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**DISCLAIMER**

The California Integrated Waste Management Board (Board), with assistance from the Metallic Discards Task Force, has compiled this guide to assist appliance recyclers in complying with the requirements of Assembly Bill 1760 of 1991 (Chapter 3.5, Statutes of 1994, now codified as Public Resources Code §42160 *et seq.*). The information contained herein does not necessarily represent the views of the Board or its employees. This guide contains information that may be useful to those wishing to get an overview of appliance recycling, specifically the processing of special materials contained within appliances. In providing this information, the Board makes no recommendation that any particular process is appropriate for any particular appliance recycler. Prior to using one or more of these processes, an appliance recycler should consult with a qualified professional(s) who can evaluate his or her specific situation. Since this guide cannot address individual situations, the Board makes no warranty, express or implied, and assumes no liability for the information contained in the succeeding text.

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## Appliance Recycling Guide

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# Appliance Recycling Guide

## 1.0 Introduction

In 1991, about 3.4 million appliances (536,000,000 pounds) were discarded in California. Included were refrigerators, freezers, clothes dryers, washing machines, dishwashers, microwave ovens, ranges/ovens, furnaces, hot water heaters, and air conditioners.

The California Legislature determined that major appliances and other large metallic discards in solid waste landfills needlessly uses scarce landfill capacity and that these items can be effectively separated from the waste stream and recycled. On January 1, 1994, a new law took effect in which the objective was to divert appliances and other large metallic discards from disposal and to recycle these items in an environmentally sound and safe manner. A primary provision of this law is the requirement to remove special materials from major appliances and other large metallic discards prior to crushing the discard for transport or transferring to a baler or shredder for recycling.

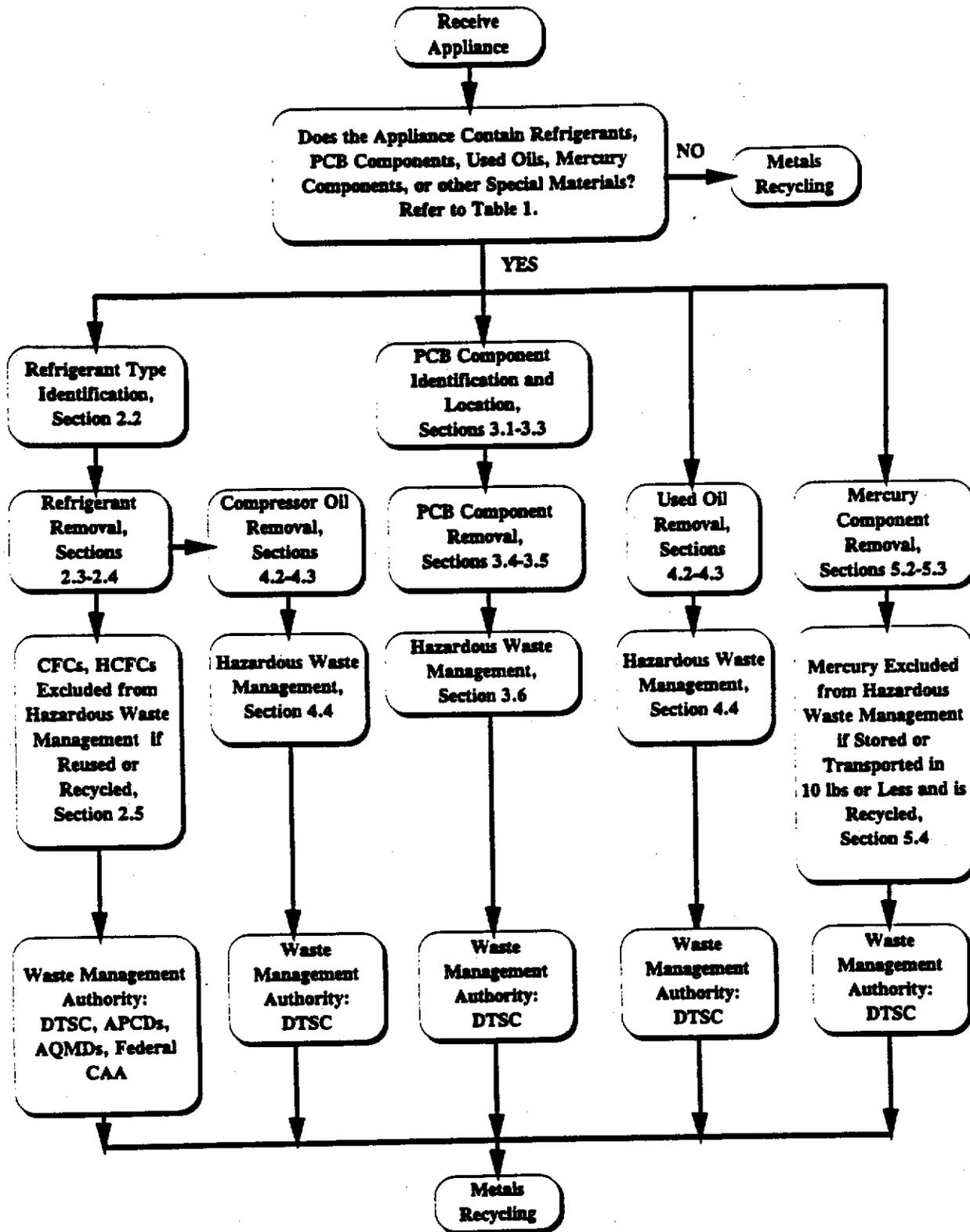
The special materials specifically outlined in this law are chlorofluorocarbons (CFCs) used as refrigerants in air conditioning and refrigeration equipment, polychlorinated biphenyls (PCBs) used in some motor capacitors and fluorescent lighting ballasts, and sodium azide used to inflate automobile air bags. Sodium azide will not be an issue of discussion for this recycling guide since most vehicles are already diverted from solid waste facilities. This law also requires the removal of other special materials regulated by the Department of Toxic Substances Control such as used oil found in compressors and transmissions and mercury found in switches and temperature control systems.

This recycling guide is developed to assist those persons in the disposal and recycling sectors who intend on processing appliances and the special materials contained within them. This guide is not intended for use by the home repair person, known as the do-it-yourselfer.

The appliance recycling guide focuses on the; 1) identification of special materials which require removal, 2) special materials removal and extraction methods, 3) identification of health and safety hazards in removing and handling special materials, and 4) management of special materials in accordance with state and federal regulations.

The appliance management system is shown in Figure 1. Section numbers refer to sections within this guide. A matrix of appliances and special materials contained within these appliances is shown in Table 1. These appliances are either known to contain or have a likelihood of containing special materials.

**Figure 1  
Appliance Management System**



DTSC - Department of Toxic Substances Control  
 APCDs - Air Pollution Control Districts  
 AQMDs - Air Quality Management Districts  
 CAA - Clean Air Act

**Table 1**  
**Special Materials Matrix**

	Refrigerants							PCB Capacitor / Ballasts*	Lubricant Oil	Mercury Switches
	CFC-12	CFC - 114	HCFC - 22	SO2	NH3	CFC- 500	CFC- 502			
Discard										
Refrigerator	X	X		X	X			X		
Freezer	X				X			X		X
Window A/C			X			X		X		
Central A/C			X					X		
Dehumidifier	X					X		X		
Microwave								X		
Clothes Washer									X	X
Fluorescent Lighting								X		
Gas Stoves										X
Water Heaters										X

\* Pre 1979 appliances with a significant likelihood of containing PCB capacitors or ballasts  
There have been suggestions that some refrigerators and freezers contain PCB capacitors.

## **2.0 Refrigerants**

### **2.1 Discards Containing Refrigerants**

The types of refrigerants typically found in appliances are CFC-12 in refrigerators, freezers, and dehumidifiers and HCFC-22 in window and central air conditioners<sup>1</sup>. CFC-114 may also be found in a small percentage of refrigerators. Some older refrigerators may also contain sulfur dioxide as the refrigerant and the occurrence of these in the waste stream is minimal, ranging from 2-5%<sup>3,4</sup>. A significantly fewer number of older refrigerators and freezers may contain ammonia as the refrigerant. Some dehumidifiers may contain CFC-500<sup>1</sup> and few window air-conditioning units may contain CFC-500 or CFC-502<sup>4</sup>. Some new refrigerators contain refrigerant HFC-134a but these units are not occurring in the disposal or recycling streams at this time.

### **2.2 How to Identify Types of Refrigerants**

Knowing the refrigerant type prior to extraction from the unit is very important. Mixing different types of refrigerants will most likely contaminate a load thereby rendering it non-recyclable. Ask your refrigerant reclaimer about refrigerant acceptance specifications.

The first step in determining the type of refrigerant used in an appliance is to look at the identification tag attached to the unit (see Figures 2 & 3). The location of the tag varies as to the manufacturer and for refrigerators and freezers, it may be located on the front or back of the unit, inside the refrigerated compartment or on side of the door, or on the compressor unit<sup>10,11</sup>. For window or central air-conditioning units, removal of the face plate or other external body panels may be required to locate identification tag<sup>10</sup>.

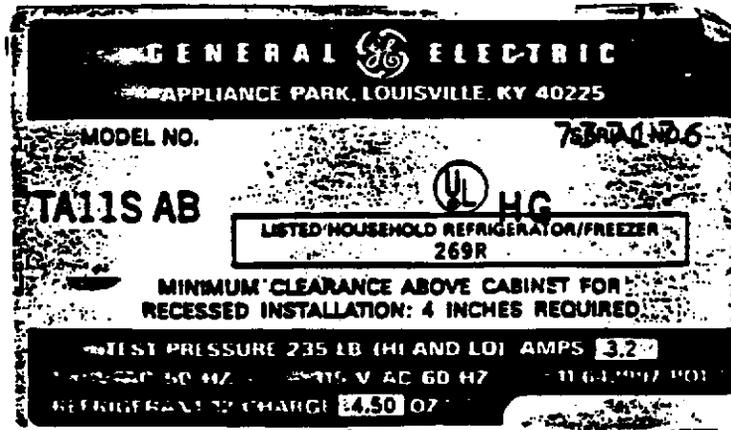
One physical characteristic used to identify ammonia and sulfur dioxide refrigerators is the compressor. The compressor used in ammonia and sulfur dioxide refrigerators are approximately 2-3 times larger by volume than the compressors within CFC type refrigerators<sup>11</sup>.

The tops of sulfur dioxide and ammonia refrigerators are typically constructed as a separate section unlike the unibody of the CFC units (see Figures 3 & 4)<sup>11</sup>. The evaporator coil is located directly underneath this top section<sup>19</sup>.

Refrigerators containing ammonia refrigerant usually require natural gas to operate them and can be identified by looking on the back of the unit for a natural gas hook-up<sup>3</sup>. Note: there may also be an electrical cord attached which is used only for the light within the refrigerator.

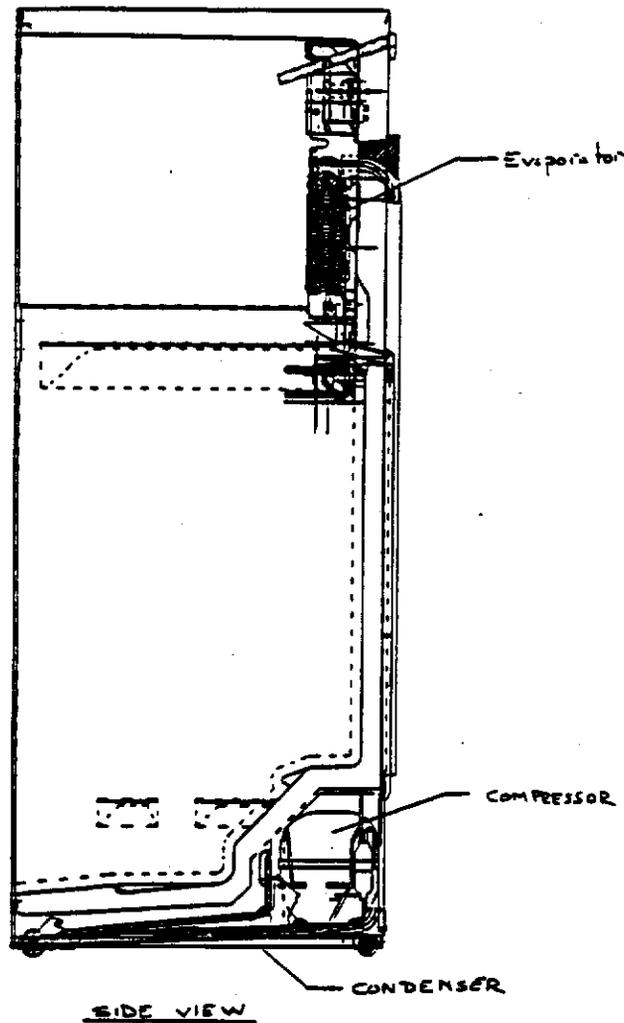
**Figure 2**

**Sample Refrigerant  
Identification Tag**



**Figure 3**

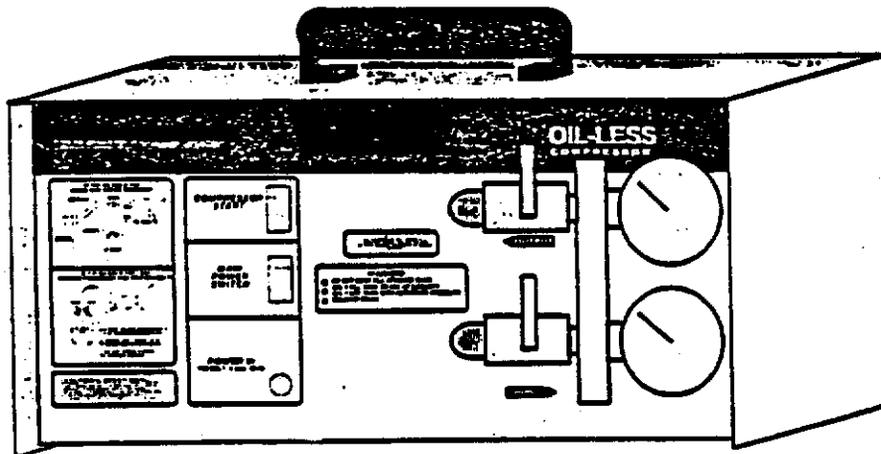
**Refrigerator Components  
(Typical Configuration)**





**Figure 4**

**Top Configurations of Sulfur  
Dioxide and Ammonia Refrigerators**



**Figure 5**

**Refrigerant Extraction  
Set-up Configuration**

A test which is used by some appliance recyclers to determine type of refrigerant is the pressure/temperature test. The type of refrigerant is determined by measuring the pressure within the system and the external atmospheric temperature. There are charts available which correlate the type of refrigerant to the known pressure and temperature. This method may result in inaccurate readings because of low system pressures. Refrigeration or air conditioning units in the recycling and disposal sectors may have reduced system pressure due to leakages caused during handling or system failure.

**Note:** The pressure/temperature method does not work well in determining whether a certain refrigerant and air conditioning unit contains CFC-12 or HFC-134a because both of these refrigerants operate at similar conditions<sup>12</sup>.

If the refrigerant type is still unknown, call your refrigerant reclaimer or equipment manufacturer for further information. One appliance recycler is storing all unknown refrigerants into a container labeled as "mixed" refrigerants. Although this container would be managed as hazardous wastes, it would keep from contaminating other loads of recyclable refrigerants<sup>14</sup>.

## **2.3 Refrigerant Extraction Methods**

### **Tools / Equipment Needed**

The basic tools and equipment needed for extracting refrigerants are; 1) piercing valve, 2) recovery or recycling equipment, and 3) storage containers.

The piercing valve is used to puncture the refrigeration coil to allow the transfer of refrigerant from the air conditioning or refrigeration system to the recovery or recycling equipment (see Figure 5).

There are two types of equipment that are used to extract refrigerant from appliances; recovery and recycling. The recovery equipment removes the refrigerant from an appliance and transfers it to a storage tank without further processing. Two types of recovery equipment are system-dependent and self-contained. The system dependent recovery equipment requires the assistance of components contained in an appliance to remove the refrigerant from the appliance. The self-contained recovery equipment is capable of removing the refrigerant from an appliance without the assistance of components contained in the appliance.

Recycling equipment removes the refrigerant from an appliance and then cleans the refrigerant by oil separation and cycling through one or more filter dryers to remove moisture, acidity, and particulate matter. The refrigerant is then transferred back into the appliance or to a storage tank. Recycling equipment would typically be used by those individuals in the appliance repair sectors because the refrigerant extracted is typically put back into the appliance after repairs or maintenance operations.

Persons in the disposal and recycling sectors do need to certify to the US EPA that such person has acquired recovery equipment that is capable of either:

1. Removing 90% of the refrigerant when the compressor of the small appliance is operating and 80% of the refrigerant when the compressor of the small appliance is not operating.
2. Evacuating the small appliance to four inches of vacuum when tested using a properly calibrated pressure gauge.

The recovery equipment may include system-dependent equipment or self-contained equipment.

### **Refrigerant Extraction**

To begin the refrigerant extraction process, the piercing valve is attached to either the high pressure side or low pressure side of the compressor. The high pressure side of the compressor is the line connected between the compressor and the condenser. The low pressure side of the compressor is the line between the compressor and evaporator (see Figure 3). In some operations, piercing valves are placed on both the high and low pressure sides of the compressor.

**Note:** If air conditioning and refrigeration equipment has been non-operational for a period of time, the pressure within the system equalizes and consequently there is no distinction of pressure at either side of the compressor.

The refrigerant recovery unit is then attached to the piercing valve, and with the valve opened and the recovery unit on, refrigerant is extracted. Several refrigeration systems may be evacuated at one time (manifolded) depending on the type of equipment used. The time of refrigerant extraction is dependent on the equipment or process used. It is recommended that the equipment manufacture be contacted for equipment and process specifications. Persons in the disposal sector who are recovering refrigerant from air conditioning and refrigeration units must either:

- 1) Recover 90% of the refrigerant in the appliance when the compressor in the appliance is operating, or 80% of the refrigerant in the appliance when the compressor in the appliance is not operating; or
- 2) Evacuate the small appliance to four inches of mercury vacuum.

The refrigerant is then either transferred to an internal storage tank within the recovery unit or is transferred directly to an external tank. Once the capacity of the internal storage tank has been achieved, the refrigerant needs to be transferred to external storage tanks. External storage tanks are usually supplied by a refrigerant reclaimer.

Your refrigerant reclaimer should be contacted for storage, used refrigerant specifications, and shipping guidelines.

#### **2.4 Hazards / Safety Precautions**

All employers must have a Material Safety Data Sheet (MSDS) for any workplace product that contains a hazardous substance(s), and must make it available to employees on request. An MSDS lists the hazardous chemical contents of a product, describes its health and safety hazards, and gives methods for using, storing and disposing of it safely. The employer may obtain an MSDS from the manufacturer of the product which contains the type of refrigerant. An example MSDS for fluorocarbons, sulfur dioxide, and ammonia is provided in appendix A.

The Hazard Evaluation System and Information Service (HESIS) produces fact sheets, booklets, and technical documents on work place chemicals. A HESIS fact sheet regarding fluorocarbons is provided in appendix B. HESIS fact sheets are designed as an aid for worker training programs and does not take the place of an MSDS. The HESIS office is located in Berkeley, California, and can be contacted at (510) 540-3138.

Employees should be trained on operational and safety aspects of any equipment used during refrigerant extraction. Employees should also be trained in first aid.

#### **2.5 Management**

##### **Recycling and Emissions Reduction, Subpart F, Part 82, Title 40, Code of Federal Regulations (40 CFR 82.150-82.166)**

Persons who remove refrigerant from small appliances prior to disposing or recycling of the small appliance do not need to be certified by the US EPA. Small appliances means any of the following products that are fully manufactured, charged, and hermetically sealed in a factory with five (5) pounds or less of refrigerant: refrigerators and freezers designed for home use, room air conditioners (including window air conditioners and packaged terminal air conditioners), packaged terminal heat pumps, dehumidifiers, under-the-counter ice makers, vending machines, and drinking water coolers.

Persons who receive a small appliance for disposal or recycling must recover any remaining refrigerant from the appliance or verify that the refrigerant has been evacuated from the appliance. Such verification must include a signed statement from the person from whom the appliance is obtained that all refrigerant that had not leaked previously has been recovered from the appliance. This statement must include the name and address of the person who recovered the refrigerant and the date the refrigerant was recovered. This statement must be kept for a minimum of three years by the final disposer or recycler. This statement must be kept on site.

Persons in the disposal and recycling sectors do need to certify to the US EPA that such person has acquired recovery equipment that meets certain requirements (see prior discussion on Tools / Equipment Needed).

### California Law

Section 25143.2(d)(7), Chapter 6.5, Division 20, Health and Safety Code (HSC), excludes CFC or HCFC compounds removed from heat transfer equipment, fire extinguishing products, or rigid foam products, from being regulated as hazardous wastes, provided the materials are reused or recycled and specified conditions are met. These conditions are set forth in HSC sections 25143.2(e), 25143.2(f), and 25143.9. Additionally, reporting requirements for recyclers operating under an exclusion are set forth in HSC section 25143.10. If CFC or HCFC compounds are managed in ways other than recycling, such as incineration, or if the specified conditions for the exclusion are not met, the CFC or HCFC compounds would be hazardous wastes, and would remain subject to all hazardous waste management requirements.

Persons with questions concerning the applicability of a recycling exclusion to a particular case regarding CFC or HCFC compounds may contact the nearest regional DTSC office. See Appendix E for addresses and telephone numbers of regional DTSC offices.

### 3.0 Polychlorinated Biphenyls (PCBs)

In 1978, the federal government banned the manufacturing, processing, and distribution of PCBs. Prior to this time, PCBs were used in small capacitors and fluorescent light ballasts of some appliances. The identification of those appliances containing PCB capacitors is limited because manufacturers did not keep complete records of where PCBs were used. This lack of information makes it very difficult for recyclers to comply with the industry standard and California law of removing PCB capacitors and ballasts prior to baling or shredding the appliance.

#### 3.1 How to Identify a Capacitor / Ballast

A capacitor is a small metal-cased or plastic-cased device used to store electrical charges which assists the motor to run more efficiently in start-up (starting capacitor) or during operation of the appliance (running capacitor). Starting capacitors contain only dry, innocuous substances whereas the running capacitors are filled with an oil that dissipates heat during operation of the motor. A ballast is an electrical capacitor used to supply the high voltage necessary to start a fluorescent lamp<sup>3</sup>.

There is no specific method to determine if an appliance contains a capacitor or not. A capacitor(s) may be found in any appliance which requires a motor to operate<sup>4</sup>.

Although there are certain appliances that have been known to contain a capacitor(s), a capacitor(s) may have been installed in other appliances during repair operations. To be sure if an appliance does or does not contain a capacitor(s), all appliances should be visually inspected.

### 3.2 Physical Characteristics / Location

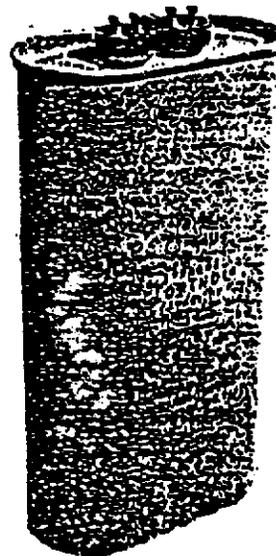
Starting capacitors are typically cylindrical in shape and the casing is predominately a black bakelite (plastic) material or aluminum shell. Some earlier type capacitors may be cardboard wrapped. Running capacitors are typically oval or rectangular in shape with a sealed metal casing<sup>15</sup> (see Figure 6).

Appliances which contain motors, such as washers and refrigerators, will usually have the motor located near the bottom and can be accessed from the rear. The capacitor, which is usually a starting capacitor, will be attached to the housing of the motor and may be covered in a protective casing<sup>16</sup>. If not attached to the housing, the capacitor, if any, may be located by following the wires from the motor.

Both window and central air conditioners may have a combination of starting and running capacitors, possibly up to four capacitors total. The casing of the air conditioners will have to be removed prior to inspection for capacitors. The capacitors will typically be attached to the fan motor and the compressor. For window air conditioning units in particular, the capacitor(s) will typically be located directly behind the control panel<sup>16</sup> (see Figure 8).

