DOE REFERENCE GUIDE

CHEMICAL THRESHOLD QUANTITY DEVELOPMENT METHODOLOGY FOR USE WITH DOE O 151.1D

Revision 000

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ACKNOWLEDGEMENTS

This reference guide was developed for the U.S. Department of Energy (DOE) to address the need for a new chemical screening methodology that is being issued in DOE Order 151.1D. This reference guide was developed by members of the Emergency Management Issues Special Interest Group, specifically the Hazards Assessment Subcommittee with support from the Subcommittee on Consequence Assessment and Protective Actions. No one or two groups may take credit for the undertaking of such an enormous task, let alone its implementation. The authors would like to thank the many members of the Emergency Management Issues Special Interest Group for their contribution to outlining this new chemical screening process at the 30th Annual Meeting, and for their ongoing efforts in maintaining an incredible culture for hazardous materials safety in the DOE Emergency Management Enterprise.

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EXECUTIVE SUMMARY

U.S. Department of Energy Order 151.1D requires the use of a methodology to establish screening threshold quantities for chemical materials. These threshold quantities are used to determine if further analysis in an EPHA is required for a given material. At the 2016 Annual Meeting of the Emergency Management Issues Special Interest Group, the Hazards Assessment Subcommittee was tasked to create this methodology to support the new Order.

This guide outlines a qualitative to semi-quantitative process for identifying or developing a threshold quantity for a chemical material. The methodology was based on a similar process used by the Environmental Protection Agency to develop threshold quantities for environmental planning and release reporting. The guide outlines the assumptions, processes, and limitations of its use and application as it applies to the Department of Energy Emergency Management Program.

1 INTRODUCTION

The U.S. Department of Energy (DOE) Order 151.1D, *Comprehensive Emergency Management System*, outlines a new screening process for determining which chemical materials require further quantitative analysis in an Emergency Planning Hazards Assessment (EPHA) [DOE, 2016]. This new process uses chemical-specific toxicology and physical property data to identify customized screening threshold quantities (TQs) for use in determining if further analysis in an EPHA is required for a given material.

2 SCOPE

This methodology applies only to the chemical material screening process contained in DOE O 151.1D to determine if a further quantitative analysis is necessary for the subject material(s).

2.1 Assumptions

The technical capacities outlined in this document are predicated on a variety of assumptions regarding the processes users will use to determine when to use this reference guide. It is assumed that users will have a varying range of chemical analysis expertise from very advanced to basic. The process is designed to be as qualitative as possible to afford the greatest usability for those less equipped to quantitatively analyze chemical materials and technical enough to allow those with advanced expertise the methodology needed to quickly asses chemical materials at their facilities.

Furthermore, it is assumed that prior to using this methodology the user will have qualitatively screened the material(s) against the exclusion criteria outlined in Attachment 3 of DOE O 151.1D (DOE, 2016). It is assumed that only the most hazardous chemical materials will require a need for comparison against a TQ in accordance with this reference guide.

If there are site- or process-specific conditions or release mechanisms that might exaggerate the impact of a particular substance, the most conservative TQ should be used, or if one is not available, a one-pound threshold will be used to conservatively screen the material.

3 THRESHOLD QUANTITY IDENTIFICATION

Developing a TQ for a given chemical requires use of a formal process in concert with professional judgement. This section outlines the process and contingencies for use in developing a TQ.

3.1 Process Overview

In those cases where a chemical material does not meet any of the exclusion criteria in DOE O 151.1D, a TQ for screening the material must be identified to determine if further analysis in an EPHA is required.

The process for identifying a TQ for a chemical begins with a qualitative assessment and becomes more of a quantitative assessment as the process moves forward. The goal is to make TQ identification as simple a process as possible based on readily available information (see Figure 1).

