XII. APPENDIX IV

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 which 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 which 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, while a third component could be included both for its toxicity and its reactivity. Note that a 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) which 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, in parts/hundred parts of water by weight; specific gravity (water = 1); percent volatiles (indicated if by weight or volume) at 70 degrees Fahrenheit (21.1 degrees Celsius); 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--single short contact, no adverse effects likely; prolonged or repeated contact, possibly mild irritation.
>
> Eye Contact--some pain and mild transient irritation; no corneal scarring.

"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 which 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 US Bureau of Mines approval class, ie, "Supplied air," "Organic vapor canister," etc. Protective equipment must be specified as to type and materials of construction.

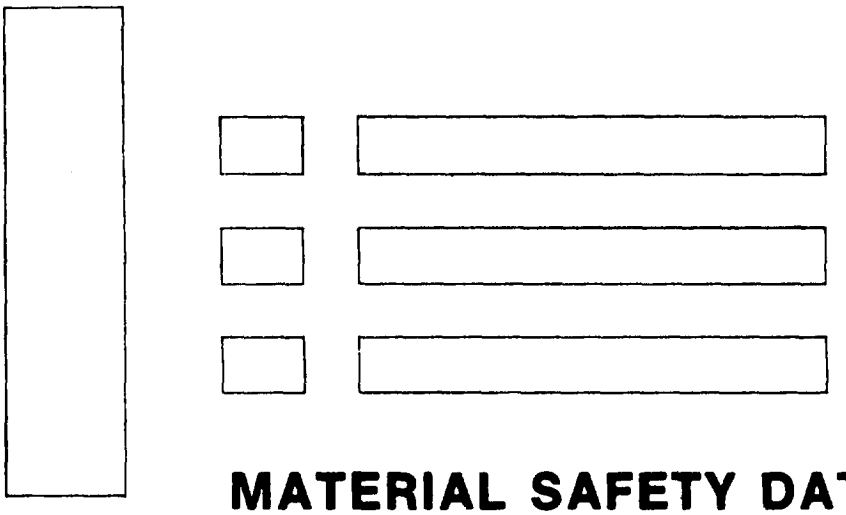
(i) Section IX. Special Precautions

"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.



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_2O=1)		VAPOR PRESSURE	
VAPOR DENSITY (AIR=1)		SOLUBILITY IN H_2O, % 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 _____

XIII. TABLES AND FIGURES

TABLE XIII-1

CONCENTRATION RANGE FOR ASPHALT HOT-MIX EMISSIONS

Compound	New Jersey Range	North Carolina Range
	ppm/vol	
Methane	2 - 3	2 - 3
C2-C6 hydrocarbons	<1**	<1**
Hydrogen sulfide	<0.2*- 1.5	<0.2*
Carbonyl sulfide	<0.2*	<0.2*
Mercaptans	<0.2*	<0.2*
Sulfur dioxide	<2*	<0.5*
Carbon monoxide	4 - 6	3
Aldehydes	<0.1*	0.3 -0.4
Phenols	<1	<1**
Ozone	<0.1	-
Nitrogen dioxide	<0.1	0.05-0.08
	mg/cu m	
C7-C14 hydrocarbons	3 - 9	3 -5
High volume sample		
Total particulates	2.6 - 6.4	0.5 -5.7
Benzene soluble	0.3 - 0.5	0.2 -5.4
	µg/1,000 cu m	
Pyrene	44 - 240, 107 avg	96
Benz(a)anthracene	5 - 24, 11 "	32 - 38
Benzo(a)pyrene	3 - 20, 11 "	14 - 22
Benzo(e)pyrene	14 - 40, 26 "	Not found
Perylene	5 - 16, 12 "	6, 6

TABLE XIII-1 (CONTINUED)

CONCENTRATION RANGE FOR ASPHALT HOT-MIX EMISSIONS

Compound	New Jersey Range	North Carolina Range
	μg/cu m	
Nickel	0.005	0.04
Vanadium	0.02-0.08	<0.1*
Cadmium		<0.05*
Lead		<0.05*

*Not detected. If present at all, the compound was at a concentration below that as shown. The less than (<) value represents the sensitivity of the sampling and analysis procedure.
**Small amount detected; less than value shown