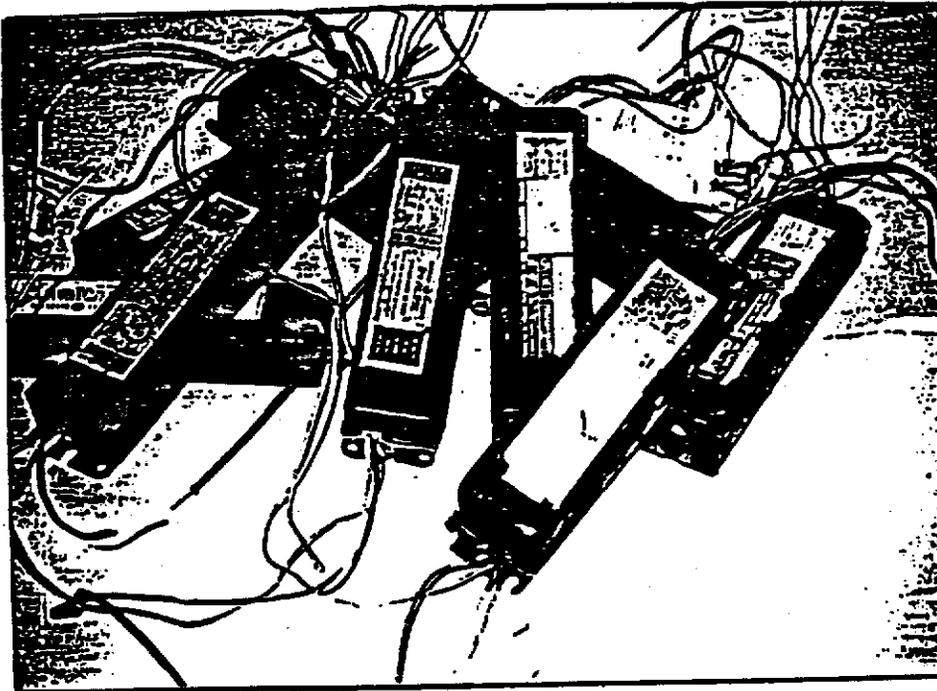


Starting Capacitor



Running Capacitor

Figure 6

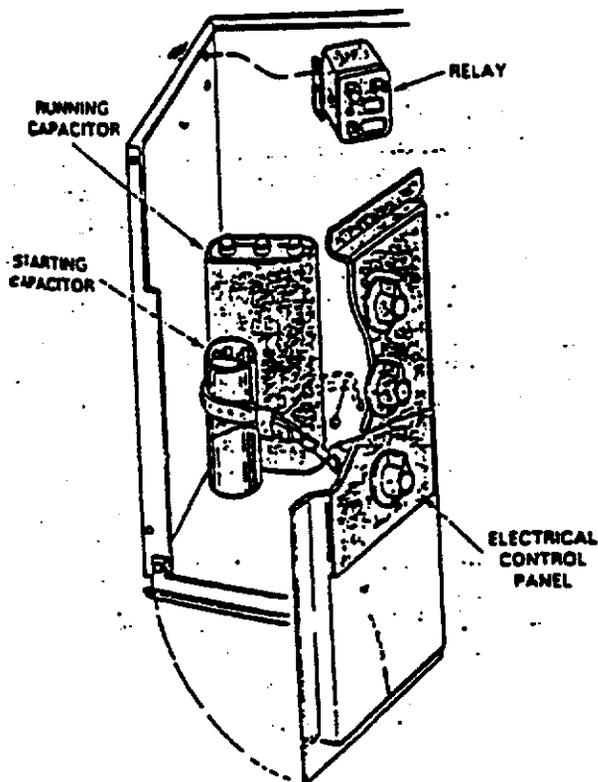


**Figure 7**

**Fluorescent Lighting Ballasts**

**Figure 8**

**Window Air-Conditioning Unit  
Showing Location of Capacitor(s)  
and Control Panel**



Microwave ovens have one capacitor located directly behind the control panel and attached to the transformer. The casing of the microwave or front panel will have to be removed prior to accessing the capacitor<sup>16</sup>.

Fluorescent light ballasts (see Figure 7) are located in the housing of light fixtures. You may have to unscrew the back panel to access the ballast<sup>16</sup>.

### **3.3 Does the Capacitor or Light Ballast Contain PCBs?**

According to the United States Environmental Protection Agency (US EPA), PCB capacitors are invariably enclosed in a sheet steel jacket (a magnet can distinguish them). The soldering of the seams or a galvanized finish may also be useful in distinguishing them from the non-PCB or electrolytic capacitors which are typically encased in either a Bakelite or aluminum shell. The only appliances identified at the time of the letter with a significant likelihood of containing a PCB-type small capacitor are room and central air conditioners, heat pumps, furnace blowers, fluorescent lighting ballasts, and microwave ovens. These units represent a relatively small percentage of recycled "white goods" (approximately 5%). There is no evidence that small PCB capacitors were used in household clothes washers, clothes dryers, dishwashers, hot water heaters, garbage disposers, trash compactors, conventional ovens, ranges, or stoves. There has been suggestions that some refrigerators and freezers contain PCB small capacitors, but the use of PCB capacitors in these units were limited<sup>17</sup>.

A capacitor may have "No PCBs" stamped on its casing, or may have a 4-digit date indicating time of manufacture. Some appliance manufacturers and repair businesses continued to use up stocks of PCB capacitors even after the 1978 ban on the production of PCBs. Some appliances manufactured after the 1978 date could therefore contain a PCB capacitor(s)<sup>21</sup>. It is anticipated that a majority of the stocked PCB capacitors were depleted within one year of the ban. Foreign oil-filled small capacitors may also contain PCBs despite Federal PCB restrictions<sup>16</sup>.

### **3.4 Capacitor / Ballast Removal Methods**

#### **Tools / Equipment Needed**

The basic tools needed for removing capacitors are; 1) screwdriver, 2) nut driver set, 3) crescent wrench, 4) socket set, and 5) side cutters or wire cutters.

#### **Capacitor Removal**

Capacitors are easily removed by loosening or removing the clamp holding the capacitor to the motor or bracket and cutting the wires from the capacitor terminals or removing the wires from the terminals if the capacitor is discharged. In some cases, the capacitor may be in a protective casing on the motor which needs to be removed first or the

capacitor may be wired to the motor bracket or other component.

Ballasts are typically fastened with screws to the light housing and would require the same tools for removal. The wires extending from the ballasts need to be cut prior to ballast removal.

### **3.5 Hazards / Safety Precautions**

All employers must have a Material Safety Data Sheet (MSDS) for any workplace product that contains a hazardous substance(s), and must make it available to employees on request. An MSDS lists the hazardous chemical contents of a product, describes its health and safety hazards, and gives methods for using, storing and disposing of it safely. The employer may obtain an MSDS from the manufacturer of the product which contains PCBs. An MSDS for polychlorinated biphenyls is provided in appendix A.

The Hazard Evaluation System and Information Service (HESIS) produces fact sheets, booklets, and technical documents on work place chemicals. A HESIS fact sheet regarding polychlorinated biphenyls is provided in appendix B. HESIS fact sheets are designed as an aid for worker training programs and do not take the place of an MSDS. The HESIS office is located in Berkeley, California, and can be contacted at (510) 540-3138.

Employees should be trained on operational and safety aspects of any equipment used during PCB ballast and capacitor removal. Employees should also be trained in first aid.

**Note:** Capacitors are capable of holding an electrical charge up to several hours and have to be discharged prior to removal. Although this may not be the case for units in the disposal or recycling sectors because of the time lapse, the conservative approach is to discharge the capacitor by shorting an insulated screwdriver across the capacitor's terminals. Also, never pull on the capacitor's terminal wires when removing a capacitor (primarily oil-filled) as the terminal seal may dislodge and cause oil spillage<sup>15</sup>.

Also, any footwear should be worn and stored in the area where capacitor removal is taking place. PCBs can be transported via foot wear<sup>3</sup>.

### **3.6 Management**

Under California law, there are no specific exemptions for PCB wastes due to the quantity or size of the waste material, such as ballasts and capacitors. PCB containing electrical components, therefore, must be managed as a hazardous waste. The generator of PCB ballasts and capacitors will need to acquire an EPA generator I.D. number

through DTSC and may be required to manifest any shipments of these ballasts and capacitors. The hauler of these items may also be required to register as a hazardous waste transporter with DTSC. There are some exceptions to the manifesting and transporter registration requirements that may apply to some generators of PCB ballasts and capacitors. For example, under section 25163(c) of the Health and Safety Code (HSC), persons transporting small quantities (no greater than 5 gallons or 50 pounds) of hazardous waste to a permitted facility are exempt from manifest and transporter registration requirements when specified conditions are met. HSC section 25163.3 provides a conditional exemption from manifest and transporter registration requirements for persons consolidating hazardous wastes from remote locations at a generator's site.

California DTSC treatment standards for PCB containing electrical components are:

- 1) Incineration in a DTSC approved incinerator with a PCB Destruction Removal Efficiency of 99.9999%; or
- 2) Disposal in a hazardous waste landfill after placement in a lab pack.

Currently, the only landfill in California that can accept hazardous PCB wastes is the Chemical Waste Management's facility at Kettleman Hills, California, (209) 386-9711. There are currently no incinerators operating in California which meet the DTSC destruction requirement.

For a further discussion on handling, treatment, and disposal of PCB wastes, refer to the PCB Fact Sheet in appendix C.

#### 4.0 Oils / Lubricants

Used oil includes any spent lubricating fluids that have been removed from vehicles, equipment, or machines. Used oil found within appliances include compressor oils contained within refrigeration and air conditioning equipment and transmission oils contained within clothes washers.

#### 4.1 Lubricant Extraction Methods

The refrigerant within air conditioning and refrigeration equipment must be extracted prior to draining the oil from the compressor or removing the compressor from the appliance. If the refrigerant is not extracted, the removal of oil from the compressor or the removal of the compressor from the appliance will cause the refrigerant to vent to the atmosphere. Section 608 of the federal Clean Air Act (CAA) prohibits individuals from knowingly venting ozone depleting compounds, used as refrigerants, into the atmosphere while maintaining, servicing, repairing or disposing of air-conditioning or refrigeration equipment. The US EPA is authorized to assess fines of up to \$25,000 per

day per violation of the federal CAA.

### Tools / Equipment Needed

The basic tools needed for removing the compressor from the appliance are; 1) socket set, 2) side cutters or wire cutters, and 3) metal cutting saw (i.e., hack saw, reciprocating saw). For oil extraction, tools that are needed include; 1) drill and bits, 2) hammer, and 3) chisel or punch.

### Compressor Removal and Oil Extraction

The compressor is typically removed from the appliance prior to oil extraction. It is recommended that metal recyclers be contacted to see if they require the compressors to be removed prior to acceptance of the unit for metals recovery. The compressor is removed by cutting the refrigerant lines and the electrical wires connected to the compressor and removal of the fasteners connecting the compressor to the unit. A method used by one recycler in California is to use a reciprocating saw to cut the refrigerant lines as well as the brackets holding the compressor to the unit.

The oil is extracted by drilling a hole in the oil reservoir of the compressor and draining the oil into a storage container. If the compressor is removed from the unit, it is usually placed on a table where it is allowed to drain into a storage container located below the table. Another method of oil extraction, for removed compressors only, is to remove the refrigerant line studs on the compressor and then place the compressor upside down to drain the oil. One recycler finds it more convenient to extract the oil by puncturing a hole through the terminal plug located on the compressor (see Figure 3). The terminal plug is accessed by removing the terminal cover, normally held on by a wire retaining clip, and removing the relay switch, overload protector, and capacitor (if any). The terminal plug on the compressor can now be punctured allowing for the oil to be extracted. This particular recycling operation uses an air chisel to puncture the compressor terminal plug.

Oil found within the transmissions of washing machines can be extracted by drilling a hole in the lubricant reservoir or by removing the gear housing.

#### 4.2 Hazards / Safety Precautions

A person who might come into contact with used oil should wear gloves, boots, goggles or other face shield, or other protective clothing as necessary such as coveralls. Protective clothing should be made of materials that are resistant to oils<sup>20</sup>.

Employees should be trained on operational and safety aspects of any equipment used during used oil extraction. Employees should also be trained in first aid.

### 4.3 Management

Used oil means any oil that has been refined from crude oil, or any synthetic oil, that has been used, and, as a result of use or as a consequence of extended storage, or spillage, has been contaminated with physical or chemical impurities. Examples of used oil are:

- spent lubricating fluids which have been removed from an engine crankcase, transmission, gearbox, or differential of an automobile, bus, truck, vessel, plane, heavy equipment, or machinery powered by an internal combustion engine;
- industrial oils, including compressor, turbine, and bearing oil;
- hydraulic oil;
- metal-working oil;
- refrigeration oil; and
- railroad drainings.

Used oil must be managed as hazardous waste unless it can be shown that the contaminants below do not exceed the indicated limits, the oil is not hazardous by any other characteristics, and the oil is not mixed with any federally listed hazardous waste:

Total arsenic:	5 mg/kg or less
Total cadmium:	2 mg/kg or less
Total chromium:	10 mg/kg or less
Total halogens:	3000 mg/kg or less (however, used oil containing greater than 1000 mg/kg total halogens is presumed to be mixed with a federally listed waste, and is thus a hazardous waste, unless it can be demonstrated that the oil does not contain more than 1000 mg/kg total halogens listed in Appendix VIII of Part 261, Title 40, Code of Federal Regulations)
Total lead:	50 mg/kg or less
Total PCBs:	2 mg/kg or less
Flashpoint:	Minimum Standards by ASTM

Compressor oil extracted from refrigeration and air conditioning equipment is typically mixed with refrigerant during equipment operation. In the case of a refrigerator or freezer which typically uses CFC-12 as the refrigerant, the compressor oil will be mixed with chlorinated fluorocarbons which are halogenated compounds.

Used oil containing more than 1000 mg/kg total halogens is presumed to be mixed with

federally listed halogenated hazardous wastes and thus would be managed as a hazardous waste in California. The oil generated from two refrigerator recycling operations in California has tested over 4000 mg/kg halogens. One recycler has taken measures to reduce the halogen concentration for purposes of recycling the oil while the other recycler sends the oil to a facility for use as a blended fuel<sup>3,20</sup>.

All generators (other than householders) and haulers of used oil must obtain an Environmental Protection Agency (EPA) identification (ID) number. For further information on how to obtain an EPA ID number, call DTSC at (916) 324-1781. Used oil haulers can be found in the yellow pages under Oil-Waste or Waste.

For a further discussion on handling, storage, and transport of used oil, refer to the Used Oil Fact Sheet in appendix C.

## **5.0 Mercury**

Mercury, a silver-white metal which is a liquid at room temperature, has been used in the past in consumer and industrial goods, such as thermometers, thermostats, barometers, electrical switches, and batteries. Now, due to environmental concerns, mercury is being phased out of batteries, and mercury temperature controls are being replaced with electronic devices. Current uses of mercury include thermometers and fluorescent lighting<sup>8</sup>.

### **5.1 Discards Containing Mercury**

Small amounts of mercury may be found in switches used in some old washing machines and chest type freezers and in temperature controls in gas stoves and water heaters<sup>1,8,14</sup>. The switch on the chest type freezer will be located under the lid seal and is used to turn on the interior light<sup>14</sup>. The switch on the washing machine is located under the lid and is used to stop the washing machine when the lid is opened during operation<sup>5</sup> (see Figure 9). You can determine if the switch is liquid filled by shaking it. These switches will either be encased in plastic or glass<sup>14</sup>. In a stove, the mercury switch is a long, thin copper tube connecting the thermostat to the gas burner control<sup>8</sup> (see Figure 10).

### **5.2 Mercury Component Removal Methods**

#### **Tools / Equipment Needed**

The basic tools needed for removing the components containing mercury are; 1) screwdriver, 2) nut driver set, 3) crescent wrench, 4) socket set, and 5) side cutters or wire cutters.

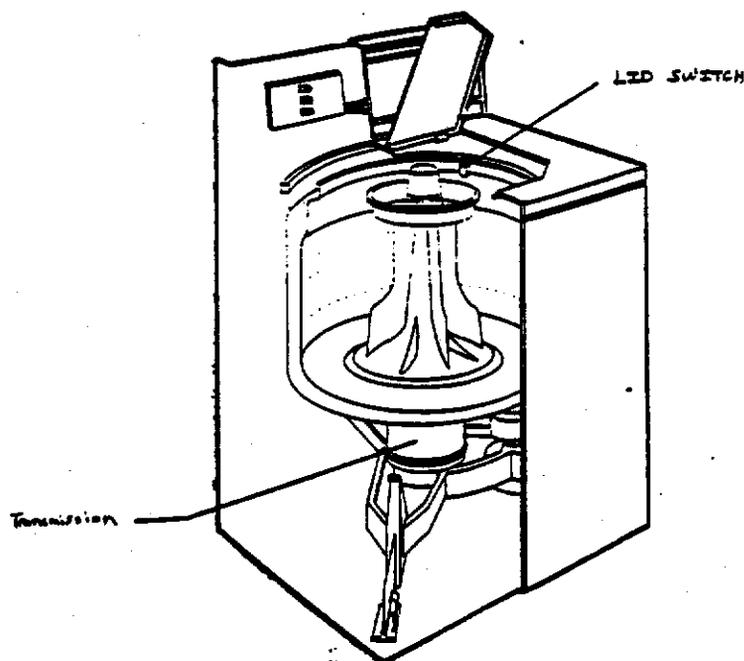
## Mercury Component Removal

**Washing machine** - the mercury switch is attached to the underside of the washer top. The washer top is held down by spring clips and can be removed by placing a screwdriver between the washer top and chassis and prying up. The mercury switch can be removed by detaching the clamp or other attaching hardware<sup>18</sup>.

**Chest type freezer** - a mercury switch on some older chest type freezers may be located on the underside of the freezer door. Once located, it can be physically removed by detaching the wire from the switch. Also, this type of freezer may contain a mercury type thermostat (i.e. capillary tube) which should also be removed. It should look like a long slender tube attached to a wire.

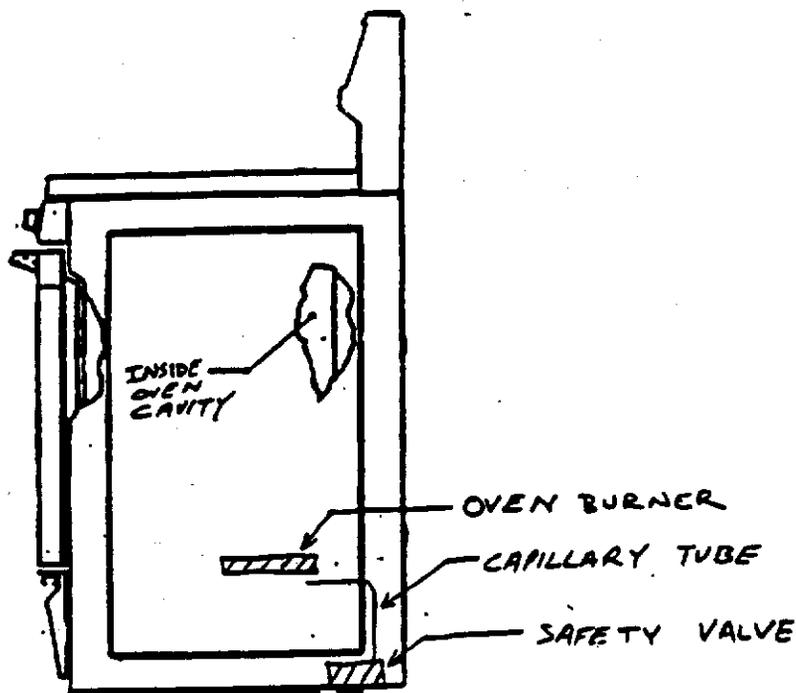
**Oven** - a thermostat (i.e. capillary tube) may be present in some ovens to control temperature. It should be carefully removed from the oven and properly disposed of. Some ovens may have a mercury switch in the door which operated the internal light. This switch should also be removed from the oven.

**Water heater** - some water heaters may have a thermostat which contains mercury. It should be removed from the water heater.



**Figure 9**

**Washing Machine Lid  
Switch and Transmission**



**Figure 10**

**Capillary Tube in  
Gas Stove**

### **5.3 Hazards / Safety Precautions**

All employers must have a Material Safety Data Sheet (MSDS) for any workplace product that contains a hazardous substance(s), and must make it available to employees on request. An MSDS lists the hazardous chemical contents of a product, describes its health and safety hazards, and gives methods for using, storing and disposing of it safely. The employer may obtain an MSDS from the manufacturer of the product containing mercury. An example of an MSDS for mercury is provided in appendix A.

The Hazard Evaluation System and Information Service (HESIS) produces fact sheets, booklets, and technical documents on work place chemicals. A HESIS fact sheet regarding mercury is provided in appendix B. HESIS fact sheets are designed as an aid for worker training programs and does not take the place of an MSDS. The HESIS office is located in Berkeley, California, and can be contacted at (510) 540-3138.

Employees should be trained on operational and safety aspects of any equipment used during mercury component removal. Employees should also be trained in first aid.

#### **5.4 Management**

**A person who stores in a container ten pounds or less of waste elemental mercury at the site of generation is exempt from hazardous waste facility permit requirements. A person who transports in a container ten pounds or less of waste elemental mercury to a resource recovery facility where mercury will be recovered from that waste is exempt from the requirements for registration with DTSC as a hazardous waste hauler and for the use of a manifest even if the transporter is not the generator of the waste. These provisions can be found in Title 22, California Code of Regulations, Section 66266.120(a)(1) and (a)(2).**

## References

1. **Research for the Development of a Reuse and Recycling Protocol for Discarded Appliances (White Goods), Prepared for the Arizona Department of Environmental Quality**
2. **Protecting the Ozone Layer: Safe Disposal of Home Appliances Containing Ozone-Depleting Substances**
3. **ARCA Trip Report. Dedication Ceremony for ARCA Facility in Compton, CA., March 10, 1994. Conversation with Glynnis Jones, ARCA, (612) 930-1750**
4. **Metallic Discards Task Force Meeting held on March 18, 1994.**
5. **Metallic Discards Management Plan; Appendices**
6. **Hesis Fact Sheet No.2; Fluorocarbons**
7. **Dangerous Properties of Industrial Materials, Third Edition, N. Irving Sax**
8. **Managing Discarded Major Appliances; University of Illinois at Chicago**
9. **Waste Management Program Guide for PCB & NonPCB Waste Light Ballasts**
10. **Field Trip to the Yolo County Landfill Metallic Discard Recycling**
11. **Field Trip to SMUD in Sacramento**
12. **Phone Conversation with DuPont on 5/19/94, 1-800-582-5606**
13. **Telephone Conversation with Jim Crager from CFC Recovery Systems, 5/26, (209) 823-7756**
14. **Telephone Conversation with Glynnis Jones from ARCA, 5/27**
15. **"PCBs in White Goods and Lighting Fixtures, Freon Recovery in White Goods", Scott County Sanitary Landfill Commission**
16. **"Guide for Removal, Storage, and Disposal of PCB Small Capacitors", State of Connecticut, Department of Environmental Protection**
17. **Letter by the Office of Pesticides and Toxic Substances, US EPA, regarding the use of PCBs in "White Goods"**

18. **Telephone Conversation with Roy's TV & Appliance, 988-0251, 6/2/94**  
**Visit with Roy's TV & Appliance, 6/3/94**
19. **Telephone Conversation with Standard Appliance Parts Company, 444-6650,**  
**6/8/94**
20. **Telephone Conversation with SMUD, Hazardous Waste Section, 732-5637**
21. **Major Appliance Management Report, Minnesota Office of Waste Management**

# **APPENDIX A**

## **Material Safety Data Sheets**

OCCUPATIONAL HEALTH SERVICES, INC.  
11 WEST 42ND STREET, 12TH FLOOR  
NEW YORK, NEW YORK 10036  
1-800-445-MSDS (1-800-445-6737) OR 1-212-789-3535

FOR EMERGENCY SOURCE INFORMATION  
CONTACT: 1-615-366-2000

## SUBSTANCE IDENTIFICATION

CAS-NUMBER 7664-41-7  
EINECS-NUMBER 20875000

SUBSTANCE: AMMONIA, ANHYDROUS

## TRADE NAMES/SYNONYMS:

ANHYDROUS AMMONIA: AMMONIA GAS: AMMONIA: NITRO-SIL: R 717: SPIRIT  
OF HARTSHORN: AMMONIA CYLINDER FOR DUPLIFLEXTER (2M): STCC 4904210:  
UN 1005: HDN: OHS01050

CHEMICAL FAMILY:  
INORGANIC GAS

MOLECULAR FORMULA: N-H<sub>3</sub>

MOLECULAR WEIGHT: 17.03

CERCLA RATINGS (SCALE 0-3): HEALTH=3 FIRE=1 REACTIVITY=0 PERSISTENCE=0  
NFPA RATINGS (SCALE 0-4): HEALTH=3 FIRE=1 REACTIVITY=0

## COMPONENTS AND CONTAMINANTS

COMPONENT: AMMONIA, ANHYDROUS CAS# 7664-41-7

PERCENT: 100.0

OTHER CONTAMINANTS: NONE

## EXPOSURE LIMIT:

AMMONIA, ANHYDROUS:

35 PPM (27 MG/M<sup>3</sup>) OSHA STEL

25 PPM (18 MG/M<sup>3</sup>) ACGIH TWA; 35 PPM (27 MG/M<sup>3</sup>) ACGIH STEL

50 PPM (35 MG/M<sup>3</sup>) NIOSH RECOMMENDED 5 MINUTE CEILING

500 POUNDS SARA SECTION 302 THRESHOLD PLANNING QUANTITY

100 POUNDS SARA SECTION 304 REPORTABLE QUANTITY

100 POUNDS CERCLA SECTION 103 REPORTABLE QUANTITY

SUBJECT TO SARA SECTION 313 ANNUAL TOXIC CHEMICAL RELEASE REPORTING

## PHYSICAL DATA

DESCRIPTION: COLORLESS GAS WITH AN EXTREMELY PUNGENT ODOR.

