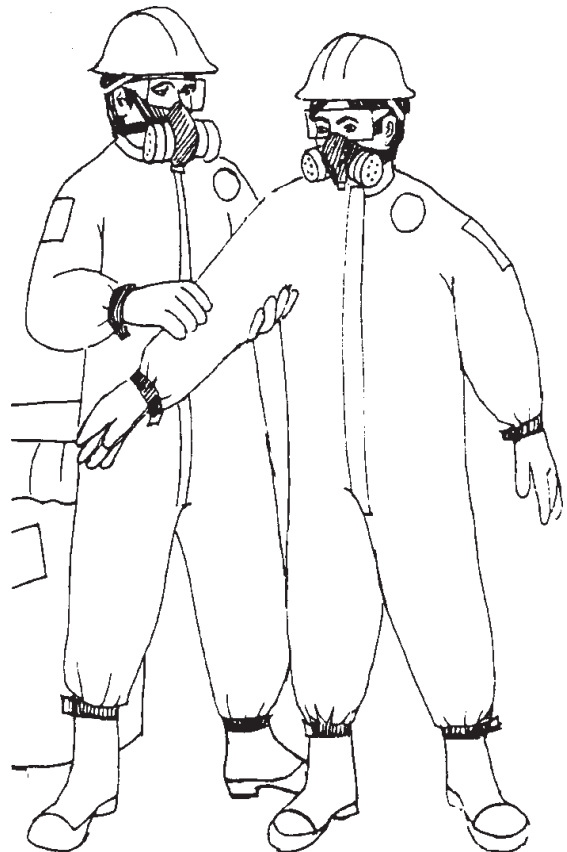


Section 15

Chemical Protective Clothing (CPC)

Purpose

To understand the uses and limitations of chemical protective clothing for operations-level emergency responders.



Section 15

**What you will find
in this section...**



Page	Fact Sheet	Title
15-4	---	Task 1
15-6	---	Hazardous Substance Fact Sheet : Hydrazine
15-9	#1	If You Can't Stand the Heat
15-11	#2	Your Skin Doesn't Stop Them
15-12	#3	ABC's of Suits
15-16	#4	For HazMat Teams Only
15-17	#5	Cloth vs. Disposables
15-18	#6	Invisible Damage
15-20	#7	No Magic Armor
15-22	#8	Eternal Vigilance: Check Your Suit
15-23	#9	Nothing Lasts Forever
15-24	#10	Write It Down
15-25	#11	Slips, Trips, and Falls

Section 15

**What you will find
in this section...**



Page	Fact Sheet	Title
15-26	---	Task 2
15-29	---	Summary

Task 1

- **Read the case study.**
- **Answer the questions using Fact Sheets and your own experience.**

Your group is representing UAW local 410 at a debriefing after a spill. As a group, please read the case study below. Answer the questions that follow using the fact sheets in this section and your own experience. Please choose one person from your group to report back your answers.

UAW Local 410 represents the workers at RocketTech, a plant that makes aircraft. One sunny day, a hydrazine (jet and rocket fuel) storage tank heated up and started to leak. The RocketTech Haz Mat team arrived and put on their SCBAs and level B protective clothing.

The Operations-level responders set up the decontamination line to clean off the Haz Mat team when they left the hot zone. Decon workers put on their usual suits - PVA (polyvinyl alcohol) rainsuits and full-face masks with charcoal filters.

About one hour into the spill, the wind shifted and blew a cloud of gas over to the decon line. No one noticed at first, but about 20 minutes later, the decon workers started to feel their skin get hot and felt dizzy. After another five minutes, all the decon workers were evacuated. Three of the four workers had first-degree burns on 18% of their skin and mild poisoning. Luckily, no one had to stay in the hospital overnight.

Task 1

continued

- **Read the case study.**
- **Answer the questions using Fact Sheets and your own experience.**

1. What level of protection were the Decon workers wearing? Was this the right level of protection for this spill? Why or why not? (Please refer to at least one fact sheet in your answer.)
2. What type of suit material would have provided more protection for the Decon workers? Please use the permeation chart for hydrazine to help you.
3. List 3 - 4 problems for people wearing chemical protective clothing. Please refer to at least one fact sheet in your answer.



HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **HYDRAZINE**

CAS Number: 302-01-2

DOT Number: UN 2029 (anhydrous)
UN 2030 (aqueous solution)

RTK Substance number: 1006

Date: September 1986 Revision: December 1994

HAZARD SUMMARY

- * **Hydrazine** can affect you when breathed in and by passing through your skin.
- * **Hydrazine** should be handled as a **CARCINOGEN--WITH EXTREME CAUTION**.
- * **Hydrazine** may cause reproductive damage.
- * **Hydrazine** is **HIGHLY CORROSIVE** and can cause severe skin and eye irritation and burns with possible damage.
- * Exposure to **Hydrazine** can irritate the nose and throat.
- * Breathing **Hydrazine** can irritate the lungs causing coughing and/or shortness of breath. Higher exposures can cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath.
- * **Hydrazine** may cause a skin allergy.
- * Exposure may damage the nervous system, causing headache, nausea, vomiting, dizziness and seizures.
- * **Hydrazine** may damage the liver, kidneys, lungs and blood cells.
- * **Hydrazine** is a (**HIGHLY**) **FLAMMABLE** and **REACTIVE** chemical and is a (**DANGEROUS**) **FIRE** and **EXPLOSION HAZARD**.

