



# **Acetonitrile**

## **Safe Storage and Handling Guide**

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# Section 1: Introduction

This booklet was prepared for individuals who handle or may come in contact with Acetonitrile. It is a compilation of practical, understandable information designed to guide the reader in responsible handling of Acetonitrile, and to answer commonly raised questions about Acetonitrile safety. Before handling, always consult a current Materials Safety Data Sheet (MSDS), available from INEOS, for information on the chemical. For more complete or detailed information, call the following numbers in the U.S.:

Emergency Notification Number	877-856-3682
Non-Emergency Information Number	866-363-2454

Information contained in this booklet is not intended to replace any legal requirements for Acetonitrile handling and storage. Supplemental or more detailed specifications may be necessary for individual application of this material. Information for this booklet was gathered from a selection of widely-recognized chemical industry publications. INEOS makes no representation as to the accuracy or applicability of such information in any specific circumstance.

## About the Chemical

Acetonitrile is a clear, colorless liquid with a sweet, ethereal odor. It is also a hazardous chemical substance and regulated as such throughout most of the world. However, its hazards and properties are well understood. When appropriate safety procedures are in place, and employees follow those procedures, no excessive danger from the chemical exists. It is essential however, that employees and affected individuals remain aware and informed. Some of the primary hazards include reactivity, fire and toxicity.

- Acetonitrile is stable under conditions of normal use. It is incompatible with acids, bases, nitrating agents, nitrogen-fluorine compounds, oxidizers, perchlorates and sulfites.
- Fires involving Acetonitrile can release toxic gases such as hydrogen cyanide, oxides of nitrogen or carbon monoxide. Its vapors can easily form explosive mixtures in air. Since these vapors are heavier than air, they can also travel along the ground and be ignited by open flames or sparks which are some distance from the site of release.

- The vapors of Acetonitrile, if inhaled at certain concentrations, can produce serious acute (short term) toxicity, including loss of consciousness or death. The duration of exposure is also a factor, as is the contact of Acetonitrile liquid or vapor with the skin. However, if administered effectively, commercially available antidotes can in most cases preclude serious harm.

## About the Company

With facilities located in Lima, Ohio and Port Lavaca, Texas in the United States, and Teeside in the United Kingdom, INEOS is the world's largest producer and marketer of Acetonitrile, a co-product of Acrylonitrile primarily used as a solvent in the production of pharmaceuticals, agricultural products and fine chemicals. INEOS uses a proprietary technology to recover and purify Acetonitrile to very high purity standards.

The one-step, fluid bed Acrylonitrile manufacturing process was developed by scientists of The Standard Oil Company (Sohio), one of INEOS's predecessors in the U.S., in the 1950s. Today, over 95 percent of the world's Acrylonitrile is manufactured using INEOS's exclusive technology. INEOS offices are located in the Houston, Texas area with research facilities located near Chicago, Illinois

## Section 2: Physical, Chemical and Thermodynamic Properties

Acetonitrile, also known as Methyl Cyanide, Cyanomethane or Ethanenitrile, is a clear, colorless liquid with a sweet, ethereal odor. Its Chemical Abstracts Service registry number is CAS No. 75-05-8. The chemical structure of Acetonitrile is: CH<sub>3</sub>CN

### Physical Properties

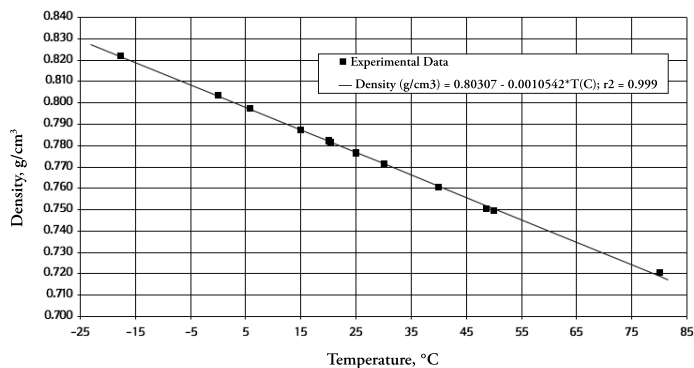
Important physical property data are listed in Table 2.1.

Table 2.1: Physical properties of Acetonitrile

Property	Value	Units	Notes	Reference
Molecular Weight	41.0524			
Boiling Point	81.60	°C	at 1 atm.	1
Melting Point	-45.7	°C		2
Density	0.77674	g/cm <sup>3</sup>	at 25°C	3
Vapor Density	1.43		relative (air=1)	
Coefficient of Thermal Expansion	0.001397	°C <sup>-1</sup>		4
Refractive Index	1.3442		Na D, at 20°C	5
Viscosity	0.352	cP	at 20°C	6
Triple Point	-43.8	°C		7
Critical Temperature	272.4	°C		8
Critical Pressure	4.83	MPa		8
Critical Volume	0.173	L		
Surface Tension	29.29	dyne/cm	at 20°C	5
Electrical Conductivity	0.000007	ohm <sup>-1</sup> cm <sup>-1</sup>	at 25°C	9
Dipole Moment	3.44	Debye	liquid phase	4
Dielectric Constant	36.0		at 25°C	6
Standard Entropy	58.67	cal/mole-°K	ideal gas, at 25°C	7
Heat of Vaporization	7.94	kcal/mole	at 25°C	7
Heat of Fusion	1.95	kcal/mole	at melting point	7
Heat of Combustion	-300.3	kcal/mole	liquid, 25°C	9
Heat Capacity, C <sub>p</sub>	21.52	cal/mole-°K	at 25°C	3
Heat Capacity, C <sub>v</sub>	15.17	cal/mole-°K	at 25°C	3
Thermal Conductivity	213	mJ/m-sec-°C	at 20°C	
Flash Point	5.6	°C	closed cup	11
Autoignition Temperature	524	°C		12
Flammable Limits in Air- lower	4.4	vol. %	at 25°C, 1 atm.	12
Flammable Limits in Air- upper	16.0	vol. %	at 25°C, 1 atm.	12

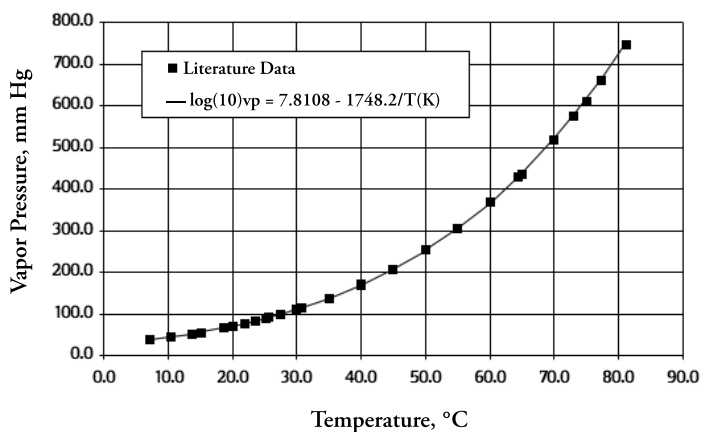
Figures 2.1 through 2.6 illustrate the temperature dependence of density, or specific gravity; vapor pressure of pure Acetonitrile and Acetonitrile/Water mixtures; viscosity; surface tension; and dielectric constant of Acetonitrile.

