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Please review the attached training material as quickly as possible and pass on to the next person on the list. Remember, your signature and the date are required (in ink) to document that you have reviewed this material. Please return this entire package to the Industrial Hygiene Coordinator.

A/B Shift Personnel

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Solvents / EDC 1

Chemical Resistant Personal Protective Equipment Written Program

I. Introduction

The primary objective of an Industrial Hygiene Program is to control health hazards. The control of health hazards can be accomplished through education and training, engineering technology, administrative measures and/or through the use of personal protective equipment (PPE).

Selection of proper PPE requires consideration of intended use, toxicology database, chemical compatibility and service life. (i.e., how often the glove, suit or boot should be discarded). The PPE is first approved by the Division PPE Committee and then by plant/department supervision and the I.H. or Safety Contact before it is used in the block.

The Safety section of job procedures and/or reference on the Safe Work Permit indicate the required PPE for the job task. These requirements apply to Dow employees and any contractors working in the area.

Decontamination procedures, in-use storage conditions and disposal frequency are documented in this written program.

II. List of Chemical Resistant Protective Equipment

A. Gloves

<u>Manufacturer's Name & Description</u>	<u>Model Number</u>	<u>Material Of Construction</u>	<u>Chemicals handled with gloves</u>
Pioneer StanSolv*	AK-22	Nitrile Rubber	All
Silver Shield*	SS504	Norfoil Laminate	All (liner for EDC liquid)
Vallen Leather Driver	TGD-258-L	Leather	Petroleum Based Oils and Dirt
Cotton		Cotton	Petroleum Based Oils and Dirt
Vinyl Impregnated			Petroleum Based Oils and Dirt
LabCraft		PVC	All (lab gloves, incidental contact)

B. Boots

<u>Manufacturer's Name & Description</u>	<u>Model Number</u>	<u>Material Of Construction</u>	<u>Boots used to protect against these chemicals</u>
Servus 12"	22148	Neoprene	All
Tingley Overshoe	1302	Neoprene	All
Tingley	98245	Nitrile Blend	All

* The Silver Shield glove is used as a liner in the Stansolv glove when prolonged exposure (>15 minutes) to liquid EDC is expected.

C. General Service Weight Suits [i.e., rainsuits, disposables (such Tyvek, Saranex)]

<u>Manufacturer's Name & Description</u>	<u>Model Number</u>	<u>Material Of Construction</u>	<u>Suits used to protect against these chemicals</u>
Neese 2 Piece Rainsuit	Type 45	PVC/Nylon/PVC	All / Splash Protection
WorkRite Coveralls		Nomex III	None
Kappler Disposable Coveralls	1681040	Tyvek Paper	None - Clean Body Covering
Kappler Saranex 23P Coveralls	77417	Saranex-Tyvek	All / Splash Protection

D. Heavy-Duty Suits [i.e., Acid Suits, Level A Suits]

<u>Manufacturer's Name & Description</u>	<u>Model Number</u>	<u>Material Of Construction</u>	<u>Suits used to protect against these chemicals</u>
LifeGuard Responder (Level A)	M-104-DYM	Multi-Film	All
LifeGuard Responder (Level B)		Multi-Film	All
StaSafe Gralite Accordion Suit	LJ-105	PVC	HCL, AHCL

III. Decontamination or Laundering Procedures

A. Gloves

Gloves are not decontaminated or laundered.

B. Boots

Boots are decontaminated by water washing or scrubbing with water and detergent.

C. General Service Weight Suits

PPE issued for splash protection must be decontaminated immediately after contamination occurs. Items issued for splash protection do not afford the necessary permeation resistance for prolonged contact with chemicals. Other equipment intended for re-use must be decontaminated before removal. Decontamination is accomplished by water washing or water and detergent washing. In some instances, a scrub brush will be needed to clean heavily soiled areas. Some of the equipment is used on a one time basis and is discarded after use. Nomex clothing must be laundered at the end of every work day. Nomex clothing that is too contaminated for laundering will be discarded.

