

X. APPENDIX II

MATERIAL SAFETY DATA SHEET

The following items of information, which are applicable to a specific product or material, shall be provided in the appropriate block of the Material Safety Data Sheet (MSDS).

The product designation is inserted in the block in the upper left corner of the first page to facilitate filing and retrieval. Print in upper case letters as large as possible. It should be printed to read upright with the sheet turned sideways. The product designation is that name or code designation that appears on the label, or by which the product is sold or known by employees. The relative numerical hazard ratings and key statements are those determined by the rules in Chapter V, Part B, of the NIOSH publication, An Identification System for Occupationally Hazardous Materials. The company identification may be printed in the upper right corner if desired.

(a) Section I. Product Identification

The manufacturer's name, address, and regular and emergency telephone numbers (including area code) are inserted in the appropriate blocks of Section I. The company listed should be a source of detailed backup information on the hazards of the material(s) covered by the MSDS. The listing of suppliers or wholesale distributors is discouraged. The trade name should be the product designation or common name associated with the material. The synonyms are those commonly used for the product, especially formal chemical nomenclature. Every known chemical designation or competitor's trade name need not be listed.

(b) Section II. Hazardous Ingredients

The "materials" listed in Section II shall be those substances that are part of the hazardous product covered by the MSDS and individually meet any of the criteria defining a hazardous material. Thus, one component of a multicomponent product might be listed because of its toxicity, another component because of its flammability, whereas a third component could be included both for its toxicity and its reactivity. Note that an MSDS for a single component product must have the name of the material repeated in this section to avoid giving the impression that there are no hazardous ingredients.

Chemical substances should be listed according to their complete name derived from a recognized system of nomenclature. Where possible, avoid

using common names and general class names such as "aromatic amine," "safety solvent," or "aliphatic hydrocarbon" when the specific name is known.

The "%" may be the approximate percentage by weight or volume (indicate basis) that each hazardous ingredient of the mixture bears to the whole mixture. This may be indicated as a range or maximum amount, ie, "10-40% vol" or "10% max wt," to avoid disclosure of trade secrets.

Toxic hazard data shall be stated in terms of concentration, mode of exposure or test, and animal used, eg, "100 ppm LC₅₀-rat," "25 mg/kg LD₅₀-skin-rabbit," "75 ppm LC man," or "permissible exposure from 29 CFR 1910.1000," or, if not available, from other sources of publications such as the American Conference of Governmental Industrial Hygienists or the American National Standards Institute Inc. Flashpoint, shock sensitivity, or similar descriptive data may be used to indicate flammability, reactivity, or similar hazardous properties of the material.

(c) Section III. Physical Data

The data in Section III should be for the total mixture and should include the boiling point and melting point in degrees Fahrenheit (Celsius in parentheses); vapor pressure in conventional millimeters of mercury (mmHg); vapor density of gas or vapor (air = 1); solubility in water by weight; specific gravity (water = 1); percent volatiles (indicated if by weight or volume) at 70 F (21.1 C); evaporation rate for liquids or sublimable solids, relative to butyl acetate; and appearance and odor. These data are useful for the control of toxic substances. Boiling point, vapor density, percent volatiles, vapor pressure, and evaporation are useful for designing proper ventilation equipment. This information is also useful for design and deployment of adequate fire and spill containment equipment. The appearance and odor may facilitate identification of substances stored in improperly marked containers, or when spilled.

(d) Section IV. Fire and Explosion Data

Section IV should contain complete fire and explosion data for the product, including flashpoint and autoignition temperature in degrees Fahrenheit (Celsius in parentheses); flammable limits, in percent by volume in air; suitable extinguishing media or materials; special firefighting procedures; and unusual fire and explosion hazard information. If the product presents no fire hazard, insert "NO FIRE HAZARD" on the line labeled "Extinguishing Media."

(e) Section V. Health Hazard Information

The "Health Hazard Data" should be a combined estimate of the hazard of the total product. This can be expressed as a TWA concentration, as a

permissible exposure, or by some other indication of an acceptable standard. Other data are acceptable, such as lowest LD₅₀ if multiple components are involved.

Under "Routes of Exposure," comments in each category should reflect the potential hazard from absorption by the route in question. Comments should indicate the severity of the effect and the basis for the statement if possible. The basis might be animal studies, analogy with similar products, or human experiences. Comments such as "yes" or "possible" are not helpful. Typical comments might be:

Skin Contact--possible systemic poisoning through skin absorption.

