

Reviewing Material Safety Data Sheets to Verify Significant Drinking Water Threats

1 INTRODUCTION

When attempting to verify the existence of a Significant Drinking Water Threat (SDWT) related to the handling and storage of dense non-aqueous phase liquids (DNAPLs) or the handling and storage of organic solvents, it may be necessary to understand certain chemical details about products that are handled or stored at the site of a potential SDWT. One resource that can often be useful for finding the required information is the Material Safety Data Sheet (MSDS) for a product. This guide will provide information on what to look for when reviewing MSDSs for the purpose of determining the presence of SDWTs.

2 THREAT OVERVIEWS

2.1 HANDLING AND STORAGE OF DNAPLS

DNAPLs are liquid chemicals that are more dense than water and do not dissolve readily in water. Because of these properties, if released to the environment, they remain as a distinct liquid in surface or ground waters and tend to sink into the ground. They can then contaminate groundwater sources. The Tables of Drinking Water Threats describes in detail the circumstances under which handling and storage of DNAPLs is considered a SDWT including specific chemical components that must be present in the product for it to be considered a SDWT.

2.2 HANDLING AND STORAGE OF ORGANIC SOLVENTS

Solvent is defined in O.Reg. 153/04 (Record of Site Condition Regulation, under the EPA).

“Solvent” means any volatile organic compound that is used as a cleaning agent, dissolver, thinner, or viscosity reducer, or for a similar purpose.

More simply, an organic solvent is an organic (carbon based) compound that is used to dissolve other organic compounds. The Tables of Drinking Water Threats describes in detail the circumstances under which handling and storage of organic solvents is considered a SDWT including specific chemical components that must be present in the product for it to be considered a SDWT.

3 LAYOUT OF INFORMATION ON MATERIAL SAFETY DATA SHEETS

The specific layout of information may vary among different MSDSs. Most, however, will have different types of information divided into numbered sections. Only two of these sections are of use for identifying potential SDWTs. These are the sections that detail the hazardous chemical ingredients in a product and the physical and chemical properties of the product. Table 1 shows an overview of the information from MSDSs that can be used for verifying SDWTs.

Table 1: Useful information found on MSDSs.

Information	Common Heading Names	Common Section Numbers	Relevant Threats
Chemical Ingredients	“Composition/Information on Ingredients” “Hazardous Ingredients” “Hazardous Ingredients of Material”	Usually section 2 or 3	Handling and Storage of DNAPLs, Handling and Storage of Organic Solvents
Physical and Chemical Properties	“Physical and Chemical Properties”	Usually section 9, but sometimes section 3 or 4	Handling and Storage of DNAPLs

3.1 HAZARDOUS CHEMICAL INGREDIENTS

This is usually section 2 or 3 of the MSDS and is titled “Composition/Information on Ingredients”, “Hazardous Ingredients”, or “Hazardous Ingredients of Material”. This section is usually formatted as a table and may include toxicological information, the proportion of the ingredient in the product, and the Chemical Abstracts Service (CAS) registry number for each ingredient. The CAS number may be useful for looking up chemicals that are unfamiliar in order to attempt to determine if there is potential that the chemical could degrade to trichloroethylene or vinyl chloride (DNAPL threats).

3.2 PHYSICAL AND CHEMICAL PROPERTIES

This section is used for verifying DNAPL Threats. It is usually located in section 9 of the MSDS but is occasionally found in section 3 or 4 immediately following the “Hazardous Ingredients” section. The key pieces of information to be found here include the density of the product (density, relative density, or specific gravity), the water solubility of the product, and the physical state of the product (liquid, solid, paste, aerosol, etc.).

4 VERIFYING THREATS

4.1 HANDLING AND STORAGE OF DNAPLS

To verify the presence of a Significant Threat related to the handling and storage of DNAPLS, the following four key pieces of information must be determined about a product:

1. Density
2. Water Solubility
3. Physical State
4. Chemical Ingredients (and potential degradation products)

4.1.1 Density

Part of the definition of a DNAPL is that it is more dense than water. There are a number of ways that this can be expressed. Table 2 shows the different ways that density can be expressed along with the density of water in some common units of measure. The density, specific gravity, or relative density of a product can often be found in the “Physical and Chemical Properties” section of the MSDS. If the value of this measure for the product is higher than that of water (shown in Table 2) then the product is more dense than water.

Table 2: The density of water in some common units of measure.

Measure	Common Units	Density of Water (at 4°C)
Density	Metric: grams per litre (g/L), grams per millilitre (g/mL), kilograms per litre (kg/L), Kilograms per cubic metre (kg/m ³) Imperial: Pounds per gallon (lb/gal)*	1000 g/L
		1 g/mL
		1 kg/L
		1000 kg/m ³
		8.34 lb/gal*
Specific Gravity (also called Relative Density)	Dimensionless	1

*Actually a measure of specific weight since pounds (lb) is a unit of force, but this is still commonly used to express density in imperial units.

