperature reaches the autoignition temperature of the vapor and oxygen is present to support ignition).

The fire hazards of carbon adsorption deodorizing systems may increase at night. At certain times (typically during the day), high temperatures may lead to the expansion of vapor in the system, and vapor is likely to exit to the atmosphere. When temperatures drop (typically at night), a slight vacuum may be created, causing air to be drawn into the system. If the carbon surface is very hot, because of the heat generated by adsorption, air drawn in over the carbon may provide the oxygen to start a fire.

Hazard Reduction

Facilities should be aware of the potential fire hazards of activated carbon systems for absorbing flammable vapors and take steps to minimize these hazards. Actions that may help to prevent fires include:

- Follow the manufacturer's instructions for design and operation of activated carbon adsorption systems.
- Ensure that a qualified engineer or technician supervises the design, construction, and operation of the carbon adsorption system.
- Evaluate the composition of the vapors that will contact the carbon and heed the manufacturer's warnings about potential hazardous interactions with the carbon. If the vapor may contain organic sulfur compounds (e.g., vapor from crude sulfate turpentine), ketones, aldehydes, or organic acids, or if the vapor contains high concentrations of organic compounds, consider the potential for development of hot spots on the carbon.
- Test the action of the vapors on carbon for potential heat release before putting the carbon adsorption system into service, if possible reactions are not known.
- If test results or known reactions with carbon indicate the potential for fires in the activated carbon system, design the system so that air does not enter the system over the carbon bed (e.g., install vacuum breakers on the storage tanks).
- If the potential exists for fires in the activated carbon system, be sure the carbon containers are separated from containers of flammable or combustible substances and can be easily and rapidly removed in case the container becomes hot or catches fire.
- If high concentrations of organic compounds may cause development of high temperatures, take steps to control the heating. Such steps may include diluting inlet air, time weighting the inlet concentration to allow heat to dissipate, and prewetting the carbon.
- Visually inspect activated carbon adsorption systems frequently for hot spots and fires.
- Before using an activated carbon adsorption system, ensure that safety systems are in place for fire prevention and mitigation, including flame arrestors to prevent the spread of fire from the carbon containers to the flammable chemical containers.
- Ensure that flammable and combustible chemicals connected to activated carbon adsorption systems are handled in accordance with applicable regulations, codes, and standards.

Information Resources

Some references that may contain information about the fire hazards of activated carbon adsorption systems and methods of minimizing them are listed below. Regulations applicable to such systems, and codes and standards that may be relevant, are also listed.

For more information consult the following:

General References

Information on carbon adsorption systems for crude sulfate turpentine can be found in W.A. Harrell, J.O. Sewall, and T.J. Walsh, "Control of Malodorous Compounds by Carbon Adsorption," American Institute of Chemical Engineers, *Loss Prevention*, Volume 12, 1979, pp 124-127.

Manufacturers of activated carbon can provide product literature with information on properties, safe handling, and use.

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Statutes and Regulations

Section 112(r) of the Clean Air Act focuses on prevention of chemical accidents. It imposes on facilities with regulated substances or other extremely hazardous substances a general duty to prevent and mitigate accidental releases. Accident prevention activities include identifying hazards and operating a safe facility.

EPA's Risk Management Program (RMP) Rule [40 CFR 68] is intended to prevent and mitigate accidental releases of listed toxic and flammable substances. Requirements under the RMP rule include development of a hazard assessment, a prevention program, and an emergency response program.

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Processes containing flammable gases and liquids may be covered under the Occupational Safety and Health Administration's (OSHA) Process Safety Management Standard, which establishes procedures intended to protect employees by preventing or minimizing the consequences of chemical accidents involving highly hazardous chemicals [29 CFR 1910.119].

OSHA also has a Standard for Flammable and Combustible Liquids [29 CFR 1910.106].

Occupational Safety and Health Administration
Phone: (202) 219-8151 - Public Information
Web site: http://www.osha.gov

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The Department of Transportation (DOT) regulates transportation of activated carbon and other flammable and combustible substances under its Hazardous Materials Regulations. Activated carbon and many combustible and flammable substances are listed individually, and several categories of flammable and combustible substances are included, in DOT's Hazardous Materials Table [49 CFR 172.102].

Department of Transportation
Phone: (202) 366-5580 - Public Information
Web site: http://www.dot.gov

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Codes and Standards

The National Fire Protection Association (NFPA) has a code for flammable and combustible liquids that may be adopted into law at the state or local level. NFPA 30 — Flammable and Combustible Liquids Code, 1996.

National Fire Protection Association
1 Batterymarch Park
P.O. Box 9101
Quincy, MA 02269-9101
Phone: (617) 770-3000
Customer Service: 1 (800) 344-3555
Web site: http://www.nfpa.org

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FOR MORE INFORMATION...

CONTACT THE EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW HOTLINE

(800) 424-9346 OR (703) 412-9810
TDD (800) 553-7672

MONDAY-FRIDAY, 9 AM TO 6 PM, EASTERN TIME

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