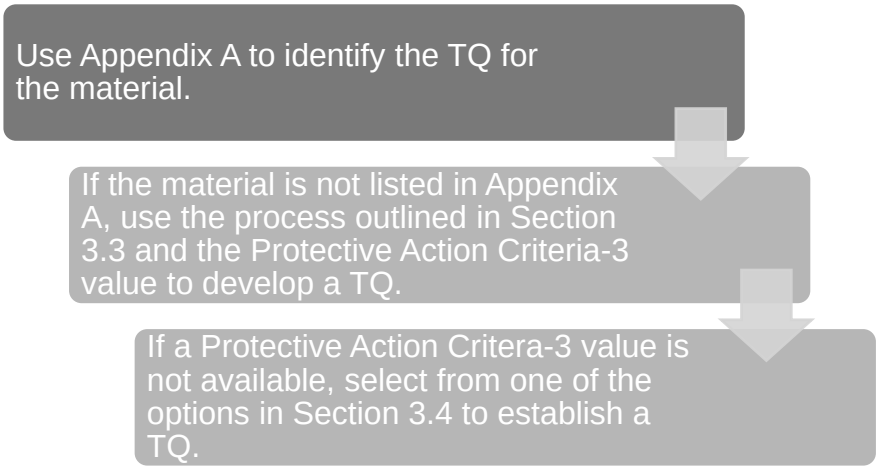

Figure 1: Threshold Quantity Identification Process

3.2 Step 1: Use of Appendix A

The process begins with a simple comparison of the chemical quantities that were not screened out by the exclusion criteria outlined in DOE O 151.1D (DOE, 2016) against the table of TQs for chemicals common in the DOE Complex (Appendix A). The list of chemical materials contained in Appendix A was developed from a survey sent out by the Hazards Assessment Subcommittee to each DOE site requesting a list of its chemical materials that required further analysis in an EPHA under DOE O 151.1C (DOE, 2005), or were screened out after further analysis concluded that an EPHA was not necessary. Over 350 individual chemical entries were received from the survey. After further analysis using the assumptions outlined in Section 2.1 and the processes in Section 3, this list was further narrowed down to 163 individual line items.

Using the processes and methodology outlined in this reference guide, TQs were developed for each of the chemical materials, for the material itself in pure form and other potential forms of matter for the material, as long as enough information on the material was provided by the sites.

If the user identifies the TQ using Appendix A, no further steps in this process are necessary. If the quantity of material in storage or use at the facility exceeds the TQ, further quantitative analysis is required. The determination to conduct further analysis must be documented in the All-Hazards Survey. If the material quantity does not exceed the TQ, no further quantitative analysis is required and this determination must be documented in the All-Hazards Survey. If the material is not listed in Appendix A, a TQ will need to be developed as detailed in Step 2.

3.3 Step 2: Developing a TQ Using PAC-3 Thresholds

If Appendix A does not contain a TQ for a material, one must be developed. This step uses Level 3 Protective Action Criteria (PAC-3) to develop the TQ.

PAC-3 thresholds that can be used are: the 60-minute Acute Exposure Guideline Levels (AEGLs) promulgated by the Environmental Protection Agency (EPA); Emergency Response Planning Guidelines (ERPGs) published by the American Industrial Hygiene Association; and Temporary Emergency Exposure Limits (TEELs) developed by DOE. A consolidated list of the

PAC thresholds as well as much of the other chemical property information needed to develop a TQ can be found at: https://sp.eota.energy.gov/pac

If PAC-3 thresholds are not provided in the TEEL database, proceed to Section 3.4.

Step 2 uses a method created by the EPA for use in developing threshold planning quantities for environmental planning and reporting purposes under the Superfund Amendments and Reauthorization Act of 1986 (EPA, 1987). This approach allows chemical specific thresholds to be developed based on the potential to be dispersed and the toxicological properties (EPA, 1987). In order to accomplish this, an Index Value is calculated and compared to an EPA table (Table 1) that correlates the index value to a planning quantity. This is accomplished using the following Equation 1.

Equation 1:

$$Index\ Value = \frac{(Level\ of\ Concern\ \times 0.1)}{V}$$

where:

Level of Concern = The PAC-3 value for the chemical (g/m^3)

V = The extent to which the material can become airborne

Each Level of Concern (LOC) is multiplied by a factor of 10% in accordance with the referenced EPA methodology (1987) which used another LOC threshold [Immediately Dangerous to Life or Health (IDLH) value] for determining the Index Value. PAC-3 was used to provide consistency with the EPA guidance since IDLH is used as a basis for TEEL-3 levels in DOE-HDBK-1046. The variable "V" is determined qualitatively or formulaically depending on the physical state of the material and/or other physical properties. This methodology uses assumptions outlined in the EPA referenced document (EPA, 1987) to determine "V".