IDENTIFICATION

Hydrazine is a colorless, fuming, oily liquid that smells like ammonia. It is used as a rocket fuel, in preparing other organic chemicals, and as an additive for boiler water.

REASON FOR CITATION

- * **Hydrazine** is on the Hazard Substance List because it is regulated by OSHA and cited by ACGIH, NIOSH, NTP, DOT, IARC, HHAG, NFPA, DEP and EPA.
- * This chemical is on the Special Health Hazard Substance List because it is a **CARCINOGEN** and a **MUTAGEN**, and is **FLAMMABLE**, **REACTIVE** and **CORROSIVE**.
- * Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

- * Exposure to hazardous substances should be routinely evaluated. This may include collecting air samples. Under OSHA 1910.20, you have a legal right to obtain copies of sampling results from your employer. If you

think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

- * **ODOR THRESHOLD = 3.0 - 4.0 ppm.**
- * The range of accepted odor threshold values is quite broad. Caution should be used in relying on odor alone as a warning of potentially hazardous exposures.

WORKPLACE EXPOSURE LIMITS

- OSHA: The legal airborne permissible exposure limit (PEL) is **1 ppm** averaged over an 8-hour workshift.
- NIOSH: The recommended airborne exposure limit is **0.03 ppm** as a ceiling concentration in any 2 hour period.
- ACGIH: The recommended airborne exposure limit is **0.1 ppm** averaged over an 8-hour workshift.

- * **Hydrazine** is a **POSSIBLE CARCINOGEN** in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.
- * The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

WAYS OF REDUCING EXPOSURE

- * Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
- * Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
- * A regulated, marked area should be established where **Hydrazine** is handled, used, or stored.
- * Wear protective work clothing.
- * Wash thoroughly immediately after exposure to **Hydrazine** and at the end of the workshift.
- * Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Hydrazine** to potentially exposed workers.

This Fact Sheet is a summary source of information of all potential and most severe health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

HEALTH HAZARD INFORMATION

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Hydrazine**:

- * Contact can cause severe skin and eye irritation and burns with possible damage.
- * Exposure to **Hydrazine** can irritate the nose and throat.
- * Breathing **Hydrazine** can irritate the lungs causing coughing and/or shortness of breath. Higher exposures can cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Hydrazine** and can last for months or years:

Cancer Hazard

- * **Hydrazine** may be a CARCINOGEN in humans. It has been shown to cause lung cancer and leukemia in animals.
- * Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard

- * **Hydrazine** may damage the developing fetus.

Other Long-Term Effects

- * **Hydrazine** may damage the liver and kidneys.
- * **Hydrazine** can irritate the lungs. Repeated exposures may cause bronchitis to develop with cough, phlegm and/or shortness of breath.
- * Exposure may damage the nervous system, causing headache, nausea, vomiting, dizziness and seizures.
- * **Hydrazine** may damage red blood cells and cause a low blood count (anemia).
- * **Hydrazine** may cause a skin allergy. If allergy develops, very low future exposures can cause itching and a skin rash.

MEDICAL

Medical Testing

For those with frequent or potentially high exposure (half the TLV or greater, or significant skin contact), the following are recommended before beginning work and at regular times after that:

- * Complete blood count.
- * Liver and kidney function tests.
- * Lung function tests.
- * Exam of the nervous system.

If symptoms develop or overexposure is suspected, the following may also be useful:

- * Consider chest x-ray after acute overexposure.
- * Evaluation by a qualified allergist, including careful exposure history and special testing, may help diagnose skin allergy.

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under OSHA 1910.20.

Mixed Exposures

- * Because smoking can cause heart disease, as well as lung cancer, emphysema, and other respiratory problems, it may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.
- * Because more than light alcohol consumption can cause liver damage, drinking alcohol can increase the liver damage caused by **Hydrazine**.

WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following controls are recommended:

- * Where possible, automatically transfer **Hydrazine** from drums or other storage containers to process containers.
- * Specific engineering controls are recommended for this chemical by NIOSH. Refer to the NIOSH criteria document: *Occupational Exposure to Hydrazines #78-172*.
- * Before entering a confined space where **Hydrazine** may be present, check to make sure that an explosive concentration does not exist.

Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:

- * Workers whose clothing has been contaminated by **Hydrazine** should change into clean clothing promptly.
- * Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **Hydrazine**.
- * Eye wash fountains should be provided in the immediate work area for emergency use.
- * If there is the possibility of skin exposure, emergency shower facilities should be provided.
- * On skin contact with **Hydrazine**, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted **Hydrazine**, whether or not known skin contact has occurred.
- * Do not eat, smoke, or drink where **Hydrazine** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating or smoking.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

The following recommendations are only guidelines and may not apply to every situation.