Adapted from reference 5

TABLE XIII-2

SOME USES AND APPLICATIONS OF ASPHALT

AGRICULTURE

- Cattle sprays
- Dampproofing and waterproofing buildings, structures
- Disinfectants
- Fencepost coating
- Mulches
- Mulching paper
- Paved barn floors, barnyards, feed platforms, etc
- Protecting tanks, vats, etc
- Protection for concrete structures
- Tree paints
- Water and moisture barriers
- Wind and water erosion control
- Weather modification areas

BUILDINGS

Floors
- Dampproofing and waterproofing
- Floor compositions, tiles, covering
- Insulating fabrics, papers
- Step treads

Roofing
- Asbestos felt
- Building papers
- Built-up roof adhesives, felts, primes
- Caulking compounds
- Cement waterproofing compounds
- Cleats for roofing
- Glass wool compositions
- Insulating fabrics, felts, papers
- Joint filler compounds
- Laminated roofing, shingles
- Liquid roof coatings
- Plastic cements
- Shingles

Walls, siding, ceilings
- Acoustical blocks, compositions, felts
- Architectural decoration
- Asbestos cement panels, felt
- Bricks
- Brick siding
- Building blocks, papers
- Dampproofing coatings, compositions
- Insulating board, fabrics, felts, paper
- Joint filler compounds
- Masonry coatings
- Plaster boards
- Putty, asphalt
- Siding compositions
- Soundproofing
- Stucco base
- Wallboard

Miscellaneous
- Air-drying paints, varnishes
- Artificial lumber
- Ebonized lumber
- Insulating paints
- Plumbing, pipes
- Treated awnings

HYDRAULICS and EROSION CONTROL

- Canal linings, sealants
- Catchment areas, basins
- Dam groutings
- Dam linings, protection
- Dike protection
- Ditch linings
- Drainage gutters, structures
- Embankment protection
- Groins
- Jetties
- Levee protection
- Mattresses for levee and bank protection
- Membrane linings, waterproofing

TABLE XIII-2 (CONTINUED)

SOME USES AND APPLICATIONS OF ASPHALT

Reservoir linings
Revetments
Sand dune stabilization
Sewage lagoons, oxidation ponds
Swimming pools
Waste ponds
Water barriers

INDUSTRIAL

Aluminum foil compositions using asphalt
Backed felts
Conduit insulation, lamination
Insulating boards
Paint compositions
Papers
Pipe wrapping
Roofing, shingles

Automotive
Acoustical compositions, felts
Brake linings
Clutch facings
Floor sound deadeners
Friction elements
Insulating felts
Panel boards
Shim strips
Tacking strips
Underseal

Electrical
Armature carbons, windings
Battery boxes, carbons
Electrical insulating compounds, papers, tapes, and coatings
Junction box compound
Molded conduits

Compositions
Black grease
Buffing compounds
Cable splicing compound
Embalming
Etching compositions
Extenders, rubber, other
Explosives
Fire extinguisher compounds
Joint fillers
Lap cement
Lubricating grease
Pipe coatings, dips, joint seals
Plastic cements
Plasticizers
Preservatives
Printing inks
Well-drilling fluid
Wooden cask liners

Impregnated, treated materials
Armoured bituminized fabrics
Asbestos compositions
Burlap impregnation
Canvas treating
Carpeting medium
Deck cloth impregnation
Fabrics, felts
Mildew prevention
Packing papers
Pipes and pipe wrapping
Planks
Rugs, asphalt base
Sawdust, cork, asphalt, composition
Textiles, waterproofing
Tiles
Treated leather
wrapping papers

Paints, varnishes, etc
Acidproof enamels, mastics, varnishes
Acid resistant coatings
Air-drying paints, varnishes

TABLE XIII-2 (CONTINUED)

SOME USES AND APPLICATIONS OF ASPHALT

- Anticorrosive and antifouling paints
- Antioxidants and solvents
- Base for solvent compositions
- Baking and heat resistant enamals
- Boat deck sealing compound
- Lacquers, japans
- Marine enamels