BOILING POINT: -27 F (-33 C)

MELTING POINT: -108 F (-78 C)

SPECIFIC GRAVITY: 0.7067 G/L @ 25 C

SOLUBILITY IN WATER: 38% @ 20 C

VAPOR DENSITY: 0.5967

VAPOR PRESSURE: 6658 MMHG @ 21 C

PH: 11.6 @ 1.0 N SOLN

ODOR-THRESHOLD: 1-5 PPM

OTHER SOLVENTS (SOLVENT - SOLUBILITY):  
SOLUBLE IN METHANOL, ETHANOL, CHLOROFORM, WATER,  
AND OTHER ORGANIC SOLVENTS.

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### FIRE AND EXPLOSION DATA

FIRE AND EXPLOSION HAZARD  
SLIGHT FIRE HAZARD WHEN EXPOSED TO HEAT OR FLAME.

MODERATE EXPLOSION HAZARD WHEN EXPOSED TO HEAT OR FLAME.

UPPER EXPLOSION LIMIT: 38%

LOWER EXPLOSION LIMIT: 15%

AUTOIGNITION TEMP.: 1204 F (651 C)

#### FIREFIGHTING MEDIA:

DRY CHEMICAL OR CARBON DIOXIDE  
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).

FOR LARGER FIRES, USE WATER SPRAY, FOG OR REGULAR FOAM  
(1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5).

#### FIREFIGHTING:

DO NOT GET WATER INSIDE CONTAINER. MOVE CONTAINER FROM FIRE AREA IF YOU CAN DO  
IT WITHOUT RISK. APPLY COOLING WATER TO SIDES OF CONTAINERS THAT ARE EXPOSED  
TO FLAMES UNTIL WELL AFTER FIRE IS OUT. STAY AWAY FROM ENDS OF TANKS. ISOLATE  
AREA UNTIL GAS HAS DISPERSED (1990 EMERGENCY RESPONSE GUIDEBOOK, DOT P 5800.5,  
GUIDE PAGE 15).

EXTINGUISH USING AGENTS INDICATED. COOL CONTAINERS WITH FLOODING AMOUNTS OF  
WATER FROM AS FAR A DISTANCE AS POSSIBLE. USE WATER SPRAY TO ABSORB CORROSIVE  
VAPORS. AVOID BREATHING CORROSIVE VAPORS; KEEP UPWIND. CONSIDER EVACUATION OF  
DOWNWIND AREA IF MATERIAL IS LEAKING.

STOP FLOW OF GAS (NFPA 325M, FIRE HAZARD PROPERTIES OF FLAMMABLE LIQUIDS,  
GASES, AND VOLATILE SOLIDS, 1984).

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### TRANSPORTATION

DEPARTMENT OF TRANSPORTATION HAZARD CLASSIFICATION 49 CFR 172.101:  
NONFLAMMABLE GAS

DEPARTMENT OF TRANSPORTATION LABELING REQUIREMENTS 49 CFR 172.101 AND  
SUBPART E:  
NONFLAMMABLE GAS

DEPARTMENT OF TRANSPORTATION PACKAGING REQUIREMENTS: 49 CFR 173.304;  
49 CFR 173.314 AND 49 CFR 173.315  
EXCEPTIONS: 49 CFR 173.306

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### TOXICITY

**AMMONIA, ANHYDROUS:**

**TOXICITY DATA:** 20 PPM INHALATION-HUMAN TCLO; 5000 PPM/5 MINUTES

INHALATION-HUMAN LCLO; 2000 PPM/4 HOURS INHALATION-RAT LC50; 4230 PPM/1 HOUR

INHALATION-MOUSE LC50; 7 GM/M3/1 HOUR INHALATION-CAT LC50; 7 GM/M3/1 HOUR

INHALATION-RABBIT LC50; 350 NG/KG ORAL-RAT LD50; 132 MG/KG UNREPORTED-HUMAN

LDLO; MUTAGENIC DATA (RTECS).

**CARCINOGEN STATUS:** NONE.

**LOCAL EFFECTS:** CORROSIVE- INHALATION, SKIN, EYE, INGESTION.

**ACUTE TOXICITY LEVEL:** TOXIC BY INGESTION, INHALATION.

**TARGET EFFECTS:** POISONING MAY AFFECT THE CENTRAL NERVOUS SYSTEM.

**AT INCREASED RISK FROM EXPOSURE:** PERSONS WITH PRE-EXISTING EYE, SKIN, AND RESPIRATORY TRACT DISORDERS.

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**HEALTH EFFECTS AND FIRST AID**

**INHALATION:**

**AMMONIA, ANHYDROUS:**

**CORROSIVE/TOXIC.** 500 PPM IMMEDIATELY DANGEROUS TO LIFE OR HEALTH.

**ACUTE EXPOSURE-** CONCENTRATIONS OF 5 PPM MAY CAUSE MINIMAL IRRITATION;

9-50 PPM MAY CAUSE NASAL DRYNESS, OLFACTORY FATIGUE, AND MODERATE

IRRITATION; 125-137 PPM MAY CAUSE DEFINITE NOSE, THROAT, AND CHEST

IRRITATION; AND 150 PPM MAY CAUSE LARYNGEAL SPASM. EXPOSURE TO

500 PPM FOR 30 MINUTES MAY CAUSE CYCLIC HYPERPNEA, INCREASED BLOOD

PRESSURE AND PULSE RATE, AND UPPER RESPIRATORY TRACT IRRITATION, SOMETIMES

PERSISTING FOR 24 HOURS; 700 PPM MAY CAUSE IMMEDIATE IRRITATION;

1500-10,000 PPM MAY CAUSE DYSPNEA, CONVULSIVE COUGHING, CHEST PAIN,

RESPIRATORY SPASM, PINK FROTHY SPUTUM, RAPID ASPHYXIA, AND DELAYED

PULMONARY EDEMA WHICH MAY BE FATAL. OTHER EFFECTS MAY INCLUDE RUNNY NOSE,

SWELLING OF THE LIPS, RESTLESSNESS, HEADACHE, SALIVATION, NAUSEA,

VOMITING, GLOTTAL EDEMA, PHARYNGITIS, TRACHEITIS, AND DIFFICULTY IN

SPEAKING. DEATH MAY RESULT FROM BRONCHOPNEUMONIA OR ASPHYXIATION DUE TO

SPASMS, INFLAMMATION, OR EDEMA OF THE LARYNX. RESIDUAL EFFECTS FROM

ACUTE EXPOSURES MAY INCLUDE HOARSENESS, PRODUCTIVE COUGH, DECREASED

RESPIRATORY FUNCTION, CHRONIC AIRWAY DYSFUNCTION, ALVEOLAR DISEASE,

BRONCHIOLITIS, BRONCHIECTASIS, EMPHYSEMA, AND ANXIETY NEUROSES.

**CHRONIC EXPOSURE-** DEPENDING ON THE CONCENTRATION AND DURATION OF EXPOSURE,

REPEATED OR PROLONGED EXPOSURE MAY CAUSE INFLAMMATORY AND ULCERATIVE

CHANGES IN THE MOUTH, POSSIBLE BRONCHIAL AND GASTROINTESTINAL

DISTURBANCES, AND EFFECTS SIMILAR TO ACUTE EXPOSURE. TOLERANCE TO

USUALLY IRRITATING CONCENTRATIONS MAY BE ACQUIRED BY ADAPTATION. IN

ANIMALS, CONTINUOUS OR REPEATED EXPOSURE TO SUBLETHAL CONCENTRATIONS HAVE

PRODUCED ADVERSE EFFECTS ON THE RESPIRATORY TRACT, LIVER, KIDNEYS AND

SPLEEN.

**FIRST AID-** REMOVE FROM EXPOSURE AREA TO FRESH AIR IMMEDIATELY. IF BREATHING HAS STOPPED, GIVE ARTIFICIAL RESPIRATION. MAINTAIN AIRWAY AND BLOOD PRESSURE AND ADMINISTER OXYGEN IF AVAILABLE. KEEP AFFECTED PERSON WARM AND AT REST. TREAT SYMPTOMATICALLY AND SUPPORTIVELY. ADMINISTRATION OF OXYGEN SHOULD BE PERFORMED BY QUALIFIED PERSONNEL. GET MEDICAL ATTENTION IMMEDIATELY.

**SKIN CONTACT:**

**AMMONIA, ANHYDROUS:**

**CORROSIVE.**

**ACUTE EXPOSURE-** EXPOSURE TO 10,000 PPM MAY CAUSE MILD IRRITATION TO MOIST

SKIN. DIRECT CONTACT WITH SOLUTIONS OR HIGH VAPOR CONCENTRATIONS (>30,000 PPM) MAY CAUSE SEVERE PAIN, A STINGING SENSATION, SEVERE BURNS AND VESICULATION, AND POSSIBLY BROWNISH STAINS. THE CORRODED AREAS ARE SOFT, GELATINOUS, AND NECROTIC, AND THE TISSUE DESTRUCTION MAY BE DEEP. IF BURNS ARE EXTENSIVE, DEATH MAY OCCUR. RARELY, VAPOR EXPOSURE MAY RESULT IN URTICARIA. DUE TO RAPID EVAPORATION, THE LIQUID MAY CAUSE FROSTBITE WITH REDNESS, TINGLING, AND PAIN, OR NUMBNESS. IN MORE SEVERE CASES, THE SKIN MAY BECOME HARD AND WHITE AND BLISTERS MAY DEVELOP.

CHRONIC EXPOSURE- EFFECTS DEPEND ON THE CONCENTRATION AND DURATION OF EXPOSURE. REPEATED OR PROLONGED CONTACT MAY CAUSE DERMATITIS OR EFFECTS SIMILAR TO ACUTE EXPOSURE.

FIRST AID- REMOVE CONTAMINATED CLOTHING AND SHOES IMMEDIATELY. WASH AFFECTED AREA WITH SOAP OR MILD DETERGENT AND LARGE AMOUNTS OF WATER UNTIL NO EVIDENCE OF CHEMICAL REMAINS (AT LEAST 15-20 MINUTES). IN CASE OF CHEMICAL BURNS, COVER AREA WITH STERILE, DRY DRESSING. BANDAGE SECURELY, BUT NOT TOO TIGHTLY. GET MEDICAL ATTENTION IMMEDIATELY.

**EYE CONTACT:**

**AMMONIA, ANHYDROUS:  
CORROSIVE.**

ACUTE EXPOSURE- EXPOSURE TO 140 PPM CAUSED SLIGHT IRRITATION TO HUMAN EYES; 700 PPM CAUSED IMMEDIATE IRRITATION. DIRECT CONTACT WITH SOLUTIONS OR HIGH VAPOR CONCENTRATIONS (>2500 PPM) MAY CAUSE SEVERE IRRITATION, SWELLING OF THE EYELIDS, LACRIMATION, BLEPHAROSPASM, PALPEBRAL EDEMA, INCREASED INTRAOCULAR PRESSURE, OVAL SEMIDILATED FIXED PUPILS, CORNEAL ULCERATION, POSSIBLY SEVERE, AND TEMPORARY BLINDNESS. THE DEGREE OF INJURY DEPENDS ON THE CONCENTRATION AND DURATION OF CONTACT. THERE MAY BE DESTRUCTION OF EPITHELIUM, CORNEAL AND LENTICULAR OPACIFICATION, AND IRITIS, ACCOMPANIED BY HYPOPYON OR HEMORRAGES AND POSSIBLY EXTENSIVE LOSS OF PIGMENT FROM THE POSTERIOR PIGMENT LAYER OF THE IRIS. WHEN DAMAGE IS LESS THAN EXCESSIVE, THESE SYMPTOMS TEND TO AMELIORATE. IN SEVERE BURNS, THE EXTENT OF THE INJURY MAY NOT BE IMMEDIATELY APPARENT. LATE COMPLICATIONS MAY INCLUDE PERSISTENT EDEMA, VASCULARIZATION AND SCARRING OF THE CORNEA, PERMANENT OPACITY, ACUTE-ANGLE GLAUCOMA, STAPHYLOMA, CATARACT, ATROPHY OF THE RETINA AND IRIS, AND SYMBLEPHARON. DUE TO RAPID EVAPORATION, THE LIQUID MAY CAUSE FROSTBITE WITH PAIN, REDNESS, AND BLURRED VISION.

CHRONIC EXPOSURE- EFFECTS DEPEND ON CONCENTRATION AND DURATION OF EXPOSURE. REPEATED OR PROLONGED CONTACT MAY RESULT IN CONJUNCTIVITIS OR EFFECTS AS IN ACUTE EXPOSURE. EXPOSURE FOR SEVERAL WEEKS TO 675 PPM CAUSED IRRITATION OF THE EYES OF DOGS AND RABBITS AND OPACITY OVER ONE-FOURTH TO ONE-HALF OF THE CORNEA IN RABBITS.

FIRST AID- WASH EYES IMMEDIATELY WITH LARGE AMOUNTS OF WATER, OCCASIONALLY LIFTING UPPER AND LOWER LIDS, UNTIL NO EVIDENCE OF CHEMICAL REMAINS (AT LEAST 15-20 MINUTES). CONTINUE IRRIGATING WITH NORMAL SALINE UNTIL THE PH HAS RETURNED TO NORMAL (30-60 MINUTES). COVER WITH STERILE BANDAGES. GET MEDICAL ATTENTION IMMEDIATELY.

**INGESTION:**

**AMMONIA, ANHYDROUS:  
CORROSIVE/TOXIC.**

ACUTE EXPOSURE- INGESTION OF SOLUTIONS MAY CAUSE IMMEDIATE PAIN AND CIRCUMORAL BURNS AND CORROSION OF THE MUCOUS MEMBRANES WHICH AT FIRST TURN WHITE AND SOAPY AND THEN BECOME BROWN, EDEMATOUS, AND ULCERATED. THERE MAY BE PROFUSE SALIVATION. SWALLOWING AND SPEECH MAY BE DIFFICULT AT FIRST AND THEN ALMOST IMPOSSIBLE. EVEN WHEN THERE IS NO EVIDENCE OF ORAL BURNS, THE ESOPHAGUS AND STOMACH MAY BE INVOLVED WITH BURNING PAIN, VOMITING, AND DIARRHEA. THE VOMITUS MAY BE THICK AND SLIMY WITH MUCOUS,

AND LATER CONTAIN BLOOD AND SHREDS OF MUCOUS MEMBRANE. EPIGLOTTAL EDEMA MAY RESULT IN RESPIRATORY DISTRESS AND POSSIBLY ASPHYXIA. SHOCK WITH MARKED HYPOTENSION, WEAK AND RAPID PULSE, SHALLOW RESPIRATION, AND CLAMMY SKIN MAY OCCUR. CIRCULATORY COLLAPSE MAY ENSUE, AND IF UNCORRECTED, LEAD TO RENAL FAILURE. IN SEVERE CASES, ESOPHAGEAL OR GASTRIC PERFORATION ARE POSSIBLE AND MAY BE ACCOMPANIED BY MEDIASTITIS, SUBSTERNAL PAIN, PERITONITIS, ABDOMINAL RIGIDITY, AND FEVER. ESOPHAGEAL, AND POSSIBLY GASTRIC OR PYLORIC STRICTURE MAY OCCUR WITHIN A FEW WEEKS, BUT MAY BE DELAYED FOR MONTHS OR EVEN YEARS. DEATH MAY RESULT WITHIN A SHORT TIME FROM ASPHYXIA, CIRCULATORY COLLAPSE, OR ASPIRATION OF EVEN MINUTE AMOUNTS. LATER, DEATH MAY BE DUE TO THE COMPLICATIONS OF PERFORATION, PNEUMONIA, OR THE EFFECTS OF STRICTURE FORMATION. INGESTION OF 350 MG/KG WAS LETHAL TO RATS. INGESTION OF A GAS IS UNLIKELY. IF LIQUID IS SWALLOWED, FROSTBITE DAMAGE TO THE LIPS, MOUTH AND MUCOUS MEMBRANES MAY OCCUR. CHRONIC EXPOSURE- DEPENDING ON THE CONCENTRATION, REPEATED INGESTION MAY RESULT IN INFLAMMATORY AND ULCERATIVE EFFECTS ON THE ORAL MUCOUS MEMBRANES AND OTHER EFFECTS AS WITH ACUTE INGESTION. INGESTION OF 80-130 MG/L FOR 17 MONTHS RESULTED IN CHRONIC ACIDOSIS AND TISSUE CHANGES IN RABBITS.

**FIRST AID-** DILUTE THE ALKALI BY GIVING WATER OR MILK IMMEDIATELY AND ALLOW VOMITING TO OCCUR. AVOID GASTRIC LAVAGE OR EMETICS. ESOPHAGOSCOPY IS THE ONLY WAY TO EXCLUDE THE POSSIBILITY OF KORROSION IN THE UPPER GASTROINTESTINAL TRACT; IF KORROSION IS SUSPECTED, ESOPHAGOSCOPY SHOULD USUALLY BE PERFORMED WITHIN 24 HOURS (DRETSBACH, HANDBOOK OF POISONING, 12TH ED.). MAINTAIN AIRWAY AND TREAT SHOCK. IF VOMITING OCCURS, KEEP HEAD BELOW HIPS TO HELP PREVENT ASPIRATION. GET MEDICAL ATTENTION IMMEDIATELY.

**ANTIDOTE:**

NO SPECIFIC ANTIDOTE. TREAT SYMPTOMATICALLY AND SUPPORTIVELY.

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**REACTIVITY SECTION**

**REACTIVITY:**

STABLE UNDER NORMAL TEMPERATURES AND PRESSURES.

**INCOMPATIBILITIES:**

AMMONIA, ANHYDROUS:

ACIDS: VIOLENT REACTION.

ALDEHYDES: MAY UNDERGO VIOLENT EXOTHERMIC CONDENSATION.

ALKYLENE OXIDES: MAY UNDERGO VIOLENT EXOTHERMIC CONDENSATION.

ALUMINUM: MAY BE KORROISIVE.

AMIDES: POSSIBLE VIOLENT REACTION.

BORON: INCANDESCENT REACTION WITH RELEASE OF HYDROGEN GAS WHEN HEATED.

BORON HALIDES: VIOLENT REACTION.

CALCIUM: EXOTHERMIC REACTION WHICH MAY BECOME INCANDESCENT.

CHLORIC ACID: FORMATION OF EXPLOSIVE COMPOUND.

CHLORINE AZIDE: FORMATION OF EXPLOSIVE COMPOUND.

CHLORINE MONOXIDE: EXPLOSIVE MIXTURE.

CHLORITES: FORMS SHOCK-SENSITIVE COMPOUND.

CHLOROPFORMAMIDINIUM NITRATE: VIOLENT REACTION.

1-CHLORO-2,4-DINITROBENZENE: VIOLENT REACTION WITH POSSIBLE EXPLOSION.

2-CHLORONITROBENZENE: VIOLENT REACTION.

CHLOROSILANE: MAY FORM SPONTANEOUSLY FLAMMABLE COMPOUND.

CHROMIUM TRIOXIDE (CHROMIC ANHYDRIDE): EXOTHERMIC OXIDATION WITH POSSIBLE INCANDESCENCE.

CHROMYL CHLORIDE: INCANDESCENT REACTION WITH POSSIBLE IGNITION.

**COPPER: MAY BE CORROSIVE.**

**DIAMINEBORONUM HEPTAHYDROTETRABORATE: VIOLENT DECOMPOSITION.**

**DIBORANE: IGNITION.**

**1,2-DICHLOROETHANE: MAY EXPLODE ON CONTACT WITH THE LIQUIFIED GAS.**

**DIMETHYL SULFATE: VIOLENT REACTION.**

**GERMANIUM DERIVATIVES: POSSIBLE EXPLOSION.**

**HALOGENS: VIOLENT REACTION WITH POSSIBLE FORMATION OF EXPLOSIVE COMPOUND.**

**HEAVY METALS AND COMPOUNDS (SILVER, GOLD, MERCURY, THALLIUM): MAY FORM COMPOUNDS WHICH ARE EXPLOSIVE WHEN DRY.**

**HEXACHLOROMELAMINE: FIRE AND EXPLOSION HAZARD.**

**HYDRAZINE AND ALKALI METALS: FORMS EXPLOSIVE METAL HYDRAZIDES.**

**HYDROGEN BROMIDE: VIGOROUS REACTION.**

**HYPOCHLOROUS ACID: EXPLODES ON CONTACT.**

**INTERHALOGENS: VIOLENT REACTION WITH POSSIBLE FORMATION OF EXPLOSIVE COMPOUND.**

**LEAD: MAY BE CORROSIVE.**

**MAGNESIUM PERCHLORATE: EXOTHERMIC REACTION FOLLOWED BY EXPLOSION.**

**NITRIC ACID: IGNITION.**

**NITROGEN TETROXIDE: VIOLENT OR EXPLOSIVE REACTION.**

**NITROGEN HALIDES: EXPLOSIVE REACTION.**

**NITRIL CHLORIDE: VIOLENT REACTION EVEN AT -75 C.**

**OXIDIZERS (STRONG): FIRE AND EXPLOSION HAZARD.**

**OXYGEN: POSSIBLE EXPLOSION.**

**OXYGEN DIFLUORIDE: IMMEDIATE REACTION PRODUCING WHITE FUMES.**

**PENTABORANE: SPONTANEOUS IGNITION.**

**PERCHLORATES: VIOLENT REACTION.**

**PHOSPHORUS OXIDES: VIOLENT REACTION WITH POSSIBLE IGNITION.**

**PICRIC ACID: FORMS EXPLOSIVE SALTS.**

**PLASTICS, RUBBER, COATINGS: MAY BE ATTACKED.**

**POTASSIUM AND ARSINE: VIGOROUS REACTION WITH THE LIQUID.**

**POTASSIUM AND PHOSPHINE: PRODUCES SPONTANEOUSLY FLAMMABLE SOLID.**

**POTASSIUM AND SODIUM NITRITE: PRODUCES EXPLOSIVE, REACTIVE SOLID.**

**POTASSIUM CHLORATE: HAZARDOUS REACTION.**

**POTASSIUM FERRICYANIDE: EXPLOSIVE REACTION.**

**POTASSIUM MERCURICYANIDE: EXPLOSIVE REACTION.**

**POTASSIUM PERMANGANATE: INCANDESCENT OXIDATION.**

**SODIUM AND CARBON MONOXIDE: FORMS EXPLOSIVE PRODUCT WITH THE LIQUID.**

**STIBINE: EXPLOSION ON HEATING.**

**SULFUR AND COMPOUNDS: MAY FORM EXPLOSIVE PRODUCT.**

**TELLURIUM HALIDES: FORMS EXPLOSIVE COMPOUND.**

**TETRAMETHYLAMMONIUM AMIDE: EXPLOSIVE DECOMPOSITION.**

**THIOCARBONYL AZIDE THIOCYANATE: EXPLOSIVE REACTION.**

**THIONYL CHLORIDE (SULFINYL CHLORIDE): FORMATION OF EXPLOSIVE COMPOUND.**

**THIOTRIETHIAZYL CHLORIDE: EXPLOSIVE REACTION.**

**TIN: MAY BE CORROSIVE.**

**TRICHLOROMELAMINE: FIRE AND EXPLOSION HAZARD.**

**VINYL COMPOUNDS: MAY INITIATE VIOLENT, EXOTHERMIC POLYMERIZATION.**

#### **DECOMPOSITION:**

**THERMAL DECOMPOSITION MAY RELEASE CORROSIVE FUMES OF AMMONIA AND TOXIC OXIDES OF NITROGEN.**

#### **POLYMERIZATION:**

**HAZARDOUS POLYMERIZATION HAS NOT BEEN REPORTED TO OCCUR UNDER NORMAL TEMPERATURES AND PRESSURES.**

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#### **STORAGE-DISPOSAL**

OBSERVE ALL FEDERAL, STATE AND LOCAL REGULATIONS WHEN STORING OR DISPOSING OF THIS SUBSTANCE. FOR ASSISTANCE, CONTACT THE DISTRICT DIRECTOR OF THE ENVIRONMENTAL PROTECTION AGENCY.