Eye Contact--some pain, transient irritation; corneal scarring if prolonged contact.

"Emergency and First-Aid Procedures" should be written in lay language and should primarily represent first-aid treatment that could be provided by paramedical personnel or individuals trained in first aid.

Information in the "Notes to Physician" section should include any special medical information that would be of assistance to an attending physician, including required or recommended preplacement and periodic medical examinations, diagnostic procedures, and medical management of overexposed employees.

(f) Section VI. Reactivity Data

The comments in Section VI relate to safe storage and handling of hazardous, unstable substances. It is particularly important to highlight instability or incompatibility to common substances or circumstances, such as water, direct sunlight, steel or copper piping, acids, alkalies, etc. "Hazardous Decomposition Products" shall include those products released under fire conditions. It must also include dangerous products produced by aging, such as peroxides in the case of some ethers. Where applicable, shelf life should also be indicated.

(g) Section VII. Spill or Leak Procedures

Detailed procedures for cleanup and disposal should be listed with emphasis on precautions to be taken to protect employees assigned to cleanup detail. Specific neutralizing chemicals or procedures should be described in detail. Disposal methods should be explicit, including proper labeling of containers holding residues and ultimate disposal methods such as "sanitary landfill" or "incineration." Warnings such as "comply with local, state, and Federal antipollution ordinances" are proper but not sufficient. Specific procedures shall be identified.

(h) Section VIII. Special Protection Information

Section VIII requires specific information. Statements such as "Yes," "No," or "If necessary" are not informative. Ventilation requirements should be specific as to type and preferred methods. Respirators shall be specified as to type and NIOSH or Mine Safety and Health Administration approval class, ie, "supplied air," "organic vapor canister," etc. Protective equipment must be specified as to type and materials of construction.

(i) Section IX. Special Precautions

"Precautionary Statements" shall consist of the label statements selected for use on the container or placard. Additional information on any aspect of safety or health not covered in other sections should be inserted in Section IX. The lower block can contain references to published guides or in-house procedures for handling and storage. Department of Transportation markings and classifications and other freight, handling, or storage requirements and environmental controls can be noted.

(j) Signature and Filing

Finally, the name and address of the responsible person who completed the MSDS and the date of completion are entered. This will facilitate correction of errors and identify a source of additional information.

The MSDS shall be filed in a location readily accessible to employees exposed to the hazardous substance. The MSDS can be used as a training aid and basis for discussion during safety meetings and training of new employees. It should assist management by directing attention to the need for specific control engineering, work practices, and protective measures to ensure safe handling and use of the material. It will aid the safety and health staff in planning a safe and healthful work environment and in suggesting appropriate emergency procedures and sources of help in the event of harmful exposure of employees.

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MATERIAL SAFETY DATA SHEET

I PRODUCT IDENTIFICATION		
MANUFACTURER'S NAME	REGULAR TELEPHONE NO. EMERGENCY TELEPHONE NO	
ADDRESS		
TRADE NAME		
SYNONYMS		
II HAZARDOUS INGREDIENTS		
MATERIAL OR COMPONENT	%	HAZARD DATA
III PHYSICAL DATA		
BOILING POINT (760 MM HG)		MELTING POINT
SPECIFIC GRAVITY (H ₂ O=1)		VAPOR PRESSURE
VAPOR DENSITY (AIR=1)		SOLUBILITY IN H ₂ O, % BY WT
% VOLATILES BY VOL		EVAPORATION RATE (BUTYL ACETATE=1)
APPEARANCE AND ODOR		

IV FIRE AND EXPLOSION DATA				
FLASH POINT (TEST METHOD)			AUTOIGNITION TEMPERATURE	
FLAMMABLE LIMITS IN AIR, % BY VOL.	LOWER		UPPER	
EXTINGUISHING MEDIA				
SPECIAL FIRE FIGHTING PROCEDURES				
UNUSUAL FIRE AND EXPLOSION HAZARD				
V HEALTH HAZARD INFORMATION				
HEALTH HAZARD DATA				
ROUTES OF EXPOSURE				
INHALATION				
SKIN CONTACT				
SKIN ABSORPTION				
EYE CONTACT				
INGESTION				
EFFECTS OF OVEREXPOSURE				
ACUTE OVEREXPOSURE				
CHRONIC OVEREXPOSURE				
EMERGENCY AND FIRST AID PROCEDURES				
EYES				
SKIN:				
INHALATION:				
INGESTION				
NOTES TO PHYSICIAN				