Once calculated, the results of Equation 1 are compared to the index values in Table 1 to determine the TQ. The TQ is then compared to the inventory, and where it is exceeded, further quantitative analysis is required.

Table 1: Threshold Quantity Determination Table

Index Value (g/m^3)	Threshold Quantity (lbs)
$<1 \times 10^{-3}$	1
$\geq 10^{-3}$ to $< 10^{-2}$	10
$\geq 10^{-2}$ to $< 10^{-1}$	100
$\geq 10^{-1}$ to < 1	500
≥ 1 to < 10	1,000
≥ 10	10,000

Gaseous Materials

"V" is assumed to be 1 for chemicals that are gaseous at ambient conditions (EPA. 1987); therefore, the Index Value simply becomes the PAC-3 value of the gas (g/m^3) multiplied by 10%. This applies to all gases regardless of storage form (i.e., compressed gas, compressed liquefied gas).

Example:

Chlorine PAC-3 Value = 58 mg/m^3

Index Value = 5.80E-02 g/m^3 x 0.1 = 5.80E-03 g/m^3

Threshold Quantity (from Table 1) = 10 lbs

Solid Materials

"V" is assumed to be 1 for chemicals that are solids in powder form (EPA, 1987). "V" is also set to 1 for molten solids; however, the quantity should be multiplied by a factor of 0.3 before being compared to the TQ (EPA, 1987). For example if a site has 1,000 lbs of molten sodium, before comparing the inventory to the 100 lb TQ for sodium, the 1,000 lbs would be multiplied by 0.3. Therefore 1,000 x 0.3 = 300 lbs, which exceeds the TQ and requires a further quantitative analysis.

The exclusion criteria for chemical materials in DOE O 151.1D allow exclusion from further analysis for any solid material that has a particle size > 10 microns, or that has no credible event types where the material could be reduced to a particle with a size < 10 microns. Only solid powders need a TQ to be developed, and, in accordance with this methodology, the "V" assumption of 1 for solids in powders is sufficient to address all solid materials requiring development of a TQ. Therefore, the Index Value simply becomes the PAC-3 value of the solid (g/m^3) multiplied by 10%.

Example:

Sodium Cyanide PAC-3 Value = 30 mg/m^3

Index Value = 3.0E-02 g/m^3 x 0.1 = 3.0E-03 g/m^3

Threshold Quantity (from Table 1) = 10 lbs

Liquid Materials

For all liquid materials, "V" is formulaically calculated. This is based on a liquid spill evaporation (Equation 2) provided in the EPA guidance document (EPA, 1987).

Equation 2:

$$V = \frac{1.6 \times M^{0.67}}{(T + 273)}$$

where:

M = Molecular weight

T = Boiling temperature (°C) at standard pressure

The Index Value is then calculated using Equation 1.

Example:

Chloroform PAC-3 Value = 16,000 mg/m^3

Index Value = (16 g/m^3 x 0.1) / 0.118 (derived from Equation 2) = 13.56 g/m^3

Threshold Quantity (from Table 1) = 10,000 lbs

If the PAC database did not have a boiling point available for a liquid then 0°C was used to reasonably bound the results of the equation. If the necessary data is not available then "V" will default to 1. This approach is conservative. If the user can locate the appropriate data, the TQ can be refined.

3.3.1 Solutions with One Hazardous Component

The TQs developed in this process are to be applied to pure chemicals; however, many of the liquid chemicals are aqueous solutions of a given solute (e.g., 32% hydrochloric acid). The authors recognized the potential need for varied TQs based on the concentration of a material in solution.

Boiling points vary with the concentration of a given chemical material in solution; therefore, using Equation 2, TQs can be calculated for varying concentrations of a solute in solution.

This process was followed for several common materials, including hydrochloric acid, hydrofluoric acid, and nitric acid (Table 2). It was identified in this analysis that despite varying boiling points of the solutions, the TQ in most cases did not vary significantly from the TQ determined for the chemical as a liquid in pure form. This approach analyzed the material as a liquid even if its pure form is a gas (e.g., hydrofluoric acid). This test round also identified that it was appropriate and not over-conservative to put the pure chemical through the liquid equation to represent the material in solution. For example, Hydrofluoric acid at 100% as a liquid has a TQ of 100 lbs, which is less conservative than using the 10 lb hydrogen fluoride TQ. If the boiling point of the solution is known, and the user wishes to determine if a higher TQ may be

present for that concentration, they can use Equations 1 and 2 and check if the TQ is higher for that concentration and apply that value to the inventory.