Miscellaneous
- Belting
- Blasting fuses
- Briquet binders
- Burial vaults
- Cashing molds
- Clay articles
- Clay pigeons
- Depilatory
- Expansion joints
- Flowerpots
- Foundry cores
- Friction tape
- Fuel
- Gaskets
- Imitation leather
- Mirror backing
- Phonograph records
- Rubber, molded compositions
- Shoe fillers, soles
- Table tops

PAVING
- Airport runways, taxiways, aprons, etc
- Asphalt blocks
- Brick fillers
- Bridge deck surfacing
- Crack fillers
- Curbs, gutters, drainage ditches
- Floors for buildings, warehouses, garages, etc
- Highways, roads, streets, shoulders
- Parking lots, driveways
- PCC underseal
- Roof-deck parking
- Sidewalk, footpaths
- Soil stabilization

RAILROADS
- Ballast-treatment
- Curve lubricant
- Dust laying
- Paved ballast, subballast
- Paved crossings, freight yards, station platforms
- Rail fillers
- Railroad ties
- Tie impregnating, stabilization

RECREATION

Paved surfaces for:
- Dance pavilions
- Drive-in movies
- Gymnasiums, sports arenas
- Playgrounds, school yards
- Race tracks
- Running tracks
- Skating rinks
- Swimming and wading pools
- Tennis courts, handball courts

Adapted from reference 8

TABLE XIII-3

EFFECTS OF OCCUPATIONAL EXPOSURE TO
ASPHALT OR ASPHALT FUMES

Number Exposed	Length of Exposure	Effects	Reference
22*	Several mon	Coughing with expectoration, burning sensation in throat and chest, frequent hoarseness, headache, nasal mucous discharge	15
22*	Several yr	Coughing with expectoration, nasal mucous discharge and inflammation, changes in vocal timbre, frequent loss of voice, tonsillitis, pharyngitis, acute febrile bronchitis, nosebleeds; 10 cases of rhinitis, 13 cases of oropharyngitis, 4 cases of laryngitis, 19 cases of bronchitis; harsh respirations with rales, basal hypophonesis with tympanic zones from emphysema, increased vascularization in bronchial areas	15
34	-	Occasional thermal burns	18
17	-	Virtually no irritation from asphalt	20
1*	31 yr	Blackish specks in sputum, chronic bronchitis, skin rashes, complete loss of voice, squamous cell carcinoma of the left vocal cord	16
462	5 yr or more	Skin cancer in 2, stomach cancer in 1; lung disease in 40, primarily bronchitis with some cases of asthma and some of emphysema; skin disease, mainly dermatitis, in 26; hypertension in 27; peptic ulcer in 12; heart disease in 17; effects not statistically different from 379 control workers	27
-**	11,478 man-yr	Ill health in 1 with no details	
1,000+	-	No evidence of ill health	27

TABLE XIII-3 (CONTINUED)

EFFECTS OF OCCUPATIONAL EXPOSURE TO
ASPHALT OR ASPHALT FUMES

Number Exposed	Length of Exposure	Effects	Reference
112	12+ yr avg	No evidence of ill health	27
-***	-	Headache in 1, silicosis in 1, leukoplakia in 1, dermatitis in 1	27
-****	-	Nasal irritation in 1, dermatitis in 14	

*Causative agent probably not asphalt
**Data obtained from 31 construction or paving companies
***Data obtained from 6 large insurance companies
****Data obtained from 15 State Boards of Health or State Highway Commissions

TABLE XIII-4

EFFECTS OF EXPOSURE TO ASPHALT FUMES ON ANIMALS

Species and Number	Exposure Concentration and Duration	Effects	Reference
Rabbits -	Dense, oily fumes	Minor, transient conjunctivitis, slight infiltration of the cornea; no controls	29
Guinea pigs (30) Rats (65)	0.4 - 2 g/hr* 5 hr/d 4 d/wk for 2 yr	Extensive, chronic fibrosing pneumonitis, peribronchial adenomatosis, squamous cell metaplasia of the bronchial mucosa, bronchiectatic lumena; no controls	19
Mice (30)	0.74- 0.93 g/hr* 6 - 7.5 hr/d 5 d/wk for a maximum of 401 exposures	Bronchitis, pneumonitis, abcess formation, loss of cilia, epithelial atrophy and fragmentation, necrosis, flattening of the epithelium, 1 bronchial adenoma, occasional epithelial hyperplasia and emphysema with focal lung collapse, peribronchial round-cell infiltration, and bronchial dilatation; no controls	30