VI REACTIVITY DATA
CONDITIONS CONTRIBUTING TO INSTABILITY
INCOMPATIBILITY
HAZARDOUS DECOMPOSITION PRODUCTS
CONDITIONS CONTRIBUTING TO HAZARDOUS POLYMERIZATION
VII SPILL OR LEAK PROCEDURES
STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED
NEUTRALIZING CHEMICALS
WASTE DISPOSAL METHOD
VIII SPECIAL PROTECTION INFORMATION
VENTILATION REQUIREMENTS
SPECIFIC PERSONAL PROTECTIVE EQUIPMENT
RESPIRATORY (SPECIFY IN DETAIL)
EYE
GLOVES
OTHER CLOTHING AND EQUIPMENT

IX SPECIAL PRECAUTIONS

PRECAUTIONARY
STATEMENTS

OTHER HANDLING AND
STORAGE REQUIREMENTS

PREPARED BY _____

ADDRESS _____

DATE _____

XI. APPENDIX III

MEDICAL TREATMENT KITS AND FIRST-AID PROCEDURES

Medical Treatment Kits

Two physicians' treatment kits should be immediately available to trained medical personnel at each plant where there is a potential for the accidental release of, or other contact with, nitriles. One kit should be portable so that it may be carried by medical personnel while accompanying a patient to the hospital. The other kit should be kept under lock and key to ensure that it is intact and available when and if needed. The key should be readily available at all times to the work supervisor on duty, and the storage place should be of such construction as to allow accessibility in the event of loss of the key.

Both kits for use by the medical personnel servicing each firm should contain the following as a minimum:

- (a) Two boxes of amyl nitrite (two dozen) ampules (each ampule containing 0.3 ml of amyl nitrite).
- (b) Two ampules of sterile sodium nitrite solution (10 ml of a 3% solution in each).
- (c) Two ampules of sterile sodium thiosulfate solution (50 ml of a 25% solution in each).
- (d) Two sterile 10-ml syringes with intravenous needles.
- (e) One sterile 50-ml syringe with intravenous needle.
- (f) One tourniquet.
- (g) One gastric tube (rubber).
- (h) One nonsterile 100-ml syringe.

The medical personnel servicing a firm where there is a potential for exposure to nitriles should be familiarized with the use of these kits. First-aid kits should be immediately available at workplaces where there is a potential for the release, accidental or otherwise, of nitriles. This

kit should contain, as a minimum, two boxes of ampules (two dozen), each containing 0.3 ml of amyl nitrite. Ampules should be replaced biannually or sooner, if needed, to ensure their potency. The amyl nitrite ampules should be protected from high temperatures. In all cases, the contents of the medical and first-aid kits should be replaced before the manufacturers' assigned expiration dates.

First-Aid Procedures

Speed in the rendering of first-aid treatment is of the utmost importance. The patient should be removed at once to an area free from nitriles or hydrogen cyanide. The rescuer should wear respiratory protective equipment so as not to be overcome or weakened by the agent.

Many victims will have stopped breathing. In this case, it is imperative that efforts at resuscitation be instituted at once and continued without interruption even while other treatment is being administered.

A physician should be summoned immediately. First-aid kits should be readily available at all times. They should be quickly accessible and should be kept in all operating areas where they may be available in case of a spill.

(a) Contact with Skin and Mucous Membranes

(1) If the skin or clothing has become contaminated with nitriles, remove clothing and flush the skin with copious amounts of water. Pay careful attention to underwear, shoes, and socks.

(2) Carry out the specific actions recommended in (c) below.

(b) Internal Ingestion

(1) If the victim is conscious, induce vomiting by having the victim drink a glassful of lukewarm saltwater, soapy water, or mustard water. If the victim is unconscious, omit this step. NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON.

(2) Carry out the specific actions recommended in (a) and (c).

(c) Inhalation

(1) Administer amyl nitrite. If the ampule is not provided with a fabric sleeve, wrap it lightly in a handkerchief or gauze pad, break it, and hold it about 1 inch from the patient's mouth and nostrils for 15 seconds. Repeat five times at 15-second intervals.

Use a fresh ampule every 5 minutes until three or four ampules have been administered. Other drugs and stimulants are rarely necessary and should be administered only by a physician or trained medical personnel under the direction of a physician.