Table 2: Threshold Calculation For Dilute Solutes

Chemical[a]	Concentration[a]	Form[a]	10% PAC-3 (g/m^3)[b]	BP (°C)	MW[b]	"V"	Index Value	TQ (lbs)
Hydrochloric Acid	100%	Liquid[c]	0.015	-85[d]	36.46	0.095	0.158	500
Hydrochloric Acid	20%	Liquid	0.015	110[e]	36.46	0.046	0.710	500
Hydrochloric Acid	32%	Liquid	0.015	84[f]	36.46	0.050	0.662	500
Hydrochloric Acid	38%	Liquid	0.015	48[e]	36.46	0.055	0.600	500
Hydrofluoric Acid	100%	Liquid[c]	0.0036	20[d]	20.01	0.041	0.089	100
Hydrofluoric Acid	9%	Liquid	0.0036	103[g]	20.01	0.031	0.640	500
Hydrofluoric Acid	48%	Liquid	0.0036	106[g]	20.01	0.031	0.640	500
Hydrofluoric Acid	49%	Liquid	0.0036	108[g]	20.01	0.031	0.636	500
Nitric Acid	100%	Liquid[c]	0.024	83[d]	63.01	0.072	0.333	500
Nitric acid	20%	Liquid	0.024	103.4[h]	63.01	0.068	0.908	500
Nitric acid	60%	Liquid	0.024	120.4[h]	63.01	0.065	0.950	500
Nitric Acid	68%	Liquid	0.024	120.5[i]	63.01	0.065	0.950	500

[a] Materials and concentrations identified by DOE sites as requiring further analysis (obtained through a survey conducted by the Hazards Assessment Subcommittee).

[b] Sourced from the Protective Action Criteria database (ATL International, 2016).

[c] Pure form represented here as a liquid.

[d] (Haynes, 2014).

[e] (Krunal Acid Agency, 2014)

[f] (Trinity Manufacturing Inc., 2015)

[g] Sourced from reference diagrams (Honeywell, 2002).

[h] (Chemical Land 21, 2016)

[i] (Seastar Chemicals Inc., 2010)

3.3.2 Solutions and Mixtures with Multiple Hazardous Components

Developing a TQ for a solution or mixture with multiple hazardous components is not possible using the EPA (1987) methodology and it is not possible to model these solutions in many Gaussian plume modeling programs used in EPHA analyses. Each component of a solution or mixture must be analyzed to determine its potential to cause downwind consequences. It is also acceptable for the user to use the most conservative TQ out of the multiple components for the solution or mixture.

3.4 CHEMICALS WITHOUT A PAC-3 VALUE

Though the PAC database is fairly inclusive, it is not exhaustive, and not every chemical that could be present in a facility is included in the PAC database. There are also limitations to the available testing data that provides a foundation for the chemical property information available for use in TQ calculations (e.g., boiling point).

In either case, where no PAC-3 value is available and/or the other necessary chemical property values are not available from a credible source, any one of the following options may be utilized.

Option 1

Set the TQ to one pound in order to allow for a proper quantitative analysis of the material and its potential consequences (EPA, 1987).

Option 2

Use the methodology in DOE-HDBK-1046-2008, *Temporary Emergency Exposure Limits for Chemicals: Methods and Practice*, which identifies the methods by which TEELs are established, to determine the appropriate PAC-3 value.

Option 3

Use another EPA (1987) methodology to calculate a relative LOC for the material using available toxicology data as follows, where the LOC equals:

a. LC_{50} x 0.1; or

b. LC_{LO}; or

c. LD_{50} x 0.01; or

d. LD_{LO} x 0.1

LD must be converted from a specific dose as a function of body weight to a concentration. Equation 3 can be used to convert LD values to a 30-minute concentration (AICHE, 2000).

Equation 3

$$\frac{mg}{m^3} = \frac{(LD_{50})(70\ kg)}{0.8\ m^3}$$

Where:

70 kg = Assumed weight of an adult male.