**\*\*STORAGE\*\***

STORE IN ACCORDANCE WITH 29 CFR 1910.111.

PROTECT AGAINST PHYSICAL DAMAGE. OUTSIDE OR DETACHED STORAGE IS PREFERRED. INSIDE STORAGE SHOULD BE IN A COOL, WELL-VENTILATED, NONCOMBUSTIBLE LOCATION, AWAY FROM ALL POSSIBLE SOURCES OF IGNITION. SEPARATE FROM OTHER CHEMICALS, PARTICULARLY OXIDIZING GASES, CHLORINE, BROMINE, IODINE, AND ACIDS (NFPA 49, HAZARDOUS CHEMICALS DATA, 1975).

STORE AWAY FROM INCOMPATIBLE SUBSTANCES.

STORE IN A COOL, DRY, WELL VENTILATED AREA

THRESHOLD PLANNING QUANTITY (TPQ):

THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 302 REQUIRES THAT EACH FACILITY WHERE ANY EXTREMELY HAZARDOUS SUBSTANCE IS PRESENT IN A QUANTITY EQUAL TO OR GREATER THAN THE TPQ ESTABLISHED FOR THAT SUBSTANCE NOTIFY THE STATE EMERGENCY RESPONSE COMMISSION FOR THE STATE IN WHICH IT IS LOCATED. SECTION 303 OF SARA REQUIRES THESE FACILITIES TO PARTICIPATE IN LOCAL EMERGENCY RESPONSE PLANNING (40 CFR 355.30).

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**CONDITIONS TO AVOID**

MATERIAL IS EXTREMELY POISONOUS; AVOID INHALATION OF VAPORS OR CONTACT WITH SKIN. CONTENTS MAY BE UNDER PRESSURE; CONTAINERS MAY RUPTURE VIOLENTLY AND TRAVEL A CONSIDERABLE DISTANCE.

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**SPILLS AND LEAKS**

**SOIL-RELEASE:**

DIG A HOLDING AREA SUCH AS A PIT, POND OR LAGOON TO CONTAIN SPILL AND DIKE SURFACE FLOW USING BARRIER OF SOIL, SANDBAGS, FOAMED POLYURETHANE OR FOAMED CONCRETE. ABSORB LIQUID MASS WITH FLY ASH OR CEMENT POWDER.

ADD DILUTE ACID TO NEUTRALIZE.

**AIR-RELEASE:**

APPLY WATER SPRAY TO KNOCK DOWN AND REDUCE VAPORS. KNOCK-DOWN WATER IS CORROSIVE AND TOXIC AND SHOULD BE DIKED FOR CONTAINMENT.

**WATER-SPILL:**

NEUTRALIZE WITH VINEGAR OR OTHER DILUTE ACID.

USE MECHANICAL DREDGES OR LIFTS TO EXTRACT IMMOBILIZED MASSES OF POLLUTION AND PRECIPITATES.

**OCCUPATIONAL-SPILL:**

STOP LEAK IF YOU CAN DO IT WITHOUT RISK. USE WATER SPRAY TO REDUCE VAPORS; DO NOT PUT WATER DIRECTLY ON LEAK OR SPILL AREA. DO NOT GET WATER INSIDE CONTAINER. ISOLATE AREA UNTIL GAS HAS DISPERSED. FOR SMALL SPILLS, FLUSH AREA WITH FLOODING AMOUNTS OF WATER. FOR LARGER SPILLS, DIKE FAR AHEAD OF SPILL FOR LATER DISPOSAL. KEEP UNNECESSARY PEOPLE AWAY; ISOLATE HAZARD AREA AND DENY ENTRY. STAY UPWIND, OUT OF LOW AREAS, AND VENTILATE CLOSED SPACES BEFORE ENTERING. ISOLATE THE LEAK OR SPILL AREA IMMEDIATELY FOR AT LEAST 150 FEET IN ALL DIRECTIONS.

REPORTABLE QUANTITY (RQ): 100 POUNDS  
THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT (SARA) SECTION 304 REQUIRES THAT A RELEASE EQUAL TO OR GREATER THAN THE REPORTABLE QUANTITY FOR THIS SUBSTANCE BE IMMEDIATELY REPORTED TO THE LOCAL EMERGENCY PLANNING COMMITTEE AND THE STATE EMERGENCY RESPONSE COMMISSION (40 CFR 355.40). IF THE RELEASE OF THIS SUBSTANCE IS REPORTABLE UNDER CERCLA SECTION 103, THE NATIONAL RESPONSE CENTER MUST BE NOTIFIED IMMEDIATELY AT (800) 424-8802 OR (202) 426-2675 IN THE METROPOLITAN WASHINGTON, D.C. AREA (40 CFR 302.6).

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### PROTECTIVE EQUIPMENT SECTION

**VENTILATION:**  
PROVIDE LOCAL EXHAUST OR PROCESS ENCLOSURE VENTILATION TO MEET PUBLISHED EXPOSURE LIMITS.

**RESPIRATOR:**  
THE FOLLOWING RESPIRATORS AND MAXIMUM USE CONCENTRATIONS ARE RECOMMENDATIONS BY THE U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, NIOSH POCKET GUIDE TO CHEMICAL HAZARDS; NIOSH CRITERIA DOCUMENTS OR BY THE U.S. DEPARTMENT OF LABOR, 29 CFR 1910 SUBPART Z.  
THE SPECIFIC RESPIRATOR SELECTED MUST BE BASED ON CONTAMINATION LEVELS FOUND IN THE WORK PLACE, MUST NOT EXCEED THE WORKING LIMITS OF THE RESPIRATOR AND BE JOINTLY APPROVED BY THE NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH AND THE MINE SAFETY AND HEALTH ADMINISTRATION (NIOSH-MSHA).

**AMMONIA:**

300 PPM- ANY CHEMICAL CARTRIDGE RESPIRATOR WITH CARTRIDGE(S) PROVIDING PROTECTION AGAINST AMMONIA.

500 PPM- ANY SUPPLIED-AIR RESPIRATOR.  
ANY POWERED AIR-PURIFYING RESPIRATOR WITH CARTRIDGE(S) PROVIDING PROTECTION AGAINST AMMONIA.  
ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR FRONT- OR BACK-MOUNTED CANISTER PROVIDING PROTECTION AGAINST AMMONIA.  
ANY SELF-CONTAINED BREATHING APPARATUS.

ESCAPE- ANY AIR-PURIFYING FULL FACEPIECE RESPIRATOR (GAS MASK) WITH A CHIN-STYLE OR FRONT- OR BACK-MOUNTED CANISTER PROVIDING PROTECTION AGAINST AMMONIA.  
ANY APPROPRIATE ESCAPE-TYPE SELF-CONTAINED BREATHING APPARATUS.

FOR FIREFIGHTING AND OTHER IMMEDIATELY DANGEROUS TO LIFE OR HEALTH CONDITIONS:

ANY SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE.

ANY SUPPLIED-AIR RESPIRATOR WITH FULL FACEPIECE AND OPERATED IN  
PRESSURE-DEMAND OR OTHER POSITIVE PRESSURE MODE IN COMBINATION WITH AN  
AUXILIARY SELF-CONTAINED BREATHING APPARATUS OPERATED IN PRESSURE-DEMAND  
OR OTHER POSITIVE PRESSURE MODE.

**CLOTHING:**

EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE (IMPERVIOUS) CLOTHING AND EQUIPMENT  
TO PREVENT ANY POSSIBILITY OF SKIN CONTACT WITH THIS SUBSTANCE.

**GLOVES:**

EMPLOYEE MUST WEAR APPROPRIATE PROTECTIVE GLOVES TO PREVENT CONTACT WITH THIS  
SUBSTANCE.

**EYE PROTECTION:**

EMPLOYEE MUST WEAR SPLASH-PROOF OR DUST-RESISTANT SAFETY GOGGLES AND A  
FACESHIELD TO PREVENT CONTACT WITH THIS SUBSTANCE.

**EMERGENCY WASH FACILITIES:**

WHERE THERE IS ANY POSSIBILITY THAT AN EMPLOYEE'S EYES AND/OR SKIN MAY BE  
EXPOSED TO THIS SUBSTANCE, THE EMPLOYER SHOULD PROVIDE AN EYE WASH FOUNTAIN  
AND QUICK DRENCH SHOWER WITHIN THE IMMEDIATE WORK AREA FOR EMERGENCY USE.

AUTHORIZED BY- OCCUPATIONAL HEALTH SERVICES, INC.

CREATION DATE: 09/11/84

REVISION DATE: 12/03/90

\*\*\*\*\*

MSDS DATE: AUGUST 1991  
 IDENTITY: SULFUR DIOXIDE  
 FORMULA: SO<sub>2</sub>

- I. MANUFACTURER IDENTIFICATION**  
 MANUFACTURER'S NAME: Will vary
- II. HAZARDOUS INGREDIENTS/IDENTITY INFORMATION**  
 HAZARDOUS COMPONENTS (SPECIFIC CHEMICAL IDENTITY, COMMON NAME(S)):  
 OSHA/PEL: 5 ppm  
 ACGIH/TLV: 2 ppm  
 NIOSH: .5 ppm
- III. PHYSICAL/CHEMICAL CHARACTERISTICS**  
 FORM: Gas or liquid  
 BOILING POINT: 147F (-10°C)  
 SPECIFIC GRAVITY (H<sub>2</sub>O=1): 1.5 @ -10°C  
 VAPOR PRESSURE (mm Hg): 2432 @ 61°F (°C)  
 MELTING POINT: -104°F (-75°C)  
 VAPOR DENSITY (AIR = 1): 2.26  
 EVAPORATION RATE (BUTYL ACETATE = 1): NA  
 SOLUBILITY IN WATER: 4.7g/100 ml @ 20°C  
 pH: 0.15  
 APPEARANCE: Colorless gas to liquid  
 ODOOR: Irritating sulfur odor
- IV. FIRE AND EXPLOSION DATA**  
 FLASH POINT (METHOD USED): NA  
 FLAMMABLE LIMITS:  
 LOWER: NA  
 UPPER: NA  
 EXTINGUISHING MEDIA: Use media appropriate for surrounding fire. Dry chemical, carbon dioxide, or halon may be used. Use water spray, fog, or standard foam for larger fires.  
 SPECIAL FIRE FIGHTING PROCEDURES: Use self-contained breathing apparatus and full protective clothing. Avoid breathing corrosive vapors. Keep upright. Move container from fire area if possible. Stay away from storage tank ends. Cool fire-exposed containers with water from side until well after fire is out. Isolate area until gas has dispersed. If the spill is small, isolate 120 feet in all directions, then evacuate in downwind direction. For larger spills, isolate 250 feet in all directions, then evacuate in downwind direction, an area .6 miles wide and .9 miles long.  
 UNUSUAL FIRE AND EXPLOSION HAZARDS: Material may burn, but will not ignite readily
- V. REACTIVITY DATA**  
 STABILITY: Stable at room temperatures  
 CONDITIONS TO AVOID: Heat  
 INCOMPATIBILITY (MATERIALS TO AVOID): Chlorates, acids, alkali metals, powdered metals, and many other substances  
 HAZARDOUS DECOMPOSITION OR BYPRODUCTS: Reacts with water or steam to form toxic and corrosive sulfurous acid  
 HAZARDOUS POLYMERIZATION: Polymerizes acetone with release of heat. Polymerizes explosively under confinement with propane.  
 CONDITIONS TO AVOID: Heat
- VI. HEALTH HAZARD DATA**  
 ROUTES OF ENTRY:  
 INHALATION? Yes

**INGESTION? Yes**

**HEALTH HAZARDS (ACUTE AND CHRONIC):** Acute exposure may cause chills, severe choking, cough, hoarseness, sneezing, tracheitis, rhinorrhea, mucous membrane irritation, nasal septum ulceration, chest pain or tightness, fatigue, nausea, vomiting, gingivitis, edema, respiratory paralysis, and death from asphyxia. Contact with skin may cause frostbite, redness, pain, and burns. Acute exposure to eyes may cause redness, pain, blurred vision, conjunctivitis, corneal burns, and opacification resulting in loss of vision. May cause burning in nostril and pharynx.

**CARCINOGENICITY:** Animal experimentation has indicated that sulfur dioxide may be a carcinogenic agent.

**SIGNS AND SYMPTOMS OF EXPOSURE:** Coughing, fatigue, nausea, choking, headache, abdominal pain, tightness and burning in chest, rapid and shallow respiration, biting of the skin, anxiety, mental confusion, pulmonary edema, and death. Contact with liquid sulfur dioxide may cause frostbite.

**MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE:** Persons with respiratory conditions and cardiovascular diseases are at greater risk.

**EMERGENCY AND FIRST AID PROCEDURES:**

**INHALATION:** Remove from area to fresh air immediately. If breathing has stopped, give artificial respiration. Maintain airway and blood pressure and administer oxygen if available. Keep victim warm and at rest. Get medical attention immediately.

**SKIN CONTACT:** Remove contaminated clothing and shoes. Wash affected area with soap or mild detergent and large amounts of water until no evidence of chemical remains. In case of chemical burns, cover area with sterile, dry dressing. Bandage securely. Get medical attention immediately.

**EYE CONTACT:** Wash eyes immediately with large amounts of water, occasionally lifting upper and lower lids, until no evidence of chemical remains (at least 15-20 minutes). In case of burns, apply sterile bandages loosely without medication. Get medical attention immediately.

**INGESTION:** If person is conscious, immediately give large amount of water or milk. Do not induce vomiting. Get medical attention immediately.

**VII. PRECAUTIONS FOR SAFE HANDLING AND USE**

**STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:** Stop leak if you can do so without risk. Use water spray to reduce vapors but do not get water on leak or spill area. Isolate area until gas has dispersed. Deny entry to area. Neutralize spilled material with crushed limestone, soda ash, or lime.

**WASTE DISPOSAL METHOD:** Bubble through aqueous alkali and bring to pH 7

**PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING:** Protect containers against physical damage. Store outdoors or in a well ventilated area of noncombustible construction.

**SHIPPING INFORMATION:**

**HAZARD CLASS:** Nonflammable gas

**UN NO.:** 1079

**DOT LABEL:** Nonflammable gas

**VIII. CONTROL MEASURES**

**RESPIRATORY PROTECTION:** Use self-contained breathing apparatus; chemical cartridge respirator with cartridges providing protection against sulfur dioxide

**VENTILATION:**

**LOCAL:** Exhaust ventilation system

**PROTECTIVE GLOVES:** Impervious gloves

**EYE PROTECTION:** Splash-proof safety goggles and faceshield

**OTHER PROTECTIVE CLOTHING OR EQUIPMENT:** Impervious clothing

**DATE OF LATEST REVISION/REVIEW:**

August 1991

**PERSON RESPONSIBLE FOR MSDS:**

Rachel Hagen

ARCA, Inc.

2601 Broadway Road N.E.

Minneapolis, MN 55413

(612) 551-1000

Sulfur Dioxide - 2

DU PONT  
Material Safety Data Sheet

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MATERIAL IDENTIFICATION

USED REFRIGERANT 12  
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MSDS NUMBER : 3035FR  
CORPORATE NUMBER : DU005351  
  
Revision Date : 11-Aug-92  
Date Printed : 19-Aug-92

MANUFACTURER/DISTRIBUTOR

Du Pont  
1007 Market Street  
Wilmington, DE 19898

PHONE NUMBERS

PRODUCT INFORMATION : 1-800-441-9442  
TRANSPORT EMERGENCY : CHEMTREC: 1-800-424-9300  
MEDICAL EMERGENCY : 1-800-441-3637

CHEMICAL FAMILY : HALOGENATED HYDROCARBON

DU PONT REGISTRY NUMBER: DP178-74-9  
FORMULA : CCl<sub>2</sub>F<sub>2</sub>  
TSCA INVENTORY STATUS : Reported/Included  
NPCA-HMIS RATINGS : Health: 1 Flammability: 0 Reactivity: 1  
Personal Protection rating to be supplied by  
user depending on use conditions.

-----  
COMPONENTS  
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Material	CAS Number	%
METHANE, DICHLORODIFLUORO- (REFRIGERANT 12)	75-71-8	95-100

MAY CONTAIN ONE OF THE FOLLOWING:

REFINED MINERAL OILS	64742-52-5	0-5
REFINED MINERAL OILS	64742-44-5	0-5
REFINED MINERAL OILS	64742-88-4	0-5
REFINED MINERAL OILS	64741-88-4	0-5
ALKYL BENZENE	68648-86-2	0-5

- Regulated as a Toxic Chemical under Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR part 372.

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PHYSICAL DATA  
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pH : Neutral  
Odor : Slight ethereal  
Form : Liquified gas  
Color : Colorless to slightly yellow  
  
Appearance : Clear

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HAZARDOUS REACTIVITY  
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Instability : Material is stable. However, avoid open flames and high temperatures.  
Incompatibility : Incompatible with alkali or alkaline earth metals- powdered Al, Zn, Be, etc.  
Polymerization : Polymerization will not occur.  
Decomposition : Decomposition products are hazardous. Used Refrigerant 12 can be decomposed by high temperatures (open flames, glowing metal surfaces, etc.) forming hydrochloric and hydrofluoric acids, and possibly carbonyl halides. Refined Mineral Oils, if present, can produce carbon monoxide and carbon dioxide upon combustion.

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FIRE AND EXPLOSION DATA  
-----

Flash Point : Will not burn  
Autoignition : Not determined  
Autodecomposition: Not determined

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FIRE AND EXPLOSION HAZARDS

Cylinders are equipped with temperature and pressure relief devices but may still rupture under fire conditions.  
Decomposition products are hazardous.

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EXTINGUISHING MEDIA

As appropriate for combustibles in area.

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SPECIAL FIRE FIGHTING INSTRUCTIONS

Use water spray or fog to cool containers. Self-contained breathing apparatus (SCBA) is required if cylinders rupture and contents are released under fire conditions.

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HEALTH HAZARD INFORMATION  
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Inhalation of high concentrations of vapor is harmful and may cause heart irregularities, unconsciousness, or death. Intentional misuse or deliberate inhalation may cause death without warning. Vapor reduces oxygen available for breathing and is heavier than air. Liquid contact can cause frostbite. May cause eye irritation.

## ANIMAL DATA:

Inhalation 30-minute LC50: 800,000 ppm in rats  
Oral ALD : >1000 mg/kg in rats

Effects in animals from single high exposure by inhalation include anesthesia and irregular heartbeat (cardiac arrhythmias). Repeated inhalation exposures produced altered respiratory function. Long-term studies showed no significant clinical, blood chemistry, or pathological effects following repeated exposures. The effects in animals from long-term ingestion of this material include slight alterations in blood chemistry and body weight gain. No other clinical, biochemical or pathological signs of toxicity have been observed.

Tests in animals demonstrate no carcinogenic activity and no developmental or reproductive toxicity. The compound does not produce heritable genetic damage in animals or genetic damage in bacterial and mammalian cell cultures.

## HUMAN HEALTH EFFECTS:

Human health effects of overexposure by eye contact with the vapor may include eye irritation with discomfort, tearing, or blurring of vision. Skin contact with the liquid may cause frostbite. Inhalation of the vapors may cause temporary nervous system depression with anesthetic effects such as dizziness, headache, confusion, incoordination, and loss of consciousness; temporary alteration of the heart's electrical activity with irregular pulse, palpitations, or inadequate circulation, or the effects of exclusion of oxygen with grossly excessive exposures.

Individuals with preexisting diseases of the central nervous or cardiovascular system may have increased susceptibility to the toxicity of excessive exposures.

## REFINED MINERAL OILS AND ALKYL BENZENE

Refined Mineral Oils and Alkyl Benzene may cause reversible eye and skin irritation upon prolonged or repeated contact. Prolonged skin exposure may defat skin and cause dermatitis. Ingestion may cause gastrointestinal cramping and diarrhea.

Material Safety Data Sheet

(HEALTH HAZARD INFORMATION - Continued)

The acute Oral LD50 in rats for Oil Mists is >15 g/kg.

**MUTAGENICITY**

The following components are listed by IARC, NTP, OSHA, or ACGIH as carcinogens. A 'P' indicates a Proposed Carcinogen.

Material	IARC	NTP	OSHA	ACGIH
REFINED MINERAL OILS	X			

**APPLICABLE EXPOSURE LIMITS**

METHANE, DICHLORODIFLUORO- (REFRIGERANT 12)

- AEL - (Du Pont): None Established
- TLV (ACGIH) : 1,000 ppm, 4,950 mg/m<sup>3</sup> - 8 Hr TWA
- PEL (OSHA) : 1,000 ppm, 4,950 mg/m<sup>3</sup> - 8 Hr TWA

- AEL is Du Pont's Acceptable Exposure Limit. Where governmentally imposed occupational exposure limits which are lower than the AEL are in effect, such limits shall take precedence.

**SAFETY PRECAUTIONS**

Avoid breathing vapors. Avoid liquid contact with skin or eyes. Use with sufficient ventilation to keep employee exposure below recommended limits.

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**FIRST AID**  
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**INHALATION**

If high concentrations are inhaled, immediately remove to fresh air. Keep person calm. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

**SKIN CONTACT**

In case of contact, flush skin with water. Treat for frostbite if necessary by gently warming affected area.

**EYE CONTACT**

In case of contact, immediately flush eyes with plenty of water for 15 minutes. Call a physician.

**INGESTION**

Ingestion is not considered a potential route of exposure.

**NOTES TO PHYSICIAN**

Because of a possible disturbance of cardiac rhythm, catecholamine drugs, such as epinephrine, should only be used with special caution in situations of emergency life support.

PROTECTION INFORMATION

GENERALLY APPLICABLE CONTROL MEASURES AND PRECAUTIONS

Normal ventilation for standard manufacturing procedures is generally adequate. Local exhaust should be used when large amounts are released. Mechanical ventilation should be used in low or enclosed places.

PERSONAL PROTECTIVE EQUIPMENT

Impervious gloves and chemical splash goggles should be used when handling liquid. Under normal manufacturing conditions, no respiratory protection is required when using this product. Self-contained breathing apparatus (SCBA) is required if a large release occurs.

DISPOSAL INFORMATION

FILL, LEAK, OR RELEASE

NOTE: Review FIRE AND EXPLOSION HAZARDS and SAFETY PRECAUTIONS before proceeding with clean up. Use appropriate PERSONAL PROTECTIVE EQUIPMENT during clean up.

Ventilate area, especially low or enclosed places where heavy vapors might collect. Remove open flames. Use self-contained breathing apparatus (SCBA) for large spills.

WASTE DISPOSAL

Comply with Federal, State, and local regulations. Reclaim by distillation or remove to a permitted waste facility.

SHIPPING INFORMATION

DOT

Proper Shipping Name : REFRIGERANT GAS, N.O.S. (CONTAINS  
DICHLORODIFLUOROMETHANE)  
Hazard Class : NONFLAMMABLE GAS, 2.2  
UN/NA No. : UN 1078  
DOT Labels(s) : NONFLAMMABLE GAS

Shipping Containers  
Tank Car  
Cylinders  
Ton Tanks

Reportable Quantity : 5000 lbs/2270 kg

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ORAGE CONDITIONS  
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Clean, dry area. Do not heat above 52 deg C (125 deg F).

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TLE III HAZARD CLASSIFICATIONS  
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Acute : Yes  
Chronic : No  
Fire : No  
Reactivity : No  
Pressure : Yes

## LISTS:

Extremely Hazardous Substance	-No
CERCLA Hazardous Substance	-Yes
Toxic Chemicals	-Yes

-----  
The data in this Material Safety Data Sheet relates only to the specific material designated herein and does not relate to use in combination with any other material or in any process.

Responsibility for MSDS : W. J. Brock  
Du Pont Chemicals  
P. O. Box 80709, Chestnut Run  
Wilmington, DE 19880-0709

\* Indicates updated section.