Clothing

- * Avoid skin contact with **Hydrazine**. Wear acid resistant gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
- * All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.
- * Safety equipment manufacturers recommend *Butyl, Nitrile, Neoprene, and Polyvinyl Chloride* as protective materials.

Eye Protection

- * Wear splash-proof chemical goggles and face shield when working with liquid, unless full facepiece respiratory protection is worn.
- * For solid wear dust-proof goggles and face shield when working with powders or dust, unless full facepiece respiratory protection is worn.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

- * Where the potential exists for exposures over **0.1 ppm**, use a MSHA/NIOSH approved supplied-air respirator with a full facepiece operated in the positive pressure mode or with a full facepiece, hood, or helmet in the continuous flow mode, or use a MSHA/NIOSH approved self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
- * Exposure to **80 ppm** is immediately dangerous to life and health. If the possibility of exposure above **80 ppm** exists, use a MSHA/NIOSH approved self-contained breathing apparatus with a full facepiece operated in continuous flow or other positive pressure mode.

HANDLING AND STORAGE

- * Prior to working with **Hydrazine** you should be trained on its proper handling and storage.
- * **Hydrazine** ignites spontaneously on contact with OIL, POROUS and ORGANIC MATERIALS (such as EARTH, WOOD and CLOTH), METALS (such as COPPER and ZINC) and METAL OXIDES.
- * **Hydrazine** is not compatible with HYDROGEN PEROXIDES, OXYGEN and STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC).

Fact Sheet #1

If You Can't Stand the Heat

The special gloves, boots, and chemical suits you wear to protect yourself at a spill are called Chemical Protective Clothing. CPC is very important, but it can make your body overheat. About 4,000 people die every year in the US from heat stroke.

Your body heats up when you are:

- ◆ Working hard
- ◆ In a hot area
- ◆ Working in hot weather
- ◆ Carrying a lot of weight (like an SCBA)
- ◆ Wearing lots of clothes (like CPC).



Your body cools itself by sweating. When air blows over the sweat, the water evaporates and cools you down. But when you're wearing a suit, the sweat can't evaporate. If you can't cool down, your body overheats. If it gets bad enough you have heat stroke. **Always work with a buddy when you are wearing CPC.** You can look out for each other and get help if you start to overheat.

Heat Stroke can kill!

Watch out for signs of heat stroke in any worker wearing CPC:

- Hot, dry skin (your body stops sweating)
- Acting confused
- Body temperature of 104 degrees or higher
- Fainting

Get the worker to decon as fast as you can. Rinse them off and **get them out of the suit and SCBA** so their body can cool down. Get medical help fast.

Fact Sheet #1, continued

To prevent heat stress, everyone working in CPC needs:

- More breaks
- More water (not colas or coffee)
- Juice or sports drinks (not salt tablets).

Fact Sheet #2**Your Skin Doesn't Stop Them**

There are hundreds of chemicals that can be absorbed by your skin and do damage to your body. A respirator alone won't protect you from chemicals that soak through your skin. You need Chemical Protective Clothing for every spill. Chemicals can burn your skin, cause rashes, or even soak through your skin and damage your nerves, heart, liver, kidneys, or other systems. They can cause cancer and other long-term diseases.

OSHA lists about 150 chemicals for which employers must prevent or reduce skin exposure. The American Conference of Governmental Industrial Hygienists (ACGIH) lists even more.

About 1/4 of the chemicals for which OSHA or ACGIH has set air limits also require skin protection. They can hurt you because they soak through your skin.

Source: ACGIH, Threshold Limit Values, Cincinnati, OH: ACGIH, 1993



Fact Sheet #3

ABC's of Suits

Levels of Protection

Thick suits that cover all your skin will protect you from strong chemicals but are also really hot. Thin suits that are more comfortable don't protect you from chemicals as well. So it's important to use just the right suit for the chemicals at the spill. Haz Mat teams have come up with a system of four levels of clothing:

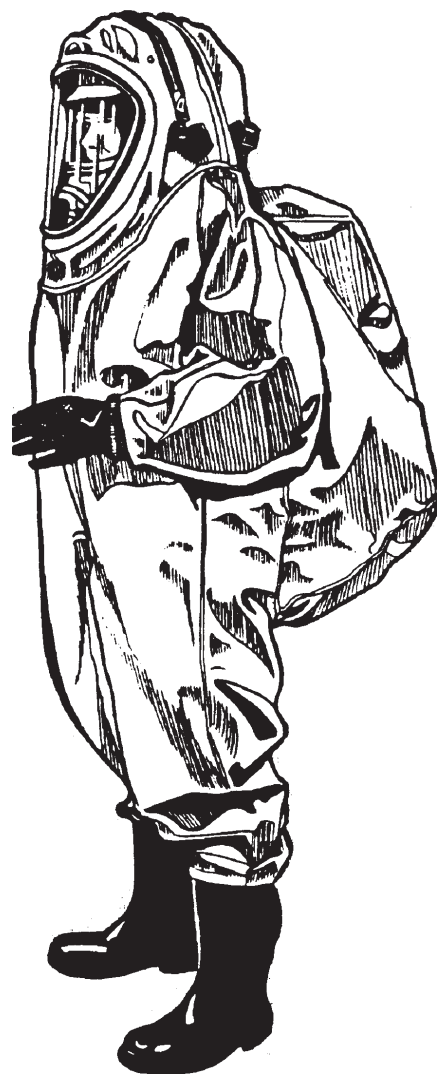
Level A

Equipment: Totally gas-tight suit with no exposed skin, SCBA inside, long Johns underneath (to soak up sweat). 2-3 layers of gloves, boots and boot covers. Sometimes a disposable suit is worn over the level A suit to protect it.

