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## **Understanding Proper Shipping Names**

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### **I - Introduction**

Full compliance with the **Department of Transportation (DOT)** regulations is necessary for the management of any water treatment business. It is both our legal and moral obligation to insure that the products we provide are transported in a safe and environmentally sound manner. We all want to avoid penalties for incorrectly labeling and describing the products we ship. In addition, your end users deserve assurance that they will not be deemed negligent in the event of an accident or spill, and you are expected to properly warn and advise them.

A knowledge of the **Proper Shipping Names (PSN)**, as required by DOT, will also enable you to determine if competitors have properly labeled their products. In these cases you can use your knowledge of the regulations to good advantage. After all, if a company is not aware of basic DOT requirements, what does that say about the MSDSs, labeling, and related hazard information they provide? Your customers will feel more comfortable buying from someone who displays complete knowledge of applicable regulations.

This article makes a distinction between “regulated” and “hazardous”. Materials shipped as corrosive, flammable, oxidizing solid, etc. are “**regulated**” by DOT. Materials that may cause adverse health effects (whether mild or severe) or physical hazards, such as slipperiness, are considered “**hazardous**”. All “regulated” materials are hazardous, but not all “hazardous” materials are regulated.

### **II - Bills of Lading**

All commercially transported materials must be accompanied by a **Bill of Lading (B/L)**, the document that describes the hazards, terms, responsibilities, liabilities, freight classifications, weights, etc. in accordance with DOT requirements. The law states that DOT regulated materials appear on the B/L under the most specific PSN available.

In the past, many corrosive products were shipped under the catch-all “**Corrosive Liquid, NOS, (i.e. sodium hydroxide), 8, UN 1760, PG II (or III)**”. This PSN made no distinction between volatile amines, alkaline products or acidic products and may still be accepted by some freight carriers who assume that you have assigned the correct PSN to your products. The DOT, however, is not always as tolerant. We must emphasize that a shipper is required by law to use the most specific PSN available and in most cases, something more specific than “**Corrosive Liquid, NOS, (i.e. sodium hydroxide), 8, UN 1760, PG II (or III)**” should be used.

“NOS”, when used as part of a PSN, refers to “**Not Otherwise Specified**”. All PSNs that include NOS must show, in parenthesis, the one (or a maximum of two) chemical ingredients which cause the product to be regulated. Since the ingredients will vary according to the formula, this portion of the PSN will be shown in the following examples as (..\*..). There are a large number of specific PSNs available and a complete list is published in **CFR 172.101**.

“UN” refers to **United Nations** and is a worldwide numbering system used to reference specific types of chemicals and their associated hazards. A list of UN numbers can also be found in the Code of Federal Regulations (CFR) 172.101 (*Hazardous Materials Table* as reproduced by J.J. Keller and others).

### III - Packaging Groups

“PG” refers to “**Packaging Group**”. The DOT has specified performance standards for packaging based on the hazards involved. PG I is for the most hazardous materials and does not normally apply to water treatment. PG II is used for some of the more hazardous water treatment chemicals such as potassium and sodium hydroxide, sulfuric acid, hydrazine, cyclohexylamine, diethylaminoethanol, and some of the biocides. Other regulated products would be shipped as PG III which has the lowest degree of hazard of all of the regulated materials. The PG number is required on the Bill of Lading but not on the container label.

### IV - General Classes

For typical industrial water treatment products, a few PSNs cover most situations:

“**Corrosive Liquid, Acidic, Inorganic, NOS, (..\*..), 8, UN 3264, PG III (or II)**”. Sulfuric acid based products can be shipped under this PSN.

“**Corrosive Liquid, Acidic, Organic, NOS, (..\*..), 8, UN 3265, PG III (or rarely II)**”. Organic, unneutralized raw materials such as HEDP, etc. should use this PSN.

“**Corrosive Liquid, Basic, Inorganic, NOS, (..\*..), 8, UN 3266, PG III (or II)**” Most neutralized, alkaline products use this PSN.

“**Corrosive Liquid, Basic, Organic, NOS, (..\*..), 8, UN 3267, PG III (or II)**”. Amine based return line treatments are typically covered by this PSN.

Sometimes a product is a simple dilution of corrosive raw materials. The old “**Corrosive Liquid, NOS, (..\*..), 8, UN 1760, PG III (or II)**” served as a way to avoid making the formula too easily known by the purchaser. Remember, however, the DOT requires the most specific PSN available to be used and if a chemical is listed in the tables of the Code of Federal Regulations (CFR) 172.101, then a simple dilution of that chemical must use the same PSN as the full strength material. An example for Caustic Soda would be:

**“Sodium Hydroxide Solution, 8, UN 1824, PG II (or III if less concentrated)”**

## **V – Combined Risks**

Volatile amines such as cyclohexylamine are often shipped either at full strength (100%), or in a concentrated form. In these cases, the PSN must reflect the fact that these materials may be both flammable and corrosive. The DOT considers anything with a closed cup flash point of under 141°F to be flammable. By contrast, insurance companies, fire departments and just about everyone else considers that materials are flammable only when their flash point is below 100°F.