4.1.2 Water Solubility

The next thing to verify is the water solubility of the product. This will determine if the product will remain primarily in a “non-aqueous phase” if released to ground or surface water. The water solubility of a product can often be found in the “Physical and Chemical Properties” section of the MSDS. Common definitions of DNAPLS include liquids with water solubility up to “slight”. Professional judgement should be used when interpreting the water solubility of a product.

4.1.3 Physical State

Another part of the definition of a DNAPL is that it is a liquid. While the physical state of the product will probably be obvious in most cases, there are some situations where it may be beneficial to look up this information using the MSDS. Often the physical state of a product is included in the “Physical and Chemical Properties” section of the MSDS. Below are some notes for consideration regarding the physical state of a product.

- Some products have their physical state described as a paste, gel, or some other semi-liquid type of state. It may be necessary to consult further expertise in these cases to determine if the product will behave as a DNAPL if released to the environment. In cases of uncertainty, it is recommended to exercise the precautionary principle and consider the product a Threat until it is reasonably proven otherwise.
- Some products will have their physical state described as an aerosol. This is referring to the state of the product once it has been dispensed from its pressurized container. It is important to be aware that, while in the container, and if the container is ruptured and spilled, the product is in fact a liquid.

4.1.4 Chemical Ingredients

In addition to the above properties, a product being handled or stored has to have the potential to result in the presence of one of the five specific chemicals listed in the Tables of Drinking Water Threats in order to be considered a SDWT. This information can be found in the “Hazardous Ingredients” section of the MSDS. The specific chemical contaminants of concern related to this Threat are listed below.

- Dioxane-1, 4 (also called 1, 4-dioxane or dioxane)
- Polycyclic Aromatic Hydrocarbons (also called PAHs)
- Tetrachloroethylene (also called perchloroethylene, PCE, perc, or tetrachloroethene)
- Trichloroethylene (also called TCE or trichloroethene) or another DNAPL that could degrade to trichloroethylene
- Vinyl chloride (also called chloroethene or chloroethylene) or another DNAPL that could degrade to vinyl chloride

Note that polycyclic aromatic hydrocarbon (PAH) refers to any of a large group of chemicals. PAHs are defined based on their chemical structure. In cases of uncertainty about a specific chemical ingredient, someone with chemical expertise should be consulted. Some common PAHs are listed below. Note, however, that this is not a complete list.

- Naphthalene
- acenaphthene
- acenaphthylene
- anthracene
- benz[a]anthracene
- benzo[a]pyrene
- benzo[e]pyrene

- benzo[b]fluoranthene
- benzo[ghi]perylene
- benzo[j]fluoranthene
- benzo[k]fluoranthene
- chrysene
- coronene
- dibenz[a,h]anthracene
- fluoranthene
- fluorene
- indeno[1,2,3-cd]pyrene
- phenanthrene
- pyrene

It should also be noted that the circumstances related to trichloroethylene and vinyl chloride also mention that another DNAPL that may degrade to form these products would also be considered a significant Threat. Since information on potential degradation products can be difficult to obtain, the best option may be to take a conservative approach and consider any chlorinated hydrocarbon to have the potential to degrade to these products until better information becomes available. This is where the CAS number that is sometimes included in the “Hazardous Ingredients” section of the MSDS may be useful. The CAS number can be used to look up the specific chemical ingredient and see an image of its chemical structure which can be used to make an informed decision about potential degradation products.

4.2 HANDLING AND STORAGE OF ORGANIC SOLVENTS

Verifying organic solvents is somewhat less complicated than verifying DNAPL Threats. To verify a SDWT related to the handling and storage of organic solvents, the following two pieces of information must be determined:

1. Chemical Ingredients
2. Does the product behave chemically as an organic solvent?

4.2.1 Chemical Ingredients

An organic solvent product being handled or stored has to have the potential to result in the presence of one of four specific chemicals listed in the Tables of Drinking Water Threats in order to be considered a SDWT. This information can be found in the “Hazardous Ingredients” section of the MSDS. The specific chemical contaminants of concern related to this Threat are listed below.

- Carbon tetrachloride (tetrachloromethane)
- Chloroform (trichloromethane)
- Methylene chloride (dichloromethane)
- Pentachlorophenol

4.2.2 Does the product behave chemically as an organic solvent?

This information is not generally provided in MSDSs. One way to determine whether a product behaves chemically as an organic solvent is to consider the product's intended use and compare that use to the definition of an organic solvent.

“Solvent” means any volatile organic compound that is used as a cleaning agent, dissolver, thinner, or viscosity reducer, or for a similar purpose. More simply, an organic solvent is an organic (carbon based) compound that is used to dissolve other organic compounds.

Below are listed some common products that would be considered to behave chemically as an organic solvent.

- Paint thinner, paint stripper, paint remover
- Furniture stripper, varnish remover
- Nail polish remover
- Degreaser, metal parts cleaner, brake cleaner, gun wash, parts washer solvent
- Dry cleaning solvent, spot remover
- Glue solvent, epoxy solvent, solvent cement

The above is by no means an exhaustive list. If a product contains one of the chemical ingredients that are listed in the Tables of Drinking Water Threats and there is uncertainty about whether or not a product would behave chemically as an organic solvent, it is recommended consider the product an organic solvent until better information becomes available.