WARNING: First-aiders should keep the ampules away from their own mouths and noses lest they become weak and dizzy and unable to give proper assistance to the victim. Amyl nitrite is flammable, and mixtures with air may be explosive if a source of ignition is present.

(2) Begin resuscitation. Before instituting artificial resuscitation, remove dentures and foreign objects, such as gum and tobacco, and any accumulated oropharyngeal fluids (saliva, etc), from the patient's mouth and pharynx, and pull the tongue forward. If the patient's breathing is weak or has stopped, start artificial resuscitation at the earliest possible moment and continue without interruption until normal breathing has been established or the patient is pronounced dead.

Mouth-to-mouth resuscitation is the preferred method because of its simplicity and effectiveness. It is, however, impossible to administer amyl nitrite while using this method. Therefore, it is advisable to switch to other methods of artificial respiration, such as the Holger-Nielsen armlift, back-pressure method, during the periods when the amyl nitrite is being given.

If a mechanical resuscitator and personnel skilled in its use are available, this equipment may be used instead of other forms of resuscitation.

(3) Keep the patient comfortably warm but not hot.

XII. TABLES AND FIGURE

TABLE XII-1

SYNONYMS FOR SELECTED NITRILES

Acetone cyanohydrin

acetoncianidrina (Ita)
 acetoncyanhydrine (Dut)
 acetoncyanhydrin (Ger)
 acetonecyanhydrine (Fre)
 acetonkyanhydrin (Cze)
 cyanhydrine d'acetone (Fre)
 acetoncianhidrinei (Rum)
 cyanohydrin-2-propanone
 2-cyano-2-propanol
 alpha-hydroxyisobutyronitrile
 2-hydroxy-2-methylpropanenitrile
 2-methylactonitrile
 oxyisobutyric nitrile
 USAF RH-8

Acetonitrile

acetonitril (Ger)
 cyanomethane
 cyanure de methyl (Fre)
 ethanenitrile
 ethyl nitrile
 methane, cyano
 methanecarbonitrile
 methyl cyanide
 USAF EK-488

Adiponitrile

adipic acid dinitrile
 1,4-dicyanobutane
 dinitrile hexanedioic acid
 hexanedinitrile
 hexanedioic acid, dinitrile
 nitrile adipico (Ita)
 tetramethylene cyanide

n-Butyronitrile

butanenitrile
 butyric acid nitrile
 1-cyanopropane
 n-propyl cyanide
 propyl cyanide

Isobutyronitrile

isopropylcyanide
 2-methylpropanenitrile
 2-methylpropionitrile

TABLE XII-1 (CONTINUED)
SYNONYMS FOR SELECTED NITRILES

<p>Glycolonitrile</p> <p>formaldehyde cyanohydrin glycolic nitrile glyconitrile</p> <p>Malononitrile</p> <p>cyanoacetonitrile dicyanomethane malonic dinitrile methane, dicyano- nitril kyseliny malonove (Cze) USAF A-4600</p> <p>Propionitrile</p> <p>cyanoethane ether cyanatus ethyl cyanide hydrocyanic ether propanenitrile propionic nitrile propionitrile</p>	<p>Succinonitrile</p> <p>butanedinitrile deprelin sym-dicyanoethane dinile ethane, 1,2-dicyano- ethylene cyanide ethylene dicyanide succinic acid dinitrile succinic dinitrile succinodinitrile suxil USAF A-9442</p> <p>Tetramethylsuccinonitrile</p> <p>succinonitrile, tetramethyl tetramethylbutanedinitrile</p>
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Adapted from references 3,123,124