**Figure 2.1: Temperature dependence of density of liquid Acetonitrile**



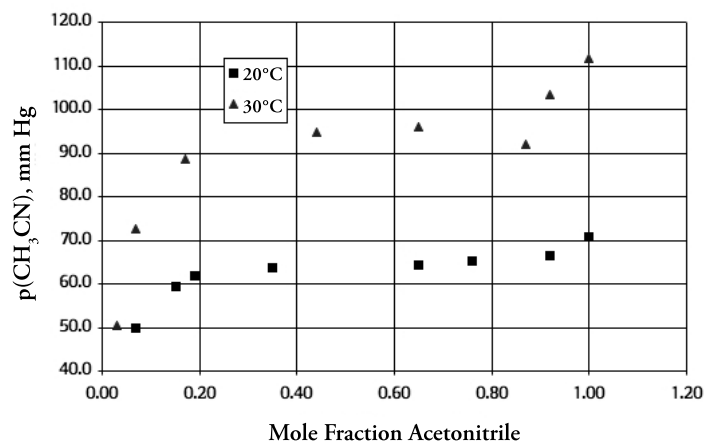
Source: Reference 5,13-22

**Figure 2.2: Vapor pressure of Acetonitrile**



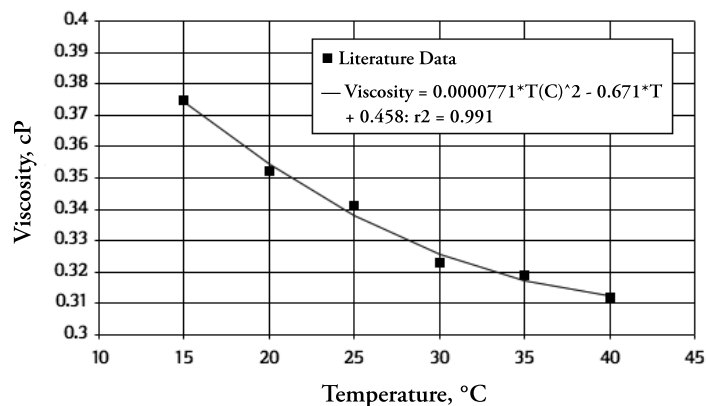
Source: Reference 6,13-22

**Figure 2.3: Acetonitrile partial pressure over Acetonitrile/Water solutions**



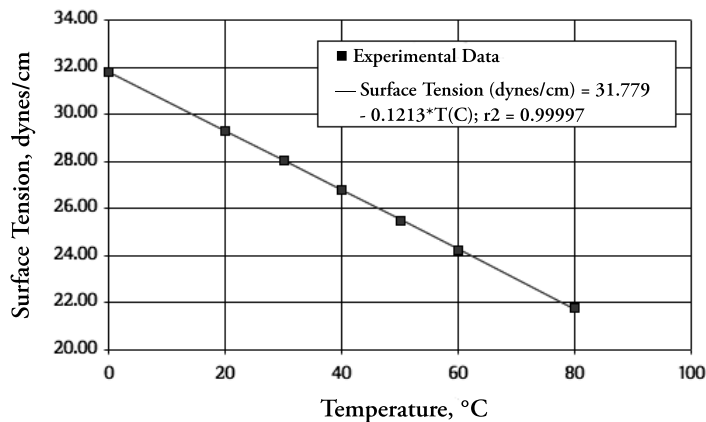
Source: Reference 6,23

**Figure 2.4: Temperature dependence of viscosity of Acetonitrile**



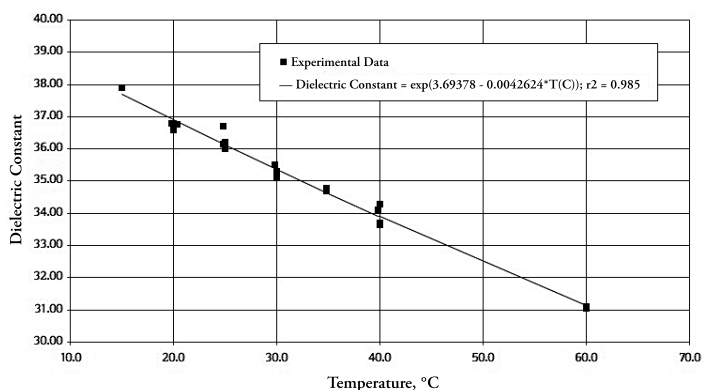
Source: Reference 6,13-22

**Figure 2.5: Temperature dependence of surface tension of Acetonitrile**



Source: Reference 5,26

Figure 2.6: Temperature dependence of dielectric constant of Acetonitrile

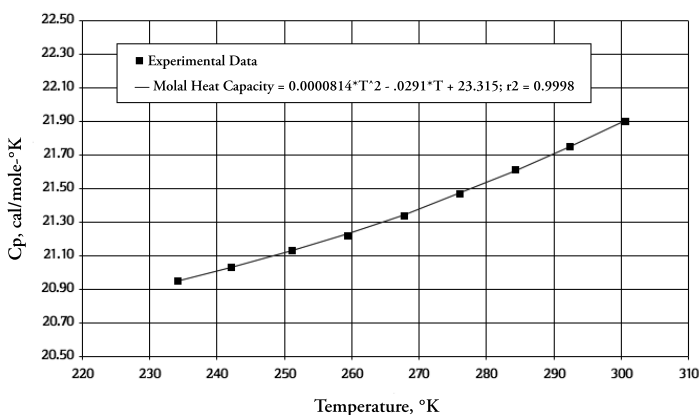


Source: Reference 1, 6, 13, 14, 22, 23

## Thermodynamic Properties

Table 2.1 includes thermodynamic properties of Acetonitrile.

Figure 2.7: Temperature dependence of molal heat capacity of liquid Acetonitrile

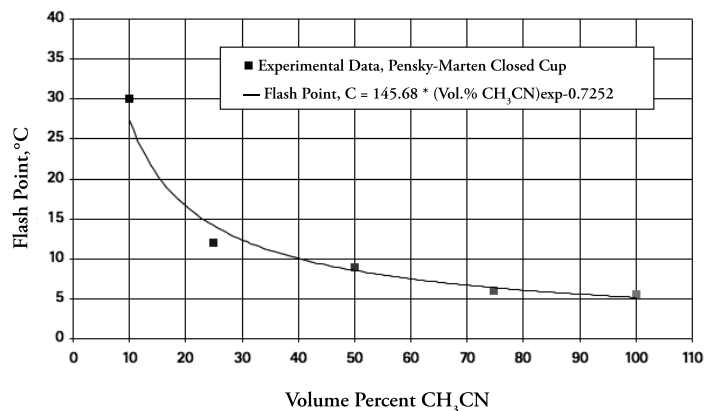


Source: Reference 7

## Flammability

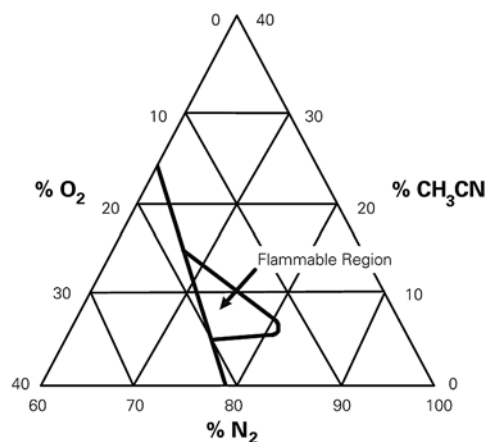
The flash point, autoignition temperature, and heat of combustion of Acetonitrile are listed in Table 2.1. The flash points of several Acetonitrile-Water mixtures have been determined. The results are shown in Figure 2.8. Vapor mixtures of Acetonitrile and air containing between 4.4 and 16 percent Acetonitrile at 25°C are potentially flammable. This flammability “envelope” is a function of temperature, pressure and the concentration of oxygen in the vapor. The flammability envelope for Acetonitrile at 40-45°C is shown in Figure 2.9.

Figure 2.8: Flash points of Acetonitrile - Water mixtures



Source: INEOS internal results

Figure 2.9: Flammability envelope for Acetonitrile



Source: Reference 30

## Chemical Properties

The chemical reactions of Acetonitrile are primarily focused on the nitrile, or -CN, group. Acetonitrile can be used to prepare amines, amides, amidines, carboxylic acids and esters, aldehydes, ketones, imines, heterocycles, orthoesters and other compounds. However, the primary industrial utility of Acetonitrile is as a solvent. As an excellent polar aprotic solvent, with a high dipole moment (3.44 D) and dielectric constant (36.0) (Table 2.1), Acetonitrile is ideally suited for chemical analysis, extractive purification and organic and biochemical reactions. For example, Acetonitrile is used as a solvent in the production of insulin and antibiotics and as a raw material in the production of naturally-occurring pesticides.

## Solubility

Acetonitrile is completely miscible with water, and its high dielectric constant and dipole moment (Table 2.1) make it a suitable solvent for many inorganic and organic compounds. Most polar organic materials are soluble in Acetonitrile.

Acetonitrile combined with one or more organic compounds or with water can form azeotropes – constant boiling mixtures. Information on Acetonitrile azeotropes is summarized in Tables 2.2, 2.3 and 2.4

**Table 2.2: Binary azeotropes of Acetonitrile**

Second Component	Second Component b.p.,°C	Azeotrope b.p.,°C	Azeotrope % CH <sub>3</sub> CN	
Boron Trifluoride	-100	101	38	
Silicon Tetrachloride	56.9	49	9.4	
Water	100	76.0	85.8	
Carbon Tetrachloride	76.75	65.1	17	
Methanol	64.7	63.45	81	
Trichloroacetonitrile		75.6	29	
Trichloroethylene	86.9	74.6	29	at 778 mm
1,2-Dichloroethane	83.15	79.1	49	
Iodoethane	72.3	<64.2		
Ethanol	78.3	72.5	44	
1-Bromopropane	71.0	63		
Propane		55	2.2	at 280 psia
Isopropyl Alcohol	82.5	74.5	52	
n-Propyl Alcohol	97.2	81.2	-72	
Chlorotrimethylsilane	57.5	56	7.4	
Ethyl Acetate	77.1	74.8	23	
Methyl Propionate	79.85	76.2	30	
Propyl Formate	80.85	76.5	33	
1-Bromobutane	101.5	<79.0		
1-Bromo-2-methylpropane	91.4	<74.5		
1-Chlorobutane	78.5	67.2	33	
1-Chloro-2-methylpropane	68.85	62.0	20	
1-Nitrobutane	78.2	<77.0		
Heptafluoroisopropyl-2-iodotetrafluoroethyl ether	86	69.5	60	
Isoprene	39.1	33.7	2.4	
Cyclopentane	49.3	<44.5	<14	
beta-Isoamylene		35.5	8.2	
gamma-Isoamylene		29.7	5.4	
2-Methyl-2-butene	38.5	36.1	8.4	
1-Pentene	30	28.7	5	
2-Pentene (cis- + trans-)	37	34.2		
Isopropyl Acetate	89.5	79.5	60	
2-Methylbutane	27.9	25.3	6.4	
Pentane	36		10	
	65	58	13	at 24 psig

Table 2.2: Binary azeotropes of Acetonitrile (continued)

Second Component	Second Component b.p., °C	Azeotrope b.p., °C	Azeotrope % CH <sub>3</sub> CN	
Benzene	80.1	73.7	31.8	
		45	30.7	at 278 mm
Cyclohexane	80.8	62.2	33 vol. %	
Methylcyclopentane	72.0	<60.5		
2,3-Dimethylbutane	58.0	48	13	
Hexane	68.8	56.8	25 vol. %	
Triethylamine	89.4	70.9	37	
Toluene	110.7	81.4	80	
Methylcyclohexane	100.8	71.1	51 vol. %	
Heptane	98.4	69.4	44 vol. %	
1,3-trans-6-cis-Octatriene	132	81	95	
1,3,7-Octatriene	125	80.5	90.5	
4-Vinylcyclohexene	127	79	89	
1-Octene	121.6	78.0	60 vol. %	
2-Octene	125.2	78.0	62 vol. %	
2,5-Dimethylhexane	109.4	<75.5		
2-Methyl-3-ethylpentane	114	65	55	
Octane	125.6	77.2	64 vol. %	
2,2,4-Trimethylpentane	99.2	68.9	38 vol. %	
Nonane	150.7	79.82		
2,2,5-Trimethylhexane	120.1	76.1	58 vol. %	
1-Decene	172	81.6	95 vol. %	
Decane	173.3	81.45		

Source: Reference 29.

Table 2.3: Ternary azeotropes of Acetonitrile

Component A	Component B	Component C	b.p., °C	Wt.% A	Wt.% B	Wt.% C
Water	Carbon Tetrachloride	Acetonitrile	60			
Water	Carbon Disulfide	Acetonitrile	39			
Water	Tetrachloroethylene	Acetonitrile	72			
Water	Trichloroethylene	Acetonitrile	67	6.4	73.1	20.5
Water	Acetonitrile	Ethanol	72.9	1	44	55
Water	Acetonitrile	Ethyl Acetate	70			
Water	Acetonitrile	Isoprene	32.4	1.08	2.32	97.6
Water	Acetonitrile	beta-Amylene	34.6	1.3	7.8	90.9
Water	Acetonitrile	Propyl Acetate	74			
Water	Acetonitrile	2-Methylbutane	24.7	0.76	5.7	93.54
Water	Acetonitrile	Benzene	66	8.2	23.3	68.5
Water	Acetonitrile	Isopropyl Ether	59	5	13	82
Water	Acetonitrile	Triethylamine	68.6	3.5	9.6	86.9
Water	Acetonitrile	Toluene	73			
Acetonitrile	Ethanol	Triethylamine	70.1	34	8	58

Source: Reference 29



**Table 2.4: Nonazeotropes of Acetonitrile**

Component
Chloroform
Dichloromethane
Formic Acid
Nitromethane
Acetic Acid
Acrylonitrile
Acetone
Methyl Acetate
N,N-Dimethylformamide
Dioxane
Diethyl Ether
Isobutyl Alcohol
Pyridine
Piperylene
Ethyl Propionate
Propyl Acetate
1-Bromo-3-methylbutane
tert-Amyl Alcohol
3-Pentanol
Chlorobenzene
2-Picoline
Ethylbenzene
Mixed Xylenes
Undecane
Water + Chloroform
Water + 1,1,2,2-Tetrachloroethane
Water + Acrylonitrile
Water + Acetone
Water + Diethylamine
Water + Butyl Acetate
Isoprene + 2-Methyl-2-butene
Isoprene + 2-Methylbutane
2-Methyl-2-butene + 2-Methylbutane
Hydrocyanic acid + Acrolein
Hydrocyanic acid + Acrylonitrile + Acrolein
Water + Ethanol + Triethylamine

Source: Reference 29.