Examples: Responder™, Chemrel Max™

Good for: For Haz Mat Teams only (Technicians & Specialists). Gases or vapors that can soak through the skin (like chlorine). High levels of chemicals.

Problems: All suits will leak eventually, not disposable, very expensive (\$400-\$1600 each), very hot, heavy and clumsy to work in, SCBA runs out of air in 30 minutes or so, no protection in a fire. Must be tested for leaks.



Level A Protection

Fact Sheet #3, continued

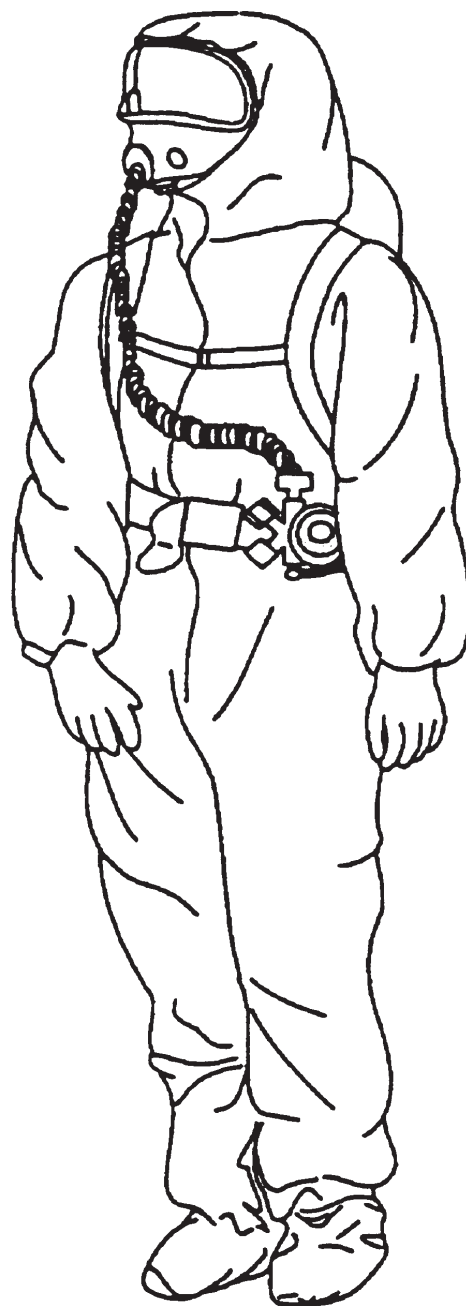
Level B

Equipment: Thick or thin suit, **not** totally gas-tight, may have **some exposed skin**. SCBA can be inside or outside, long johns underneath, 2 - 3 layers of gloves, and boots.

Examples: Responder

Good for: Some dangerous chemicals that can be inhaled or splashed on your skin. Some are disposable.

Problems: Not for gases or vapors that will soak through skin or are very toxic, expensive (\$100-175 each), very hot, clumsy to work in, SCBA runs out of air in 30 minutes or so, no protection in a fire.