End of MSDS

**MONSANTO COMPANY**  
800 N. LINDBERGH BLVD.  
ST. LOUIS, MO 63167

**Emergency Phone No.**  
(Call Collect)  
314-694-1000

Date: 10/88

MONSANTO PRODUCT NAME  
**Polychlorinated  
Biphenyls (PCBs)**

## PRODUCT IDENTIFICATION

**Synonyms:** PCBs  
Chlorodiphenyl (\_\_\_% Cl)  
Chlorinated biphenyl  
Polychlorinated biphenyl  
Chlorinated biphenyls  
(approx. \_\_\_% Cl)

**Trade Names/  
Common Names:** Aroclor<sup>®1</sup> Series 1016, 1221, 1232, 1242, 1248, 1254, 1260  
Therminol<sup>®1</sup> FR Series

PYRANOL<sup>®2</sup> and INERTEEN<sup>®3</sup> are trademarks for commonly used dielectric fluids that may have contained varying amounts of PCBs as well as other components including chlorinated benzenes.

ASKAREL - Generic name for a broad class of fire-resistant synthetic chlorinated hydrocarbons and mixtures used as dielectric fluids that commonly contained about 30-70% PCBs. Some ASKAREL fluids contained 99% or greater PCBs and some contained no PCBs.

This list of trade names is representative of several commonly used Monsanto products (or products formulated with Monsanto products). Other trademarked PCB products were marketed by Monsanto and other manufacturers. PCBs were also manufactured and sold by several European and Japanese companies. Contact the manufacturer of the trademarked product, if not in this listing, to determine if the formulation contained PCBs.

<sup>®1</sup> Registered trademark of Monsanto Company  
<sup>®2</sup> Registered trademark of General Electric Company  
<sup>®3</sup> Registered trademark of Westinghouse Electric Corporation

**CAS No.'s:** 001336363, 053469219, 021672296, 01109769, 011096825 and others

## WARNING STATEMENTS

Federal regulations under the Toxic Substances Control Act require PCBs, PCB items, storage areas, transformer vaults, and transport vehicles to be marked. (check regulations, 40 CFR 761, for details)

**CAUTION**  
CONTAINS  
**PCBs**  
Polychlorinated Biphenyls

A toxic environmental contaminant requiring special handling and disposal in accordance with U.S. Environmental Protection Agency Regulations (EPA 761) for Disposal Information Contact the nearest U.S. EPA Office

In case of accident or spill call the nearest U.S. Coast Guard National Response Center 800 424 8802

And Contact \_\_\_\_\_  
Tel. no. \_\_\_\_\_

**CAUTION**  
CONTAINS  
**PCBs**  
Polychlorinated Biphenyls

FOR PROPER DISPOSAL INFORMATION  
CONTACT U.S. ENVIRONMENTAL  
PROTECTION AGENCY

## PRECAUTIONARY MEASURES

Care should be taken to prevent entry into the environment through spills, leakage, use, vaporization, or disposal of liquid or containers. Avoid prolonged breathing of vapors or mists. Avoid contact with eyes or prolonged contact with skin. If skin contact occurs, remove by washing with soap and water. Following eye contact, flush with water. In case of spillage onto clothing, the clothing should be removed as soon as practical, skin washed, and clothing laundered. Comply with all federal, state, and local regulations.

## EMERGENCY AND FIRST AID PROCEDURES

- Ingestion:** Consult a physician. Do not induce vomiting or give any oily laxatives. NOTE TO PHYSICIAN—If large amounts are ingested, gastric lavage is suggested.
- Skin:** If liquid or solid PCBs are splashed or spilled on skin, contaminated clothing should be removed and the skin washed thoroughly with soap and water. NOTE TO PHYSICIAN—Hot PCBs may cause thermal burns.
- Eyes:** Eyes should be irrigated immediately with copious quantities of running water for at least 15 minutes if liquid or solid PCBs get into them. A petrolatum-based ophthalmic ointment may be applied to the eye to relieve the irritating effects of PCBs.
- Inhalation:** Remove to fresh air. If skin rash or respiratory irritation persists, consult a physician. NOTE TO PHYSICIAN—If electrical equipment arcs over, PCBs or other chlorinated hydrocarbon dielectric fluids may decompose to produce HCl, hydrochloric acid, a respiratory irritant.

## OCCUPATIONAL CONTROL PROCEDURES

- Eye Protection:** Wear chemical splash goggles and have eye baths available where there is significant potential for eye contact.
- Skin Protection:** Wear appropriate protective clothing and chemical resistant gloves to prevent skin contact. Consult glove manufacturer to determine appropriate type glove for given application. Wear chemical goggles, face shield, and chemical resistant clothing such as a rubber apron when splashing is likely. Wash immediately if skin is contaminated. Remove contaminated clothing promptly and launder before reuse. Clean protective equipment before reuse. Provide a safety shower at any location where skin contact can occur. Wash thoroughly after handling. **ATTENTION!** Repeated or prolonged contact may cause chloracne in some people.
- Respiratory Protection:** Avoid breathing vapor or mist. Use NIOSH/MSHA approved equipment when airborne exposure limits are exceeded. Full facepiece equipment is recommended and, if used, replaces need for face shield and/or chemical splash goggles. Consult respirator manufacturer to determine the type of equipment for a given application. The respirator use limitations specified by NIOSH/MSHA or the manufacturer must be observed. High airborne concentrations may require use of self-contained breathing apparatus or supplied air respirator. Respiratory protection programs must be in compliance with 29 CFR Part 1910.134.
- Ventilation:** Provide natural or mechanical ventilation to control exposure levels below airborne exposure limits (see below). If practical, use local mechanical exhaust ventilation at sources of air contamination such as open process equipment.
- Airborne Exposure Limits:** Chlorinated biphenyl (approximately 42% chlorine)  
OSHA PEL: 1 mg/m<sup>3</sup> 8-hour time-weighted average - Skin\*  
ACGIH TLV: 1 mg/m<sup>3</sup> 8-hour time-weighted average - Skin\*  
2 mg/m<sup>3</sup> short-term exposure limit - Skin\*

\*Skin notation means that skin absorption of this material may add to the overall exposure. Avoid skin contact.

(OCCUPATIONAL CONTROL PROCEDURES continued on page 3)

# Monsanto MATERIAL SAFETY DATA

## OCCUPATIONAL CONTROL PROCEDURES (continued)

### Airborne

#### Exposure Limits (Continued):

Chlorinated biphenyl (approximately 54% chlorine)  
OSHA PEL: 0.5 mg/m<sup>3</sup> 8-hour time-weighted average - Skin\*  
ACGIH TLV: 0.5 mg/m<sup>3</sup> 8-hour time-weighted average - Skin\*  
1 mg/m<sup>3</sup> short-term exposure limit - Skin\*

\*Skin notation means that skin absorption of this material may add to the overall exposure. Avoid skin contact.

## FIRE PROTECTION INFORMATION

### Fire and Explosion:

PCBs are fire-resistant compounds. They may decompose to form CO, CO<sub>2</sub>, HCl, phenolics, aldehydes and other toxic combustion products under severe conditions such as exposure to flame or hot surfaces.

At temperatures in the range of 500-650°C in the presence of excess of oxygen PCBs may form polychlorinated dibenzofurans (PCDFs). Laboratory studies under similar conditions have demonstrated that PCBs do not produce polychlorinated dibenzo-p-dioxins (PCDDs).

PCBs in electrical equipment have been reported to produce both chlorinated dioxins (PCDDs) and furans (PCDFs) during fire situations. These combustion products may result all, or in part, from non-PCB components of the dielectric fluids or other combusted materials. Consult the equipment manufacturer for information regarding composition of the dielectric fluids in electrical apparatus.

Standard fire fighting wearing apparel and self-contained breathing apparatus should be worn when fighting fires that involve possible exposure to chemical combustion products. Fire fighting equipment should be thoroughly cleaned and decontaminated after use.

Federal regulations require all PCB transformers to be registered with fire response personnel.

If a PCB transformer is involved in a fire-related incident, the owner of the transformer may be required to report the incident. Consult and follow appropriate federal, state, and local regulations.

## REACTIVITY DATA

PCBs are very stable, fire-resistant compounds.

## HEALTH EFFECTS SUMMARY

### Skin Contact:

PCBs can be absorbed through intact skin. Local action on skin is similar to that of common organic solvents where contact leads to removal of natural fats and oils with subsequent drying and cracking of the skin. A potential exists for contracting chloracne.

### Eye Contact:

The liquid products and their vapors are moderately irritating to eye tissues.

### Ingestion:

The acute oral toxicities of the undiluted compounds are: LD<sub>50</sub> rats—8.65 gm/kg for 42% chlorinated, and 11.9 gm/kg for 54% chlorinated—"slightly toxic."

### Inhalation:

Animal experiments of varying duration and at different air concentrations show that for similar exposure conditions, the 54% chlorinated material produces more liver injury than the 42% chlorinated material.

(HEALTH EFFECTS SUMMARY continued on page 4)

# Monsanto MATERIAL SAFETY DATA

## HEALTH EFFECTS SUMMARY (continued)

Other:

There are literature reports that PCBs can impair reproductive functions in monkeys. The National Cancer Institute performed a study in 1977 using Aroclor 1254 with both sexes of rats. NCI stated that the PCB, Aroclor 1254, was not carcinogenic under the conditions of their bioassay. There is sufficient evidence in the scientific literature to conclude that Aroclor 1260 can cause liver cancer when fed to rodents at high doses. Similar experiments with less chlorinated PCB products have produced negative or equivocal results.

The consistent finding in animal studies is that PCBs produce liver injury following prolonged and repeated exposure by any route. If the exposure is of sufficient degree and duration. Liver injury is produced first, and by exposures that are less than those reported to cause cancer in rodents. Therefore, exposure by all routes should be kept sufficiently low to prevent liver injury.

Numerous epidemiological studies of humans, both occupationally exposed and non-worker environmentally exposed populations, have not demonstrated any causal relationship between PCB exposures and chronic human illnesses such as cancer or neurological or cardiovascular effects. PCBs can cause dermatological symptoms; however, these are reversible upon removal of exposure source.

PCBs are identified as hazardous chemicals under criteria of the OSHA Hazard Communication Standard (29 CFR Part 1910.1200). PCBs have been listed in the International Agency for Research on Cancer (IARC) Monographs (1987)-Group 2A and in the National Toxicology Program (NTP) Annual Report on Carcinogens (Fourth).

### PHYSICAL DATA

#### PROPERTIES OF SELECTED AROCLORS<sup>1</sup>

PROPERTY	1016	1221	1232	1242	1248	1254	1260
Color (APHA)	40	100	100	100	100	100	150
Physical state	mobile oil	mobile oil	mobile oil	mobile oil	mobile oil	viscous liquid	sticky resin
Stability	inert	inert	inert	inert	inert	inert	inert
Density (lb/gal 25°C)	11.40	9.85	10.55	11.50	12.04	12.82	13.50
Specific gravity x-15.5°C	1.36-1.37 x-25°	1.18-1.19 x-25°	1.27-1.28 x-25°	1.30-1.39 x-25°	1.40-1.41 x-65°	1.49-1.50 x-65°	1.55-1.56 x-90°
Distillation range (°C)	323-356	275-320	290-325	325-366	340-375	365-390	385-420
Acidity mg KOH/g. maximum	.010	.014	.014	.015	.010	.010	.014
Fire point (°C)	none to boiling point	176	238	none to boiling point			
Flash point (°C)	170	141-150	152-154	176-180	193-196	none	none
Vapor pressure (mm Hg @ 100°F)	NA	NA	0.005	0.001	0.00037	0.00006	NA
Viscosity (Saybolt Univ. Sec. @ 100°F) (centistokes)	71-81 13-16	38-41 3.6-4.6	44-51 5.5-7.7	82-92 16-19	185-240 42-52	1800-2500 390-540	— —

NA—Not Available

Polychlorinated Biphenyls (PCBs)

MATERIAL SAFETY DATA

# Monsanto MATERIAL SAFETY DATA

## SPILL, LEAK & DISPOSAL INFORMATION

Cleanup and disposal of liquid PCBs and other PCB items are strictly regulated by the federal government. The regulations are found at 40 CFR Part 761. Consult these regulations as well as applicable state and local regulations prior to any disposal of PCBs, PCB items, or PCB-contaminated items.

If PCBs leak or are spilled, the following steps should be taken immediately:

All non-essential personnel should leave the leak or spill area.

The area should be adequately ventilated to prevent the accumulation of vapors.

The spill/leak should be contained. Loss to sewer systems, navigable waterways and streams should be prevented. Spills/leaks should be removed promptly by means of absorptive material, such as sawdust, vermiculite, dry sand, clay, dirt or other similar materials, or trapped and removed by pumping or other suitable means (traps, drip-pans, trays, etc.).

Personnel entering the spill or leak area should be furnished with appropriate personal protective equipment and clothing as needed. See Occupational Control Procedures section of this MSDS.

Personnel trained in the emergency procedures and protected against the attendant hazards should shut off sources of PCBs, clean up spills, control and repair leaks and fight fires in PCB areas.

All wastes and residues containing PCBs (e.g., wiping cloths, absorbent material, used disposable protective gloves, clothing, etc.) should be collected, placed in proper containers, marked and disposed of in the manner prescribed by EPA regulations (40 CFR Part 761) and applicable state and local regulations.

Various federal, state and local regulations may require immediate reporting of PCB spills and may also define spill clean-up levels. Consult your attorney or appropriate regulatory officials for information relating to spill reporting and spill clean-up.

## ENVIRONMENTAL INFORMATION

Care should be taken to prevent entry of PCBs into the environment through spills, leakage, use, vaporization or disposal of liquids or solids. PCBs can accumulate in the environment and can adversely affect some animals and aquatic life. In general, PCBs have low solubility in water, are strongly bound to soils and sediments, and are slowly degraded by natural processes in the environment.

## ADDITIONAL COMMENTS

### Polychlorinated Biphenyls

For regulatory purposes, under the Toxic Substances Control Act the term "PCBs" refers to a chemical substance limited to the biphenyl molecule that has been chlorinated to varying degrees or any combination of substances which contain such substance (40 CFR Part 761).

Chemically, commercial PCBs are defined as a series of technical mixtures, consisting of many isomers and compounds that vary from mobile oily liquids to white crystalline solids and hard non-crystalline resins. Technical products vary in composition, in the degree of chlorination and possibly according to batch.

The mixtures generally used contain an average of 3 atoms of chlorine per molecule (42% chlorine) to 5 atoms of chlorine per molecule (54% chlorine). They are used as components of dielectric fluids in transformers and capacitors. Prior to 1972, PCB applications included heat transfer media, hydraulic and other industrial fluids, plasticizers, carbonless paper, paints, inks and adhesives.

In 1972 Monsanto restricted sales of PCBs to applications involving only closed electrical systems (transformers and capacitors). In 1977 all manufacturing and sales were voluntarily terminated. In 1979 EPA restricted the manufacture, processing, use, and distribution of PCBs to specifically exempted and authorized activities.

**DATE:** 10/1/88**SUPERSEDES:** All prior to 10/1/88**FOR ADDITIONAL NON-EMERGENCY INFORMATION, CONTACT:**

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Note: Although the information and recommendations set forth (hereinafter "information") are presented in good faith and believed to be correct as of the date hereof, Monsanto Company makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will Monsanto Company be responsible for damages of any nature whatsoever resulting from the use of or reliance upon information. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS.

# **APPENDIX B**

## **HESIS Fact Sheets**

# H E S I S Fact Sheet No.2

Hazard Evaluation System & Information Service ☐ 2151 Berkeley Way Berkeley, CA 94704 ☐ 415-540-3138

State of California: George Deukmejian, Governor; Department of Health Services: Kenneth W. Elzer, MD, MPH, Director; Department of Industrial Relations: Ron Nishimi, Director.

## Fluorocarbons (Freons®)

**Health Hazard Summary:** *The most common effect of overexposure to fluorocarbons is irritation of the skin. Fluorocarbons can also affect your nervous system, causing symptoms similar to drunkenness. If used with adequate ventilation, the commonly used fluorocarbons rarely cause human health problems other than mild skin irritation.*

### HOW TO FIND OUT IF YOU ARE WORKING WITH FLUOROCARBONS

"Fluorocarbon" is a general name for a class of widely used industrial solvents. Although there are many different fluorocarbons, most of them share the same general properties. However, in order to use fluorocarbon products safely, you still need to know *which* fluorocarbon you're using. The specific chemical names for some of the most-used fluorocarbons are listed on page 3. Some of the common names and trade names for fluorocarbons in general are:

CFC	FC	Halon
Alcofrene®	Arcton®	Arklong®
Blaco-Trop®	Freon®	Frigen®
Genesolv®	Genetron®	Isotron®
Ucon®		

Five fluorocarbons account for almost all fluorocarbon use: FC-12, FC-11, FC-22, FC-113 and FC-114. Some of the commonest uses are listed in the box to the right, along with the specific compounds which are most likely to be used for each purpose.

In addition, fluorocarbons are often treated as "inert ingredients" in many products such as pesticides.

Many brand name products actually contain a mixture of a fluorocarbon plus one or two other ingredients. Some of these products are listed in the box on page 2. In some cases, the other ingredients are more hazardous than the fluorocarbon.

Under the state and federal Hazard Communication Standards (California *GISO 5194* and U.S. *29 CFR 1910.1200*), your employer must tell you if you are working with any hazardous substances and must train you to use them properly.

If you think you may be exposed to hazardous chemicals at work, ask to see the Material Safety Data Sheets (MSDSs) for the products you are using. An MSDS lists the hazardous chemical contents of a product, describes its health and safety hazards, and gives methods for using, storing and disposing of it safely. The MSDS should also include information on fire and explosion hazards, reactivity, first aid, and procedures for handling leaks and spills. Your employer must

Use	Fluorocarbons Most Likely to Be Used
cleaning and degreasing	FC-113 or FC-11
air conditioning and refrigeration	FC-22, FC-12, or FC-11
foam-blowing	FC-11
aerosol propellants	FC-12, FC-11, or (in cosmetics) FC-114
plastics manufacture	FC-12, FC-22, or FC-142b
fire extinguishers	FC-13B1 or FC-12B2

### Some Products That Contain Fluorocarbons

Freon TF®	FC-113 (100%)
Freon TA®	FC-113 & acetone (89%/11%)
Freon TE®	FC-113 & ethanol (96%/4%)
Freon TE-35®	FC-113 & ethanol (65%/35%)
Freon TMC®	FC-113 & methylene chloride (50%/50%)
Freon TES®	FC-113 & ethanol & nitromethane (95%/4%/1%)
Freon TMS®	FC-113 & methanol & nitromethane (94%/6%/1%)
Freon TP-35®	FC-113 & isopropanol (65%/35%)
Freon TWD-602®	FC-113 & water & detergent (91%/6%/3%)
Genetron 500®	FC-12 & FC-152a (74%/26%)
Genetron 502®	FC-115 & FC-22 (51%/49%)

have an MSDS for any workplace product that contains a hazardous substance, and must make it available to employees on request.

This Fact Sheet is an aid for worker training programs. It does not take the place of a Material Safety Data Sheet.

## HOW FLUOROCARBONS ENTER AND AFFECT YOUR BODY

Fluorocarbons enter your body when you breathe their vapors in the air. Small amounts of the liquid can also be absorbed through your skin, particularly with lengthy skin contact. The most common effect of overexposure to fluorocarbons is irritation of the skin. Overexposure to fluorocarbons in the air most commonly affects your skin, respiratory tract, or nervous system, as described below.

**Skin, Eyes, Nose and Throat:** Fluorocarbons, like other organic solvents, can dissolve your skin's natural protective oils. Frequent skin contact with liquid fluorocarbons can cause dryness, redness, flaking, cracking, and dermatitis (skin rash). If air concentrations are kept below Cal/OSHA's Permissible Exposure Limits (PELs - see "Legal Exposure Limits" on page 3), fluorocarbons probably will not irritate your eyes, nose, or throat.

**Nervous System:** Fluorocarbons, like other organic solvents, can affect your central nervous system (your brain) the same way drinking alcohol does. Moderate overexposure for brief periods can cause effects which

### Effects of Fluorocarbons on the Nervous System

headache	nausea	lightheadedness
weakness	vomiting	dizziness
tiredness	slurred speech	feeling "high"
confusion	loss of balance	poor coordination

last for only a short time. For the commonly used fluorocarbons, these effects can occur at exposure levels of about 1000-5000 "ppm" (see "Legal Exposure Limits"). These effects can increase your chances of having accidents. At very high exposure levels, fluorocarbons and other solvents can cause disorientation, and may make you pass out.

Some studies suggest that repeated, frequent overexposure to some organic solvents over months or years can have long-lasting and possibly

permanent effects on the nervous system. The exposure levels at which these effects occur are not known, and the effects have not been studied in workers exposed only to fluorocarbons.

The symptoms of these long-term effects include fatigue, poor muscle coordination, difficulty concentrating, loss of short-term memory, and personality changes such as increased anxiety, nervousness, and irritability.

**Liver:** One infrequently used fluorocarbon, FC-21, causes liver damage in animals repeatedly exposed to 200 ppm or more. For this reason, FC-21 has a lower Permissible Exposure Limit than other fluorocarbons. Whether this effect occurs in humans has not been studied. Other fluorocarbons have not caused liver damage in animals.

**Heart:** During overexposure to fluorocarbons, your heart becomes more sensitive to adrenalin. Strenuous exercise or lack of oxygen, combined with severe overexposure (well over 5000 ppm), could cause your heart to fail. Warning symptoms could include dizziness and palpitations (skipped heartbeats). However, lower-level exposures, even over a long period of time, have not been found to have any effect on the heart.

**Cancer:** In animal studies, FC-11 and some rarely-used fluorocarbons (FC-134a, FC-143a) did not cause cancer. FC-22, which is used mainly in refrigeration and air conditioning, caused a slight increase in cancer in animals exposed to a very high level (50,000 ppm) over their lifetime. Two rarely-used fluorocarbons, FC-31 and FC-133a, also caused cancer in animals. No research has been done to find out whether fluorocarbons can cause cancer in humans. However, based on the available information, if there is any risk of cancer from exposure to the commonly used fluorocarbons, it is likely to be very low.

**Reproductive System:** In rats, inhalation of FC-22 at very high levels (50,000 ppm) during pregnancy

resulted in birth defects. Inhalation of lower levels (10,000 ppm) had no effect. Exposure of male rats at 50,000 ppm had no effect. Commonly-used fluorocarbons probably do not affect human reproduction. However, a pregnant woman should minimize her exposure to any organic solvent, including fluorocarbons, until their effects have been studied more thoroughly.

## TESTS FOR EXPOSURE OR MEDICAL EFFECTS

Fluorocarbons are mostly eliminated from your body within a day or so. There is no medical or laboratory test that can accurately measure the amount of fluorocarbons in your body, or that can identify any damage that fluorocarbons might cause. Therefore, testing is not recommended or legally required.

However, it is generally recommended that workers who are frequently exposed to fluorocarbons or other hazardous substances receive a complete physical examination, including an occupational and medical history, at the beginning of employment. Periodic follow-up examinations are also recommended.

## LEGAL EXPOSURE LIMITS

California's Division of Occupational Safety and Health (DOSH, or Cal/OSHA) sets and enforces workplace chemical exposure limits.

Cal/OSHA has established workplace Permissible Exposure Limits (PELs) for some fluorocarbons. Cal/OSHA's PELs for fluorocarbons are listed in the table below. By law, your average exposure during any single 8-hour workday must not exceed the PEL. Your exposure may legally be above the PEL at times, but only if it is below the PEL at other times, so that your average exposure for any 8-hour workshift is not higher than the PEL.

For FC-12 and FC-113, Cal/OSHA has also set "excursion" limits which must not be exceeded for more than 30 minutes during any 8-hour workshift, and "ceiling" limits which must never be exceeded at any time. The PELs for fluorocarbons are usually expressed as

"ppm" (parts of the chemical per million parts of air), or sometimes as "mg/m<sup>3</sup>" (milligrams of the chemical per cubic meter of air). PELs have not been established for infrequently-used fluorocarbons whose potential health effects have not been studied.

If you have any of the symptoms described above while you are working with fluorocarbons, you may be exposed at more than the legal exposure limits. Talk to your supervisor and/or your union. If any worker might be exposed to a substance at more than the legal exposure limit, the employer must measure the amount of the chemical in the air in the work area (Cal/OSHA regulation *GISO 5155*). You have the right to see the results of such monitoring relevant to your work (California *GISO 3204* and U.S. *29 CFR 1910.20*).

You also have the right to see and copy your own medical records and records of your exposure to toxic substances. These records are important in determining whether your health has been affected by your work. If your employers have such records, they must keep them and make them available to you for at least 30 years after the end of your employment.