## References

The references listed below provide the original descriptions of experimental methods for determining the physical and thermodynamic properties of Acetonitrile and include summary articles describing the properties, manufacture, use and chemistry of Acetonitrile.

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## Section 3: Storage and Transfer

Each bulk storage facility requires individual consideration based on the user's specific requirements, the nature of the site and the impact on any existing facilities in the vicinity.

Acetonitrile is commonly delivered to customers in ISO tank container, bulk truck, rail car, drum and ship. Storage facility design should carefully consider the optimum storage capacity – keeping in mind the expected delivery vehicle, quantity required and estimated future capacity requirements.

Acetonitrile storage and handling is subject to regulations and controls in many parts of the world. Requirements of local and national regulations should be determined at the earliest point in the design of a storage facility.

### Storage Hazards

The primary hazard from Acetonitrile storage is the potential for liquid ignition or vapor explosion should the material breach the tank. Also Section 2, Table 2.2, 2.8, and 2.9]

### Prevention of Flammability

“Nitrogen blanketing” substantially reduces the potential for flammability of vapors above the surface of liquid Acetonitrile. During nitrogen blanketing, oxygen is purged from the vapor space in the vessel or tank. The oxygen level should be purged to below 8 percent. Nitrogen blanketing may be accomplished through various systems.

### Tank Location

The arrangement of tanks and equipment should permit access for normal operation and maintenance, emergency response teams and equipment, as well as emergency evacuation. Storage facility personnel should also be familiar with locally-available fire fighting capabilities.

Tank “farms” housing other chemicals must be designed to keep all chemicals segregated – especially in the event of a spill or fire. Products which chemically react with Acetonitrile should not be stored in the vicinity.

Storage tanks should be constructed at ground level and in open air. This placement will allow easy detection of unwanted vapor emissions and will aid natural ventilation in dispersing vapors.

Tanks must be located away from a potential source of ignition, including the possibility of radiation from a fire in an adjacent area. Local regulations should be consulted to determine and design adequate space between tanks.

Storage tanks should be discharged by pump. Gravity discharge from a bottom outlet is not recommended – during an emergency, flow from a bottom outlet could be difficult or impossible to stop.

All tanks should be surrounded by a dike wall capable of containing 110 percent of the largest tank within the dike. The walls and floor of the dike should be impervious to liquid and designed to withstand a full hydrostatic head. Suitable construction materials include compacted clay, concrete, synthetic sheeting or geotextiles. In many locations around the world, selection of these materials may be subject to applicable regulatory requirements.

Dike walls should be no higher than 5 feet in order to ensure adequate ventilation of the area, ready access for fire fighting and easy escape during an emergency. Intermediate dike walls are recommended to segregate tanks into groups and to minimize the impact of an accidental spill on adjacent areas. The floor of the diked area should slope away from tanks to prevent minor spills from collecting and remaining underneath a tank.

Drainage of surface water and rain runoff should be provided for, preferably by air-driven pump or an electric pump with a flameproof motor. Diked areas with drains should have valves located outside the dike walls. These valves should be marked with a precautionary warning and should remain shut, except when run-off is being removed.

### Tank Design

The tank should be designed in accordance with an appropriate, recognized standard of good engineering. Stainless steel or carbon steel are recommended for tank construction. Carbon steel tanks should be cleaned either by chemical or physical means before initial use to remove rust. If the tank is cleaned by chemical means, further cleaning with water, according to an accepted procedure, is mandatory in order to prevent a potential chemical reaction. Special cleaning requirements are necessary for High Purity grade Acetonitrile.

Tank roofs should be fixed, with or without an internal floating roof. Internal floating roofs significantly reduce vapor emissions. These floating roofs may be constructed of aluminum for weight savings and lower expense. Seals on internal floating roofs may be vapor mounted double seal, or liquid mounted double seal. Manufacturer’s specifications should be consulted for the proper type of seal – to accommodate individual storage locations climatic conditions and material compatibility.

Steam cleaning can damage commonly used floating roof seal materials. Tanks with floating roofs must not be steamed unless the seals are designed to withstand steam cleaning. Multi-compartment tanks are not recommended because of potential product contamination and possible heating from adjacent compartments.

Where vent scrubbers are used as part of a vapor control system, suitable arrangements should be made for the disposal of vent scrubber water or carbon drums, depending on the system used.

A manhole, or “manway,” of at least 20-inches should be provided on all tanks to allow for internal inspection and cleaning. The following table lists recommended manway sizes based on the diameter of the tank:

**Table 3.1: Recommended manway sizes**

Tank diameter (ft.)	Number and size of manways (in.)
0 – 24'	1 manway, 20"
25' – 100'	2 manways, 24" each
101' – 150'	3 manways, 24" each
151' – 250'	4 manways, 24" each

Internal pipework should be designed to prevent splash filling.

New tanks should be designed for full draining – sloped to an outlet with no areas where Acetonitrile might be trapped during draining.

## Tank Inspection

Tank inspection should be performed in accordance with API 653 (the American Petroleum Institute’s standard for “Tank Inspection, Repair, Alteration, and Reconstruction”.) The following guidelines for external and internal inspections are based on the API recommendations, however, more frequent inspections may be necessary for compliance with local requirements.

### External Inspections

- Routine in-service inspections - The external condition of the tank should be monitored by close visual inspection from the ground on a routine basis. The interval of such inspections should be consistent with conditions at the particular site, but should not exceed one month.
- Scheduled inspections - All tanks should be given a formal visual external inspection at least every 5 years, or at the quarter corrosion rate of the shell, whichever is less. Inspections should be performed by an inspector who is qualified in accordance with API 653 Section 4.10.
- In-service ultrasonic thickness measurements of the shell - The extent of such measurements should be determined by the owner/operator. When used, the ultrasonic thickness measurements should be made at intervals not to exceed the following:
  - a. Five years after a new tank is commissioned
  - b. At five-year intervals for existing tanks where the corrosion rate is not known
  - c. When the corrosion rate is known, the maximum interval should be 15 years or RCA/2N years, whichever is less. [“RCA” is the “remaining corrosion allowance,” and “N” is the shell corrosion rate in mils per year.]

### Internal Inspection

Corrosion rates measured during previous inspections or experience with tanks in similar service should be considered in determining the intervals between internal inspections. Measured or anticipated bottom corrosion rates in relation to the minimum required thickness of tank bottoms should also be considered.

The actual inspection interval should be set to ensure that the bottom plate minimum thicknesses at the next inspection are not less than:

- 0.10 inches for tank bottom/foundation design with no means for detection and containment of a bottom leak, or
- 0.05 inches for a design with the means to provide detection and containment of a bottom leak.

In no case, however, should the interval between inspections exceed 10 years.

When corrosion rates are not known, or when the owner/operator's experience cannot determine the minimum bottom thickness at the next inspection, the actual bottom thickness should be determined by regular internal inspection(s) for the next 10 years.

## Piping

A tank discharge line should be provided which should be a minimum of 2" nominal bore. The line may be taken from the bottom or side of the tank and should be fitted with an isolating valve, as close to the tank wall as possible. In all cases, discharge should be by pump.

Capability for draining the tank should be provided. Drainage should take place from the lowest point in the tank with a suitable isolation valve. The isolation valve should be closed and locked when not in use.

Wherever possible, continuous welding should be used in pipeline construction. Flange joints should be used where pipes are periodically disconnected for maintenance or inspection. Flanges should conform to the American National Standards Institute (ANSI) 150 lb. PTFE envelope gaskets should be used; gaskets of similar non-swelling material are also suitable. Screwed fittings should not be used except with stainless steel components.

Piping should not be located over doorways or windows, or close to possible sources of ignition – to minimize the possibility of accidental damage. Fixed (stationary), dedicated loading/unloading arms are recommended. Hoses used for loading and unloading should be Acetonitrile-resistant lined, armored austenitic stainless steel flex hose or equivalent. Hoses should be frequently inspected for wear or damage, and replaced as necessary.

Tanks should be fitted with a grounding point and connected to a good ground. The resistance to ground at any point of the installation should be less than 10 ohms. This also applies to the grounding point of all discharge equipment, which should be connected to the same ground. If discharge equipment is grounded independently, the ground should have minimal resistance between the discharge equipment and the tank-pipework system.

## Pumps

Pumps should be located outside of tank dikes, on an impervious base, in an open space. They should not be located in walled-off or confined spaces.

Centrifugal pumps designed to ANSI (American National Standards Institute) standards or an equivalent are normally used for transferring Acetonitrile to and from storage. The pump mechanical seals can be of either the single, double or tandem seal design. To maintain product quality, both the single and double seals should be self flushing. For added environmental protection, tandem seals with a self flush inboard and a seal water flush outboard seal may be used. Seal face materials should be carbon against silicon carbide or carbon against tungsten carbide. For Acetonitrile service, the seal gasket elastomer should be silicone rubber.

For High Purity Acetonitrile, polypropylene filters must be fitted at the discharge side at the pump. They are also required for any loading line used.

Plastic pumps should not be used. Pumps should be constructed of either cast steel or stainless steel.

Pumps may be driven pneumatically, hydraulically or electrically. Electric pumps should be flameproof. Remote control pumps should also have a shut-off button at the pump's delivery point. Pumping output should not exceed the recommended speed or capacity of the piping system, especially in the discharge pipelines.

Gravitational flow may occur in a centrifugal pump when the pump is stopped. This flow should be anticipated and compensated for.

## Valves

Isolating valves may be ball or gate valves with PTFE seats. Angle or globe valves are also acceptable for Acetonitrile service. Diaphragm valves should not be used with Acetonitrile.

Valve bonnet gaskets may be soft iron, spiral wound or equivalent. Valve stem packings should be Garlock 9000 EVSP (or equivalent) graphite packing.

## Level and Temperature Measurement

Storage tanks should be provided with a means for determining both the liquid level and tank temperature. Opening a gauge hatch is not recommended where it might involve personal exposure to Acetonitrile. Where manual or open measurement is unavoidable, operators must wear suitable protective clothing and respirators to protect against Acetonitrile exposure. (See Sections 6 and 7.) Level indicators should be intrinsically safe for use with Acetonitrile, based on nationally accepted standards. High level alarms and automatic feed cut-off controls should be considered for installation in a tank to prevent overfilling.

## Sampling and Analytical Techniques

Analysis of representative samples is commonly performed to determine the product quality of Acetonitrile. Key parameters of quality include appearance, water, etc. (see Section 3). The following should be observed:

- Closed systems should be used for drawing product samples. Totally enclosed sampling systems minimizing personnel exposures.
- Clean, dry polypropylene or amber-colored glass bottles should be used for sample collection. Polypropylene bottles should be checked frequently for stress cracks or other signs of wear, and should be replaced when necessary to prevent unexpected leakage. Clear glass should not be used if prolonged exposure to light is expected.