0.8 m³ = Approximate air volume inhaled in 60 minutes

4 CONCLUSION

From this process, a TQ will be identified for comparison against the site's chemical inventory item(s) which did not meet any of the exclusion criteria in DOE O 151.1D. The process begins qualitatively and becomes more quantitative as the process progresses. It is not expected that this process will be without hurdles, nor will all individual chemicals fit within the general methods outlined in this document. The Emergency Management Issues Special Interest Group Hazards Assessment Subcommittee and the Subcommittee on Consequence Assessment and

Protective Actions will address specific issues with the process as it is implemented. These subcommittees will also assist with further development of guidance on this process and the implementation of other components of DOE O 151.1D.

5 REFERENCES

American Institute of Chemical Engineers, (2000). Guidelines for Chemical Process Quantitative Risk Analysis. American Institute of Chemical Engineers. New York, NY

ATL International, (2016). Protective Action Criteria. Revision 28A. Accessed on May 1, 2016 from: http://www.atlintl.com/doe/teels/teel.html

Chemical Land 21, (2016). Nitric Acid. Accessed on May 1, 201t6 from: http://www.chemicalland21.com/industrialchem/inorganic/nitric%20acid.htm

Environmental Protection Agency, (1987). Threshold Planning Quantities Technical Support Document. Washington, D.C.

Department of Energy (DOE), (2016). Comprehensive Emergency Management System. DOE O 151.1D. Washington, D.C.

DOE, (2005). Comprehensive Emergency Management System. DOE O 151.1C. Washington, D.C.

Haynes, W.M. (2014). Handbook of Chemistry and Physics. 95th Edition. CRC Press, Boca Raton, FL.

Honeywell, (2002). Hydrofluoric Acid Properties [PDF]. Honeywell Specialty Chemicals, Volume 1.1, January.

Krunal Acid Agency, (2014). Hydrochloric Acid (Commercial/CP/LR/AR Grade). Accessed on May 1, 2016 from: http://www.krunalacid.com/hydrochloric-acid-commercial-cp-lr-ar-grade.htm

Seastar Chemicals Inc., (2010). Material Safety Data Sheet: Nitric Acid [PDF]. February.

Trinity Manufacturing Inc., (2015). Safety Data Sheet Hydrochloric Acid, 32-36% [PDF]. June, 1.

APPENDIX A: THRESHOLD QUANTITIES FOR COMMON MATERIALS

Chemical Name	CAS Number	Form	TQ (lbs)
1-Bromo-3-Chloro-5, 5 Dimetnylhydrantoin	16079-88-2	Solid	100
1-Hydroxyethylidene 1,1-Diphosphonic Acid	6419-19-8	Liquid	500
2-Chloroethanol	107-07-3	Liquid	100
Acetic Acid	64-19-7	Liquid	500
Acetic Anhydride	108-24-7	Liquid	500
Acetonitrile	75-05-8	Liquid	500
Acetyl Chloride	75-36-5	Liquid	500
Acrylic Acid	79-10-7	Solid	100
Activated Carbon	7440-44-0	Solid	10
Ammonia	7664-41-7	Gas	100
Ammonium Biflouride	1341-49-7	Liquid	1000
Ammonium Flouride	12125-01-8	Liquid	1000
Ammonium Hydroxide	1336-21-6	Liquid	1000
Ammonium Molybdate Tetrahydrate	12054-85-2	Solid	100
Argon	7440-37-1	Gas	10000
Arsine	7784-42-1	Gas	1
Barium Nitrate	10022-31-8	Solid	500
Benzyl Chloride	100-44-7	Liquid	500
Beryllium	7440-41-7	Solid	1
Beryllium Oxide	1304-56-9	Solid	1
Boric Acid	10043-35-3	Liquid	500
Boric Acid	10043-35-3	Solid	100
Boron Trichloride	10294-34-5	Gas	100
Calcium Hydroxide	1305-62-0	Solid	500
Calcium Oxide	1305-78-8	Solid	100
Carbon Dioxide	124-38-9	Gas	1000
Carbon Dioxide	124-38-9	Solid	1000
Carbon Monoxide	630-08-0	Gas	100
Carbon Tetrachloride	56-23-5	Liquid	1000
Ceric Ammonium Nitrate	16774-21-3	Liquid	500
Chlorine	7782-50-5	Gas	10
Chlorine Trifluoride	7790-91-2	Gas	10
Chloroacetic Acid	79-11-8	Solid	10
Chlorobenzene	108-90-7	Liquid	1000
Chloroform	67-66-3	Liquid	10000
Chlorosulfonic Acid (Csa)	7790-94-5	Liquid	100
Chromic Acid	1333-82-0	Liquid	100
Cobalt	7440-48-4	Solid	10