Level B Protection

Fact Sheet #3, continued

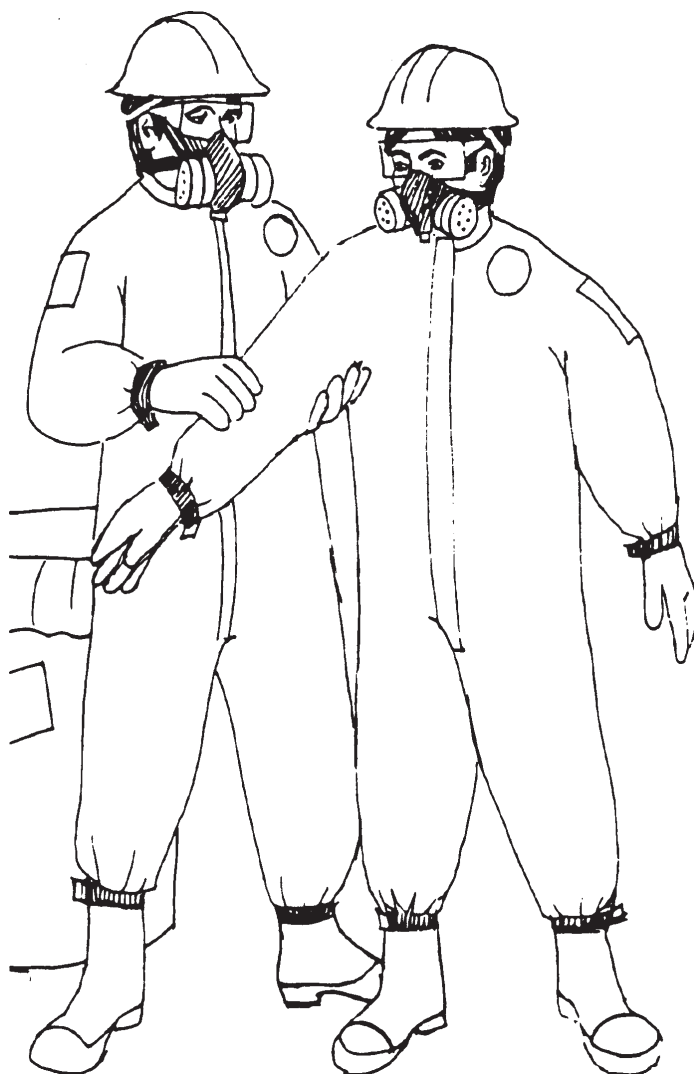
Level C

Equipment: Thin chemical suit (or chemical pants and jacket), gloves, cartridge/filter respirator, sometimes face shield, gloves, boots, work clothes underneath.

Examples: Tyvek , Saranex-laminated Tyvek

Good for: Possible small splashes of chemicals. Many are disposable. Only \$3-\$15 per suit. Light, easier to work in. Won't run out of air. Used for decon only.

Problems: Not for gases or vapors that will soak through skin or are toxic at low amounts, hot, not for enclosed areas without air flow, need separate boots and gloves, no protection in a fire.



Level C Protection

Fact Sheet #3, continued

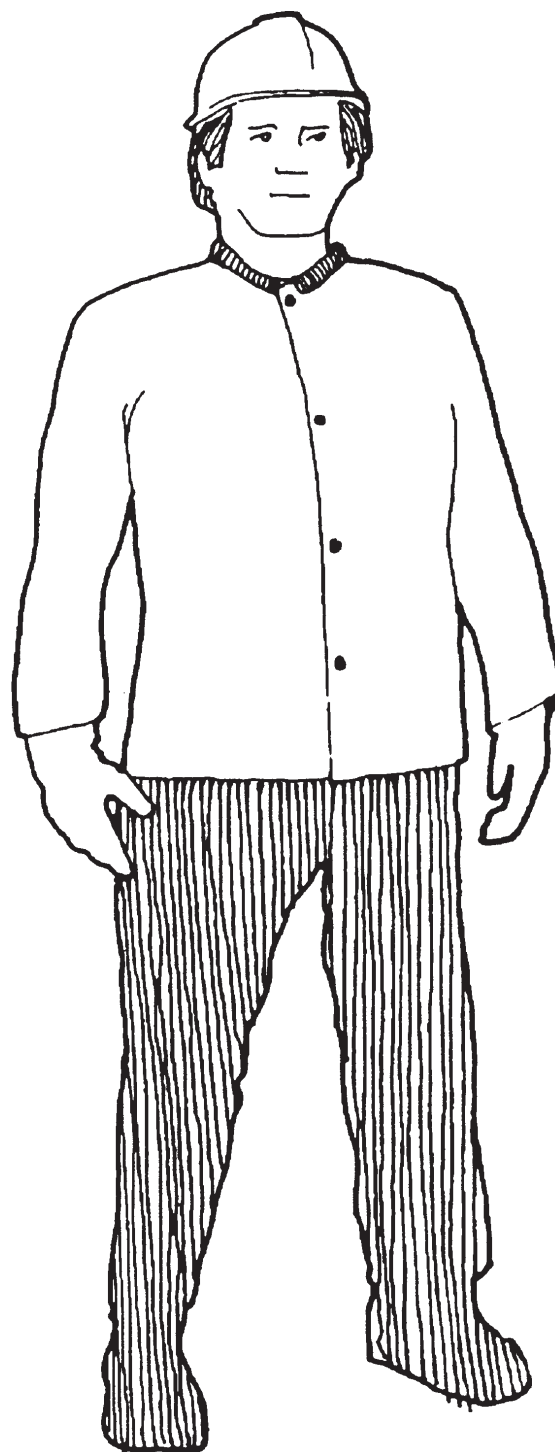
Level D

Equipment: Regular work clothes

Examples: Carharts

Good for: NOT FOR SPILL RESPONSE.

Problems: No protection at all from chemicals. Must be thrown away if chemicals spill on it, cannot be washed clean.



Level D Protection

Sources: (1) "Personal Protective Equipment," Chapter 5 in Gary Togle, ed., *Hazardous Materials Response Handbook, 2nd ed.*, Quincy, MA: National Fire Protection Association, 1993, p.45-62. (2) "Guidelines for the Selection of Chemical Protective Clothing," Appendix F, American

Fact Sheet #4

For Haz Mat Teams Only

Conference of Governmental Industrial Hygienists, Cincinnati, OH, 1983.

Remember, your job is to control a spill from a safe distance where you are not exposed to chemicals. These are deadly chemicals, and you need special training to handle them.

Most of the time, you should do jobs that can be done with level C or D protection, but you might wear level B, too. You are NOT trained to do anything that requires you to wear level A protection.

