



Standard Practice for Sampling and Handling Aniline¹

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1. Scope

1.1 This practice covers procedures for sampling and handling aniline.

1.2 Any person sampling or handling aniline should have specific first aid instructions and equipment available for use in the event of personal contact or exposure.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific hazard statements, see Sections 3, 4, 5, 6, 7 and 8.

2. Referenced Documents

2.1 ASTM Standards:

E 300 Practice for Sampling Industrial Chemicals²

2.2 Other Documents:

OSHA Regulations, 29 CFR, paragraphs 1910.1000 and 1910.1200³

DOT Regulations, 49 CFR, Subchapter C; Parts 171-180³

3. Description of Product

3.1 Typical Properties and Characteristics (See Table 1):

3.2 *Stability*—Aniline is a stable material under normal conditions. It does not decompose at its boiling point or when exposed to high environmental temperatures for long periods. Although the vapor given off at elevated temperatures is flammable, aniline can be handled with little danger of fire. Should aniline ignite, it may be successfully extinguished with water, applied in the form of a fog or spray (see 4.2).

3.3 *Solubility*—Aniline is miscible with alcohol, ether, benzene, and most organic solvents. It is only slightly soluble in water.

3.4 Classification and Regulations:

3.4.1 Aniline is classified as a Class 6 Poison by DOT and the United Nations. As such, it must be packaged in DOT specification containers when shipped by rail, water, or high-

TABLE 1 Typical Properties and Characteristics of Aniline

Chemical names	aniline, aminobenzene, benzenamine, phenylamine
Common names	aniline, aniline oil blue-oil
Empirical formula	C ₆ H ₅ NH ₂
Physical form	oily liquid at normal temperature
Color	colorless to light yellow (clear)
Light sensitivity	tends to become amber brown in color upon exposure to air and light
Boiling point	184.2°C (364°F) at 760 mm Hg
Specific gravity	1.022 at 20/4°C
Solidification point, anhydrous basis, min	-6.2°C (21°F)
Explosive limit lower	1.3 volume % in air
Flash point	
Closed cup	70.0°C (158°F)
Open cup	75.6°C (168°F)
Ignition temperature	1418°F ^A
Odor threshold	0.5 ppm ^A
Poisonous gas produced	when heated ^A

^AWeiss, G. *Hazardous Chemicals Data Book*, Second Edition.

way, and all of the DOT Regulations regarding loading, unloading, handling, labeling, and other functions must be followed.

3.4.2 Department of Transportation (DOT) Regulations regarding the shipping of this chemical are specified in 49CFR. Regulations include the handling of aniline packages and return of empty containers. All containers should carry an identifying label or stencil and must bear the DOT POISON label. Aniline is ordinarily transported in tank cars, tank trucks, or metal drums. Sample shipped by air must be packaged to comply with IATA regulations.

3.5 *Toxicity*—Although aniline is highly toxic, it may be handled safely if proper precautions are observed. The odor of aniline can be positively detected at 1.1 ppm in the atmosphere by 50 % of people.⁴ Avoid contact with skin. Maintain adequate ventilation.

4. Hazards

4.1 Consult current OSHA regulations, supplier's Material Safety Data Sheets, and local regulations for all materials utilized in this practice.

4.2 Health:

4.2.1 Aniline is highly toxic and may enter the body easily and rapidly by absorption through the skin, by ingestion, or by

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² *Annual Book of ASTM Standards*, Vol 15.05.

³ Available from Superintendent of Documents, Government Printing Office, Washington, DC 20402.

⁴ "Odor as an Aid to Chemical Safety: Odor Thresholds Compared with Threshold Limit Values and Volatilities for 214 Industrial Chemicals in Air and Water Dilution," *Journal of Applied Toxicology*, August 1983.

inhalation of the vapor. The most common incidences of accidental poisoning are due to spillage of the liquid on the skin or clothing resulting in direct skin contact or the prolonged inhalation of vapor because of inadequate ventilation.

4.2.2 Aniline causes the oxygen-carrying pigment in the blood, hemoglobin, to change to a form known as methemoglobin; thus the ability of the blood to transport oxygen to tissues is reduced in aniline poisoning. The systemic effects of poisoning varies with the intensity of the exposure. Cyanosis, the most common symptom of aniline poisoning, is characterized by a bluish tinge which results from the inadequate oxygenation of tissues. Discoloration is most noticeable on the cheeks, lips, ears, fingernail beds, or oral membranes. When the liquid has penetrated the skin, the area of contact will sometimes appear cyanotic. Poisoning may also give rise to headaches, palpitation, dizziness, nausea, difficult breathing, convulsions, and psychic disturbances. Aniline is likewise a mild irritant to the eyes and could cause corneal damage. If a splash occurs, wash the eyes with profuse amounts of water for a minimum duration of 15 min. In all cases, contact a physician as soon as possible.