D. Heavy-Duty Suits

Decontamination is accomplished by water washing or water and detergent washing. In some instances, a scrub brush will be needed to clean heavily soiled areas.

IV. In-Use Storage Practices

A. Gloves

Issued for personal use. As soon as heavy soiling (contamination) is evident during the course of the workday the gloves are discarded. Normally discarded at the end of the work day or sooner and not placed into storage.

B. Boots

Issued for personal use. As soon as heavy soiling (contamination) is evident during the course of the workday the boots may be discarded if they cannot be decontaminated. At the end of the workday, the boots are placed on the boot rack in the locker room where they are purged with plant air until the next time they are worn. Normal lifespan is 6 months to one year.

C. General Service Weight Suits

Issued for personal use. Rainsuits and Nomex are removed for laundering as soon as heavy soiling (contamination) is evident during the course of the workday. The Nomex suits (each employee is issued at least two pair) are stored in personal lockers. The Rainsuits or Nomex may be discarded if they cannot be decontaminated. Other one-time-use PPE is discarded at the end of the work day or sooner. These items are used on a per-day basis and in-use storage is normally not required.

D. Heavy-Duty Suits

Storage and re-use of these items is evaluated on an individual (per job) basis. Heavy-Duty suits may require frequent cleanings during the course of the job, and will be cleaned as per manufacturers instructions before storage. These suits are normally discarded dependent on contamination and/or wear.

V. Disposal Frequency

A. Gloves

As needed dependent on contamination, usually at least once a shift or at the end of the shift.

B. Boots

As needed dependent on contamination, usually at least once every 6 months to a year.

C. General Service Weight Suits

As needed dependent on contamination and wear, usually at least once every 6 months to a year. Some suits are intended for disposal immediately after use.

D. Heavy-Duty Suits

As needed dependent on contamination and wear (disposal is evaluated on an individual (per job) basis).

VI. Attachments

The performance data for the chemical resistant equipment listed is attached.

Philip S. Brown
Industrial Hygiene Contact

A. M. Dunn
Plant Superintendent

Date : 9 / 2 / 94

Next Review : 3/95

Personal Protective Equipment Program Permeation Resistance Data

Chemical Protective Gloves

Nitrile Gloves:

The Edmont Solvex 37-175 Nitrile Glove (13" length, 15 mils thickness, with flock lining, cost ~\$1/pair) is the primary chemical resistant glove used in the Louisiana Division. The Pioneer Stansol AK-22 Nitrile Glove (12" length, ~ 15 mil thickness, with knit lining, cost ~\$4/pair) is also used in those plants where gloves are worn for extended periods. Under these situations the knit lining is more comfortable because it absorbs hand perspiration and that is the reason for the higher cost. The nitrile gloves generally range in thickness from 11 mils to 22 mils. The thicker the glove the better the chemical resistance and physical strength, but finger dexterity decreases as the thickness increases. The 22 mil glove has 4 times the breakthrough time and 1/2 the permeation rate as the 11 mil. The 15 mil glove provides a good balance between chemical resistance and finger dexterity.

Flat Film Gloves:

Additional chemical protection is achievable with the use of the Edmont 4H or Silver Shield Glove. These ambidextrous gloves have superior chemical resistance to a wide variety of chemicals, and are very thin and light weight. Constructed using "Flat Film" technology (a film layer construction of polyethylene (PE)/Ethylene vinyl alcohol/PE, cost \$1/pair), they may serve as a liner for other gloves, or, can be used alone.

Neoprene:

The Edmont Scorpio 8-354 Neoprene Glove (14" length, heavy weight, knit lined, cost \$3/pair) is designed for heavier duty work, provides some thermal protection, has a knit liner to absorb hand perspiration and is easy on and off, but has less finger dexterity than the Edmont Solvex 37-175 gloves. The chemical resistance performance is similar to the nitrile, but should not be used with certain chlorinated solvents (i.e.; carbon tetrachlorine, chloroform, 1, 1, 1- trichloroethane, and perchloroethylene).