Here are some activities you might be asked to do in a spill and what you will probably wear:

Level D work:

- ⇒ Support work outside of the cold zone.
- ⇒ Putting down spill control dikes in front of chemicals that don't have vapors that harm the skin.
- ⇒ Closing valves or switches that are far away from a spill.

Level B or C work:

- ⇒ Decon for HazMat teams wearing level B or C suits (the decon team has to wear at least level C protection.)

You might need level B for a few decon jobs, but be sure you are trained to use the equipment at your plant. For example, you need a lot of training on how to use, maintain, and store the SCBAs at your plant. You also need to know what kind of Level B suits you will use (what material they are made of and how to put them on).

Fact Sheet #5

Cloth vs. Disposables

Like diapers, some suits are made to be washed and reused, and some are made to be thrown away after each use. Level A suits are usually washed and reused because they are so expensive. Some level B and C suits are disposable. **Be sure to find out which kind you have**, otherwise you can contaminate yourself or throw away a \$500 suit! Here are some examples of materials that reusable and disposable suits are made of:

Level	Reusable Suits are Made of:	Disposable Suits are Made of:
Level A Gas-tight SCBA inside	All	None
Level B Heavy, not gas-tight, SCBA inside or outside of suit	Butyl rubber Nitrile Other materials	Saranex-laminated Tyvek
Level C Light Air Purifying Respirator (not SCBA)	Rain suits: -PVC -Neoprene -Vinyl -Polyurethane -SBR rubber -Other materials	Tyvek Chemtuff



Fact Sheet #6

Invisible Damage

Choosing the right material is a tricky process. Manufacturers publish charts showing how long each material will last with different chemicals. Sometimes the damage that a chemical will cause is obvious, like burning a hole through the suit. But sometimes you can't see the damage at all.

Ways that Chemicals can Damage Suits

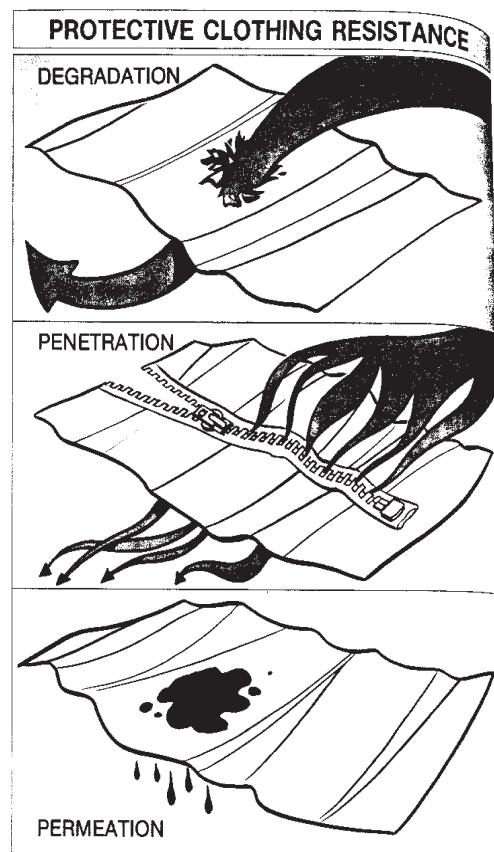
Burns

Chemicals can burn a hole through the material or melt the fabric. This kind of damage is often easy to see. It is called degradation. This often happens after you step in a puddle of chemicals or get a big spill on your suit.

Zippers and Seams

Chemicals can leak through seams or zippers. This is called penetration. It is important to put duct tape on all of your zippers, on the cuffs of your gloves, and the top of your boots.

Some suits (like a Level C rainsuit) have lots of seams. One-piece suits have fewer seams.



Soaking Through – Permeation

Chemicals can soak right through the material. The damage is invisible. This happens faster in hot weather. It also happens faster with some chemicals than with others. You don't have to wade through a

Fact Sheet #6, continued

puddle of chemicals. It can happen if you just splash chemicals on the suit or if there are enough vapors in the air.

Permeation is the most serious kind of damage, because you don't know the suit is not protecting you.

Taping, Zippers, and Seams

Tape zippers closed with duct tape. Tape pant legs to boots and sleeves to gloves with duct tape, too. Fold over the end of the tape to make a tab after you have sealed the opening. The tab makes it easy to get the tape off when you go through decon.



Fact Sheet #7

No Magic Armor

Each of the 13 common materials will only protect you from a few chemicals. There is no “magic armor” that will protect you from all chemicals, even for a few minutes. For example, PVA will protect you from pentane, but will let formic acid soak right through. Natural rubber will fall apart in pentane but will keep formic acid off your skin.

According to the National Fire Protection Association,

“It is most important to note that there is no material that provides satisfactory protection from all chemicals.”






On the next page is an example of a permeation chart. For each chemical, the chart shows about how long different materials will last. So for a spill of methylene chloride, PVA, 4H, or Responder would be the best materials to use. You wouldn't want to use suits or gloves made of butyl rubber or neoprene, to name a few, for the methylene chloride emergency.