Table XII-2
PHYSICAL AND CHEMICAL PROPERTIES OF 10 NITRILES*

Substance	Molecular Formula	Molecular Weight	Specific Gravity	Melting Point (C)	Boiling Point (C)	Flashpoint (C)	Vapor Pressure (mmHg)	Vapor Density	Solubility	Odor	Form
MONONITRILES											
Acetonitrile	CH ₃ CN	41.05	0.786	-43+2	81.6, 760 mmHg 13.0, 50 mmHg -15.0, 10 mmHg	48+7 (Cleveland open cup)	73.0 at 20 C 87.0 at 24 C 100.0 at 27 C 310.0 at 55 C	1.42	Miscible with water, methanol, ethyl alcohol, ether, chloroform, acetone, carbon tetrachloride, ethylene chloride	Ethereal	Liquid
Propionitrile	CH ₃ CH ₂ CN	55.08	0.782	-98+6	97.1-97.4	61 (open cup)	35.2 at 20 C	1.90	Miscible with water, alcohol, ether
n-Butyronitrile	CH ₃ (CH ₂) ₂ CN	69.11	0.793	-112.6	116-117, 760 mmHg	79 (open cup)	14.0 at 20 C	-	Sl sol in water; sol in benzene, miscible with alcohol, ether, dimethylformamide	Sharp, suffocating	..
Isobutyronitrile	(CH ₃) ₂ CHCN	69.11	0.773	-75	107	-	-	-	Sl sol in water; sol in acetone; very sol in alcohol, ether	-	..
CYANOHYDRINS											
Glycolonitrile	CH ₂ (OH)CN	57.05	1.104	-	183, 759 mmHg with slight decomposition	-	119 at 24 C	1.97	Sol in water, ethanol, ether	None	Oily liquid
Acetone cyanohydrin	CH ₃ C(OH)CNCH ₃	85.11	0.932	-20	95, 760 mmHg 82, 23 mmHg 90, 20 mmHg 81, 15 mmHg	165	0.8 at 20 C 23.0 at 82 C	2.93	Sol in water, alcohol, ether, acetone, benzene; insol in petroleum ether, carbon disulfide	Bitter almond	Liquid
DINITRILES											
Malononitrile	NCCH ₂ CN	66.06	1.049	30-31	218-220, 760 mmHg	234	-	-	Sol in water, acetone, benzene; very sol in alcohol, ether; insol in ethanol	None	Crystalline
Succinonitrile	NC(CH ₂) ₂ CN	80.09	0.9867	57-57.5	265-267, 760 mmHg 158-160, 20 mmHg	270	2.0 at 100 C	2.10	Sol in water (12.8 g/100 ml); more sol in ethyl alcohol, acetone, benzene, ether; sl sol in carbon disulfide	..	Waxy solid
Adiponitrile	NC(CH ₂) ₄ CN	108.14	0.967	1-3	295, 100 mmHg	199.4 - 200 (open cup)	2.0 at 119 C	3.73	Sl sol in water (6/1, 100 ml); sol in methanol, ethyl alcohol, chloroform; partly sol in carbon tetrachloride	Detectable, not characterized	Oily liquid
Tetramethylsuccinonitrile	NCC(CH ₃) ₂ C(CH ₃) ₂ CN	136.20	1.070	169-170.5 (Sublimes)	-	-	-	-	Sol in alcohol	None	Solid

*Colorless, except malononitrile (yellow)

Adapted from references 3, 36, 40, 123, 125, 126, 128

TABLE XII-3

INDUSTRIAL USES OF SELECTED NITRILES

Mononitriles	Cyanohydrins	Dinitriles
Acetonitrile	Acetone cyanohydrin	Adiponitrile
Solvent	Intermediate for resins	Synthetic fiber synthesis
Hydrocarbon additive		Rubber accelerator manufacture
Acetophenone synthesis	Glycolonitrile	Corrosion inhibitor manufacture
1-Naphthaleneacetic acid synthesis	Barrier resin additive	
Thiamine synthesis	Bactericide and fungicide synthesis	Malononitrile
Propionitrile	Hydantoin synthesis	Lubricating oil additive
Solvent	Chloroacetonitrile synthesis	Thiamine synthesis
n-Butyronitrile	Glycine synthesis	Pteridine-type anticancer agents synthesis
	Alpha-aminonitriles synthesis	Photosensitizer synthesis
Specialty chemicals synthesis	Aminoethylpiperazines synthesis	Acrylic fibers synthesis
Pharmaceutical chemicals synthesis		Dyestuff synthesis
Isobutyronitrile		Tetramethylsuccinonitrile
Catalyst		Decomposition product of azo-
Gasoline additive		isobutyronitrile (used as a propellant gas in production of light polyvinyl foams)

Adapted from references 3,8,13,14,127

TABLE XII-4
OCCUPATIONS WITH POTENTIAL EXPOSURE TO SELECTED NITRILES

Fibermakers	Maintenance workers
Organic nitrile synthesizers	Perfumemakers
Petroleum hydrocarbon purifiers	Thiaminemakers
Tank coaters	Laboratory technicians
Drugmakers	Firefighters
Plastic workers	Photographic workers
Animal and vegetable oil processors	Pipefitters
Drum fillers	Millwrights
Industrial laundry workers	