Polyvinyl Chloride:

The Best Hustler 725R PVC Glove (12" length, heavy weight, flock lined, cost \$3/pair) is designed for heavier work duty, provides some thermal protection, and is easy on and off but again has less finger dexterity than the Edmont Solvex 37-175 glove. This glove has acceptable chemical resistance performance for 50% caustic and 10% hydrochloric or sulfuric acid (but not for high concentrated acids). It is generally not good for chlorinated solvents because it will remove the plasticizer from the glove and accelerates degradation. The Caustic Plant uses this glove to catch hot caustic samples because of the thermal protection.

Permeation Data:

The PPE Glove Permeation Table (attached) provides the approval status of the above gloves based upon information supplied by the manufacturer's of the gloves and the approval of the LAD Industrial Hygiene Department. This information is based on immersion of the glove into the chemical or heavy contact to the chemical and work experience.

Chemicals for which the gloves are un-acceptable for use or for which data is not available may present a problem in determining the appropriate glove for the task. In most cases, the problem can be resolved by examining: 1) the potential type of contact during the task (brief, splash, immersion, etc.), 2) the characteristics of the chemical itself (corrosive to the skin, absorbed through the skin in toxic amounts), 3) the **historical experience with the glove usage in the plant**. Many times, gloves are worn for jobs only as a precaution, or to protect against the possibility of incidental contact for a short duration. In these cases, the gloves selected should provide protection similar to their normal capabilities (if more than incidental contact occurs, the gloves would be removed immediately and decontaminated or replaced). The Safety Section of the Operating Procedures should specifically state the type of gloves needed for the job.

Chemical Protective Clothing-General Service Suits

Kappler Disposable Tyvek:

The Kappler Disposable Tyvek coveralls are made of non-woven polyolefin filaments. They are primarily used in the Louisiana division when handling or working with various types of dusts, powders, dirt, oils and greases and other non corrosive, viscous liquids which will not penetrate the garment. Because of the economics (\$2.44 ea.), these coveralls shall be disposed at the end of the work day. These coveralls do not have a protective barrier to liquids or gases.

Kappler Polyethylene Coated Tyvek:

The Kappler Polyethylene Coated Tyvek coveralls are made of a 1.25 mil polyethylene coating (yellow) applied to a Tyvek substrate. The protective barrier is good for inorganic acids and bases (i.e., chlorine gas, sodium hydroxide, sulfuric and hydrochloric acid), and heavy contact with oils and greases. It is not to be used with most organic chemicals although it would provide some splash protection. The garment has sewn seams that allow liquid penetration. Again because of economics (\$4.44 ea.), these coveralls shall be disposed at the end of the work day.

Kappler Saranex 23-P Laminated Tyvek:

The Kappler Saranex 23-P Laminated Tyvek coveralls are made of a multi-layered barrier film (made by Dow Chemical) which is laminated to the Tyvek substrate. The barrier film is 2.0 mil thick and is composed of low density polyethylene (outer layer), ethylene vinyl acetate (glue layer), Saran (resin-based polymer barrier film) and finally glued with EVA to the substrate.

It offers very good barrier protection to several chemicals typically used in the Louisiana Division (see attached list). The garment has a strapped overlay seam which is strong and prevents any liquid penetration. A storm flap over the zipper also prevents liquid penetration. In addition there is high tensile and tear strength and good puncture and abrasion resistance. It provides good splash protection and liquid holdout for those chemicals for which it is approved. Because of the cost of the overalls (~\$20/ea.), it is used for selected jobs and then disposed of. It is considered "limited-use" clothing and not to be laundered for re-use.

Neese Rainsuits:

The Neese Rainsuits (2 piece suit or raincoat) are made of PVC/nylon/PVC layered construction which is 12 mils thick. The material does provide some chemical resistance but is not intended to be a protective barrier. The garment has water proof seams and the jacket/coat has a storm flap. They are available with or without a hood.