To prevent the build up of static electricity during sampling, draw product slowly; ensure that dip pipes, if used, are free from rough edges; and make necessary grounding connections. Special requirements are necessary for dealing with samples for High Purity grade Acetonitrile.

## Nitrogen Blanketing

Nitrogen blanketing is recommended for keeping the oxygen level at or below 8%, for fire protection. (See explanation in Section 4).

## Vapor Control System

A vapor control system should be installed at the facility to control displaced vapors from transport equipment during loading or unloading. Vapors should be kept from release into the atmosphere for the protection of operators and the environment.

A number of different control systems are available and local regulatory requirements may vary. Vapors can be destroyed through incineration; recovered through a refrigeration/condensation process; absorbed through charcoal; processed through a scrubbing system; or vapor balanced to a storage tank.

Proper training of ship and facility personnel is essential for safe operation. Training is essential to reduce the possibility of the following hazards: flame propagation from vessel to shore systems; over or under pressurization; and chemical spillage.

## Electrical Considerations

Pumps, tanks, electric motors and all parts of the system must be effectively grounded to prevent the accumulation of static electrical charges. Working areas (e.g. tank stairs, platforms, loading and unloading points) should be adequately illuminated during working hours.

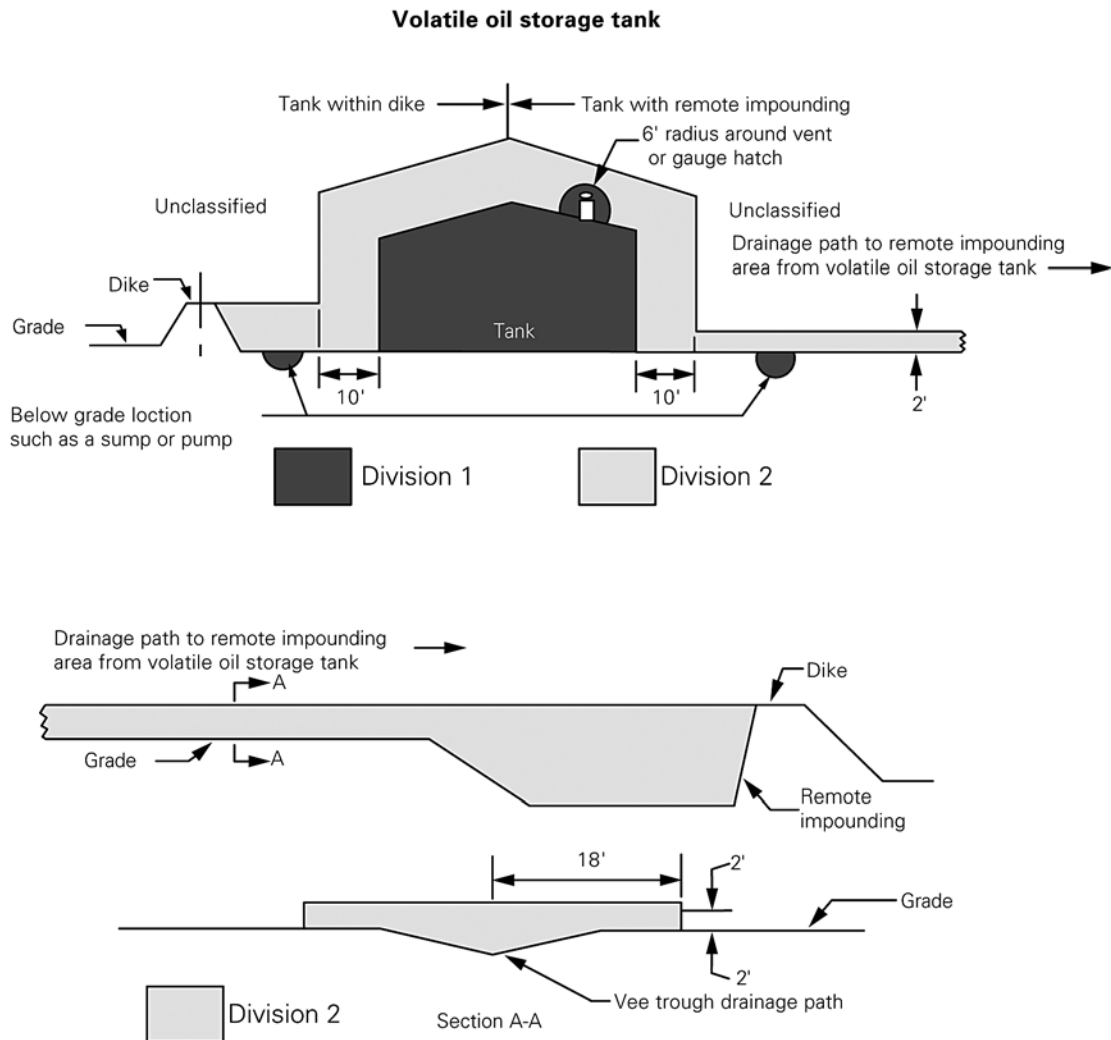
Electrical equipment used in hazardous areas must be non-sparking or otherwise suitable for the area where it will be used. The selection, installation and maintenance of such electrical equipment should be based on an internationally accepted hazardous area classification scheme. First, determine the area's classification. Next, consult an accepted electric code which lists suitable equipment for use in that area classification.

In the United States, the appropriate national or international electric code should be used in conjunction with the area classification methodology for a "heavier-than-air" gas source. See Appendix 1 for API (American Petroleum Institute) "Recommended Practice 500" diagrams of tank, rail/truck and marine area classifications. The National Electric Code is not provided and must be consulted elsewhere.

## Appendix 3.1

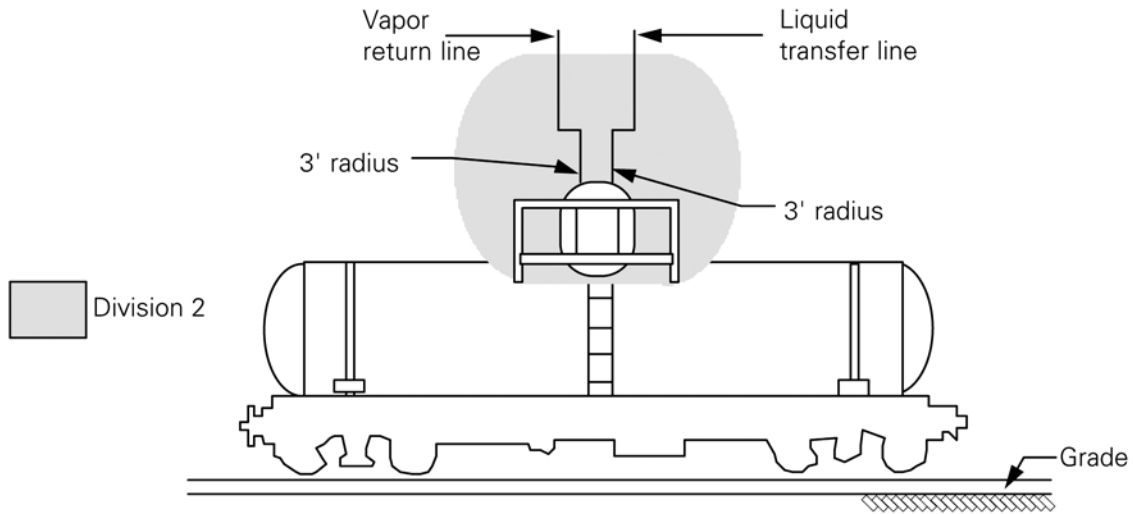
Appendix 3.1 contains diagrams of the electrical classification areas for storage tanks, marine applications and truck and rail. All diagrams in Appendix 3.1 are included courtesy of the American Petroleum Institute; publication #RP 500, Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities. First Edition, June 1, 1991.

Figure A-1a: Volatile oil with heavier-than-air gas source

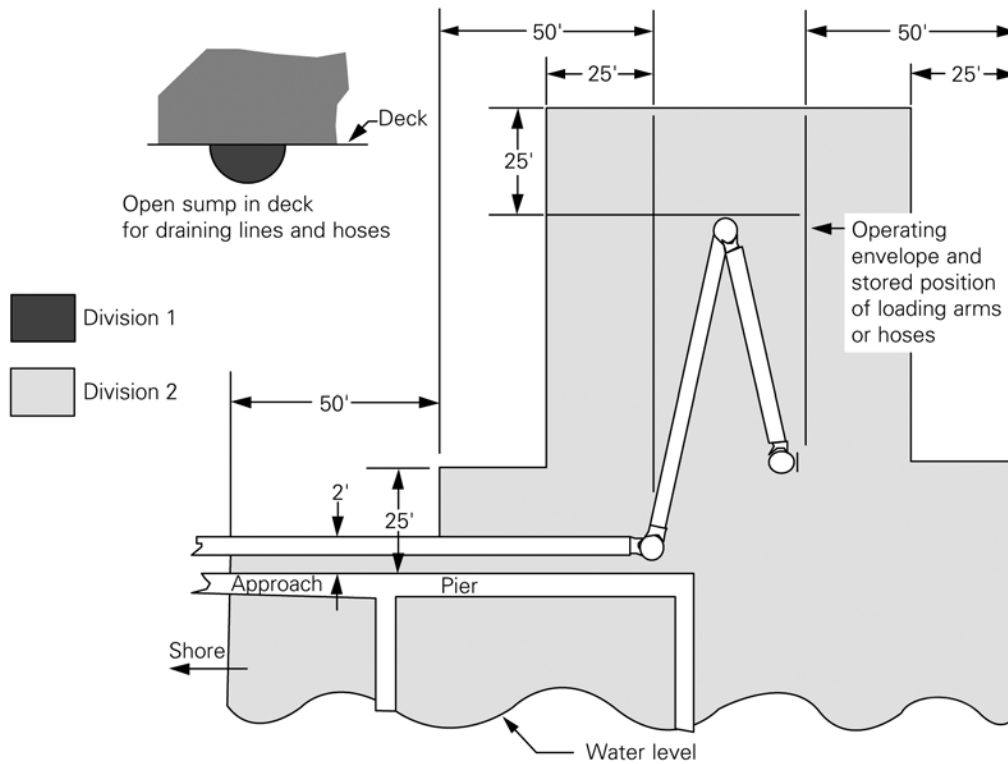


1. For floating-roof tanks, the area above the tank roof and within the shell is classified Division 1.
2. High filling rate or blending operations involving Class 1 liquids may require extending the boundaries of classified areas.
3. Distances given are for typical process areas and oil and gas handling facilities; they must be used with judgement, with consideration given to all factors discussed in the text.

**Figure A-1b: Tank car/tank truck loading and unloading via closed system  
Transfer through dome only (NFPA 497A)**



**Figure A-1c: Volatile oil with heavier-than-air gas source**



1. The “source of vapor” shall be the operating envelope and stored position of the outboard flange connection of the loading arm (or hose).
2. The berth area adjacent to tanker and barge cargo tanks is to be Division 2 to the following extent:
  - a. 25 feet horizontally in all directions on the pier side from that portion of the hull containing cargo tanks.
  - b. From the water level to 25 feet above the cargo tanks at their highest position
3. Additional locations may have to be classified as required by the presence of other sources of flammable liquids on the berth, or by the Coast Guard or other regulations.