4.2.3 The threshold for *aniline-skin* is 2 ppm (10 mg/m³ of air) as defined by the American Conference of Governmental and Industrial Hygienists. The most potential contribution to the overall exposure to aniline is by the cutaneous route, either by airborne, or more particularly, by direct contact with the skin. Therefore, the threshold limit value for aniline-skin is 2 ppm to suggest appropriate measures for the prevention of cutaneous absorption so that the threshold limit is not invalidated. With respect to airborne exposure, the threshold limit value of aniline is 2 ppm (10 mg/m³ in air) for an 8-h working exposure. Short term inhalation limits are 50 ppm for 30 min.

4.3 Fire:

4.3.1 Aniline has a flash point of 70°C well above room temperature. Consequently, ignition in air is difficult and the rate of flame propagation is slow. Fires involving aniline can be extinguished with carbon dioxide, dry chemical, and water fog. If water is used on an aniline fire in which the liquid temperature is near or above the boiling temperature of water, there will be a boil-over as a result of rapid steam formation and spattering of the aniline. This increases the toxic hazard. Therefore, in fighting large fires use fog, foam, or spray in preference to a solid stream of water.

4.3.2 Always avoid skin contact or inhaling of vapors while combating a fire. Fire fighters must be equipped with standard fireman's clothing plus respiratory protection.

4.4 For chemical emergency (spill, leak, fire, exposure or accident), call CHEMTREC day or night at 800-424-9300. For emergency calls outside the United States call 703-527-3887. (Collect calls are accepted and all calls are recorded.)

5. Protective Equipment

5.1 Persons handling aniline must use proper protective equipment. Wearing a chemical protective suit with self-contained breathing apparatus is generally recommended. However, protective equipment is not an adequate substitute for safe working conditions, proper ventilation, and good work practices. Personal protective equipment only protects the worker wearing it and other unprotected people in the work

area may still be exposed to danger. Education of the worker in the proper use of protective equipment is essential.

6. Precaution

6.1 Any person sampling or handling these products should have specific first aid instructions and equipment available for use in the event of personal contact or exposure.

6.2 Conduct sampling and handling operations only by carefully instructed, experienced, reliable employees, under adequate supervision.

6.3 Accomplish loading, unloading, and sampling operations only when adequate lighting is provided.

6.4 Take extreme care to avoid spills and leaks. In case of a spill, wash contaminated areas thoroughly with large quantities of water and collect the liquid in the local chemical waste system. All spill-related activities should comply with applicable EPA, and OSHA and local regulations and laws.

6.5 Follow shipper's instructions always, and read and observe all caution markings on containers.

6.6 Although the vapor given off at elevated temperatures from phenol or cresylic acid will ignite, these materials can generally be handled with little direct danger of fire. The flash points of the liquids are higher than the temperatures at which they are normally handled. In spite of this, carefully restrict open flames and smoking in the vicinity of loading, unloading, and storage operations.

6.7 Do not permit any person ever to enter an empty aniline tank, tank car, or tank truck until it has been thoroughly washed out with warm water, followed by a thorough steaming. Ensure that oxygen content is acceptable and vessel is free of organic vapors. Require the approval and observation by a supervisor in every case. Review Sections 7 and 8 in detail.

6.8 Allow no eating or drinking in close proximity to the aniline handling or sampling operation.

6.9 Employees shall:

6.9.1 Know the hazards connected with the handling of aniline.

6.9.2 Be completely acquainted with the purpose, use, and maintenance of personal protective equipment;

6.9.3 Be trained to report promptly to supervision all suspected leaks or equipment failures;

6.9.4 Be trained to recognize and report symptoms of systemic poisoning or skin contact; be thoroughly trained in the proper procedures for administering first aid and for obtaining professional medical help;

6.9.5 Know and routinely practice the accepted methods of sampling and handling aniline in order to avoid spilling or splashing, leaks, skin contact, vapor or mist inhalation, or ingestion;

6.9.6 Be completely familiar with the location and operation of safety showers, eye baths, hose lines, and all other first aid equipment; and

6.9.7 Know the importance of personal cleanliness and the necessity for immediate removal of clothing contaminated with aniline.

7. Unloading of Tank Cars or Tank Trucks

7.1 Always keep in mind that the main hazards are exposure

to liquid aniline and toxic fumes. Personal protective equipment is not an adequate substitute for safe working conditions and intelligent conduct on the part of employees working with aniline. Furthermore, the correct usage of personal protective equipment requires the education of the worker in the proper employment of the materials available to him.

7.2 Level and secure any tank car or tank truck against movement during unloading. In the case of tank cars, use derails. Set the truck brakes and block the wheels.

7.3 Prior to unloading, read and observe all caution markings on both sides of the transport and the dome. Equip each transport with a safety valve and an approved rupture disk, in accordance with DOT specifications.

7.4 Sample the contents of the tank car or tank truck through the open dome or manhole. The person taking the sample must wear the proper protective equipment (see Section 5).

7.5 The preferred method for unloading tank trucks is by pump and not air pressure. Unloading of tank cars through a dip leg inserted in the dome is preferred to bottom unloading. Do not use air pressure for unloading of tank cars. Use of a pump is recommended.