## REDUCING YOUR EXPOSURE

Your employer is required to protect you from being exposed to chemicals at levels above the legal limits. See the "Resources" section on page 4 for information about how Cal/OSHA and Cal/OSHA Consultation Service can help you and your employer.

Substitution: The most effective way to reduce hazardous chemical exposures is to use safer chemicals in place of more dangerous ones. However, the health and safety hazards of other organic solvents must be

### PERMISSIBLE EXPOSURE LIMITS FOR FLUOROCARBONS

Number	Chemical Name	Chemical Formula	PEL	
			ppm	mg/m <sup>3</sup>
FC-11	trichlorofluoromethane	CCl <sub>3</sub> F	1000	5600
FC-12	dichlorodifluoromethane	CCl <sub>2</sub> F <sub>2</sub>	1000*	4950*
FC-12B2	dibromodifluoromethane	CB <sub>2</sub> F <sub>2</sub>	100	860
FC-13B1	bromotrifluoromethane	CB <sub>2</sub> F <sub>3</sub>	1000	6100
FC-21	dichlorofluoromethane	CHCl <sub>2</sub> F	10	42
FC-22	chlorodifluoromethane	CHClF <sub>2</sub>	1000	3500
FC-112	1,1,2,2-tetrachloro-1,2-difluoroethane	C <sub>2</sub> Cl <sub>4</sub> FC <sub>2</sub> F	500	4170
FC-112a	1,1,1,2-tetrachloro-2,2-difluoroethane	CCl <sub>3</sub> CClF <sub>2</sub>	500	4170
FC-113	1,1,2-trichloro-1,2,2-trifluoroethane	CCl <sub>2</sub> FC <sub>2</sub> ClF <sub>2</sub>	1000**	7600**
FC-114	1,2-dichlorotetrafluoroethane	CClF <sub>2</sub> CClF <sub>2</sub>	1000	7000
FC-115	chloropentafluoroethane	CClF <sub>5</sub>	1000	6320

\* The FC-12 "excursion" limit is 2500 ppm; the "ceiling" limit is 6200 ppm.

\*\* The FC-113 "excursion" limit is 1500 ppm; the "ceiling" limit is 2000 ppm.

considered before choosing them as a substitute. Generally, fluorocarbons are less hazardous than most other organic solvents.

**Engineering Controls:** When possible, employers must use engineering and administrative controls rather than personal protective equipment to prevent overexposures. Engineering control methods include installing ventilation, changing work practices, or changing the work process. Containers should be tightly covered to prevent evaporation. Some work processes can be isolated, enclosed, or automated to reduce exposures.

**Local exhaust ventilation systems ("hoods")** are the most effective type of ventilation control. These systems capture contaminated air at its source before it spreads into the air in your breathing zone.

**Personal Protective Equipment:** When engineering controls cannot sufficiently reduce exposures, a respirator must be worn and a respiratory protection pro-

gram must be developed, as outlined by Cal/OSHA regulations (*GISO 5144*). An industrial hygienist or other knowledgeable person should be consulted to ensure that the equipment is appropriate and is used correctly. Improper respiratory equipment may not provide adequate protection.

Fluorocarbons have poor warning properties, so the cartridge or canister on an air-purifying respirator could wear out and need replacement without your knowing that it was no longer effective. Therefore, only a supplied-air respirator or an SCBA is approved.

If frequent and prolonged skin contact with fluorocarbons is necessary or if splashes may occur, personal protective equipment such as gloves, goggles, or face-shields should be worn. Protective clothing should be made of a material which is resistant to the specific fluorocarbon you are using. For instance, neoprene rubber is reported to be resistant to FC-12 and FC-113. Even the most resistant materials will be penetrated quickly and should be replaced often.

## RESOURCES

- *California workers, employers, and health care professionals who have questions about the health effects of workplace chemicals can contact HESIS at 415/540-3014, Monday-Friday from 1-5 pm. You may call collect from within California.*
- *Employees who need information or assistance concerning workplace health and safety regulations, or who want to file a complaint, can contact Cal/OSHA. Workers who are not covered by state regulations will be referred to the appropriate federal agency. Look in your local phone book's government section under "California, Industrial Relations, Occupational Safety and Health," or call the nearest area office:*

Sacramento	916/920-6123
San Francisco	415/557-1677
Van Nuys	818/901-5403
- *Other resources for employees may include your supervisor, your union, your company health and safety officer, your doctor, or your company doctor.*
- *Employers who want free assistance to evaluate and improve workplace health and safety can contact the nearest area office of the Cal/OSHA Consultation Service:*

Sacramento	916/920-6131
San Francisco	415/557-2870
Fresno	209/445-5072
Van Nuys	818/901-5422
Downey	213/861-9993
San Diego	619/279-3771
- *In a medical emergency, call 9-1-1, or contact the nearest Poison Control Center. See "Crisis Hotlines" listed near the front of your local phone book.*
- *HESIS produces fact sheets, booklets, medical treatment guidelines, and technical documents on workplace chemicals. All publications are free. Some are available in Spanish or other languages. For a publications list and order form, call 415/540-3138, or write: HESIS, 2151 Berkeley Way, Room 504, Berkeley CA 94704.*

# H E S I S Fact Sheet No.13

Hazard Evaluation System & Information Service ☐ 2151 Berkeley Way Berkeley, CA 94704 ☐ 415-540-3138

State of California: George Deukmejian, Governor; Department of Health Services: Kenneth W. Elzer, MD, MPH, Director; Department of Industrial Relations: Ron Gould, Director.

## Polychlorinated Biphenyls (PCBs)

*PCBs (polychlorinated biphenyls) have been widely used since the 1930s, because of their excellent electrical- and temperature-insulating abilities. For many years, PCBs were considered to be almost non-toxic, since there were very few reports of illness even among industrial workers who were exposed to fairly large amounts. In 1978, the Environmental Protection Agency (EPA) began to impose bans on PCB manufacturing and sales and on most PCB uses. Nevertheless, it is still possible for workers to be exposed to PCBs, either through servicing and handling equipment that contains PCBs, or as a result of leaks, spills, and fires. This fact sheet answers some of the most frequently asked questions about PCBs.*

### • Why did the EPA ban PCBs?

The toxic effects of PCBs first drew attention in 1968, when over 1200 people in Japan were poisoned by eating food cooked in oil that was heavily contaminated with PCBs and other chemicals. This caused illnesses which became known as Yusho (rice oil) disease. Soon afterward, studies showed that PCBs cause cancer in test animals. Therefore, it is considered likely that PCBs can cause cancer in humans.

But why were PCBs banned, while many other chemicals which also cause cancer in test animals were not? PCBs remain in the environment for a long time, because they do not break down. Also, their elimination from the body is very slow, so that levels in body tissues may increase with time. Thus, PCBs build up in the food chain, so that the fish and animals we eat could contain significant amounts.

In short, the thing that sets PCBs apart from other equally toxic industrial chemicals is the

ability of PCBs to persist in the environment and accumulate in the body and the food chain.

### • Where are PCBs found?

PCBs were used mainly in electrical transformers and capacitors, heat transfer systems, and hydraulic systems. They were also used in inks and carbonless copy paper and for a variety of other purposes, but the EPA ban now prohibits almost all of these other uses. Nowadays, PCBs are found mostly in transformers and capacitors. These may be contained in industrial equipment (such as welding equipment), medical equipment (such as X-ray machines), and household appliances (such as refrigerators and microwave ovens).

The ballasts of some fluorescent light fixtures contain PCBs. During normal operation of a fluorescent light, the PCBs are entirely enclosed, and you cannot be exposed to them. However, when the capacitor wears out, sometimes it may burn or break and leak PCBs.

## • How can I tell whether a piece of equipment contains PCBs?

Check for a manufacturer's label, which may give the date of manufacture and the trade name of the fluid. Some trade names that may refer to PCBs include Aroclor, Askarel, Eucarel, Pyranol, Dykanol, Clorphen, Clorinol, Chlorextol, Diacolor, Hyvol, Asbestol, Inerteen, Elemex, Saf-T-Kuhl, No-Flanol, Nepolin, EEC-18, and others.

Equipment manufactured after 1979 usually does not contain PCBs. Most pre-1979 capacitors do contain PCBs, while many pre-1979 transformers do not. Transformers within buildings or vaults are more likely to contain PCBs. New equipment should be labeled "No PCBs."

PCBs are clear, amber-colored, or dark oily liquids. They may have a faint smell like motor oil,

and some contain chlorobenzenes which make them smell like mothballs. Fluorescent light ballasts may contain about an ounce of PCBs; a utility pole capacitor or transformer may contain much more. Usually what leaks from a burned-out light ballast is not PCBs but a black tarry material that is used to muffle noise from the capacitor. However, it is safest to assume that anything that leaks from a transformer, capacitor, or light ballast contains PCBs, unless there is a "No PCBs" label on the equipment.

## • How might I be exposed to PCBs?

PCBs are easily absorbed through the skin, so direct contact with PCB oils is one way you could be exposed. Another way is by inhaling PCB vapors from overheated equipment that contains PCBs. PCBs normally don't evaporate much, so there are hardly any vapors to inhale unless the PCBs are heated. Finally, most of us absorb small amounts of PCBs from the food we eat. It is important to understand that PCBs are like most other cancer-causing agents — with small exposures, there is very little increase in cancer risk.

## • What should I do if I get exposed to PCBs?

If PCBs contact your skin, remove any contaminated clothing and wash the skin immediately with soap and water. Don't use an organic solvent such as kerosene, paint thinner, or degreaser to wash PCBs off your skin; that could increase the absorption of PCBs through your skin. Dispose of heavily contaminated clothing as described above; very lightly contaminated clothing can be washed with detergent, separately from other clothes. You do not need to see a doctor unless you develop a severe skin rash, which is unlikely. If PCBs get in your eyes, flush your eyes with water for 15 minutes and then see a doctor.

## • Is there any way to measure the effect of PCB exposure on my health?

No. There is no test that can measure or predict the health effects of a person's PCB exposure. PCB levels in blood or body fat can be measured,

## • What should be done in case of a PCB leak or spill?

1. Rope the area off so that only cleanup workers will enter.

2. Use absorbent materials to soak up the spill. Avoid contact with these materials.

3. Do not allow PCBs to enter a water drainage system.

4. Use an organic solvent (kerosene, for example) to wipe off smooth hard surfaces of non-disposable objects. Surfaces such as cloth, wood, and concrete absorb PCBs; they cannot be completely cleaned.

5. Dispose of contaminated objects and cleanup materials (rags, absorbent particles, damaged equipment, disposable protective clothing, etc.) by wrapping them in layers of newspaper, then sealing them in impermeable containers such as heavy double-wrapped plastic bags. Contact the Environmental Protection Agency and the Toxic Substances Control Division (TSCD) at the telephone numbers below for instructions on how to dispose of them.

Environmental Protection Agency	415/974-7054
TSCD Southern California	213/620-2380
TSCD North Coast California	415/540-2043
TSCD Northern California	916/739-3145

but no one knows what any given level of PCBs in the blood or fat means. Also, these tests are expensive and are not always accurate. Although PCBs can affect the levels in your blood of certain enzymes made by your liver, there is no reliable way to relate these levels to PCB exposure. Many other chemicals, especially alcohol, affect liver enzyme levels much more than PCBs do. Therefore, none of these tests is recommended as a test for PCB effects.

### • Is there any treatment for PCB exposure?

No. Once PCBs enter your body, there is no way to remove them. They will naturally be slowly eliminated from your body. There is no evidence that weight-loss programs or saunas can speed up their elimination.

### • Compared to other cancer-causing agents, how toxic are PCBs?

In terms of their ability to cause cancer in animals, PCBs are in the middle range. That is, small doses don't have any detectable effect, but very large doses clearly cause an increase in animal cancer rates. We don't know whether PCBs can cause cancer in humans. Some workers have been heavily exposed to PCBs, because for many years PCBs were believed to be among the safest of industrial chemicals. Victims of Yusho disease were exposed to even greater amounts. Studies of these groups of heavily exposed people have given limited evidence of an increased cancer risk. It seems clear that an occasional exposure to PCBs will not substantially increase your chance of getting cancer during your lifetime. However, it is sensible to avoid exposure whenever possible.

### • Do PCBs have any other health effects?

Years ago, many workers were frequently exposed to PCBs without proper protection. Some of them developed chloracne, a painful and persistent form of acne. Other than the possible increase in cancer rates, this is the only health effect that has been found in people who work with PCBs.

Some people have reported skin and eye irritation, headaches, or nausea. These effects are usually associated with PCB fires, where other chemicals are involved.

A variety of other symptoms were seen in Yusho victims, but these people had eaten substantial amounts of PCBs and other more toxic chemicals, such as dioxins. Now that most PCB

### • What can I do to prevent exposure to PCBs?

1. Check equipment labels to determine whether the equipment contains PCBs. Make sure that all equipment that contains PCBs is labeled according to Environmental Protection Agency requirements. For information on EPA's rules for labeling and handling of PCBs, call 415/974-7054.

2. Before you handle equipment that contains PCBs, inspect it for leaks or damage.

3. Avoid skin or eye contact with PCBs. If you might come in contact with PCBs, wear gloves, boots, goggles, or other protective clothing. Protective clothing should be made of materials that are resistant to PCBs, such as Viton<sup>®</sup>, Saranex<sup>®</sup>, polyethylene, polyvinyl alcohol, polytetrafluoroethylene, butyl rubber, nitrile rubber, or neoprene. Polyvinyl chloride and natural rubber (latex) are not recommended materials. PCBs will soak through almost any protective clothing material within hours, so disposable clothing is best. If dust contaminated with PCBs might be present, wear a respirator.

4. Wash carefully with soap and water after you remove your protective equipment or clothing.

5. Don't try to clean up a PCB leak yourself -- notify someone who has been trained to handle PCB cleanups.

6. If electrical equipment containing PCBs is involved in a fire, PCB vapors or combustion products may be released (see below). Ventilate the area thoroughly before entering, or wear a NIOSH-approved respirator with a combined dust and organic vapor filter cartridge. Your sense of smell will not warn you that PCB vapors are present.

uses have been banned, no one is likely to be exposed to large amounts.

### • Is PCB exposure especially hazardous for a pregnant woman?

PCBs do not cause birth defects, judging from animal experiments and from studies of Yusho victims who were exposed while pregnant. However, a pregnant woman's exposure to large amounts of PCBs could affect the subsequent health of her baby and could cause spontaneous abortion or miscarriage if the exposure levels are high enough to make the mother sick. In animals, high doses of PCBs can also reduce fertility. Exposure of humans to these large amounts of PCBs is very unlikely nowadays.

### • What if PCBs are involved in a fire?

When PCBs are burned, they can form polychlorinated dibenzofurans (PCDFs) and polychlorinated dibenzodioxins (PCDDs). Some of these compounds are far more toxic and cancer-causing than PCBs, and they can be the main hazard from a PCB fire. Fortunately, only very small amounts of these compounds are usually created. Like PCBs, they usually cause no short-term health effects (except chloracne if exposure is very large). Also, as with PCBs, there is no useful way to measure or predict health effects, there is no treatment for an exposed person, and a single exposure would not substantially increase your lifetime risk of getting cancer.

## RESOURCES

Some HESIS publications are available in Spanish or other languages. Also available from HESIS at no charge is *A Guide to Industrial Solvents*, in English and Spanish. For copies, call 415/540-3138.

For information about the health effects of workplace chemicals, contact HESIS at 415/540-3014 (you can call collect from within California).

State, county, and city government employees who need information or assistance concerning workplace health and safety regulations, or who want to file a complaint, can contact the nearest office of the California Division of Safety and Health (DOSH):

Sacramento	916/920-6123
San Francisco	415/557-1677
Van Nuys	818/901-5403

Other employees who need information or assistance concerning workplace health and safety regulations or who want to file a complaint can contact one of the area offices of the federal Occupational Safety and Health Administration (OSHA):

Walnut Creek	415/943-1973
West Covina	818/915-1558
Long Beach	213/514-6387
Sacramento	916/646-9220
San Diego	619/569-9071

Employers who want free assistance to evaluate and improve workplace health and safety can contact the nearest office of the DOSH Consultation Service:

Sacramento	916/920-6131
San Francisco	415/557-1034
Fresno	209-445-5072
Downey	213/861-9993
Panorama City	213/786-3870
San Bernardino	714/383-4567
San Diego	714/280-5304

In a medical emergency, contact your local Poison Control Center. See your local phonebook under "Emergency Phone Numbers" on the inside front cover.

If you have questions about exposure to PCBs outside the workplace, contact the Toxic Info Center hotline at 800/233-3360.

# H E S I S Fact Sheet No.16

Hazard Evaluation System & Information Service ☐ 2151 Berkeley Way Berkeley, CA 94704 ☐ 415-540-3138

State of California: George Deukmejian, Governor; Department of Health Services: Kenneth W. Elmer, MD, MPH, Director; Department of Industrial Relations: Ron Reed, Director.

## Mercury

**Health Hazard Summary:** *Overexposure to elemental (metallic) mercury most commonly affects the nervous system, causing weakness, fatigue, and loss of appetite. It can also damage the kidneys. In limited studies, mercury has been found to affect pregnancy or fertility in male and female laboratory animals. A major source of chronic exposure to mercury is from inadequate cleanup of spills.*

### HOW TO FIND OUT IF YOU ARE WORKING WITH MERCURY

**Odor and Appearance:** Elemental mercury is an unusual metal because it is a liquid rather than a solid, and it slowly evaporates at room temperature. Mercury has no odor. Another name for elemental or metallic mercury is "quicksilver." This is the kind of mercury used in thermometers. Mercury can combine with other chemicals to form organic (carbon-containing) or inorganic mercury compounds. These other mercury compounds, such as might be found in contaminated fish, are not discussed here. This Fact Sheet deals only with elemental, or metallic, mercury in its liquid and vapor (gas) forms.

**Jobs Where Mercury Is Used:** Mercury is commonly used in dentistry, for the preparation of fillings; in laboratories and hospitals, as a reagent and fixative; and in medical instruments, electrical equipment, thermometers, barometers, pharmaceuticals, and some fluorescent light bulbs. It is also used in the chloralkali industry, the manufacture of glassware and jewelry, and the recovery of gold and silver.

**Your Right to Know:** Under the state and federal Hazard Communication Standards (California GISO 5194 and U.S. 29 CFR 1910.1200), your employer must tell you if you are working with any hazardous substances, including mercury, and must train you to use them safely.

If you think you may be exposed to hazardous chemicals at work, ask to see the Material Safety Data Sheets (MSDSs) for the products in your work area. An MSDS lists the hazardous chemical contents of a product, describes its health and safety hazards, and gives methods for its safe use, storage, and disposal. The MSDS should also include information on fire and explosion hazards, reactivity, first aid, and procedures for handling leaks and spills. Your employer must have an MSDS for any workplace product that contains a hazardous substance, and must make it available to employees on request.

This Fact Sheet is an aid for worker training programs. It does not take the place of a Material Safety Data Sheet.

### HOW MERCURY ENTERS AND AFFECTS YOUR BODY

Liquid mercury easily changes into a vapor. You are most likely to be exposed by breathing in mercury vapors, which are easily absorbed through your lungs into your body. Liquid mercury is not well absorbed through the skin. However, harmful absorption can occur through broken or damaged skin, or if there is lengthy skin contact.

Most effects of mercury exposure develop slowly over time. Symptoms usually occur only after repeated overexposure. These effects include insomnia, loss of

appetite, nausea, weakness, and muscle tremors. Brief exposures to very high levels of mercury vapors can affect the lungs.

**Nervous System:** Long-term overexposure to mercury vapors can cause a number of symptoms. The first symptoms may be loss of appetite, fatigue, insomnia, and changes in behavior or personality (nervousness, excitability, and shyness). Later, more serious symptoms may include nausea, abdominal cramps, diarrhea, weight loss, weakness, and muscle tremors. Some of these symptoms have been reported after years of exposure to mercury at air levels slightly above the legal limits (see "Legal Exposure Limits"). When overexposure stops, these symptoms will usually go away.

Severe mercury poisoning can permanently damage the nervous system. Such damage may be accompanied by hallucinations, whole-body tremors, a tingling "pins and needles" sensation, pain, tenderness, numbness, and weakness. An interesting note is the past use of mercury in felt production. Felt hat manufacturers suffered from many symptoms of high-level mercury exposure, as witnessed in the Mad Hatter character in *Alice in Wonderland*, and the popular phrase "mad as a hatter."

**Kidney:** Long-term overexposure to mercury can injure the kidneys. In most cases, this damage is reversible and kidney function will gradually recover once exposure is stopped. No obvious symptoms are associated with kidney damage, unless the injury is severe. Special urine tests are used to detect this kidney damage (see "Tests for Exposure and Medical Effects"). Generally you will not have kidney damage if you do not have other symptoms of chronic mercury overexposure.

**Lungs:** Inhalation of very high levels of mercury vapors can affect the lungs, causing coughing, chest tightness and pain, difficulty in breathing, and pulmonary edema (fluid in the lungs). Fever, chills, nausea, and vomiting may also occur. If you develop these symptoms after an exposure to mercury, see your physician immediately.

**Eyes, Nose, and Throat:** Long-term mercury overexposure can cause increased salivation and inflammation of the mouth and gums. Repeated exposure to mercury vapors may also discolor the lenses of your eyes. This discoloration (usually brown) is a sign of mercury overexposure. It can occur with or without other symptoms of overexposure.

**Skin:** Prolonged skin contact with liquid mercury can irritate the skin and cause a rash that allows increased absorption through the skin.

**Cancer:** There is little reason to think that mercury could cause cancer, although that possibility has not been studied.

**Reproductive System:** The effects of metallic mercury on pregnancy and reproduction have not been studied thoroughly. When metallic mercury vapor is absorbed into your body, some of it is changed into another form, inorganic mercury. In limited studies, exposure of pregnant animals to moderate levels of either metallic or inorganic mercury caused growth retardation, birth defects, and death of the fetus or of the offspring shortly after birth. In another study, exposure of male animals to inorganic mercury reduced their fertility.

It is not known whether mercury causes similar effects in humans, but, based on the animal studies, you should handle it as a potential human reproductive toxin and minimize your exposure (see "Reducing Your Exposure"). Nursing women should also avoid exposure to mercury, since inhaled mercury can enter a woman's breast milk.

## TESTS FOR EXPOSURE AND MEDICAL EFFECTS

The amount of mercury in your body can be estimated by measuring mercury in urine or blood. Urine analyses are best for assessing long-term exposures. Blood tests are useful for assessing recent high-level exposures, if the test is done immediately after exposure. Tests for mercury exposure should be selected and evaluated on a case-by-case basis by medical personnel who are familiar with these tests. Other medical tests may be needed, as determined by a physician. For example, follow-up of neurological and kidney function may be appropriate for employees with long-term exposures. More details on these tests are available through HESIS.

## LEGAL EXPOSURE LIMITS

California's Division of Occupational Safety and Health (DOSH, or "Cal-OSHA") makes and enforces regulations for chemical exposure in the workplace. Cal/OSHA has adopted two kinds of legal limits for the amount of mercury in your breathing zone. The first is a Permissible Exposure Limit (PEL) of 0.05 milligrams of mercury per cubic meter of air ( $0.05 \text{ mg/m}^3$ ), as an average level over eight hours. This means that you may be exposed to a level greater than  $0.05 \text{ mg/m}^3$  during part of the work day, as long as you are exposed to less than  $0.05 \text{ mg/m}^3$  at other times, so that your average exposure

during any eight-hour work shift is no more than 0.05 mg/m<sup>3</sup>. Cal/OSHA's second limit is a 0.1 mg/m<sup>3</sup> "ceiling limit" which must *never* be exceeded for any period of time.

If you think that you may be overexposed, talk to your supervisor and/or your union. If any state, county, or local government employee might be exposed to a substance at more than the legal limit, the employer must measure the amount of the chemical present in the air in the work area (Cal/OSHA regulation *GISO 5155*). You have the right to see the results relevant to your work area (*GISO 3204*).

You also have the right to see and copy your own medical records and records of your exposure to toxic substances. These records are important in determining whether your health has been affected by your work. Employers who have such records must keep them and make them available to you for at least 30 years after the end of your employment.

## REDUCING YOUR EXPOSURE

Your employer is required to protect you from being exposed to mercury at levels above the legal limits. For information about how Cal/OSHA and Cal/OSHA Consultation Service can help you and your employer, see the "Resources" section on page 4.

**Spills:** An emergency response procedure should be created for areas where spills of liquid mercury can occur. Spilled mercury should be collected promptly. It is much easier to clean up spills on floors that do not have cracks or seams. Rugs should not be used in areas where mercury can be spilled, because rugs can absorb substantial amounts of spilled mercury, which will slowly evaporate to contaminate the workplace air.