Cyclohexylamine’s primary hazard, as stated in CFR 172.101, is corrosivity. Flammability is considered a **“subsidiary hazard”**. The PSN should be: **“Cyclohexylamine (Cyclohexylamine Solution if it is diluted), 8, (3), UN2357, PG II (or III)”**. A corrosive label showing the “hazard class”, (8) is required. A flammable label that shows the hazard class (3 for flammables) may be required for the subsidiary hazard (at approximately 50% or higher cyclohexylamine).

Diethylaminoethanol’s primary hazard is also corrosivity with a subsidiary flammable hazard. The PSN should be: **“2-Diethylaminoethanol (2-Diethylaminoethanol Solution if it is diluted), 8, (3), UN 2686, PG II (or III)”**. A corrosive label (with the 8 on it) and a subsidiary flammable label (with 3 on it for approximately 75% or higher DEAE) are required.

The primary hazard of morpholine is flammability with corrosivity as a subsidiary hazard. 100% morpholine is now PG I. The PSN should be: **“Morpholine (Morpholine Solution if it is diluted), 3 (8), UN 2054, PG I (or II or III)”**. A flammable label (with 3 on it) as well as a corrosive label (with 8 on it) are required. Morpholine, if diluted so that the flash point is over 141°F (less than 70% morpholine) would then ship as: **“Corrosive Liquid, Basic, Organic, NOS, 8, (morpholine), UN 3267, PG I, II, or III”** depending on degree of dilution.

## **VI - Testing**

How do we determine if a product is really corrosive? If the raw materials in a formula are not themselves corrosive, it is fairly certain that a dilution is not corrosive. Classification for a dilution of corrosives is less clear although in most cases these products, unless very dilute, would also be corrosive with the exception that combining acid and alkaline corrosivities may result in a neutral, non-corrosive, solution..

pH is often used as a general guide to corrosivity. If the pH is less than 2 or greater than 12.5, the material is considered corrosive by the DOT. DOT does, however, require that products be tested to determine both corrosivity and to establish the proper PG. It is possible that a product with a pH of over 2 or under 12.5 may still be considered corrosive based on the DOT accepted membrane or rabbit skin tests. If the corrosive ingredients are all PG III, then the finished dilution should also be PG III. A PG II raw material can become PG III when diluted although at what concentration this occurs will vary. To be certain, we must test.

Fortunately there are not too many raw materials that are PG II. Probably the most common are cyclohexylamine, caustic soda, caustic potash, sulfuric acid, diethylaminoethanol, and some of the biocides. In regard to caustic soda or caustic potash neutralized formulas, these products would normally only have a few percent of excess caustic and could ship as PG III.

## VII -Hazardous Substances

Some materials are considered to be “Hazardous Substances” (HS) by DOT and as such warrant additional attention. All HSs have a “Reportable Quantity” (RQ) which is the amount, per container, above which emergency response must be alerted in case of a spill or discharge. This information must also be properly described on the Bill of Lading and on the label. Most RQ quantities are high enough to not be an issue for shipments 55 gallon or less. Shipments of totes or in bulk may, however, quickly exceed the RQ.

Probably the most frequently encountered example is sodium nitrite which the DOT considers an HS, and for which it has established an RQ of 100 pounds. If the percent of sodium nitrite for a typical closed loop treatment is held to about 18% there should not be more than 100 pounds of sodium nitrite per 55 gallon drum and the RQ would not apply. If the sodium nitrite percentage is higher, separate labels may be required for the same product, i.e. a 55 gallon drum may require an RQ while smaller containers (30,15, and 5 gallon) will not.

Dry formulations or tote/bulk shipments may easily contain more than 100 pounds of sodium nitrite per container and need to reference the RQ on the label and shipping papers. An example of one way this can be done for a liquid alkaline/nitrite product would be: “**Corrosive Liquid, Basic, Inorganic, NOS, (sodium hydroxide, RQ – sodium nitrite), 8, UN 3266, PG III**”. Most dry sodium nitrite type products would be shipped as “**Oxidizing Solid, NOS, (RQ – sodium nitrite), 5.1, UN 1479, PG III**”. A subsidiary Toxic, Poison, or PG III label (with 6 on it) would be required for products containing 36% or more of sodium nitrite. The PSN would then be:“**Oxidizing Solid, NOS (RQ – sodium nitrite), 5.1, (6), UN 1479, PG III**”.

## VIII – Concluding Comments

While it important to make sure that corrosive products are properly labeled as corrosive, care must also be taken to insure that non-corrosive products are not labeled as corrosive. Labeling everything as corrosive “just to be safe” can cause serious problems. If there were a spill at, or on the way to a customer’s facility, a corrosive label would trigger emergency response. Emergency response is expensive and you may be held legally and financially responsible if your incorrect labeling initiated these actions.

There are many other aspects of DOT compliance such as labels, determining freight class, proper loading and segregation of materials that should also be addressed. Hopefully, the information provided in this article will be a helpful tool in attaining compliance with, and in understanding at least some of the current DOT requirements.