## Appendix 3.2

The following diagrams illustrate the recommended construction of Acrylonitrile load and unload terminals for truck, rail, ISO tank, and marine. However, many other systems are in place and are equally suitable for safe and efficient Acrylonitrile handling.

## Abbreviations

CD = Chemical drain  
 LI = Level indicator  
 TI = Temperature indicator  
 LAH = Level alarm high  
 S/D = Shut down  
 O<sub>2</sub> = Oxygen  
 FO = Fail open

Figure A-2a: Acetonitrile ship loading

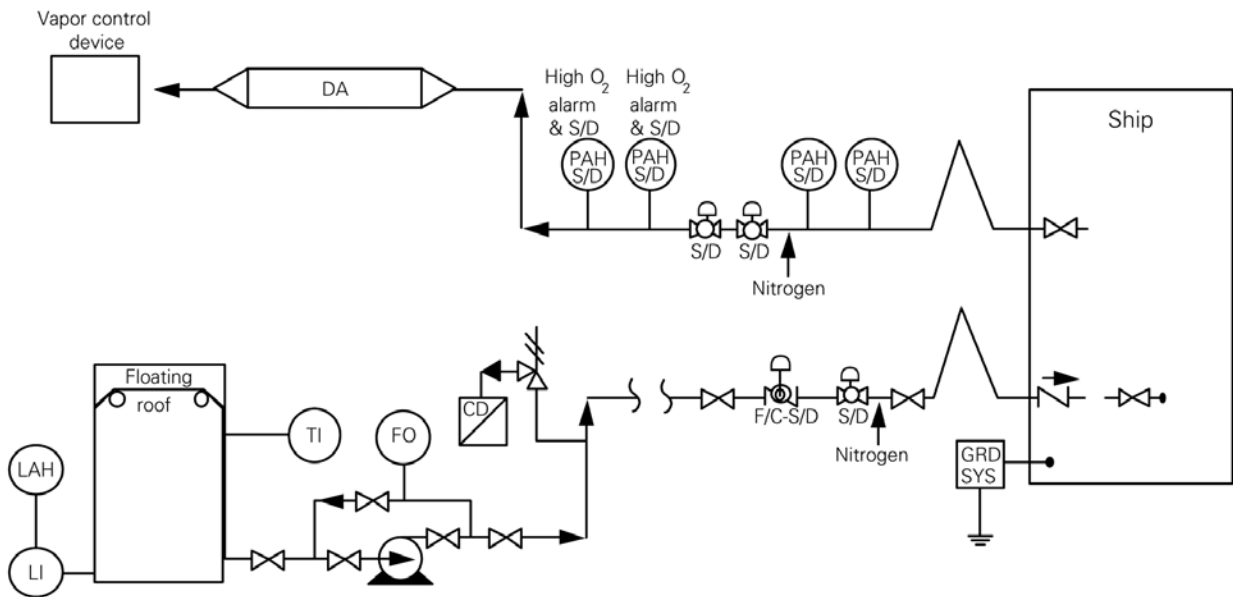


Figure A-2b: Acetonitrile ship unloading

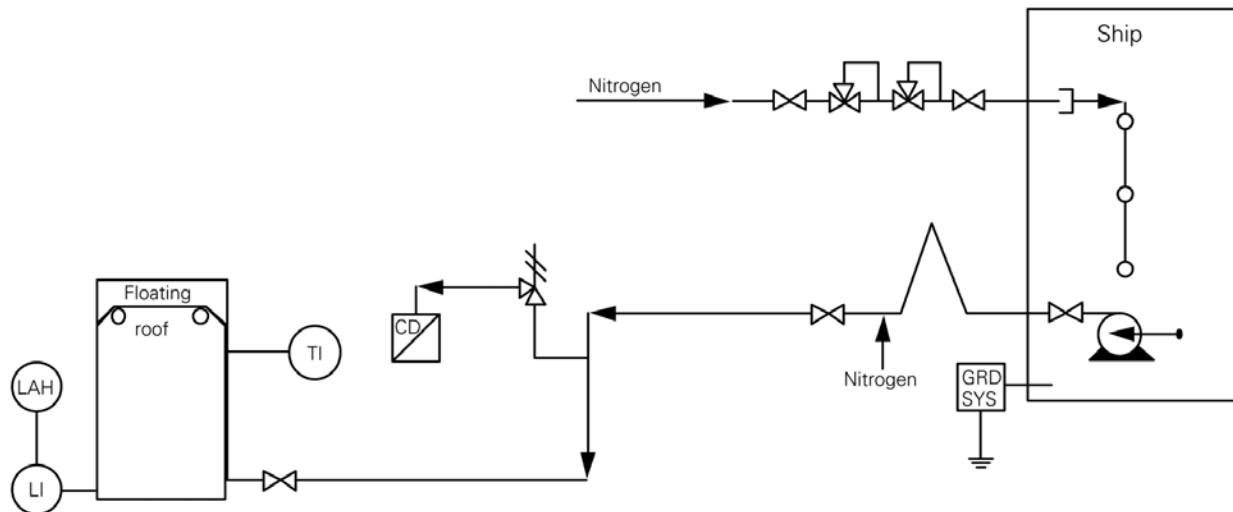


Figure A-2c: Acetonitrile railcar loading

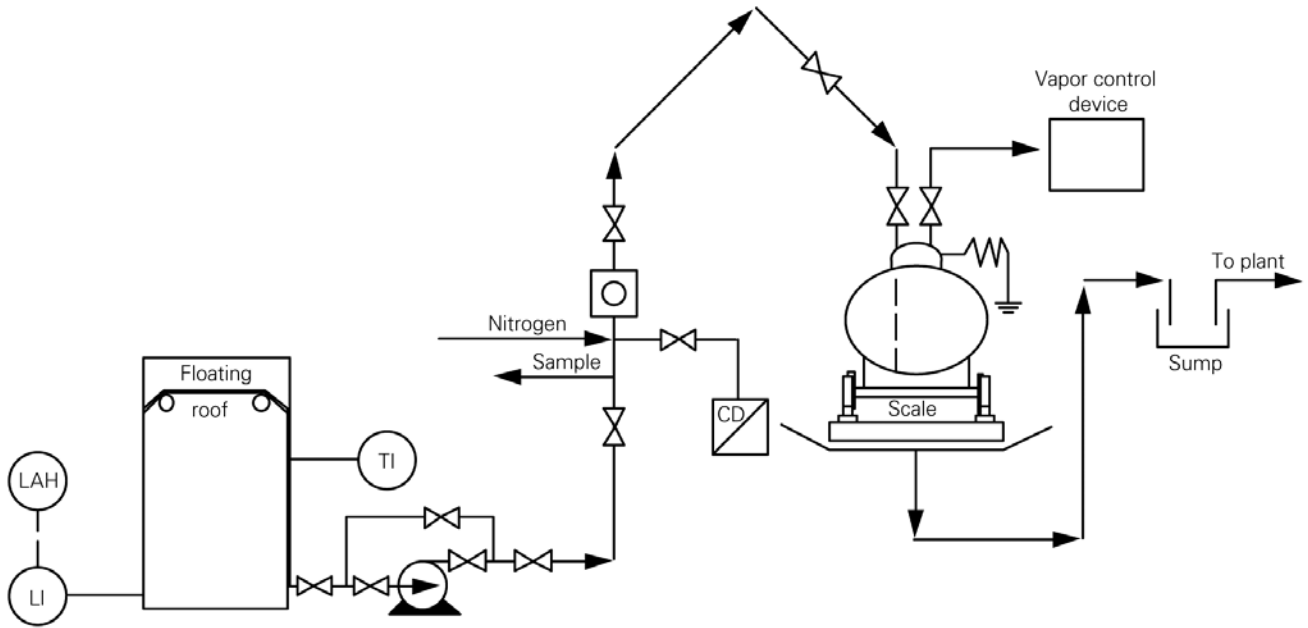


Figure A-2d: Acetonitrile railcar unloading

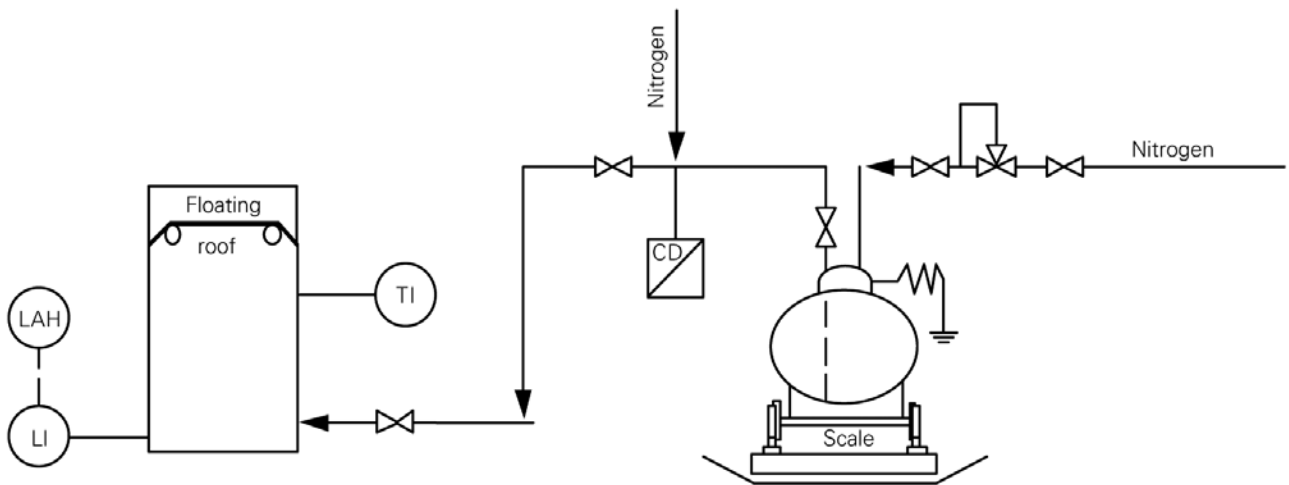


Figure A-2e: Acetonitrile Iso-truck loading

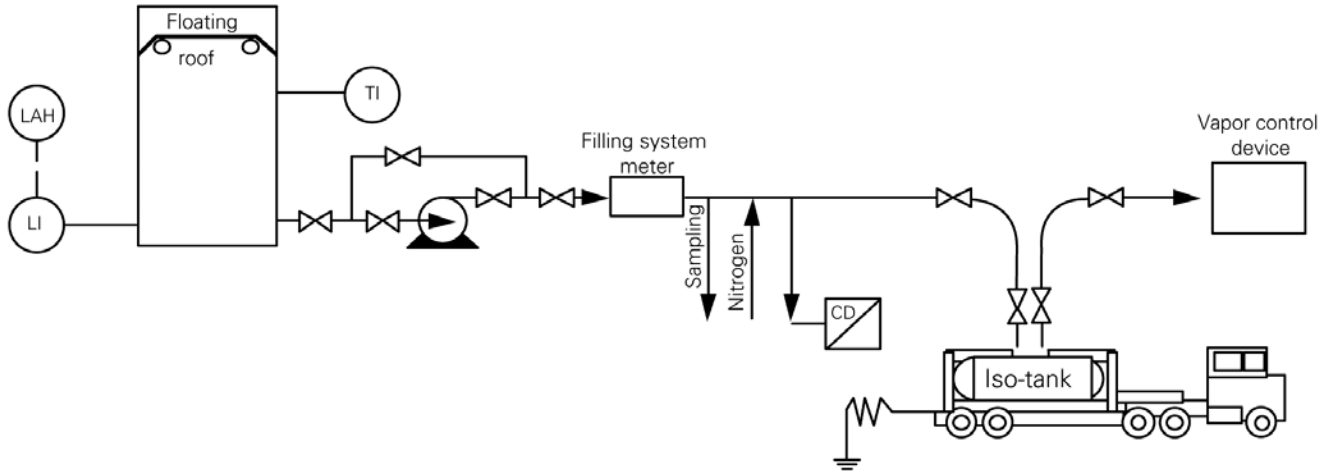


Figure A-2f: Acetonitrile Iso-truck unloading

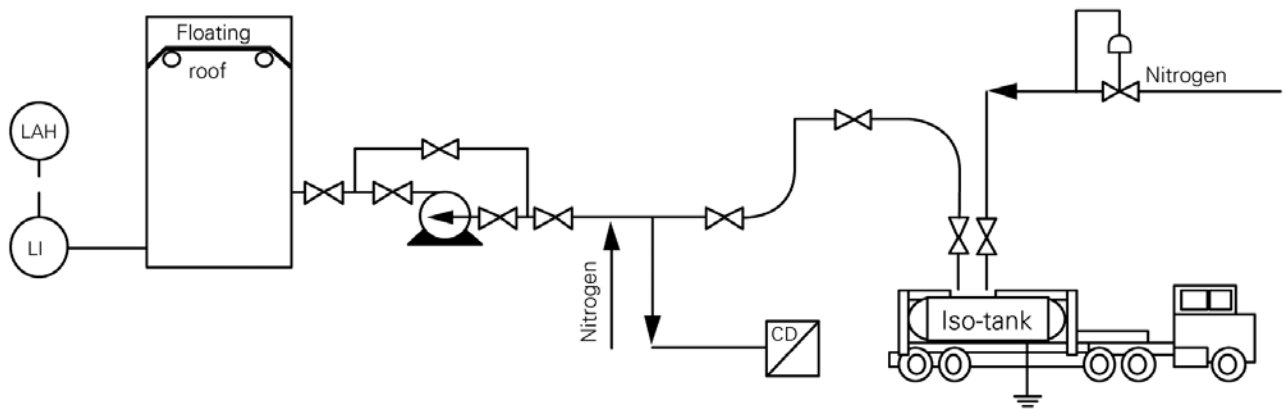


Figure A-2g: Acetonitrile truck loading

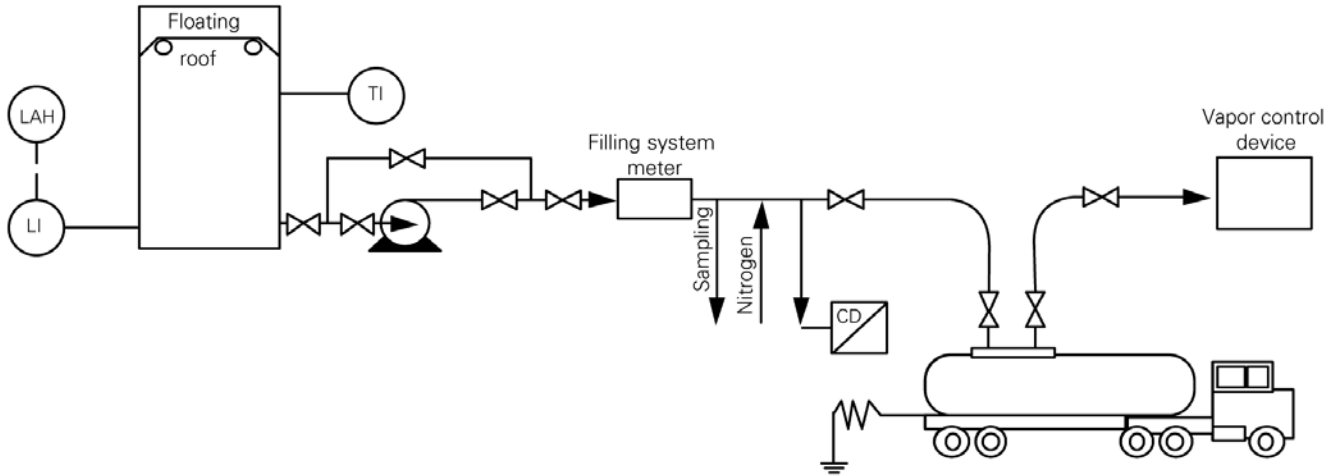
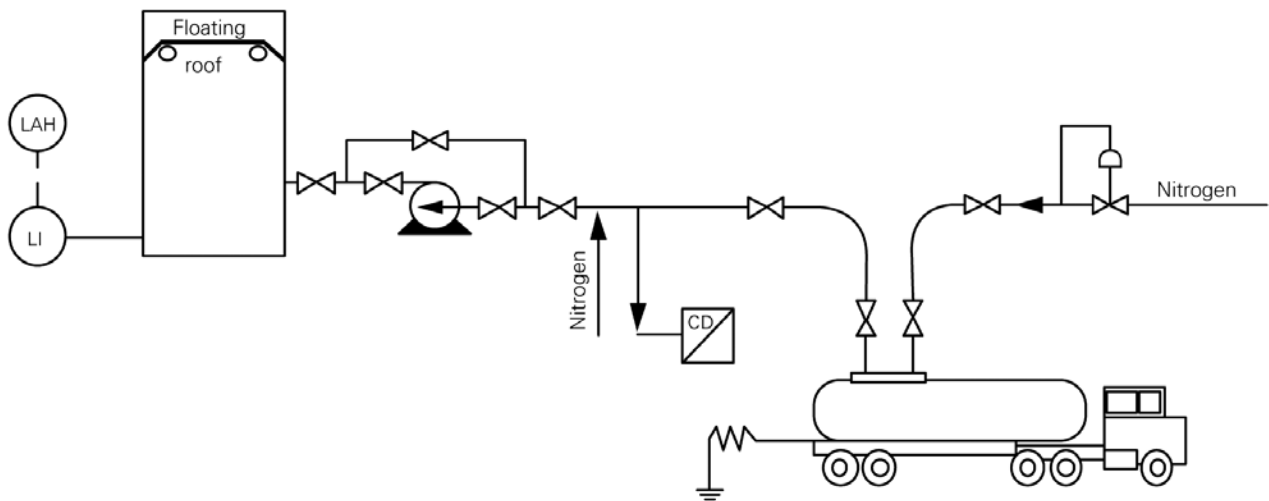


Figure A-2h: Acetonitrile truck unloading



## Section 4: Transport

Equipment and procedures for transfer and transport of Acetonitrile will vary widely depending on prevailing national and local operating regulations. However, some basic principles of safe handling apply regardless of a facility's location.

### General Safety for Transfer and Transport

Acetonitrile is commonly transported via ISO tank container, bulk truck, rail car, drum or ship. Product transfer facilities and transport equipment must be designed to eliminate or responsibly manage potential Acetonitrile handling hazards. Facilities and equipment must be diligently maintained and properly used.

Transport equipment should meet the requirements of state, federal and international regulations and may be subject to periodic inspection and testing under those regulations. Recognized authorities may perform inspections and testing in the facility's region.

Written operating instructions should be available at all transfer points, covering the applicable procedures for Acetonitrile transfer. Personnel at all filling points must be fully trained in the implementation of the instructions. Both routine and emergency transfer situations should be covered in the written instructions.

An inspection check list is recommended for evaluating the condition of Acetonitrile transport equipment. The evaluation should be performed before, during and after transfer.

All necessary protective clothing and emergency equipment should be readily available at all key areas of the transfer operation. Personnel should be thoroughly trained in the use of this clothing and equipment. (See Section 6)

Static electricity may build up during the loading or unloading of any Acetonitrile transport mode. Acetonitrile must not be splash loaded. An approved grounding connection should be used during loading and unloading, and the grounding system should be checked periodically.