When you have a spill, check the charts from the company that manufactures the suits used at your plant.

Sources: Gary Togle, ed., Hazardous Materials Response Handbook, 2nd edition, Quincy, MA: National Fire Protection Association, p. 50

Fact Sheet #7, continued

Permeation Chart

	Recommended (Chemical won't soak through for at least 8 hrs)
	Recommended (Chemical won't soak through for at least 4 hrs)
	Caution (Chemical can soak through in 1-4 hours)
	Not Recommended (degradation may occur)
	Not Tested

	Butyl Rubber	Natural Rubber	Neoprene	Nitrile Rubber	Polyethylene	Polyvinyl-Alcohol (PVA)	Polyvinyl-Chloride (PVC)	Telton™	Viton™	Saranex™	4HT™ (PE/VAL)	Barricade™	Chemrel™	Responder™
Dibromochloromethane	NR	NR	NT	NT	NT	NR	NR	NT		NT	NT	NT	NT	NT
1,1-Dichloroethane	NR	NR	NT	NT	NR	C	NR	NT	C	NT	NT	NT	NT	NT
1,2-Dichloropropane	NR	NR	NT	NT	NT		NR			NT	NT	NT	NT	NT
Ethyl bromide	NR	NR	NT	NT	NT	C	NR		C	NT	NT	NT	NT	NT
Ethylene Dibromide	NR	NR	NT	NT	NR		NR			NR	NT	NT	NT	NT
Ethylene dichloride	NR	NR	NT	NT	NR		NR			NT			NT	
Freon 113 or TF	NR	NR	C		NR		NR			NT				
Freon TMC	NR	NR	NR	NR	NT		NR	NT	NT	NT	NT	NT	NT	NT
Halothane	NR	NR	NR	NR	NT		NR	NT	NR	NT	NT	NT	NT	NT
Methyl bromide		C		NT	NR	NT	NR	NT	NT	NR	NT	NT	NT	NT
Methyl chloride	NR	NR	NT	NT	NR	NT	NR	NR	NT		NT		NT	
Methylene bromide	NR	NR	NR	NR	NT		NR	NT	NT	NT	NT	NT	NT	NT
Methylene chloride	NR	NR	NR	NR	NR		NR	C	NR	NR			NR	

Source: Forsberg, K. and Mansdorf, S.Z., Quick Selection Guide to Chemical Protective Clothing, 2nd edition, Van Nostrand Reinhold, NY

Fact Sheet #8

Eternal Vigilance: Check Your Suit

Sometimes disposable suits are not made perfectly. Sometimes reusable suits are damaged during a response. They aren't cleaned off enough, or they aren't stored carefully. So it's very important to check your suit before you put it on. If there are any problems with the suit, return it and get another one. Here is a checklist for inspecting suits. The answer to every question should be yes.

Checklist	Yes	No
Is it clean?	---	---
Are the seams sealed		
On the hood?	---	---
Under the arms?	---	---
Between the legs?	---	---
On the feet?	---	---
Check the zipper		
Does it open and close easily?	---	---
Are the seams around the zipper closed?	---	---
Check for rips and tears		
Are the feet intact?	---	---
No rips in the back?	---	---
No rips between the legs?	---	---
Check for holes, soft spots, or hard patches		
Are the feet intact?	---	---
Are the sleeves intact?	---	---
Are the legs intact around the boots?	---	---

Level A suits need special tests to make sure they are totally gas-tight. Haz Mat teams will inflate their suits and check to make sure there are no leaks.

Fact Sheet #9

Nothing Lasts Forever

Every time you leave a spill, you have to clean off your suit and other equipment. This is called **decontamination or decon**. Sometimes you wash off your suit with soap and water. Sometimes you wear two suits, wipe them off, and throw them out. In the next section, we will explain how to do decon.

Decon is not perfect. Soap and water can't clean off all of the chemicals. Eventually, chemicals will damage the suit, and it will have to be thrown out. Here are some tips for keeping suits clean for longer:

- * 1. Use the right material for the chemicals involved in the emergency. Select the material that lasts the longest.
- 2. Stay away from puddles that could be chemicals. This will keep chemicals off your boots and your suit.
- 3. Assign one member of the spill control team to carefully move nails, broken glass, or other sharp objects out from under foot. Use a broom and dust pan, not your hands to clean up sharp objects.
- * 4. Use disposable suits whenever you can. You don't have to worry about cleaning them perfectly, you just throw them out.
- * 5. Always wear extra, disposable gloves and boot covers on top of your suit. They will help keep chemicals off the suit, and you can just throw out the disposable covers.
- 6. Be sure to scrub suits all over and rinse them a couple of times. If you rush through decon, chemicals will stay on the suits and damage the material during storage.
- 7. Some companies use special lights (called "black lights," "ultraviolet" or "UV" lights) to check whether suits are really clean. This only works with some chemicals. The UV lights can also damage your eyes. Anyone who uses them needs special glasses to protect their eyes.

Fact Sheet #10

Write it Down

In the middle of an emergency, you don't want to be researching chemical compatibility charts. Your plant's emergency plan should spell out in detail what kind of CPC you need for each chemical.