The primary use of this item is rain protection and would provide some protection for dirt, grime, oil, greases and incidental contact with chemicals. The suits can be laundered for reuse.

Chemical Protection-Heavy Duty Suits

The chemical performance data base for the following suits is available from the Division PPE Committee or the Industrial Hygiene Department.

Sta-Safe Gralite 20 and Hi-Glo Acid Suits:

The Sta-Safe Gralite 20 (gray) and Hi-Glo (yellow) Suits are made of a special polyvinyl chloride compound that gives protection to severe corrosive and abrasive conditions. The Gralite 20 fabric is 30 mils thick and the Hi-Glo is 20 mils thick and consequently somewhat lighter in weight.

The 2 piece suit consists of a jacket and bib overall (with polypropylene webbing shoulder straps). The seams are reinforced and the flexibility of the material permits general ease of movement. The jacket sleeve is designed to provide a liquid-tight seal when properly used with the rigid plastic inset placed inside a glove gauntlet. An accessory is a chemical hood made of the Gralite 20 material with hard hat insert and a large permanent inner window and replaceable cover window. A full face air-line respirator can be used inside the hood.

There is limited chemical resistant data on the Gralite 20 (see attached list) and no data on the Hi-Glo. The protective barrier is good for inorganic acids and bases i.e., chlorine gas, sulfuric acid (98%) and sodium hydroxide (50%) and should not be used with chlorinated solvents although it would provide some splash protection. These suits can be laundered and reused. The price of the Gralite 20 jacket/bib overalls is \$118/\$66, Hi-Glo jacket/bib overalls is \$91/\$48 and the Gralite 20 chemical hood is \$180 respectively.

Since there is limited chemical performance data, another very important factor is the plant's historical experience with the acid suit usage in that there have been no problems with suit deterioration or skin burns etc.

Wheeler Aluminized PBI/Kevlar Suit:

The Wheeler Aluminized PBI/Kevlar 2-piece suit is made of an aluminized film laminated to a PBI/Kevlar knit fabric. The 2-piece suit consists of a jacket and pants. The use of this suit is restricted for handling alkyl catalysts in the polyethylene plants because of the pyrophoric nature of the catalyst. The suit was recommended by Ethyl Corporation who is the supplier of the alkyl materials. The price of the 2 piece suit is \$175.

~~As~~ In-house laboratory screening tests were performed by direct contact of the suit material with heptane and isopentane for 15 mins. There was no visual evidence of deterioration or liquid penetration through the material.

Responder Life Guard Level A Suit:

The Responder Life Guard Level A totally encapsulated suit is made of a multi-film construction which provides excellent chemical resistance to a broad range of chemicals. This material exhibits no permeation breakthrough after 8 hours of exposure to the ASTM F1001 chemical test battery using the ASTM F739 permeation test protocol. An additional 100 chemicals have been tested with successful results other key features include light weight, ease of mobility, durable seams, double over-lapping storm flaps and excellent physical strength. The 40 mil PVC window comes with a 5 mil FEP Teflon overlay. The suit comes with a replaceable butyl gloves and silver shield glove liners. The price of the suit is \$450 and is classified as a "limited use" apparel to be discarded when it becomes contaminated or shows signs of wear.

Chemron Chemrel Max:

The Chemron Chemrel Max Level A suit or coveralls are made of multi-film construction which provides excellent chemical resistance to a broad range of chemicals (similar as described in the Responder section and are also "limited use" apparel).

The Chemrel Max 102 Level A suit is approved for the materials which are used in the Vinyl II plant.

The Chemrel Max 203 coveralls are approved for the materials which are used in the Vector SBC plant.

MSA Blue Max Level A Suit:

The MSA Blue Max Level A totally encapsulated suit is made of a multi-film construction which provides excellent chemical resistance to a broad range of chemicals (similar as described in the Responder section and are also "limited use" apparel).

The MSA Blue Max Level A Suit is approved for the materials which are used in the Glycol II plant with emphasis on ethylene oxide. The suit window has a 5 mil FEP Teflon overly to the 40 mil PVC underlens which provide protection against liquid EO.