Nitrogen blanketing substantially reduces the potential for flammability of vapors above the surface of liquid Acetonitrile. Nitrogen blanketing is used in closed cargo transfer handling systems during loading and unloading of truck, rail car or marine transport equipment. See Section 3 for further explanation of nitrogen blanketing.

Transfer of Acetonitrile at a customer's facility is the customer's responsibility. Technical and safety information is available from INEOS.

### Marine Safety

All ships should be approved for cargo transfer based on a recognized standard of marine safety.

A ship/shore check list or "Declaration of Inspection" should be completed to confirm that the vessel and the terminal have compatible equipment for the safe transfer of Acetonitrile.

All cargo lines used in the loading and unloading operation should be pressure tested with nitrogen for confirmation of a contained, closed system and its integrity. This testing should be witnessed by a terminal representative, an approved cargo surveyor or a INEOS representative. Special tank cleaning and inspection procedures are required for High Purity grade Acetonitrile.

Nitrogen blanketing of a ship's cargo tanks is not required under international regulations. However, nitrogen blanketing is recommended for some transfer situations. Certain storage terminals are equipped with vapor control balance systems. Vessels transferring Acetonitrile to such terminals should be nitrogen blanketed to reduce the oxygen level to less than 8 percent. Also, all ship cargo tanks should be nitrogen blanketed.

If flaring of loading vapors is considered, take extra precautions to prevent flashback and other hazards.

## **Truck, ISO Tank and Rail Car Safety**

Strict inspection should be performed before each load of Acetonitrile is loaded into an ISO tank container, bulk truck or rail car. All new truck/rail transport equipment should be inspected by a recognized professional prior to initial loading. Likewise, all transport equipment should be inspected prior to loading and after service, maintenance or repair. Truck and rail transport equipment should be nitrogen blanketed at a pressure of 1-3 psi.

## **Drum Safety**

Acetonitrile arriving in drums should not be unloaded until the delivery vehicle is in its final unloading position – with all appropriate braking precautions in place.

Leaving vehicle doors open for several minutes will allow for ventilation before unload personnel enter a cargo area containing drums of Acetonitrile.

Prior to unloading, the driver should inspect the drums for leakage. If a leak is found, all unload personnel should leave the area and report the leak to the facility's authorities. The shipper should also be notified of the leak.

Unload drums with appropriate equipment, such as a fork lift.

