

Waste Management Guide

for Used PRISM[®] Membrane Separators



The PRISM Membranes Business unit develops, manufactures, and sells gas membrane separators. This group pioneered gas membrane separation for commercial use with early projects commissioned in 1977 and full-scale commercialization in 1979.

Our Membrane separators generate gas onsite in the following industries: aerospace, oil and gas, food and beverage, marine, and many others. Primary applications include nitrogen generation, air dehydration, hydrogen recovery, biogas upgrading, and the generation of oxygen enriched air.

PRISM membrane separators manufactured by Air Products (formerly Permea) are assembled from non hazardous materials. Please note that the ultimate responsibility for the waste determination, transportation, and method of disposal remains with the owner of the separator and may differ by region or municipality.

The first step is to determine if the separator has any contamination due to the type of service it has been in.

If the separator is not contaminated:

It may be disposed of as non-hazardous waste. Many parts of the membrane separators are recyclable if recycling services are available in your area. Disassembly can be achieved by cutting the tube at each end where it meets the cap, and then the shell can easily be separated from the fiber inside.

The following parts can often be recycled, but this will ultimately depend on your local recycling service:

- Aluminum end caps
- Acrylonitrile butadiene styrene (ABS plastic) or metal shell
- Polymeric fiber inside (not epoxy region)

If the separator is contaminated by hazardous materials:

In industrial processing applications, separating gas mixtures may cause the membrane separators to become contaminated with components of the gas stream. These contaminants may concentrate on the surface or be absorbed within the materials that make up the separator. In this situation, the owner of the separator must make the judgment as to how to dispose of the separator in compliance with applicable local, state and national regulations.

Depending on the type and concentration of the contaminants within the separator, it may still be possible to consider the separators as non-hazardous or it may have to be disposed in a hazardous waste landfill or by a hazardous waste incinerator. If the contaminant is not permanently absorbed into the separator (like with hydrogen sulfide) it may be possible to off-gas the contaminant by placing in a well-ventilated, secure area until the contaminant dissipates. Afterwards, dispose the membrane separators as mentioned above.

One of the most commonly found contaminants is oil. Unless this contaminant exhibits a flash point of 55°C or is present in quantities exceeding the threshold, it is typically non-hazardous. Following are very basic guides for classifying hazardous waste in the US and Europe. This chart asks questions that determine a waste as hazardous or non-hazardous. It may take someone with environmental expertise to make the determination.

Technical questions concerning these issues may be directed to the GEG Technical Information Center at 800-752-1597 or www.airproducts.com/fastfacts.

Basic Guide for Hazardous Waste Classification (US)

A solid waste that exhibits one or more of the following characteristics is a hazardous waste:

- Ignitability
- Corrosivity
- Reactivity
- Toxicity

Ignitability:

1. It is a liquid and has a flash point of 140°F or less?
2. It is not a liquid and is capable of ignition under standard temperature and pressure through friction or reaction with water or spontaneous chemical changes?
3. It is an oxidizer as defined in 49 CFR 173.151.
4. It is an ignitable compressed gas as defined in 49 CFR 173.300.

If the answer to any of the above is yes, the material is classified as hazardous waste. If not, proceed to the next set of questions.

Corrosivity:

1. The material is aqueous and has a pH equal to or less than 2 or equal to or greater than 12.5.
2. It is a liquid and corrodes steel as determined by National Association of Corrosion Engineers Standard TM-01-69.

If the answer to any of the above is yes, the material is classified as hazardous waste. If not, proceed to the next set of questions.

Reactivity:

1. It is unstable and readily undergoes violent change.
2. It reacts violently with water.
3. It forms potentially explosive mixtures with water.
4. When mixed with water, it generates toxic gases, vapors or fumes in a quantity sufficient to present a danger to humans or the environment.
5. It contains cyanide or sulfide waste which when exposed to pH conditions below 2 or above 12.5 can generate toxic gases, vapors or fumes in a quantity sufficient to present a danger to humans or the environment.
6. It is capable of detonation or explosive reaction if exposed to a strong initiating source or if heated in confinement?
7. Is it capable of detonation or explosion at standard temperature and pressure?
8. Is it a forbidden explosive, Class A explosive or Class B explosive as defined in 49 CFR?