Chemical Name	CAS Number	Form	TQ (lbs)
Cuperous Cyanide	544-92-3	Solid	100
Cyanogen Chloride	506-77-4	Gas	10
Depleated Uranium	7440-61-1	Solid	10
Dichlor (1,2-Dichloroprop-1-Ene)	563-54-2	Liquid	500
Methylene Chloride (Dichloromethane)	75-09-2	Liquid	10000
Diethyl Ethylphosphonate	78-38-6	Liquid	500
Diethylaminoethanol	100-37-8	Liquid	1000
Diethylaminoethanol (DEAE)	100-37-8	Liquid	1000
Diisopropylamine (DIA)	108-18-9	Liquid	1000
Dimethylamine	124-40-3	Gas	100
Dipotassium Hexafluorozirconate	16923-95-8	Liquid	500
Ethylene Oxide	75-21-8	Gas	100
Ferric Sulfate	10028-22-5	Solid	100
Ferrous Sulfamate	14017-39-1	Liquid	500
Fluorine	7782-41-4	Gas	10
Fluoroboric Acid	16872-11-0	Liquid	500
Fluorosilicic Acid	16961-83-4	Liquid	500
Formaldehyde	50-00-0	Gas	10
Formalin	50-00-0	Liquid	500
Gadolinium Nitrate	10168-81-7	Solid	100
Germane	7782-65-2	Gas	1
Helium	7440-59-7	Gas	1000
Hydrazine	302-01-2	Liquid	500
Hydrochloric Acid	7647-01-0	Liquid	500
Hydrofluoric Acid	7664-39-3	Liquid	100
Hydrogen Bromide	10035-10-6	Gas	100
Hydrogen Chloride	7647-01-0	Gas	100
Hydrogen Cyanide	74-90-8	Liquid	100
Hydrogen Fluoride	7664-39-3	Gas	10
Hydrogen Iodide	10034-85-2	Gas	100
Hydrogen Peroxide	7722-84-1	Liquid	500
Lead Fluoroborate	13814-96-5	Liquid	500
Lithium Fluoride	7789-24-4	Solid	100
Lithium Hydride	7580-67-8	Solid	1
Lithium Hydroxide	1310-65-2	Liquid	500
Lithium Hydroxide	1310-65-2	Solid	10
Lithium Hydroxide Monohydrate	1310-66-3	Solid	10
Magnesium Nitrate	10377-60-3	Liquid	1000
Manganese	7439-96-5	Solid	500
Manganese(II) Nitrate	10377-66-9	Liquid	100