If a spill occurs:

- People not involved in the cleanup should leave the immediate area.
- Windows should be opened to help ventilate the area.
- Do not use a regular vacuum cleaner to clean up a spill; regular vacuum cleaners will spread mercury around the room and increase airborne contamination.
- Small spills may be picked up with adhesive tape or a hypodermic syringe.

- Large spills can be suctioned into a trap partially filled with water, or you can use a mercury spill cleanup kit commercially available from a safety equipment supplier. A wash bottle trap or a cleanup kit should always be on hand, and you should be trained to use them.
- After all visible mercury has been collected, the area should be washed with a calcium polysulfide solution (about 2-4 tablespoons of lime sulfur per gallon of water), then washed with a detergent solution, and rinsed.
- Following cleanup, the area should be monitored using a mercury sniffer. The employer can contact the Cal/OSHA Consultation Service (a non-enforcement agency) to request a worksite visit to assess whether cleanup has been adequate (see "Resources" on page 4).

**Safe Work Practices:** Safe work practices can greatly reduce your exposure to mercury. Store mercury in unbreakable containers in a cool, dry, well ventilated area away from heat. Keep containers of liquid mercury tightly sealed, and place suitable metal or plastic pans under mercury equipment to reduce hazards from spills. Sealed waste containers (rather than open ones) can minimize vapors escaping into the room.

Do not heat mercury. When heated, liquid mercury evaporates more rapidly. Dangerous levels of mercury in the air may result.

Good personal hygiene will help prevent exposure of yourself and others. Always wash your hands before eating, drinking, or smoking. Mercury on your hands or under your fingernails is a dangerous source of exposure. If liquid mercury is spilled on you, change out of contaminated clothing to avoid spreading the contamination to your home.

**Engineering Controls:** When possible, employers must use engineering and administrative controls rather than personal protective equipment to prevent overexposure. Engineering control methods include installing ventilation and changing the work process. Certain work processes can be isolated, enclosed, or automated to reduce exposures.

Local exhaust ventilation systems ("hoods") are the most effective type of ventilation control. These systems capture contaminated air at its source before it spreads into the air in your breathing zone.

**Personal Protective Equipment:** When engineering controls cannot sufficiently reduce exposures, a respirator

must be worn and a respiratory protection program must be developed by the employer, as outlined in Cal/OSHA regulations (*GISO 5144*). The only respirators approved for protection against mercury vapor are supplied-air devices, in which compressed breathing-quality air is delivered to a facepiece or hood. An industrial hygienist or other knowledgeable person should be consulted to ensure that the equipment is appropriate and is used correctly.

If skin or eye contact with liquid mercury is possible, other protective equipment such as gloves or faceshields should be worn. Protective clothing should be made of a material resistant to mercury, such as rubber. Gloves should be replaced frequently (especially after finishing with a mercury handling procedure), because residues on

your gloves can contaminate the work area. Gold jewelry should not be worn when working with mercury, because the vapors may discolor the metal.

**Disposal:** Mercury can often be recycled. Mercury waste must be disposed of as hazardous waste according to state and local regulations. Mercury must not be poured down the sink. (See "Resources" for disposal information).

**Substitution:** The most effective way to reduce hazardous chemical exposures is to use a safer chemical, if one is available. The health and safety hazards of the substitute must also be carefully considered, to ensure that it is actually safer. However, for most uses of mercury there are few effective substitutes.

## RESOURCES

- California workers, employers, and health care professionals who have questions about the health effects of workplace chemicals can contact HESIS at 415/540-3014. You may call collect from within California.

- Employees who need information or assistance concerning workplace health and safety regulations, or who want to file a complaint, can contact the nearest office of Cal/OSHA:

Bakersfield	San Bernardino
Chico	San Diego
Concord	San Francisco
Covina	San Jose
Downey	San Mateo
Eureka	Santa Ana/Anaheim
Fresno	Santa Fe Springs
Long Beach	Santa Rosa
Los Angeles	Stockton
Modesto	Ukiah
Oakland	Van Nuys
Redding	Ventura
Sacramento	Vernon/Commerce
Salinas	

For the address and telephone number of the Cal/OSHA office nearest you, look in the government section near the front of the telephone book, under "California, Department of Industrial Relations, Division of Occupational Safety and Health."

- Other resources for employees may include your supervisor, your union, your company health and safety officer, your doctor, or your company doctor.

- Employers who want free, non-enforcement assistance to evaluate and improve workplace health and safety can contact the nearest office of the Cal/OSHA Consultation Service:

Downey	213/861-9993
Fresno	209/454-1295
Sacramento	916/920-6131
San Diego	619/279-3771
San Francisco	415/557-1715

- For questions about disposal of hazardous wastes, contact the nearest regional office of the California Toxic Substances Control Division (TSCD):

Sacramento	916/739-3145
Berkeley	415/540-2043
Los Angeles	213/620-2380
Long Beach	213/590-5950

- In a medical emergency, call 9-1-1, or contact the nearest Poison Control Center. See "Crisis Hotlines" listed near the front of your local phone book.
- HESIS produces fact sheets, booklets, medical treatment guidelines, and technical documents on workplace chemicals. All publications are free. Some are available in Spanish or other languages. To request publications or a list and order form, call 415/540-3138, or write: HESIS, 2151 Berkeley Way, Room 504, Berkeley CA 94704.

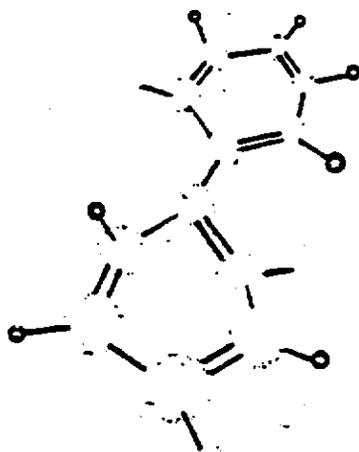
# **APPENDIX C**

## **DTSC Fact Sheets**

# FACT Sheet

California Department of  
Toxic Substances Control • July 1992

## PCB Handling, Treatment, and Disposal



### Classification

The Department of Toxic Substances Control (DTSC) has classified polychlorinated biphenyls (PCBs) as a hazardous waste when the concentrations are equal to or greater than 5 mg/l in liquids or when the total concentrations are equal to or greater than 50 mg/kg in nonliquids (Title 22, California Code of Regulations (CCR), §66261.24). The 5 mg/l and 50 mg/kg figures can also be expressed as 5 ppm and 50 ppm, respectively. When the total concentrations of PCBs are equal to or greater than 5,000 ppm in a waste, DTSC then regulates this waste as an Extremely Hazardous Waste (Title 22, CCR, §66261.113).

There are, however, situations in which waste with PCB concentrations below 5 ppm are further restricted or regulated by DTSC, the U.S. Environmental Protection Agency (U.S. EPA), or other State regulations. In California, burning of used oil that contains PCBs above their detection limit ( $\geq 2$  ppm) can only be done at DTSC-authorized facilities that have also met the Federal requirements for this type of activity as outlined in Division 40 of the Code of Federal Regulations (CFR), Part 761. Materials which contain any detectable concentrations of PCBs are prohibited from being released into sources of drinking water under Proposition 65 guidelines (Health & Safety Code §25249.5 et seq.). California's Office of Environmental Health Hazard Assessment is the lead agency concerning Proposition 65 regulations. Information regarding the Proposition 65 regulations can be obtained by calling (916) 445-6900.

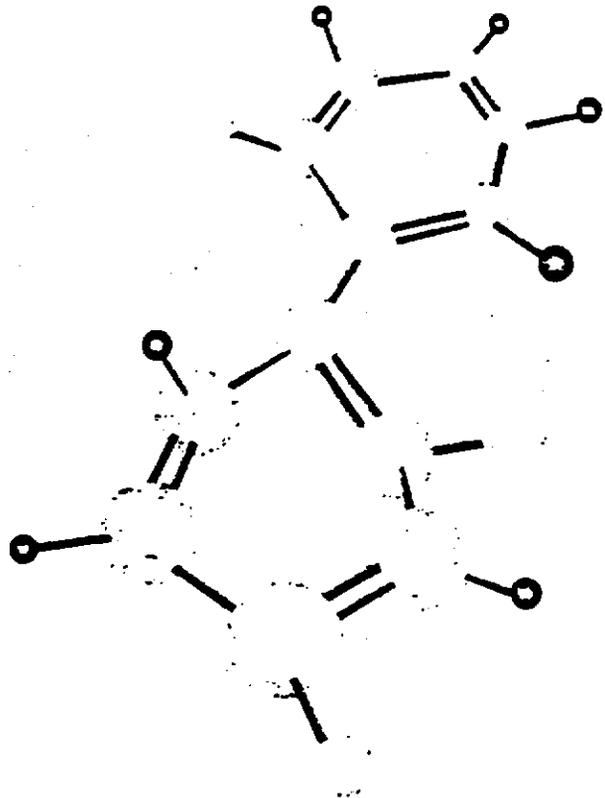
## CALIFORNIA/U.S. EPA DIFFERENCES

Since DTSC along with the U.S. EPA regulates PCBs, this sometimes causes confusion as to which set of regulations takes precedence. Under Section 18 of the Federal Toxic Substances Control Act (TSCA), the States are given the right to apply more stringent PCB regulations. Listed below are the main differences between California and U.S. EPA's PCB regulations:

- With few exceptions, the U.S. EPA does not regulate liquids with PCB concentrations below 50 ppm. In California, however, liquid wastes with PCB concentrations equal to or greater than 5 ppm are classified as hazardous waste.
- Under U.S. EPA regulations, drained PCB-contaminated transformer carcasses are allowed to be disposed in municipal landfills. California has classified drained waste transformer carcasses as hazardous waste if the oil that was drained from the carcass had transformer oil with PCB concentrations equal to or greater than 5 ppm.
- There is no exemption under California DTSC regulations due to PCB quantity or size of the waste material that contains PCBs. Items such as fluorescent light ballasts with PCB capacitors are covered under California DTSC regulations, whereas, Federal regulations would exempt them under the TSCA small capacitor definition.
- California, along with the other States, does not have the authority to regulate use of PCBs. Therefore, there are no DTSC regulations that would require removal of an item that contained PCBs such as a transformer or fluorescent light ballast. Generators, however, would still have to comply with appropriate Federal removal requirements, if applicable. DTSC hazardous waste regulations apply only when and if material which contains PCBs becomes a waste.

## PCB TREATMENT STANDARDS

The table on page 3 lists PCB waste categories with their corresponding California DTSC treatment standards for land disposal (§66268.110 of Title 22, CCR). It should also be noted that, in addition to these treatment standards, there are other waste management options available for PCB material which would still be in compliance with both California and Federal regulations which are not listed in the table below. For a further discussion of the other waste management options for PCB material, see the second question under the Frequently Asked Questions section of this fact sheet.



**PCB Treatment Standards Table**

PCB WASTE	TREATMENT STANDARD
Liquids with a PCB concentration $\geq$ 5 ppm.	1) Incineration in a DTSC approved incinerator that meets 40 CFR 761 requirements. or 2) Treatment to a PCB concentration level of < 2 ppm.
Drained PCB or PCB-contaminated transformer carcasses.	1) Incineration in a DTSC approved incinerator that meets 40 CFR 761 requirements. or 2) After draining and/or flushing of PCBs in the transformer carcass in accordance with 40 CFR 761, the carcass shall be filled with a nonbiodegradable absorbent material and disposed in a hazardous waste landfill.
PCB containing electrical equipment that is not regulated under TSCA such as small capacitors, light ballasts, and fixtures.	1) Incineration in a DTSC approved incinerator with a PCB Destruction Removal Efficiency (DRE) of 99.9999%. or 2) Disposal in a hazardous waste landfill after placement in a lab pack.

Currently, the only landfill in California that can accept hazardous PCB wastes is the Chemical Waste Management's facility at Kettleman Hills, California, (209) 386-9711. Although the PCB treatment standards listed above use the phrase "DTSC-approved incinerator," there are no incinerators operating in California which meet this requirement. In the future, if any incinerators in

California are allowed to burn PCB wastes, they will be required to obtain DTSC approval which would require them to have a PCB DRE of 99.9999%. All commercially available incinerators that can burn PCB wastes are presently located outside of California.

## FREQUENTLY ASKED QUESTIONS

- What is California's requirement for the disposal of fluorescent light ballasts which contain PCBs?

Fluorescent light ballasts which contain PCBs are considered hazardous waste and must be transported and disposed of as hazardous waste. There is no exemption or cutoff number because of the number of ballasts being disposed. The disposal options for fluorescent light ballasts which contain PCBs (§66268.110 of Title 22, CCR) are either 1) incineration in an incinerator permitted to burn PCB wastes, or 2) placement in lab packs and then disposed in a hazardous waste landfill.

- What are some of the other waste management options for PCBs?

Retrofilling and dechlorination are two commercially available technologies used for eliminating PCBs in transformer oil. Several companies that have been operating in California for a number of years and are in compliance with both State and Federal PCB regulatory requirements offer this type of service in California. Essentially, these technologies either remove or destroy the PCB molecules in the transformer oil thereby lowering the concentration of PCBs to permit-required or client-desired levels of treatment. Transformer decommissioning is an option that entails a further rinsing and cleaning of the transformer carcass after which the carcass is physically disassembled and the different metal sections separated and recovered for their metal recycling value.

- What is California's requirement for PCB spills?

As a general rule, California uses U.S. EPA's PCB Spill Cleanup Policy which is published in 40 CFR, Part 761, Subpart G, for guidance concerning PCB cleanup levels. There are many different scenarios

which can result from the spillage of oil containing PCBs ranging from a spill on a roadway to small seepage on a transformer pad. Listed below are the agencies which might become involved or require notification as a result of a PCB spill:

California Office of Emergency Services (OES)  
(800) 852-7550

Spills that are of immediate danger to nearby inhabitants or the environment.

EPA Region 9  
(415) 744-1087

Assistance with any U.S. EPA reporting requirements or PCB-related technical support.

National Response Center (NRC)  
(800) 424-8802

All new spills containing more than 50 ppm PCB should be reported to U.S. EPA within 24 hours of spill discovery. All spills involving 10 pounds or more of PCBs by weight must be reported to the NRC.

Department of Toxic Substances Control  
Regional Offices

Region 1 — Sacramento (916) 255-3545

Region 1 — Fresno (209) 297-3901

Region 2 — Berkeley (510) 540-2122

Region 3 — Glendale (818) 551-2800

Region 4 — Long Beach (310) 590-4868

Spills of any type of hazardous waste should be reported to the nearest DTSC regional office. Depending on the PCB spill location, the regional office might have you contact the local city or county health department to handle any spill reports that might be required.

Office of Environmental Health Hazard  
Assessment — Proposition 65 Requirements  
(916) 445-6900

They require notification of PCB spills that may potentially be released into sources of drinking water.

# California Department of Toxic Substances Control Regional Offices



See page 6 for additional sources of PCB information.

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## OTHER SOURCES OF INFORMATION

While this fact sheet answers several of the questions concerning PCB handling, treatment, and disposal, there can be case-specific situations that are not covered by the information presented here. Listed below are additional sources of information for PCB-related issues that are not within the scope of this publication:

- **California Department of Toxic Substances Control Program**  
Sacramento, CA, (916) 322-3670. Information concerning PCB treatment technologies and California's DTSC PCB regulations governing use, treatment, storage, and disposal.
- **U.S. EPA TSCA Information**  
Washington, D.C., (202) 554-1404. General information concerning the Federal PCB regulations governing use, treatment, storage, disposal, labeling, and removal.
- **U.S. EPA Region 9**  
San Francisco, CA, (415) 744-1087. Technical and regulatory assistance regarding PCB-related activities.

- **Electric Power Research Institute (EPRI)**  
Palo Alto, CA, (415) 855-2000. Technical information on various PCB issues such as treatment technologies, PCB replacement materials, and PCB analysis. Sponsors national biennial PCB seminar.
- **Water Resources Control Board**  
Sacramento, CA, (916) 657-2390. Information on regulations regarding the release of PCB material which might contaminate groundwater and placement of any debris containing PCBs into municipal landfills.
- **California Occupational Safety and Health Consultation Service (Cal-OSHA)**  
South San Francisco, CA, (415) 703-4341. Information on protective equipment and exposure levels when working around PCB materials.
- **Hazard Evaluation System Information Service (HESIS)**  
Berkeley, CA, (510) 540-2115. Background material and information on characteristics of toxic substances.

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STATE OF CALIFORNIA

**DEPARTMENT OF TOXIC SUBSTANCES CONTROL**  
P.O. Box 806  
Sacramento, CA 95812-0806



# FACT SHEET

## USED OIL AND USED OIL FILTERS

California Environmental Protection Agency

DEPARTMENT OF TOXIC SUBSTANCES CONTROL

June 1998



### I. USED OIL MANAGEMENT

#### Introduction



This fact sheet was produced by the Department of Toxic Substances Control (DTSC) to outline requirements for generators and transporters of used oil and used oil filters in California. For a complete description of those requirements, consult Article 13, Chapter 6.5, Division 20 of the

California Health and Safety Code (HSC), commencing with section 25250, and Title 22 of the California Code of Regulations (CCR), Division 4.5, Chapter 29, commencing with section 66279.1 (for used oil), and section 66266.130 (for used oil filters).

#### Legal Definition of Used Oil

"Used oil means any oil that has been refined from crude oil, or any synthetic oil, that has been used, and, as a result of use or as a consequence of extended storage, or spillage, has been contaminated with physical or chemical impurities."

#### Used oil includes but is not limited to the following:

##### 1. Used motor oils:

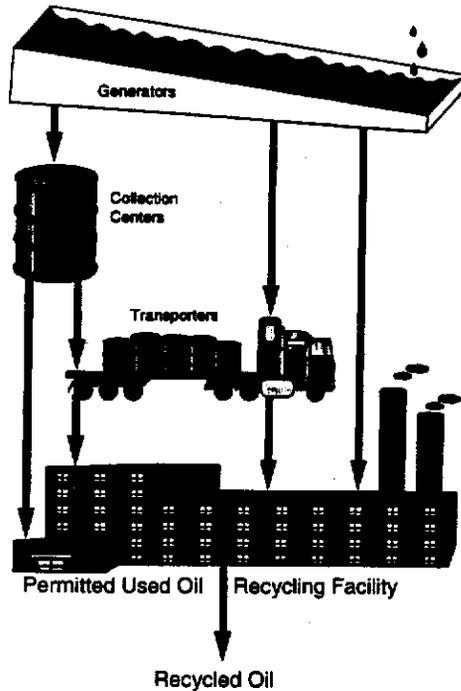
Vehicle crankcase oils  
Engine lubricating oils  
Transmission fluids  
Gearbox and differential oils

##### 2. Used industrial oils:

Hydraulic oils  
Compressor oils  
Turbine oils  
Bearing oils  
Gear oils  
Transformer (electrical) oils  
Refrigeration oils  
Metalworking oils  
Railroad oils

#### Used oil does NOT include:

Antifreeze  
Brake fluid  
Other automotive wastes  
Fuels (gasoline, diesel, kerosene, etc.)  
Grease  
Solvents  
Substances which are not oils  
Oils with a flashpoint below 100 degrees Fahrenheit  
Oils containing more than 1,000 ppm total halogens unless the rebuttable presumption is rebutted  
Oils mixed with hazardous waste  
Wastewater containing small amount of used oil  
Oils containing 5ppm PCBs or greater  
Oily wastes which are not used oil  
Oily wastewaters which are not used oil  
Tank bottoms  
Used oil processing bottoms  
Used oil re-refining distillation bottoms



### Used Oil Management

- Used oil is required to be managed as a hazardous waste in California unless it is shown to meet the specifications for recycled oil [HSC section 25250.1(b)(1)] or qualifies for a recycling exclusion [HSC section 25143.2].
- In most instances, this means that the generator contracts with a registered hazardous waste transporter to have the used oil picked up within 90 days of generation and transported to an authorized facility, typically a used oil recycling facility where the used oil is processed into recycled oil.
- Mixing of hazardous waste, including household hazardous waste, with used oil is prohibited.

Don't mix used oil with anything else (paint, gasoline, solvents, antifreeze, etc.).



### Used Oil Generator Requirements

- Persons or businesses generating used oil must meet used oil generator requirements. Used oil collection centers must also meet used oil generator requirements.
- Householders who change their own oil ("do-it-yourselfers") are exempted from regulation as used oil generators. Householders are allowed to self-transport the used oil they generate to a used oil collection center or to a used oil recycling facility if specified conditions are met.
- An identification number issued by DTSC is required for each location where used oil is stored. A generator with two or more sites of storage at the same location needs only one identification number. Generators of 100 kilograms or less of hazardous waste per month (including used oil) who ship only used oil under a modified manifest or spent solvent under a milkrun procedure are not required to obtain an identification number.



**TO GET AN IDENTIFICATION NUMBER  
CALL: (916) 324-1781 OR  
1-800-61-TOXIC**

- Hazardous waste can be stored onsite for a period of up to 90 days without obtaining a hazardous waste storage facility permit. If used oil is the only hazardous waste generated and more than 100 kg (approximately 27 gallons) of used oil is generated in any calendar month, the 90-day period begins on the first date on which any amount of used oil accumulates. If used oil is the only hazardous waste generated and not more than 100 kilograms (approximately 27 gallons) of used oil is generated in any calendar month, the 90-day period begins on the date the generator has accumulated 100 kilograms of used oil. Generators of less than 1,000 kilograms of hazardous waste per month may qualify for longer storage periods when certain conditions are met [HSC section 25123.3(h)].

- Used oil must be stored in tanks or containers in good condition. Tanks and containers must be made of non-earthen, non-absorbing, rust-resistant material such as steel or oil-resistant plastic, and have adequate structural support to contain the used oil. "Good condition" means no severe rusting, no apparent structural defects or deterioration, and no leaking. All tanks and containers must have tight-fitting lids that are kept closed except when used oil is being added or removed. Regular inspections and routine maintenance of all storage tanks and containers are required. Faulty tanks and containers must be repaired or replaced.

- Secondary containment for storage tanks is required. Secondary containment is a backup containment system designed to prevent the release and migration of wastes or accumulated liquids out of a storage tank or a storage tank system. Examples of secondary containment systems include: an impervious barrier such as a liner, a vault, a double-walled tank or an impervious bermed area.

- Aboveground storage tanks and containers accumulating used oil, and fill pipes used to transfer used oil into underground storage tanks must be labeled with the words "USED OIL-HAZARDOUS WASTE," the initial date of accumulation, and the name and address of the generator. **For shipping, containers must also be labeled with the following:**

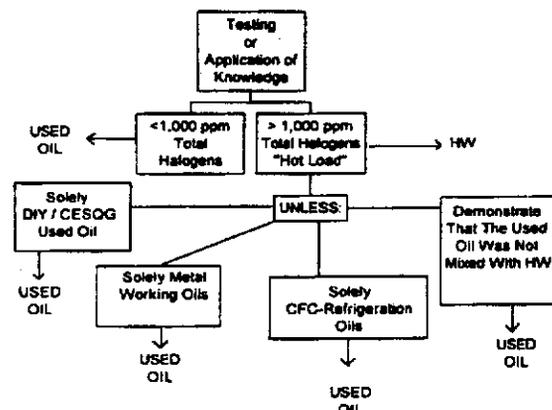
- The statement: "Hazardous Waste - State and Federal Law Prohibit Improper Disposal. If found, contact the nearest police or public safety authority, the U.S. Environmental Protection Agency or the California Department of Toxic Substances Control."
- The generator's name and address.
- The proper Department of Transportation (DOT) shipping name and the generator's

identification number.

- The Uniform Hazardous Waste Manifest number.
- The shipping identification number.
- Additional requirements for used oil generators are contained in the HSC and 22 CCR provisions cited at the beginning of this fact sheet.

### The Rebuttable Presumption (Total Halogens Determination)

The Used Oil Handler is Required to Make a Total Halogens Determination:



Used oil handlers (e.g., generators, used oil collection centers, transporters and used oil recycling facilities) are required to determine whether the total halogen content of each used oil shipment exceeds 1,000 ppm halogens. Used oil determined to contain more than 1,000 ppm total halogens is presumed to have been mixed with halogenated hazardous waste. Used oil containing more than 1,000 ppm total halogens must be managed as a Resource Conservation and Recovery Act (RCRA) hazardous waste unless the used oil can be demonstrated not to have been mixed with halogenated hazardous waste (i.e., unless the presumption is rebutted). This requirement is called the "rebuttable presumption."