Here is an example of a good emergency plan:

Spill	PPE
Mineral spirits Dept. 93	Level: B Respirator: SCBA Suit: One-piece Saranex-laminated Tyvek Gloves: Neoprene outer gloves, latex inner gloves Boots: Nitrile Other: Disposable boot covers Decon: Wet
Chlorine Waste Water Treatment Dept.	Level: A Respirator: SCBA Suit: Fully-encapsulating Responder suit with built-in gloves and boots Gloves: PVC outer gloves, latex inner gloves Boots: PVC over-boots Other: disposable boot covers Decon: Wet
Ethylene Glycol Dept. 204	Level: C Respirator: Full-face APR with OV filters Suit: One-piece Tyvek (2) Gloves: Polyurethane outer gloves, latex inner gloves Boots: Natural rubber boots Other: None Decon: Dry

Fact Sheet #11

Slips, Trips, and Falls

Protective clothing is not only hot, it's hard to work in. You need more time to do your work when you're wearing CPC. Suits get in the way because:

- ◆ They have long legs that bunch up.
- ◆ They don't stretch when you move so they bind like a bad-fitting pair of overalls.
- ◆ Gloves make it hard to pick up small objects, and big boots can trip you up.
- ◆ The respirator mask fogs up so you can't see what you're doing.
- ◆ Your co-workers can't hear you when you talk inside a respirator.

In fact, more injuries are caused by slips, trips, and falls than by chemicals during emergency response. Take extra care when you are wearing chemical protective clothing.

Task 2

- **Choose a volunteer.**
- **Help each other dress out in Level C.**
- **Perform check using list below.**

Before you practice putting on level C chemical protective clothing, have one person volunteer from your small group who will dress out later in another exercise. As a group, you will learn how to put on a suit, gloves, boots, and an air purifying respirator. Use the checklist below to help you through the steps and to check your partner’s CPC. The fact sheet on “Eternal Vigilance” will help you do the inspection, too.

- 1) Pick a suit (they come in different sizes), inner gloves, outer gloves, boots and a roll of duct tape.

Checklist	Yes	No	Corrected
Inspect the suit	___	___	___
Put on suit	___	___	___
Tape up zipper, putting tabs on the tape ends.	___	___	___
(If the suit is too big, make a belt out of tape around your waist.)			
Put on boots	___	___	___
Tape top of boots to pant legs, putting tabs on tape.	___	___	___

Task 2

continued

- **Choose a volunteer.**
- **Help each other dress out in Level C.**
- **Perform check using list below.**

2) Pick a full-face air-purifying respirator. Choose the size that fit you best when you did the respirator activity.

	Yes	No	Corrected
Check the respirator for dirt, tears.	___	___	___
Check inside for missing valves.	___	___	___
Put on respirator, under hood of suit, tighten straps.	___	___	___
Do negative-pressure (suck-in) fit check.	___	___	___
Do positive-pressure (blow out) fit check.	___	___	___
Tape hood around respirator, if needed.	___	___	___
Put on inner gloves.	___	___	___
Put on outer gloves (gloves inside sleeves) and tape. Put tabs on tape.	___	___	___
Walk around the classroom wearing full level C.	___	___	___

Task 2

continued

- **Choose a volunteer.**
- **Help each other dress out in Level C.**
- **Perform check using list below.**

Yes No Corrected

When you are done, remove the gloves, boots, suit, and respirator.

___ ___ ___

Write your name on your suit. Then wash or wipe out your respirator.

___ ___ ___

Summary

Chemical Protective Clothing (CPC)

- ★ As an Operations-Level emergency responder, you are trained to control spills from a safe distance. Your job is done in clean areas, except for working on the decon line. You will wear Level B or C to do decon. You must be trained on the equipment at your plant.
- ★ Heat stroke can kill. Always work with a buddy when you wear Chemical Protective clothing. CPC is important, but it can make your body overheat.
- ★ There are 4 levels of personal protective equipment (ppe) from A to D. These levels are different combinations of chemical clothing and respiratory protection. Level A gives the most skin and breathing protection. Level D provides none.
- ★ Some suits are made to be used once, then thrown away. Never reuse a disposable suit. Be sure to find out which kind you have.
- ★ A suit is not magic armor. One material (like PVA or Saranex) can only protect you from a few chemicals.
- ★ Suits don't last forever. Chemicals will damage suits sooner or later. Your suit can also rip or tear during an emergency response.
- * Check your suit before you put it on. Check around the zipper and check all of the seams for rips or tears. If you find any tears, dirt, or chemicals on the suit, get another one.

Summary

continued

Chemical Protective Clothing (CPC)

- ✱ It is very important to decontaminate suits as you leave the emergency. But decontamination can't clean off all of the chemicals. Eventually, the chemicals will damage the suit.
- ✪ Your emergency plan needs to spell out which material will be used for each chemical. For example, the plan could say, "In a cyclohexanol spill, HazMat Responders will wear Viton."
- ✱ Suits are bulky and make work much harder. More injuries are caused by slips, trips, and falls than by chemicals during emergency response.