Adapted from references 3,8,127

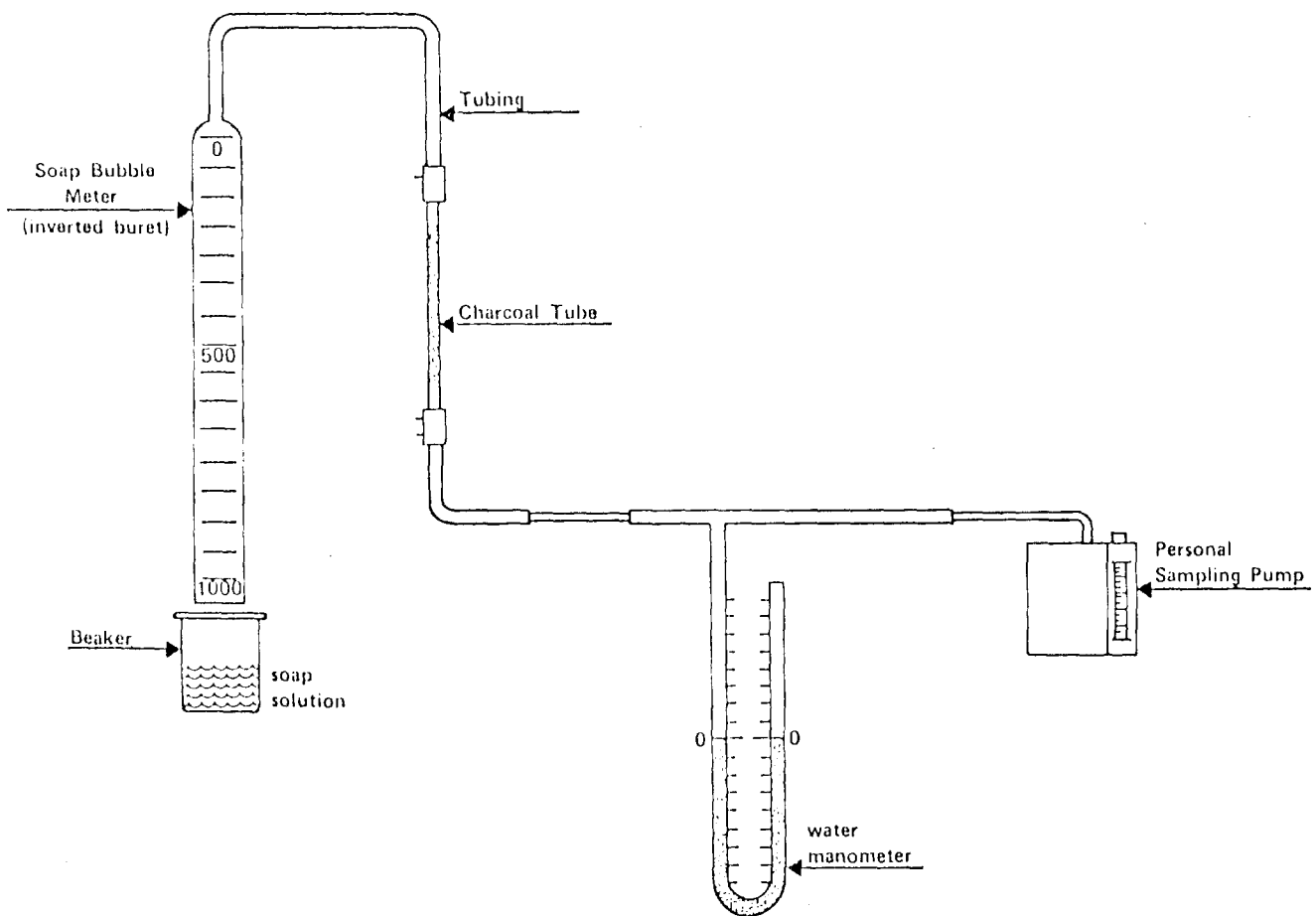


FIGURE XII-1

CALIBRATION SETUP FOR PERSONAL SAMPLING PUMP WITH CHARCOAL TUBE

DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
ROBERT A. TAFT LABORATORIES
4676 COLUMBIA PARKWAY, CINCINNATI, OHIO 45226

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