The rebuttable presumption works as follows in California:

1. Generators, transporters and used oil collection centers are required to test or apply knowledge to determine whether a used oil shipment has a total halogen content over or under 1,000 ppm. If a generator, transporter or used oil collection center chooses to apply knowledge to determine that used oil does not contain more than 1,000 ppm total halogens, the application of knowledge must be done in accordance with criteria specified in 22 CCR: section 66279.10(a)(1)(B) for generators, section 66279.10(a)(3)(B) for transporters and section 66279.10(a)(6) for used oil collection centers.

2. Used oil transfer facilities and used oil recycling facilities are required to test each shipment of used oil for total halogens [22 CCR section 66279.90(a)] before accepting the shipment.

3. If it is determined that the used oil shipment contains greater than 1,000 ppm total halogens, used oil is presumed to have been mixed with halogenated hazardous waste and must be handled as RCRA hazardous waste, unless the presumption is rebutted.

4. In order to rebut the presumption that the used oil shipment was mixed with RCRA hazardous waste, the used oil handler must demonstrate that the used oil was not mixed with halogenated hazardous waste. Where this demonstration is successfully made, the used oil is regulated as used oil. The rebuttable presumption is deemed rebutted for the following types of used oils where specified conditions [22 CCR section 66279.10(b)] are met: metalworking oils/fluids containing chlorinated paraffins, refrigeration oils contaminated with chlorofluorocarbons, and used oil which is exclusively household "do-it-yourselfer" used oil or used oil from a conditionally exempt small quantity generator. (A conditionally exempt small quantity generator is a generator who generates no more than 100

kilograms of hazardous waste in a month and does not accumulate more than 1,000 kilograms of hazardous waste onsite at any time.)

### Transportation of Used Oil



In general, California law requires that used oil be transported by a registered hazardous waste transporter. However, there are a few instances in which the use of a registered hazardous waste transporter is not required. These are as follows:

- Householders and conditionally exempt small quantity generators are allowed to transport up to 20 gallons of used oil per trip to an authorized used oil collection center where a single container does not exceed 5 gallons, if specified conditions are met. Authorized used oil collection centers include: certified used oil collection centers [Public Resources Code section 48622], recycle-only household hazardous waste collection facilities, or collection facilities operating pursuant to HSC section 25250.11.
- Persons, including householders and conditionally exempt small quantity generators are allowed to transport up to 5 gallons of used oil per trip to an authorized hazardous waste facility, including a permitted household hazardous waste collection facility, if specified conditions are met [ HSC section 25163(c)].
- Mobile maintenance operations (see below) may transport up to 55 gallons of used oil in any one vehicle at any one time from an off-site location to a consolidation point.

When used oil is transported by a registered hazardous waste transporter, either a full hazardous waste manifest or a modified hazardous waste manifest must be used. When a modified

hazardous waste manifest is used, the driver is required to provide the generator (at the time of used oil pickup) with a legible copy of a receipt for each quantity of used oil received. The generator must maintain these receipts for three (3) years. *Each receipt must contain the following information:*

- (A) Generator's name, address, identification number (if applicable) and telephone number.
- (B) Generator's signature or signature of generator's representative.
- (C) Date of shipment.
- (D) State manifest number (pre-printed on the manifest).
- (E) Volume and shipping description of each type of used oil received.
- (F) Name and address of the authorized facility to which the used oil is being transported.
- (G) The transporter's name, address and identification number.
- (H) The driver's signature.

• Additional requirements for used oil transporters are contained in the HSC and 22 CCR provisions cited at the beginning of this fact sheet.

### **"Mobile Maintenance" Operations**

Businesses that generate used oil in the performance of routine maintenance operations at off-site locations are subject to special requirements. Such businesses include offsite heavy equipment operations (e.g., construction vehicle fleets) and mobile oil-changing businesses providing oil changes for personal and business vehicles at the customer's location. *The following requirements apply:*

1. The business must have a point of consolidation.
2. Not more than 55 gallons can be transported in any one vehicle at any one time from an off-

site location to the point of consolidation.

3. The transport vehicle must be owned by the business or by an employee of the business. The business is not required to be a registered hazardous waste transporter in order to transport 55 gallons or less of used oil from an off-site location to the point of consolidation.
4. The point of consolidation must have an identification number and must be at a non-residential location.
5. The used oil is deemed to be generated at the point of consolidation upon consolidation. The mobile maintenance operator must have an identification number using the point of consolidation address.
6. The used oil must be handled and stored at the point of consolidation in accordance with all applicable hazardous waste laws.
7. The consolidated used oil must be transported by a registered hazardous waste transporter from the point of consolidation to a permitted used oil recycling facility.

### **Miscellaneous**

It is unlawful to dispose used oil on land, to sewers and other water systems, and to burn used oil as a fuel or by incineration, including in space heaters and similar devices. The use of used oil as a dust suppressant ("road oiling") or for insect or weed control is prohibited.

Generators of used oil who also operate used oil collection centers, such as service stations, are advised to not mix the used oil generated in their business with the used oil from the used oil collection center. The rebuttable presumption is not deemed rebutted if used oil from householders or conditionally exempt small quantity generators has been mixed with used oil from other sources.

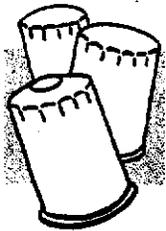
## Useful Phone Numbers

- For specific locations of authorized used oil collection centers in your area:  
CAL/EPA Recycling Hotline at  
1-800-CLEANUP (1-800-253-2687).
- For additional information on used oil:  
The appropriate DTSC Regional Office  
(see map for phone numbers).
- For additional information on identification numbers:  
DTSC Generator Information Services Section (916) 324-1781 or (800) 61-TOXIC (800-618-6942).
- To report illegal disposal or management of used oil:
  - Your local Certified Unified Program Agency.
  - The Toxics Hotline 1-800-69-TOXIC (1-800-698-6942).
  - The appropriate DTSC Regional Office (see map for phone numbers).
- For questions about operating a certified used oil collection center, call the CIWMB at (916) 255-2891.

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## II. USED OIL FILTER MANAGEMENT

### Introduction



Used oil filters may exhibit hazardous characteristics for lead, other heavy metals and oil-based compounds. Used oil filters must either be managed as hazardous waste, or in accordance with the requirements of 22 CCR section 66266.130 as outlined in this fact sheet. DTSC adopted special regulations in 1991 [22 CCR section 66266.130] to encourage recycling of used oil filters and to protect the public health, safety, and the environment from the potential hazards posed by disposal of used oil filters. These requirements are directed primarily at non-household generators of used oil filters, such as businesses and used oil collection centers. Used oil filters not managed as described in this fact sheet, are required to be managed as a fully

regulated hazardous waste. Disposal of used oil filters in trash cans and at sanitary landfills is prohibited. Fuel filters are not used oil filters.

### Summarized Management Requirements

Used oil filters managed according to 22 CCR section 66266.130 must be:

1. Drained of all free-flowing oil.
2. Properly contained, labeled and stored.
3. Stored without exceeding allowed time limits.
4. Transported to an allowed destination for purposes of metal reclamation.
5. Transported under a bill of lading with a copy kept by the generator for three years.

6. All used oil removed from the filters must be managed in accordance with all applicable requirements of Article 13, HSC Chapter 6.5, Division 20 and 22 CCR section 66279.

### Detailed Management Requirements



#### Draining

Used oil filters are required to be drained of all free-flowing used oil. "Free-flowing used oil" means a continuous stream of used oil exiting the filter when the filter is inverted. Used oil exiting drop-by-drop is not considered to be free-flowing. If the filter is equipped with a device which impedes the drainage of used oil from the filter, that device must be manipulated to allow the used oil to exit the filter freely.

Used oil filters drained of free-flowing used oil may be punctured, crushed, opened, further drained, or otherwise handled without authorization from the DTSC, for purposes of recycling the filters, provided that any used oil or other residue generated in the course of the activity is properly managed according to 22 CCR Division 4.5.

#### Containers

1. The drained filters must be contained in rain-proof, non-leaking containers with tightly-sealed lids.

2. The container must be labeled "Drained Used Oil Filters" and the initial date of accumulation or receipt marked on each container. The initial date of accumulation is the date when the first filter is placed in the container, or the date when a full or partially full container of filters is received at a second location.



3. Businesses or public agencies accepting used oil filters from householders must place the filters in containers upon acceptance to capture all used oil that separates from the filters. Upon reaching a location where proper drainage is practical, the filters must be contained as described above, and any used oil drained from the filters managed in accordance with all applicable requirements.

#### Storage

1. Up to one ton of used oil filters can be stored for a period of up to 1 year, unless the storage facility has a hazardous waste permit authorizing storage of used oil filters.

2. Storage of one ton or more of used oil filters is limited to 180 days, unless the storage facility has a hazardous waste permit authorizing storage of used oil filters.

#### Allowed Destinations

The only allowed destinations for used oil filters are:

1. To a smelter or scrap metal processor where the used oil filters are recycled.

2. To a municipal solid waste incinerator for energy recovery if the residual casings are subsequently transferred to a smelter or scrap metal processor for recycling.

3. To a storage or consolidation facility that subsequently transfers the filters to a smelter, scrap metal processor or municipal solid waste incinerator as described above.

4. To an authorized hazardous waste facility.

#### Transportation

1. Only properly-drained filters can be transported.

2. The containers must be tightly-sealed during transportation to prevent any spillage of used oil.

3. The containers are required to be well-secured in the transport vehicle to prevent movement or tipping during transportation.

4. A bill of lading must accompany each shipment of used oil filters, and must contain the following information:

### BILL OF LADING

A. The name, address and telephone number of the generator.

B. The name, address and telephone number of the transporter.

C. The name, address and telephone number of the receiving smelter, scrap metal processor, municipal solid waste incinerator, or storage or consolidation facility.

D. The quantity and size of the containers in the shipment.

E. The date of transportation.

5. A copy of each bill of lading is required to be maintained by the transporter, generator and receiving facility for three (3) years.

### To report illegal disposal or management of used oil filters:

- Your local Certified Unified Program Agency.
- The Toxics Hotline 1-800-69-TOXIC (1-800-698-6942).
- The nearest DTSC Regional Office (see map for phone numbers).



**DEPARTMENT OF TOXIC SUBSTANCES CONTROL**

P STREET, 4TH FLOOR  
BOX 806  
SACRAMENTO, CA 95812-0806  
(916) 445-2625



May 20, 1994

**TO: All Interested Parties**

**SUBJECT: INTERIM POLICY REGARDING TRANSPORTATION OF LIGHTING WASTES**

The mercury-containing lighting waste recycling facilities issued Interim Status December 31, 1993, pursuant to Health and Safety Code sections 25200.5, 25200.9, and 25201.6, are required to operate those facilities in compliance with Health and Safety Code section 25201.6 and title 22, California Code of Regulations (title 22 CCR) section 67800.1. These facilities must comply with the standards for interim status facilities as specified in title 22, CCR, division 4.5, chapter 15. These standards require the use of a manifest and a registered transporter for the shipment of hazardous wastes to the Interim Status facility for the purposes of recycling.

Until the creation of the Standardized Permit tier, the Department of Toxic Substances Control (Department) historically allowed fluorescent-lamp waste recycling facilities to operate pursuant to Research, Development, and Demonstration (RD&D) variances. Each of the RD&D variances allowed the use of a bill of lading and a non-registered transporter for the transportation of fluorescent lamps to the recycling facility. A Fact Sheet issued by the Department's Pollution Prevention, Public and Regulatory Assistance Program in November 1992 (copy enclosed) details this variance policy. The policy was based on an interpretation of title 22, CCR, section 66266.120 that allows transportation of up to ten pounds of elemental mercury to a recycling facility without the use of a manifest or a registered transporter.

The Department is reviewing the applicability of title 22, CCR, section 66266.120, and is proposing to develop regulations specifically addressing the transportation of mercury-containing lighting wastes to recycling facilities. The Department is considering proposing a modified manifesting system for lighting wastes. Your comments will be solicited during the development of these regulations.



Printed on Recycled Paper

All Interested Parties

Page 2

Due to the widespread circulation of the Fact Sheet among lighting waste generators and significant concerns raised by the lighting waste industry, the Department will, as an interim measure, continue its policy of not enforcing the requirement that mercury-containing lighting wastes be transported using a manifest and a registered transporter, subject to the conditions specified in the fact sheet, when those wastes are transported to an authorized lighting waste recycling facility in California. This general policy will terminate at the effective date of the regulations discussed above.

If you have any questions regarding the proposed regulations or the interim policy, please contact me at the number above, or you may contact Mr. Lloyd Batham, Chief of the Transportation Unit, at (916) 324-2438.

Sincerely,



Larry Matz, Chief  
Surveillance and Enforcement Branch  
Hazardous Waste Management Program

Enclosure

cc: Lloyd Batham, Chief  
Transportation Unit  
Hazardous Waste Management Program

# LIGHTING WASTES

- Fluorescent Light Tubes
- PCB-Containing Ballasts
- High Intensity Discharge (HID) Lamps

## BACKGROUND

Spent fluorescent light tubes and High Intensity Discharge (HID) lamps contain mercury which, when disposed in a municipal landfill, can leach into the soil and groundwater. Light ballasts containing PCBs can also pose potential problems when improperly disposed.

Increased awareness of energy savings using newer, more efficient fluorescent lighting has prompted many businesses to replace older lighting fixtures with new equipment. These efforts have increased the need to properly manage lighting wastes.

## WASTE CLASSIFICATION

Spent fluorescent light tubes and HID lamps are regulated by the Department of Toxic Substances Control (Department) because they contain mercury, which is listed as a presumptive hazardous waste in Appendix X, Chapter 11, Title 22, California Code of Regulations (22 CCR). Spent fluorescent light tubes and HID lamps typically contain concentrations of mercury (an inorganic persistent and bioaccumulative toxic substance) exceeding the Total Threshold Limit Concentration (TTL) and/or the Soluble Threshold Limit Concentration (STLC) values. The regulatory thresholds are 20 mg/kg and 0.2 mg/l, respectively, as noted in Section 66261.24 (a) (2) (A), 22 CCR.

In addition, these wastes may be regulated as a federal hazardous waste in accordance with the Resource Conservation and Recovery Act (RCRA), if they contain concentrations of mercury which exceed the characteristic of toxicity as measured by the Toxicity Characteristic Leaching Procedure (TCLP) pursuant to Section 261.24, Title 40, Code of Federal Regulations (40 CFR). It is the generator's responsibility to classify their waste. The U.S. EPA is currently reviewing these wastes and may revise its regulations in the future.

Fluorescent light ballasts which contain polychlorinated biphenyls (PCBs) are considered hazardous (Appendix X, Chapter 11, 22 CCR) and are regulated by the Department. Ballasts

manufactured after January 1, 1978 do not contain PCBs, and should be labeled as such on the ballast. If you are unsure if a ballast contains PCBs, you can contact the manufacturer.

## RECYCLING

Spent fluorescent light tubes can be recycled, allowing for the recovery of the mercury, glass, and aluminum end caps. Within California, there are three facilities with Department authorization to accept non-RCRA fluorescent tubes for recycling. These facilities are listed on the other side of this Fact Sheet. The Department encourages the recycling of spent fluorescent light tubes in order to eliminate their disposal to landfills and the environmental problems that may result.

There currently are no facilities authorized to accept HID lamps or ballasts for recycling within California. This situation is subject to change pending further technology development or the establishment of permitted facilities.

## DISPOSAL

The Department's interim policy currently allows a generator to dispose as nonhazardous waste no more than a combined total of 25 spent fluorescent light tubes and HID lamps, regardless of size, in a day. Quantities greater than this, which are destined for land disposal, must be managed as a hazardous waste and are subject to land disposal restrictions. For more information on land disposal restrictions, contact the Department's Treatment Standards Unit at (916) 323-6042.

For PCB-containing ballasts, there are two disposal options: (1) incineration in an incinerator permitted to burn PCB wastes, or (2) placement in lab packs and then disposal in a hazardous waste landfill. Currently, there are no incinerators operating in California permitted to accept PCB wastes. There are incinerators authorized to accept PCBs located outside of California. The only landfill in California that can accept hazardous PCB wastes is the Chemical Waste Management facility at

Kettleman Hills, (209) 386-9711.

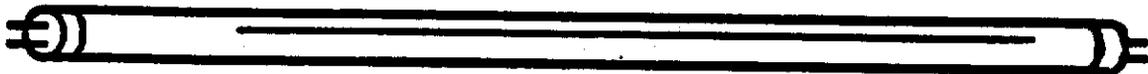
### STORAGE AND TRANSPORTATION

Because spent fluorescent light tubes and HID lamps are hazardous wastes, they need to be properly labeled as such if stored on site. If storage is to be greater than 90 days, a Department permit or variance is required. Although use of a manifest and registered hauler is typically required for hazardous waste transportation, if a generator is transporting fluorescent tubes to an authorized fluorescent tube recycler they are only required to list the waste on a Bill of Lading and do not require a registered hauler. These conditions apply only to generators sending spent fluorescent tubes to an authorized recycler and not for spent tubes destined for land disposal. The tubes must be intact, not crushed, and preferably shipped in the containers in which the new lamps

came. The generator should contact the recycler for any further specific requirements. Shipment of spent HID lamps and PCB-containing ballasts to an authorized treatment, storage or disposal (TSD) facility requires manifesting and transporting by a registered hazardous waste hauler. Further questions regarding shipping can be directed to the Department's Transportation Unit at (916) 323-3219.

### FUTURE DIRECTION

The Department plans to continue efforts to encourage recycling of lighting wastes within California. Future efforts will include increasing spent fluorescent tube recycling capacity as well as establishing HID lamp recycling facilities. If you have any questions or comments, please contact the Department at (916) 322-3670.



## Fluorescent Tube Recyclers

### **Lighting Resources, Inc.**

805 E. Francis Street  
Ontario, CA 91766  
(909) 923-7252

Contact: John Chilcott

### **Mercury Recovery Services**

2021 South Myrtle  
Monrovia, CA 91016  
(818) 301-1372

Contact: Bob Roberts

### **Mercury Technologies, Inc.**

30677 Huntwood Avenue  
Hayward, CA 94544  
(510) 429-1129

Contact: Paul Abernathy

### **Allied Environmental Technology**

47375 Fremont Boulevard  
Fremont, CA 94538  
(510) 490-8686

Contact: Fred Bryant

State of California  
Department of Toxic Substances Control  
P.O. Box 806  
Sacramento, CA 95812-0806

# **APPENDIX D**

## **Equipment Suppliers and Special Material Recyclers**

## **REFRIGERANT RECOVERY EQUIPMENT**

- 1. Air-Conditioning & Refrigeration Institute. 1992. Directory of Certified Refrigerant Recovery/Recycling Equipment. Arlington, Virginia. (703) 524-8800.**
- 2. Look Under "Appliance Repair" in Yellow Pages of Phone Directory and ask the service person where they purchased their recovery/recycling equipment.**

## **REFRIGERANT RECYCLERS**

- 1. Refrigerant Engineering Society Service, (708) 297-6464**
- 2. Look Under "Appliance Repair" in Yellow Pages of Phone Directory**

## **REFRIGERANT RECLAIMERS**

- 1. Look Under "Appliance Repair" in Yellow Pages of Phone Directory and ask the service person where they take their used refrigerant.**
- 2. US EPA Hotline, Directory of Certified Refrigerant Reclaimers, 800-296-1996.**

## **OIL RECYCLERS**

**California Waste Exchange; Directory of Industrial Recyclers**

## **MERCURY RECYCLERS**

**California Waste Exchange; Directory of Industrial Recyclers**

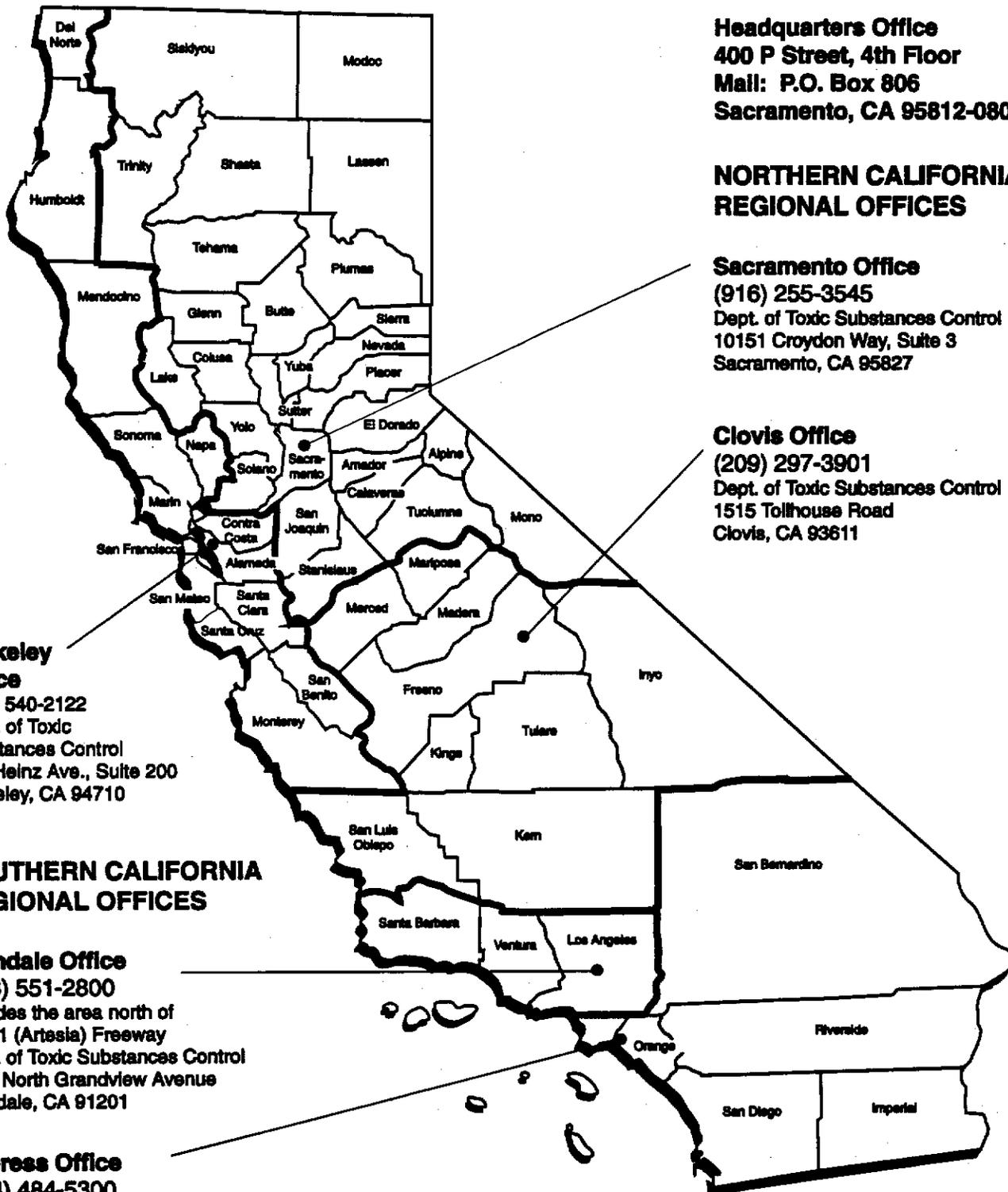
## **METAL RECYCLERS**

**Look under "Scrap" in Yellow Pages of Phone Directory**

# **APPENDIX E**

**Department of Toxic Substances Control  
Regional Offices**

# California Environmental Protection Agency DEPARTMENT OF TOXIC SUBSTANCES CONTROL



**Headquarters Office**  
400 P Street, 4th Floor  
Mail: P.O. Box 806  
Sacramento, CA 95812-0806

## NORTHERN CALIFORNIA REGIONAL OFFICES

**Sacramento Office**  
(916) 255-3545  
Dept. of Toxic Substances Control  
10151 Croydon Way, Suite 3  
Sacramento, CA 95827

**Clovis Office**  
(209) 297-3901  
Dept. of Toxic Substances Control  
1515 Tollhouse Road  
Clovis, CA 93611

**Berkeley Office**  
(510) 540-2122  
Dept. of Toxic Substances Control  
700 Heinz Ave., Suite 200  
Berkeley, CA 94710

## SOUTHERN CALIFORNIA REGIONAL OFFICES

**Glendale Office**  
(818) 551-2800  
Includes the area north of  
the 91 (Artesia) Freeway  
Dept. of Toxic Substances Control  
1011 North Grandview Avenue  
Glendale, CA 91201

**Cypress Office**  
(714) 484-5300  
Includes the area south of  
the 91 (Artesia) Freeway  
Dept. of Toxic Substances Control  
5796 Corporate Avenue  
Cypress, CA 90630