Store the drums where they can be protected against potential sources of puncture.

Once emptied of Acetonitrile, dispose of drums in a safe, environmentally responsible manner. At a minimum, drums should be emptied of all product and rinsed three times with water. The rinse water should then be drained into a suitable water treatment system.

## Section 5: Fire Safety

### Fire-Related Chemical Properties

Acetonitrile is a flammable liquid requiring safe handling to avoid fire or explosion. The chemical must not contact an open flame. At room temperature, Acetonitrile vapors combined with air form flammable or explosive mixtures. Acetonitrile vapors are heavier than air and may travel considerable distances or settle in low-lying areas. Acetonitrile vapors may explode in the presence of a source of ignition. Ignited vapors also have the potential to “flash back” to the origin of the vapor, creating another fire hazard at the source. Refer to Section 2 for flammability data.

### Prevention

The most effective way of preventing an Acetonitrile fire is to keep Acetonitrile vapors contained or keep them from a source of ignition. Vapor emissions should be controlled, and monitoring for accidental vapor releases should be performed to guard against possible ignition. Sources of ignition (electricity, static, etc.) should be eliminated in areas generating unavoidable vapors, or where accidental vapor releases are highly probable. All mechanical equipment used near Acetonitrile storage and handling areas must be designed for low flammability (intrinsically safe). Also, fire fighting equipment, sufficient for the maximum incident potential, should be readily at hand in these areas.

Acetonitrile fires may be extinguished with:

- foam - AFFF (aqueous film forming foam) that is alcohol resistant is recommended for extinguishing polar solvents such as Acetonitrile. Protein and other foams may be ineffective.
- dry chemical - Potassium bicarbonate-based dry chemical
- carbon dioxide/Halon® - substitute

Water alone is ineffective as an extinguishing agent. However, it may be used to cool fire-exposed containers, to disperse vapors, to protect personnel or to flush spills away from sources of ignition.

Exposed firefighters should wear approved self-contained breathing apparatus with full face mask and full protective equipment. For advanced or massive fires, fire fighting should be done from a safe distance or protected location.

Care must be exercised in determining sufficient fire fighting ability when confronting an incident. The potential for a small fire to increase rapidly into a major fire should be anticipated. A single fire fighter should immediately notify other emergency response personnel who will be ready to assist if the fire increases.

### Decomposition Products

Burning Acetonitrile may produce toxic gases such as hydrogen cyanide, nitrogen dioxide, carbon monoxide or carbon dioxide. Emergency response personnel as well as the surrounding population must be protected against exposure to these gases. Evacuation procedures should be in place in all work and public areas adjacent to Acetonitrile storage and handling facilities. Run-off from fighting an Acetonitrile fire should be contained to prevent harm to the surrounding public and environment.

## Section 6: Occupational Safety and Health

The possibility of exposure exists for those who manufacture, transport, handle and use Acetonitrile. Exposure to high concentrations of Acetonitrile in the air, significant skin or eye exposure, or ingestion of Acetonitrile can result in serious illness and even death. Workplace fatalities have been documented in painters applying Acetonitrile-containing paint, and in a laboratory worker using Acetonitrile as a general cleaning solvent. Fatalities have also been documented in adults and children following ingestion of Acetonitrile-containing consumer products.

### Signs and Symptoms of Short Term Overexposure

Acetonitrile is readily absorbed into the body following inhalation or ingestion; it is less well absorbed following dermal exposure. Acetonitrile's acute toxic effects are believed to be mediated, at least in part, by its conversion by the body to cyanide, and the signs and symptoms are like those of acute cyanide poisoning. Toxic effects usually appear several hours after exposure. Signs and symptoms of acute Acetonitrile intoxication include eye irritation, headache, irritation of the throat and mucous membranes, nausea, vomiting, weakness, chest pain, tightness in the chest, rapid heart rate, reduced blood pressure, short and shallow breathing and lightheadedness. Death can occur if appropriate medical treatment is not administered. Animal experiments indicate that inhalation of airborne concentrations above 3,000 ppm for four hours may be fatal. No serious effects were reported in healthy volunteers exposed to 160 ppm acetonitrile vapor for four hours. Ingestion of 1 to 2 grams of Acetonitrile per kilogram of body weight has been reported to be fatal in humans.

### Chronic Health Effects

Acetonitrile does not accumulate in the body. No studies have been reported that investigate the chronic health of workers exposed to low levels of Acetonitrile. The chronic toxicity of Acetonitrile has been investigated by the U.S. National Toxicology Program (NTP). The primary focus of NTP's experimentation was evaluation of Acetonitrile's cancer causing potential in long-term laboratory animal experiments. In these experiments, rats and mice were exposed to airborne Acetonitrile concentrations up to 400 ppm or 200 ppm, respectively, for a lifetime (2 years). In

reporting the findings of experiments the NTP concluded that long-term exposure to maximum doses produced no evidence of carcinogenic activity in male mice, female mice or female rats. Findings in male rats exposed to the maximum dose were considered to be suggestive of adverse liver changes.

Experiments investigating the potential of Acetonitrile to induce developmental abnormalities in the fetuses of exposed rats have also been reported. No adverse effects were noted on fetuses at doses up to and exceeding the maximum which could be tolerated by the pregnant dams. Overall, results of genotoxicity assays, reported by a variety of investigators, show a lack of such potential.

For further information on the health effects of Acetonitrile, please refer to INEOS's most recent Material Safety Data Sheet (MSDS).

### First Aid and Medical Response

This section is designed to assist non-medical personnel in treating individuals exposed to Acetonitrile. Qualified medical personnel should be consulted as soon as possible after exposure to Acetonitrile. The health effects of acute exposure to Acetonitrile can be reversed through decontamination and appropriate first aid. Length of exposure and concentration, particularly of vapors in air, will determine the consequences of exposure to Acetonitrile.

All chemical handling facilities should be equipped with "quick drenching" stations, including emergency wash stations and showers. These stations must be located for easy access to all personnel throughout the plant. Employees must be trained in the use of this equipment, and the equipment must be regularly inspected, maintained, and tested to verify proper operability.

### Emergency First Aid

Call for assistance immediately, and begin treatment for the following:

- **Eye Contact** – Flush immediately with large amounts of tepid water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. If irritation, pain, swelling, watery eyes or light sensitivity persists after 15 minutes, seek qualified medical follow-up. Also see treatment for inhalation on the following page.



- **Skin Contact** – Thoroughly wash the affected area. If irritation or pain persist after washing, seek qualified medical attention. Also see treatment for inhalation. Any clothing soaked with Acetonitrile should be removed immediately. Enclose contaminated articles in a plastic bag to prevent further exposure. Before reuse, contaminated clothing must be washed in an appropriate hazardous waste containment laundry system. Contaminated leather shoes, belts, wallets or clothing must be discarded, since it has been demonstrated that they cannot be adequately decontaminated.
- **Inhalation** – Affected individuals, especially if unconscious, must be moved from the toxic environment to fresh air immediately; if available, administer 100 percent oxygen. If breathing has stopped, perform mouth to mask or Ambu bag resuscitation. If breathing and pulse are not detected, perform cardiopulmonary resuscitation. If Acetonitrile poisoning is suspected and consciousness is impaired or decreasing, the individual should be treated aggressively for cyanide poisoning.

- **Ingestion** – If Acetonitrile is swallowed, do not induce vomiting. Vomiting may cause the individual to draw vomit into the lungs. Any person with potential ingestion of Acetonitrile Containing products (Acetonitrile as major component) should be taken to a hospital.

## Exposure Limits

Occupational exposure to Acetonitrile is governed by regulations and guidelines established to protect employees from potentially harmful chemical effects. Many countries have determined reasonable occupational exposure limits for Acetonitrile. For a partial list of those limits, see Table 6.1.

## United States Exposure Limits

In the United States, three organizations have developed limits for exposure to Acetonitrile. These limits should be used as a guide in assessing and controlling work-related exposures.

**Table 6.1: Sample of Acetonitrile Exposure Limits**

Country	Time Weighted Average (TWA) (usually 8 hours)	Short Term Exposure Limit (STEL)
Belgium	40 ppm; Skin	60 ppm (15 minute)
France	40 ppm; Skin	
Germany	20 ppm; Skin	40 ppm (15 minute)
Korea	40 ppm	60 ppm (15 minute)
Netherlands	20 ppm	
Singapore	40 ppm	60 ppm (15 minute)
Switzerland	20 ppm	40 ppm
United Kingdom	40 ppm	60 ppm
United States		
OSHA-PEL	40 ppm	
NIOSH-REL	20 ppm	
ACGIH-TLV	20 ppm; Skin A4 - Not classified as a human carcinogen	Not specified

## OSHA-PEL

The Occupational Safety and Health Administration (OSHA) has developed an exposure limit for Acetonitrile. No employee should be exposed to an airborne concentration of Acetonitrile in excess of forty (40) parts of Acetonitrile per one (1) million parts of air, or 40 ppm, during an eight (8) hour, timeweighted average - the Permissible Exposure Limit (PEL).

Acetonitrile can affect the body if it or its vapor comes in contact with the skin or the eyes, or if they are inhaled or swallowed. Therefore, the maximum concentration of Acetonitrile exposure allowed over an eight (8) hour workday is 40 ppm.

Acetonitrile odor cannot consistently be detected below 60 ppm. Since this concentration is above the Permissible Exposure Limit, when Acetonitrile odor is detected anyone exposed to it must move to fresh air immediately.

Acetonitrile exposure levels above 40 ppm and skin or eye contact with the chemical must be prevented. To do so, appropriate controls must be in place – engineering controls, such as revision in process design or additional ventilation; administrative controls such as worker rotation; and approved worker safety controls, such as personal protective equipment.

## NIOSH-REL

The National Institute for Occupational Safety and Health (NIOSH) has developed a Recommended Exposure Limit (REL) of twenty (20) ppm as an eight (8) hour time-weighted average with a skin notation. Because of its ability to form cyanide in the body, NIOSH has also determined that 500 ppm is the Immediately Dangerous to Life and Health (IDLH) value for Acetonitrile in air.

## ACGIH-TLV

The American Conference of Governmental Industrial Hygienists (ACGIH), in 2002, established twenty (20) ppm as the Threshold Limit Value (TLV) for an eight (8) hour time-weighted average period. The skin designation has been added to advise that significant exposure is possible through skin absorption. The A4 designation has also been added indicating that Acetonitrile is “Not Classified as a Human Carcinogen.” The former STEL has been dropped.

## Selecting Acceptable Exposure Limits

Facilities selecting and applying acceptable Acetonitrile exposure limits should consult locally prevailing government standards, which should be met as a minimum. Limits for short-term exposure should also be applied where acceptable exposure limits are likely to be exceeded for tasks of short duration, usually 15 minutes or less.