*Asphalt lost from heated container by volatilization or decomposition

TABLE XIII-5

SUMMARY OF EFFECTS OF EXPOSURE TO ASPHALT ON ANIMALS

Species and Number	Exposure: Route	Exposure: Amount, Strength, and Diluent	Exposure: Frequency and Duration	Effects	Reference
Mice (32)	Dermal	75-100 mg - -	1- 3/wk 22-270 paintings	Chronic dermatitis; lung adenoma, 1; papilloma at painting site, 1; tumor of skin accessory structure origin, 1; no controls	32
Mice (40)	"	75-100 mg - -	- 16-240 paintings	Chronic dermatitis; epidermoid carcinomas, 3; papillomas, 2; no controls	32
Mice (20)	"	20- 30 mg 90% Toluene	3/wk 284 paintings	Chronic dermatitis; epidermoid carcinomas, 9; lung adenomas, 2; hair loss, scaling of skin, 2 papilloma in 15 controls	32
Mice (218)	"	2.5 mg - Benzene	2/wk 81 wk	Hyperplasia of epidermis, inflammation, ulceration, and abcess formation, amyloid accumulation in spleen and kidneys; 6 skin tumors, including 1 carcinoma; similar signs in controls, including 1 nonmalignant papilloma, no carcinomas	3
Mice (50) Rabbits (6)	"	- - -	2/wk 2 yr max	No neoplasms	19
Mice (250)	"	- - Acetone	"	Skin carcinomas, 2; papillomas, 2; leukemias, 4; Kupffer-cell sarcoma, 1	19

TABLE XIII-5 (CONTINUED)

SUMMARY OF EFFECTS OF EXPOSURE TO ASPHALT ON ANIMALS

Species and Number	Exposure: Route	Exposure: Amount, Strength, and Diluent	Exposure: Frequency and Duration	Effects	Reference
Mice (68)	Dermal	- - Benzene	2/wk -	Epidermoid carcinomas, 12; papillomas, 5; hair loss at painting site, dry, scaling skin in test animals and in 63 controls	31
Mice (50)	"	- 40% Benzene	1/wk 19 mon	Squamous cell carcinoma, 1; sebaceous adenoma, 1; pulmonary adenomas and adenocarcinomas in 5 mice; epidermal atrophy, focal hyperplasia, hyperkeratosis, acute and chronic inflammation; epidermal atrophy, focal hyperplasia, hair follicle atrophy in controls	17
"	"	- 40% Benzene	"	Subcutaneous fibrosarcoma, 1; papilloma, 1; pulmonary adenoma, 1; lymphoreticular sarcomas, 2; hepatic hemangioma, 1; epidermal atrophy, focal hyperplasia, hyperkeratosis, acute and chronic inflammation; controls same as above	17
Mice (40)	"	- 40% Benzene	"	Pulmonary adenoma, 1; epidermal atrophy; focal hyperplasia, hyperkeratosis, acute and chronic inflammation; controls same as above	17

TABLE XIII-5 (CONTINUED)

SUMMARY OF EFFECTS OF EXPOSURE TO ASPHALT ON ANIMALS

Species and Number	Exposure: Route	Exposure: Amount, Strength, and Diluent	Exposure: Frequency and Duration	Effects	Reference
Mice (37)	Dermal	- 40% Benzene	1/wk 19 mon	Pulmonary adenoma, 1; epidermal atrophy, focal hyperplasia, hyperkeratosis, acute and chronic inflammation; controls same as above	17
Mice (50)	Subcutaneous	200 mg - -	1*	Lung adenoma, 1; asphalt deposits covered by thin, relatively acellular sheath; no controls	32
"	"	200 mg - -	1**	Rhabdosarcomas, 2, 1 metastatic to lung and liver; skin accessory-structure tumor, 1 metastatic to lung; no controls	32
Mice (62)	"	0.2 ml 1% Olive oil	2/wk 41 wks, 1/wk until death	Rhabdosarcomas 1; fibrosarcomas, 7; no metastasis; 60 ocntrols had no tumors	31
Mice (200)	im	0.1 ml 50% Tricaprylin	Every 2 wk for 12 weeks	Sarcomas, 3; no tumors in 144 controls injected subcutaneously	19
Rats (120)	"	0.2 ml 50% Tricaprylin	Every 2 wk for 24 wk	Sarcomas, 13; no controls	19