If the answer to any of the above is yes, the material is classified as hazardous waste. If not, proceed to the next set of questions.

Toxicity:

1. The waste contains any contaminant listed in the EPA's Table of Maximum Concentration of Contaminants for the Toxicity Characteristic at a concentration above the maximum listed.
2. Generators of solid waste are required to determine if their wastes exhibit toxic characteristics by either using their knowledge of the waste generating process or by testing the waste in accordance with the Toxicity Characteristic Leaching Procedure.

If the answer to any of the above is yes, the material is classified as hazardous waste. If the material does not meet any of the above qualifications it is non-hazardous waste.

Basic Guide for Hazardous Waste Classification (Europe)

Hazardous wastes are defined by reference to list for wastes and a determination must be made if the waste possesses any of the hazardous properties H1 – H15.

Reference should be made to the SDS (safety data sheet) of other hazard classification of the contaminant, for each hazard there is a threshold above which the as hazardous. [Commission decision of 3 May 2000 \(2000/532/EC\)](#) C establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste has a full list of thresholds that are applied for each hazardous property

Wastes classified as hazardous are considered to display one or more of the properties listed in Annex III to Directive 91/689/EEC and, as regards H3 to H8, H10 (1) and H11 of the said Annex, one or more of the following characteristics:

- flash point $\leq 55^{\circ}\text{C}$,
- one or more substances classified (2) as very toxic at a total concentration $\geq 0,1\%$,
- one or more substances classified as toxic at a total concentration $\geq 3\%$,
- one or more substances classified as harmful at a total concentration $\geq 25\%$,
- one or more corrosive substances classified as R35 at a total concentration $\geq 1\%$,
- one or more corrosive substances classified as R34 at a total concentration $\geq 5\%$,
- one or more irritant substances classified as R41 at a total concentration $\geq 10\%$,
- one or more irritant substances classified as R36, R37, R38 at a total concentration $\geq 20\%$,
- one substance known to be carcinogenic of category 1 or 2 at a concentration $\geq 0,1\%$,
- one substance known to be carcinogenic of category 3 at a concentration $\geq 1\%$
- one substance toxic for reproduction of category 1 or 2 classified as R60, R61 at a concentration $\geq 0,5\%$,
- one substance toxic for reproduction of category 3 classified as R62, R63 at a concentration $\geq 5\%$,
- one mutagenic substance of category 1 or 2 classified as R46 at a concentration $\geq 0,1\%$,
- one mutagenic substance of category 3 classified as R40 at a concentration $\geq 1\%$.

Example for oil contamination:

Contaminating oil, other than diesel, should be assumed to possess the following risk phrases associated with the hazards indicated:

- R65 (H5 Harmful),
- R45 (H7 Carcinogenic)
- R63 (H10 Toxic for Reproduction)
- R46 (H11 Mutagenic)
- R51/53 (H14 Ecotoxic)

The assessment of the waste is based on the presence of oil and considers each of the following using the Total Petroleum Hydrocarbons (TPH) (C6 to C40) concentration.

Below are typical the concentration of TPH to the threshold concentrations of oil on the separator above which the separator itself should be typically classified as hazardous waste:

1. If the concentration of TPH is $\geq 25\%$ the waste will be H5* Harmful. If the concentration of TPH is $\geq 5\%$ the waste will be H10 toxic for reproduction.
2. If the concentration of TPH is $\geq 2.5\%$ the waste will be H14* Ecotoxic.
3. If the concentration of TPH is $\geq 0.1\%$ the waste will be H7 Carcinogenic and H11 Mutagenic unless the concentration of benzo-a-pyrene is $<0.01\%$ of the concentration of the TPH

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