Chemical Name	CAS Number	Form	TQ (lbs)
Mercury(II) Nitrate	10045-94-0	Liquid	100
Mercury	7439-97-6	Liquid	100
Methane	74-82-8	Gas	10000
Methyl Chloroform	71-55-6	Liquid	10000
Methyl Mercury	22967-92-6	Liquid	1
Methylene Chloride	74-87-3	Liquid	1000
Methylhydrazine	60-34-4	Liquid	10
Morpholine	110-91-8	Liquid	10000
Nickel	7440-02-0	Solid	10
Nitric Acid	7697-37-2	Liquid	500
Nitric Oxide	10102-43-9	Gas	10
Nitrogen	7727-37-9	Gas	10000
Nitrogen Dioxide	10102-44-0	Gas	10
Nitrogen Tetroxide	10544-72-6	Gas	10
Nitrous Acid, Sodium Salt	7632-00-0	Liquid	500
Nitrous Oxide	10024-97-2	Gas	1000
Octamethylcylcotetrasiloxane	556-67-2	Liquid	500
Oleum	8014-95-7	Liquid	100
Oxalic Acid	144-62-7	Solid	100
Perchloric Acid	7601-90-3	Liquid	500
Phosphine	7803-51-2	Gas	1
Phosphoric Acid	7664-38-2	Liquid	500
Potassium Bifluoride	7789-29-9	Solid	500
Potassium Fluoride	7789-23-3	Liquid	10000
Potassium Gold Cyanide	554-07-4	Liquid	500
Potassium Hydroxide	1310-58-3	Liquid	500
Potassium Hydroxide	1310-58-3	Solid	10
Potassium Tetrafluoroborate	14075-53-7	Liquid	500
Pyridine	110-86-1	Liquid	10000
R-11 (Trichlorofluoromethane)	75-69-4	Gas	1000
R-113 (1,1,2-Trichloro-1,2,2-Trifluoroethane)	76-13-1	Liquid	10000
R-114 (1,2-Dichloro-1,1,2,2-Tetrafluoroethane)	76-14-2	Gas	10000
R-115 (1-Chloro-1,1,2,2,2-Pentafluoroethane)	76-15-3	Gas	10000
R-12 (Dichlorodifluoromethane)	75-71-8	Gas	10000
R-123 (1,1-Dichloro-2,2,2-Trifluoroethane)	306-83-2	Liquid	10000
R-124 (1-Chloro-1,2,2,2-Tetrafluoroethane)	2837-89-0	Gas	1000
R-134A (1,1,1,2-Tetrafluoroethane)	811-97-2	Gas	10000
R-141b 1,1-Dichloro-1-Fluoroethane	1717-00-6	Liquid	10000
R-152A (1,1-Difluoroethane)	75-37-6	Gas	1000
R-22 (Chlorodifluoromethane)	75-45-6	Gas	1000

Chemical Name	CAS Number	Form	TQ (lbs)
R-32 (Difluoromethane)	75-10-5	Gas	1000
Silver Nitrate	7761-88-8	Solid	1
Sodium	7440-23-5	Solid	100
Sodium Bifluoride	1333-83-1	Solid	100
Sodium Bisulfite Solution	7631-90-5	Liquid	500
Sodium Carbonate	497-19-8	Solid	100
Sodium Cyanide	143-33-9	Solid	10
Sodium Fluoride	7681-49-4	Liquid	10000
Sodium Hydroxide	1310-73-2	Liquid	500
Sodium Hydroxide	1310-73-2	Solid	10
Sodium Hypochlorite	7681-52-9	Liquid	500
Sodium Hydride	7646-69-7	Solid	10
Sodium Molybdate	7631-95-0	Liquid	100
Sodium Nitrite	7631-99-4	Liquid	500
Sodium Nitrite	7631-99-4	Solid	100
Sodium Permanganate	10101-50-5	Liquid	100
Sodium Silicate	1344-09-8	Liquid	500
Sodium Sulfite	7757-83-7	Solid	100
Sulfamic Acid	5329-14-6	Solid	100
Sulfur Dioxide	7446-09-5	Gas	10
Sulfuric Acid	7664-93-9	Liquid	500
Tetrachloroethylene	127-18-4	Liquid	1000
Thionyl Chloride	7719-09-7	Liquid	100
Thorium Nitrate	13823-29-5	Liquid	100
Thorium Oxide	1314-20-1	Solid	500
Titanium Tetrachloride	7550-45-0	Liquid	100
Tri-2-Ethylhexyl Phosphate	78-42-2	Liquid	500
Tributyl Phosphate	126-73-8	Liquid	1000
Trichloromethane (Chloroform)	67-66-3	Liquid	10000
Triethylamine	121-44-8	Liquid	1000
Trimethylamine	75-50-3	Gas	100
Tungsten(Iv) Fluoride	7783-82-6	Gas	100
Unsymmetric Dimethylhydrazine (UDMH)	57-14-7	Liquid	100
Uranium	7440-61-1	Solid	10
Uranium Dioxide	1344-57-6	Solid	10
Uranium Hexafluoride	7783-81-5	Gas	10
Uranium Octoxide	1344-59-8	Solid	10
Uranium Oxide	1344-59-8	Solid	10
Uranium Trioxide	1344-58-7	Solid	1
Uranyl Fluoride	13536-84-0	Solid	10

Chemical Name	CAS Number	Form	TQ (lbs)
Uranyl Nitrate	10102-06-4	Liquid	100
Yttritum	7440-65-5	Solid	100
Zinc Bromide	7699-45-8	Liquid	500
Zinc Cyanide	557-21-1	Solid	100