7.6 Inspect lines prior to unloading to ensure that the connections and valve settings are correct and that there are no loose or broken connections. If a spill, leak, or overflow occurs during the unloading, stop the pump or air supply promptly, shut off valves and clean up the spill before other actions are taken. All spill-related activities should comply with applicable EPA, OSHA and local regulations and laws.

7.7 When loading is completed and lines have been drained, close all valves tightly. Table 2 is information for placards and labeling.

8. Sampling of Tank Cars or Tank Trucks

NOTE 1—For full details concerning the proper sampling procedures consult Practice E 300.

NOTE 2—Refer to Section 5 for protective equipment recommendations.

8.1 Aniline is extremely hygroscopic and great care must be taken to obtain a suitable sample and to protect it during the determination of its solidification or boiling points, or both. Since aniline also slowly darkens due to slight oxidation to air and light, take the samples in brown (amber) glass bottles.

8.2 Since aniline is homogeneous, only limited sampling is usually required. Samples may be taken through an open manhole or dome by means of a clean, dry, 1-pt amber bottle held in a clean, dry sheath of stainless steel or nickel attached to a long rod or light-weight chain of the same material (see Fig. 2 of Practice E 300). Avoid copper if the material is to be used for the manufacture of copper-free dyes or rubber chemicals. Iron, in some instances, causes undesired contamination and should be treated in a similar manner.

8.3 Fit the sample bottle with a glass stopper to which is attached a light metal chain. Lower the bottle to an approximate middle of the tank and pull the stopper out with a sharp jerk of the chain. Then raise it at such a rate that it is essentially full when it emerges from the liquid. Stopper the bottle before making any attempt to rinse the material from the outside.

8.4 Emphasis should be placed on cleanliness and dryness. Both the sample bottle and its holder must be *clean* and *dry*. Transfer the sample to another bottle for storage. A suitable bottle for storing the sample is one commonly known as a “Boston Round.” The storage sample bottle must be made of amber glass, with a screw cap closure fitted with a polyethylene liner.

8.5 Label the sample container to indicate, as a minimum, the date and time, source of the sample, type of material, quantity, hazards, purpose of the sample, and the name of the sample, in accordance with OSHA regulations.

9. Handling and Sampling of Drums

9.1 Aniline is usually shipped in 55-gal steel drums. The following types are normally utilized: UN standard 1A1 steel drums not over 55 gal in capacity and with welded seams and reinforced chimes; which have passed required performance tests for at least Packing Group II. Do not use paraffin- or plastic-lined drums. Mild steel or cast iron are not recommended if discoloration is to be kept at a minimum.

9.2 If proper precautions are taken, drums may be used for storage. Store them under a shed-type roof to protect them from the direct sun. Handle containers carefully to prevent damage, and examine shipments carefully for leaking drums. Drums are not pressure containers and must be emptied by using a self-priming, hand or motor-driven pump, or by gravity flow.

9.3 It is necessary that the operator wear goggles, and a chemical protective suit (a self-contained breathing apparatus might also be required if testing indicates significant exposure), and use a bung or plug wrench when removing the body plug from a drum. Place the drum upright, stand to one side and turn your face away during this operation. After the plug starts to loosen, give it not more than one full turn. If internal pressure exists, allow it to escape to the atmosphere. Then the operator can loosen the plug further and remove it.

9.4 If the drums are emptied by gravity, insert a valve or faucet in the end bung and support and block the container to prevent movement.

9.5 It is recommended that a stainless steel sampling tube be utilized for sampling drums. Avoid copper tubing, particularly if the material is to be used for the manufacture of copper-free dyes or rubber chemicals. The tube should be designed so that it will be within 6 in. of the bottom (a detailed description of the drum sampling tube is given in Practice E 300). Insert the

TABLE 2 Bulk Packaging Regulatory Information

NOTE 1—Single packagings not permitted on passenger aircraft per the International Civil Aviation Organization Technical Instructions for the Safe Transport of Dangerous Goods By Air and the International Air Transport Association Dangerous Goods Regulations.

DOT Basic Description	RQ lb	Listed Marine Pollutant?	Packaging Authorization 49 CFR, 173*		Label(s)	Placards	Remarks
			Exception	Non-bulk Bulk			
Aniline, 6.1, UN1547, 11	5000	No	None	202 243	Poison	Poison	see Note 1

open tube through the bung of the upright drum and lower it to the bottom. With the thumb over the upper opening, withdraw the tube (thief) quickly and transfer the contents into a bottle. Wear clean rubber or PVC gloves during this operation. Avoid handling any part of the tube that has been immersed in the liquid. Do not permit the hands to come in direct contact with any part of the sample.

9.6 As an alternative sampling procedure, transfer the sample directly from the sampling tube into a side-arm vacuum

flask by means of siphoning with a double-valve aspirator bulb. Before collecting the sample, thoroughly flush the device with the material being sampled. Then transfer the material from the vacuum flask to the amber-colored sample bottle.

10. Keywords

10.1 aniline; handling; sampling

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