*After 111 d, 13 mice reinjected with 200 mg
**After 4 mon, 18 mice reinjected

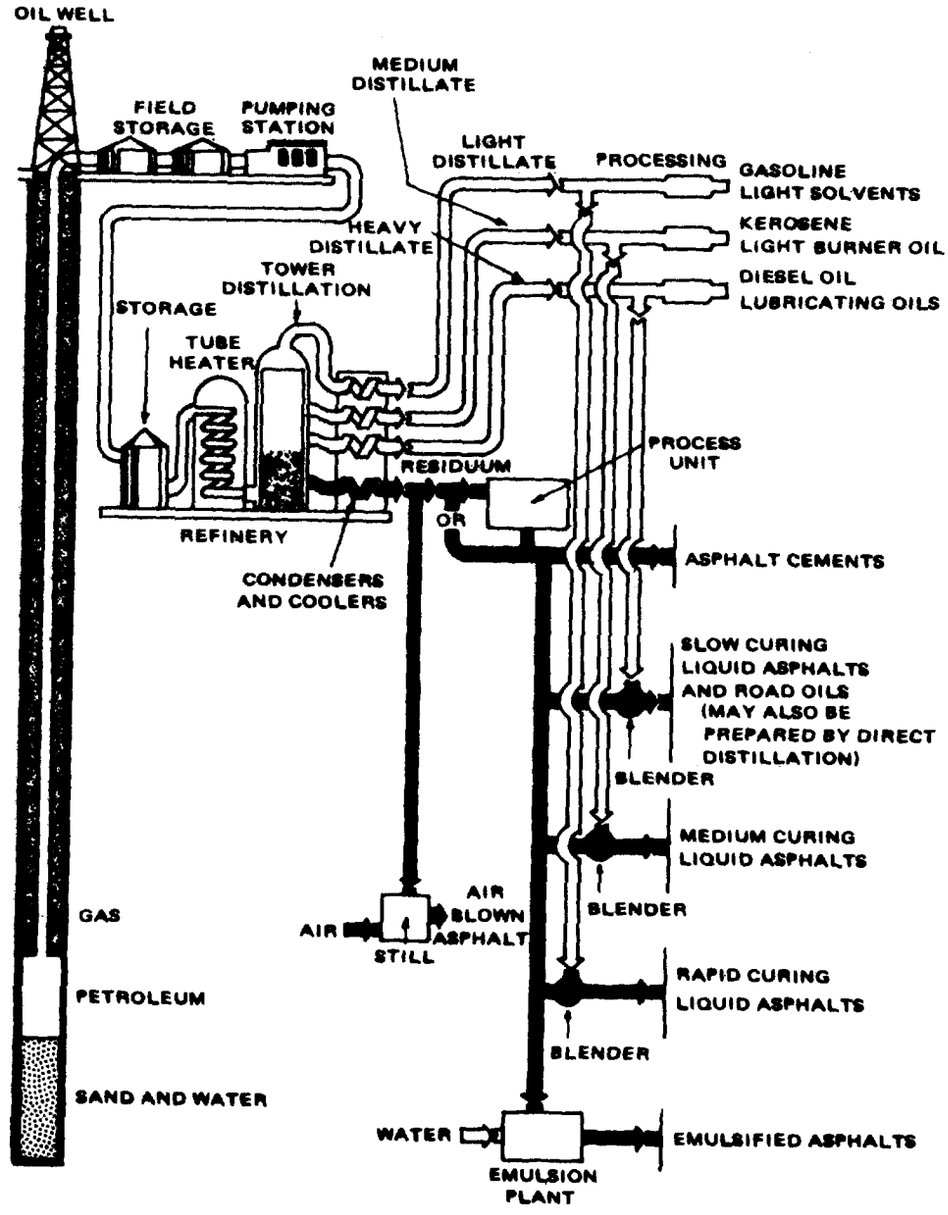


FIGURE XIII-1.
PETROLEUM ASPHALT FLOW CHART

Adapted from reference 8.