Kappler Saranex 23-P/Tyvek

Typical chemicals handled in LAD

for which suit is approved Δ	Chemicals not approved Δ	Vendor Data not available Δ
methyl chloride * + epichlorohydrin * + meneral spirits styrene * + butadiene + methanol * ethylene glycol chlorine gas hydrogen chloride gas * hydrochloric acid (37%) * nitric acid (70%) * phosphoric acit (85%) * sulfur acid conc. * ammonium hydroxide (28%) * sodium hydroxide (50%) * ethylene glycol monobutyl ether - (Dowanol EB) 1,1,2,2 tetrachloroethane * +	carbon tetrachloride * + chloroform + perchloroethylene + ethylene oxide + toluene * methylene chloride + ammonia anhydrous *	ethylene dichloride + 1,1,1 trichloroethane 1,2 propylene oxide + cyclohexane benzene + xylene propylene dichloride + propylene chlorodydrin * vinyl chloride + misc. oil and grease

* Corrosive to skin and/or toxic by absorption

+ Known or suspect carcinogen

Δ Based on Chemical Resistance Performance Data from the Vendor

Sta-Safe Gralite 20 Acid Suit

Typical chemicals handled in LAD

for which suit is approved Δ

Chemicals not approved Δ

Vendor Data not available Δ

chlorine gas
sodium hydroxide (50%) *
cell effluent *
sulfuric acid (98%) *

methylene chloride +
perchloroethylene +
toluene *

isopentane
sec-Butyl Lithium *
phosphoric acid *
silicon tetrachloride *
propylene oxide +
propylene dichloride +
hydrochloric acid *
propylene chlorohydrin *
formic acid *

* Corrosive to skin and/or toxic by absorption

+ Known or suspect carcinogen

Δ Based on Chemical Resistance Performance Data from the Vendor

PPE Glove Permeation Table

	Edmont 37-175	Pioneer AK-22	Edmont 4-H	Silver Shield	Edmont 8-354	Best 725R
1,1,2,2-tetrachloroethane* +						
1,1,2-trichloroethane * +						
5% 2-butoxyethanol						
acetic acid (lab) *						
acetone						
Alphachem 1175 detergent *						
ammonia *						
benzene +						
biphenyl						
biphenyl oxide						
butadiene +						
carbon disulfide (lab) *						
carbon tetrachloride * +						
chlorine						
Chloroethene						
chloroform +						
cyclohexane						
cyclopentadiene						
diethylene glycol						
dimethyl ether						
dimethyl sulfide						
diphenyl ethane						
dipropylene chloride						
Dowanol ethers *						
epichlorohydrin * +						
ethanol						
ethanolamines						
ethyl benzene						
ethyl chloride						
Ethylene dichloride +						
ethylene glycol						
ethylene oxide +						
formic acid *						
gasoline						
heptane						
hexachlorobenzene * +						

	Edmont 37-175	Pioneer AK-22	Edmont 4-H	Silver Shield	Edmont 8-354	Best 725R
hexachlorobutadiene * +						
hexachloroethane * +						
hexane						
hydrogen chloride *						
Isopar C, E, or M						
isopentane						
isoprene						
kerosene						
methanol *						
methyl chloride * +						
methyl diethanolamine						
methyl ethyl ketone						
methylene chloride +						
mineral spirits						
misc. oil and greases						
n-butanol *						
Naptha						
octane						
octene						
pentane						
perchloroethylene +						
phosphoric acid *						
propylene dichloride +						
propylene glycol						
propylene oxide +						
pyridine						
sec. butyl lithium						
sodium hydroxide *						
styrene * +						
sulfuric acid *						
sulfuric dioxide						
t-butyl catechol *						
toluene *						
vinyl chloride +						
xylene						

* Corrosive to skin and/or Toxic through absorption.

+ Known or suspected human carcinogen.

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Acceptable for use with this chemical.

Un-acceptable for use with this chemical.

Data not available.