## Monitoring for Acetonitrile Exposure Levels

There is no direct reading instrument that specifically measures airborne concentrations of Acetonitrile. A photoionization detector can be satisfactorily used to assess airborne Acetonitrile levels. However, the user should be aware that the presence of other organic vapors can result in inaccurate or misleading readings. Personnel sampling may be conducted using a personal sampling pump and charcoal tube. Monitoring must be done initially to establish a baseline, and whenever there are changes in the production process, control or personnel. A (statistically) representative number of eight (8) hour PEL measurements should be collected. Also, non-routine activities such as a periodic maintenance procedures may require more frequent or additional monitoring.

Monitoring to evaluate a worker's eight (8) hour exposure potential is performed using NIOSH Method 1606. To perform this method, Acetonitrile vapor is collected on charcoal adsorption tubes. The collected vapor is then desorbed by solvent and the amount of Acetonitrile present is determined by gas chromatography using a flame ionization detector.

Regardless of the monitoring method used, the results must be at a confidence level of 95 percent. The confidence level must be accurate within plus or minus 35 percent for concentrations at or above the acceptable exposure limit, or within plus or minus 50 percent for concentrations below the acceptable exposure limit.

## Personal Protective Equipment

When effective engineering controls are not feasible, or while they are being instituted, respiratory protection may be used to reduce employee Acetonitrile exposure to within permissible exposure limits.

## Skin Protection

Impermeable protective clothing must be used by all employees who work in locations where Acetonitrile is likely to come in contact with the eyes or the skin. It must also be ensured that employees wear the appropriate protective clothing in all applicable Acetonitrile work locations.

Impermeable protective clothing includes rubber gloves, chemical boots and suits, and splash-proof safety goggles or face shields. These items, and other Acetonitrile protective clothing must be made from material specifically recommended for protection against Acetonitrile penetration. Also, the duration of the job task, the thickness of the protective clothing materials, and the “breakthrough time” must also be considered in selecting appropriate protective wear. Breakthrough time is the amount of time the material will keep out Acetonitrile liquid before penetration takes place. See Table 6.2 Impervious Materials Data for Acetonitrile Protection for details.

Other considerations in selecting the proper materials should include the effects of temperature, pressure and the need for flexibility.

## Respirator Selection

All respirators used in Acetonitrile operations must be designed specifically for use with Acetonitrile. In the United States, selection of a suitable respirator should be made from those jointly approved by the Mine Safety and Health Administration (MSHA) and NIOSH. Specific selection criteria include:

- information on general conditions of use;
- physical, chemical and toxicological properties of Acetonitrile;
- odor threshold data;
- NIOSH recommended exposure limit;
- OSHA permissible exposure limits;
- IDLH value;
- eye irritation potential;
- service life for canisters and cartridges.

**Table 6.2: Impervious materials data for Acetonitrile protection**

Material	Breakthrough (minutes)
butyl rubber	>480
neoprene	30
polyvinyl alcohol (PVA)	150
DuPont CPF® 4	>480
DuPont Responder®	>480
Siebe North Silver Shield®	>480

\*Although this information provides a general overview of protection factors for various types of chemical protective clothing, specific data and use limitations from protective clothing manufacturers should be consulted prior to selection.

Respirators should be tested and serviced on a regular basis. Inspection and replacement of worn or deteriorated parts must be performed regularly, as well as regular cleaning and disinfecting. All respirator equipment should be stored in a clean, sanitary location.

## Respirator Use

Respiratory protection should be used in the following circumstances:

- during the installation of engineering controls;
- during maintenance and repair activities;
- during reactor cleaning where use of engineering controls is not feasible;
- when available engineering controls are not sufficient to reduce exposure below permissible exposure limits;
- during emergencies;
- in any situation where monitoring finds Acetonitrile vapor concentrations above applicable exposure limits.

## Employee Training

Employers must provide respirators to employees working in areas where exposure is likely to reach or exceed the acceptable exposure limit. Employees should be trained in the use and necessity of respirators and employers must provide necessary respirators at no cost to the employee.

Employee training should include instruction and “hands-on” use of the respirator – including proper fit and adjustment; the impact of glasses or facial hair on maintaining a tight seal; and, the need for periodic testing of equipment to ensure continued protection. Site-specific training should also be conducted to alert employees to the various areas of the facility where protection is mandatory. Instruction should also include training on the selection and limitations of respiratory protection.

All employees should be given a medical examination to determine whether each is physically able to perform the required work while wearing a respirator. Employee medical status should be reviewed annually.

The use of respirators in Acetonitrile operations must comply with a written respiratory protection procedure – including a list of specific respirators that must be worn at specific work stations, and when each respirator must be worn. The procedure must also instruct employees to:

- inspect the face piece and perform positive and negative pressure tests to verify functionality and to ensure a proper fit before each use;
- label the cartridge with the date and time of installation;
- discard the cartridge at the end of each shift or, as an alternative, describe a change-out schedule based upon an objective and documented evaluation of suitable service life for specific exposure circumstances;
- keep the respirator securely sealed at all times in the work area.

Employers should periodically confirm that proper procedures for respirator use are consistently followed by all employees.

# Section 7: Emergency Response & Environmental Protection

Emergency response to an unplanned release of Acetonitrile may never occur if the chemical is stored and handled properly at all times. However, as with all hazardous substances, accidents are always possible. Therefore, sufficient emergency response capability is a necessity for responsible management of a hazardous chemical facility.

The preparation conducted before an emergency occurs is the most important part of an effective emergency response plan. All facilities should develop a thorough plan covering all possible consequences of an Acetonitrile emergency, including problems that might be specific to a particular site. Emergency response plans should be tested through periodic drills that involve all emergency response personnel, both on-site and in the local community.

Note: This section is only a summary of the steps needed to execute an effective emergency response to an Acetonitrile release. See other sections of this booklet for fire fighting procedures and emergency medical response.

## Definition of Emergency

An “emergency” is any occurrence resulting in the unexpected, significant release of Acetonitrile. In an Acetonitrile “emergency,” loss of containment has occurred and must be stopped in order to protect employees, the public and/or the surrounding environment.

An incident confined to a limited area, which can be handled by on-site, trained personnel using proper protective clothing and equipment, is not considered an emergency situation. Non-emergency situations can include malfunctioning pumps, defective lines, or leaking valves or seals. Also, small spills may occur but can generally be handled without alarm.

## Initial Response Activities

All chemical facilities should be equipped with a plantwide emergency notification system or alarm.

Emergency response personnel should determine the need for respiratory protection, (primary) exposure monitoring, evacuation procedures, and other immediate activities.

The emergency area, or “hot zone,” must be surrounded and sufficiently barricaded in order to control access and to prevent inadvertent exposure to the chemical.

Acetonitrile vapors are heavier than air and travel along the ground. Any spark or flame could ignite the vapors and could cause a “flash back” to the source of the release. Flash backs have the potential for causing explosion.

With the accidental release of any flammable substance, including Acetonitrile, all “hot work” such as welding and vehicular traffic in the area must be stopped immediately.

All reasonable efforts must be made to stop the flow of Acetonitrile into the emergency situation, such as closing valves or shutting off pumps and electrical circuit breakers.

## Evacuation

The area surrounding an Acetonitrile emergency should be evacuated immediately. The scope of the evacuation should be determined by the size of the spill, the wind direction, and whether or not a loss of containment can be stopped.

“Shelter in place” is the best response in certain circumstances. However, this determination must only be made by experienced professionals, such as community emergency response crews or fire fighters in hazardous materials response.

## Communication

Local emergency response authorities should be immediately notified of an Acetonitrile emergency. Consult local and national regulations for notification requirements. Many government agencies require immediate notification of specific agencies and reporting of estimated chemical quantities involved in the emergency.

In the United States, Acetonitrile is listed as a CERCLA hazardous substance and EPCRA extremely hazardous substance with a Reportable Quantity (RQ) of 5000 pounds (about 760 gallons). Releases of Acetonitrile above the RQ are subject to the “immediate” reporting requirements contained in the regulations and includes notification of the National Response Center, the Local Emergency Planning Committee and the State Emergency Response Commission.

## Emergency Rescue

The first response crew at the scene must wear, at a minimum, a self-contained breathing apparatus (SCBA) for respiratory protection and chemical protective clothing for skin protection against liquid or high vapor level contact.

This protection must be maintained until air monitoring can determine the concentration of Acetonitrile vapors which will assist in the determination of the appropriate protection.

Exposure readings should be taken by trained individuals at a safe distance from the source, preferably up wind. A reading of 500 ppm in air is considered immediately dangerous to life or health. A SCBA and a totally-encapsulating chemical protective suit are unconditionally required in concentrations of 500 ppm or more.

## Decontamination

A suitable location must be selected for primary decontamination – safely cleaning of personnel, equipment and supplies after exposure. This is one of the most important steps in assuring personal safety during and immediately after an emergency.

The entry point to the decontamination area should be clearly marked. Persons leaving the “hot zone” should immediately pass through a shower, proceeding to decontaminate using soap and water. Any contaminated equipment should be decontaminated if possible. Contaminated equipment that cannot be decontaminated should be left in the area and properly disposed of. Run off water should be directed to a safe area for treatment and disposal.

## Environmental Protection

A release of Acetonitrile can severely impact the environment if not properly managed. Therefore, safeguards must be in place throughout the Acetonitrile production and handling process to prevent or minimize release of the chemical to the environment. These include processes engineered to minimize emissions, properly designed pollution control equipment and handling procedures developed to anticipate and prevent releases to the environment. Nonetheless, emergency response plans should be developed to mitigate the environmental impact from a release of Acetonitrile.

## Environmental Regulation

Most countries regulate the production, handling, storage and release and disposal of Acetonitrile and its byproducts through comprehensive environmental laws or standards. However, Acetonitrile production and handling facilities

outside of the United States may be regulated much differently than those within the U.S. It is always prudent to consult with local, regional and national regulatory authorities regarding the applicable environmental standards for an Acetonitrile production or handling facility. Generally, environmental requirements and industry standards can be obtained from industry and trade associations. INEOS’s Health Safety and Environment Group can also provide assistance with regulatory compliance issues.

## Regulatory Information

The product and uses described herein may require product registrations and notifications for chemical inventory listings, or for specific uses (e.g. related to foods, drugs, pesticides, medical devices). The U.S. Product Safety Commission requires Child Resistant Packaging for some household products containing more than 500 mg. of acetonitrile in a single container.

## Health and Safety Information

The product described herein may require precautions in handling and use because of toxicity, flammability, or other consideration. The available product health and safety information for this material is contained in the Material Safety Data Sheet (MSDS) that may be obtained by calling +1-866-363-2454 (Toll Free-North America). Before using any material, a customer is advised to consult the MSDS for the product under consideration for use.

The Material Safety Data Sheet for this product contains shipping descriptions and should be consulted, before transportation, as a reference in determining the proper shipping description. If the material shipped by INEOS is altered or modified, different shipping descriptions may apply and the MSDS of the original material should not be used.

For additional information, on samples, pricing and availability, please contact:

INEOS Nitriles  
Customer Service  
2600 South Shore Blvd.  
League City, TX 77573  
Toll-free: 866-363-2454  
Fax: 866-398-8807

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