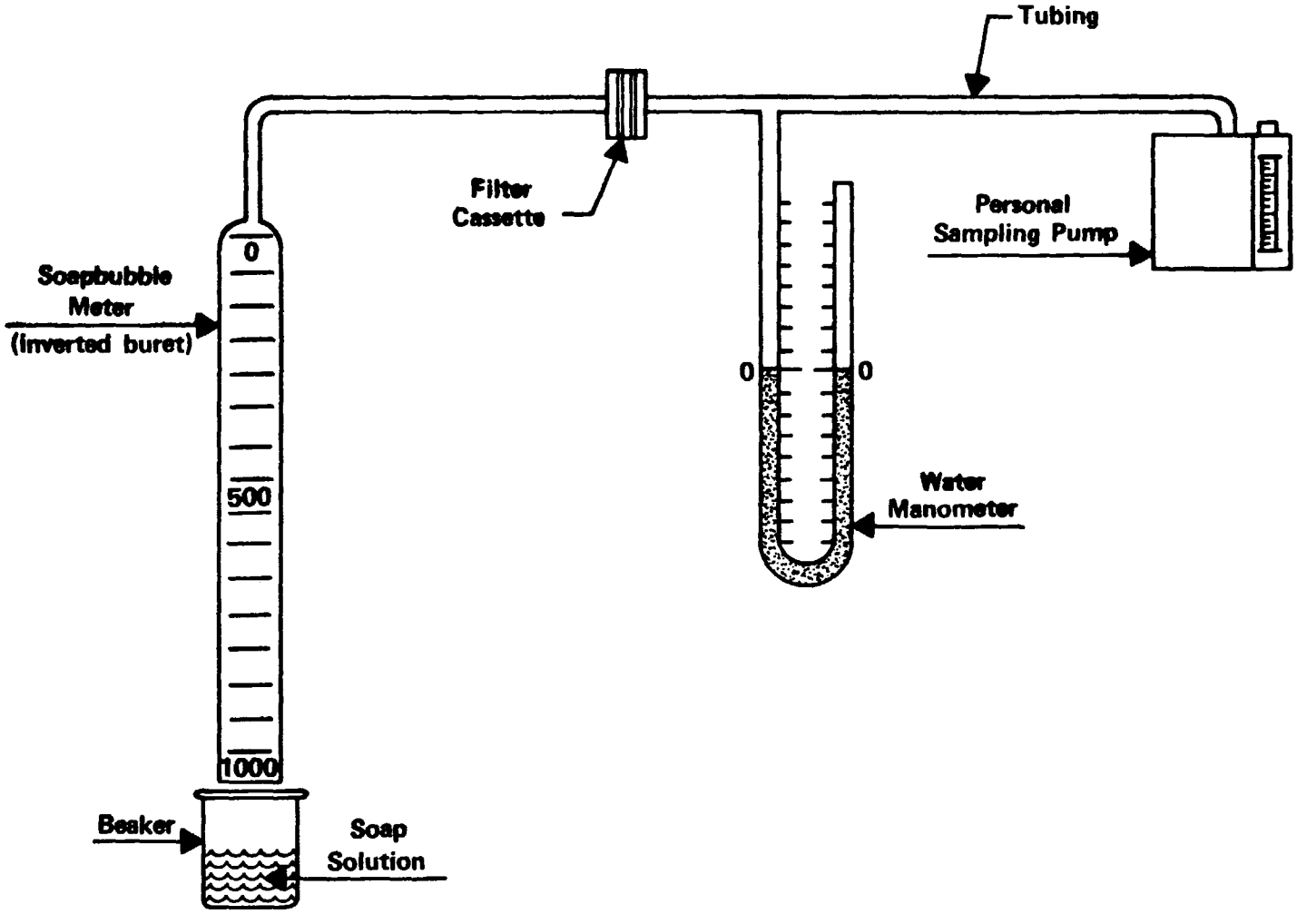


FIGURE XIII–2

CALIBRATION SETUP FOR PERSONAL SAMPLING WITH FILTER CASSETTE

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