Health and Safety Practices for SPF Applications

OSHA Safety and Health Regulations
Related to SPF Applications
Introduction

This course provides the attendee with basic safety and health information specifically oriented to the sprayfoam applicator. It presents OSHA requirements on selected topics that are typically encountered by applicators during sprayfoam projects. The presentation and accompanying material is designed to "train the trainer" so that participants can instruct their colleagues in basic OSHA safety and health requirements specific to sprayfoam applications.

The Training CD includes the following instructional material:

- This Training Manual
- 4 Power Point Presentations
- 4 Training Handouts
- 4 Training Quizzes
- 6 Safety and Health Posters

It should be noted that this course and instructional materials does not include a complete identification and instruction of all OSHA safety and health related topics that may be encountered during sprayfoam applications. Each company should assess each application to develop a safety and health plan appropriate for their operations and projects.

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Chapter 1: Written Safety Program & Reporting Injuries

Written Safety Program Elements:

OSHA requires that each business have a written safety program specific to their operations. To assist businesses in developing a written safety program OSHA provides a document entitled: *OSHA Sample Safety and Health Program for Small Business*
http://63.234.227.130/SLTC/etools/safetyhealth/mod2_sample_sh_program.html

In this document, OSHA identifies 4 elements to a written safety program "

- Management Leadership and Employee Involvement;
- Worksite Analysis;
- Hazard Prevention and Control;
- Training.

Management Leadership and Employee Involvement: This element consists of identification of hazards, developing and documenting means of communicating policies and goals of the company regarding safety and health topics.

The main purpose is to demonstrate to OSHA that the employer has effectively involved all employees in the safety and health policies of the company. OSHA specifically recommends that written documents include:

- "Worksite policy (note how this policy is communicated to the work force and visitors);
- Current year's goals, objectives, action plans, and program evaluation;
- Job descriptions that include safety and health responsibilities;
- Performance evaluations that include an evaluation of safety and health responsibilities
- Budget showing money allocated to safety and health;
- Contractor bidding proposal sheets showing all contractors' prior safety and health record;
- Orientation outline for all site visitors, including contractors;

- Evidence of employee involvement, such as committee minutes or other records of employee participation in safety and health program decisions."

Worksite Analysis: As the name implies, the employer is required to conduct a worksite analysis of hazards at the jobsite. OSHA recommends that the workers take a direct involvement in recognizing potential hazards along with the employer. They further recommend that safety oriented work tasks take precedent over job related work tasks. Documentation of worksite analysis as recommended by OSHA would include:

- "Results of baseline safety and health surveys, with notation of hazard correction;
- Forms used for change analyses, including safety and health considerations in the purchase of new equipment, chemical, or materials;
- JHAs; (Jurisdictions having Authority i.e., local, state, federal, agency)
- Employee reports of hazards;
- Site safety and health inspection results, with hazard corrections noted;
- Accident investigation reports, with hazard corrections noted;
- Trend analyses results."

Hazard Prevention and Control: OSHA prefers hazard elimination and prevention over controls. For example in the safety program sample document OSHA recommends that first hazards be eliminated when economically feasible, secondly, use barriers to protect persons from hazards and lastly control exposure to hazards through administrative procedures such as frequent breaks and job rotation.

Another section of the sample safety program has the management ensure that "the workplace and all machinery are cared for properly so that the environment remains safe and healthy."

Of course employee involvement requires employees to follow the established safety rules which would include the wearing of appropriate personal protective equipment. A form of progressive discipline is suggested.

For instance, employees who violate company safety and health policies are treated as follows:

1st offense: oral warning
2nd offense: written reprimand
3rd offense: 2-3 day suspension
4th offense: termination

This section would also be where information such as how persons needing emergency care are treated & transported, who is trained to handle first aid and other emergency responses, and equipment needed for emergency response.

This section of the written safety program would address:

- Hazard communication
- Hearing conservation
- Bloodborne pathogens
- Confined spaces
- Lockout/tagout
- Emergency evacuation
- PPE

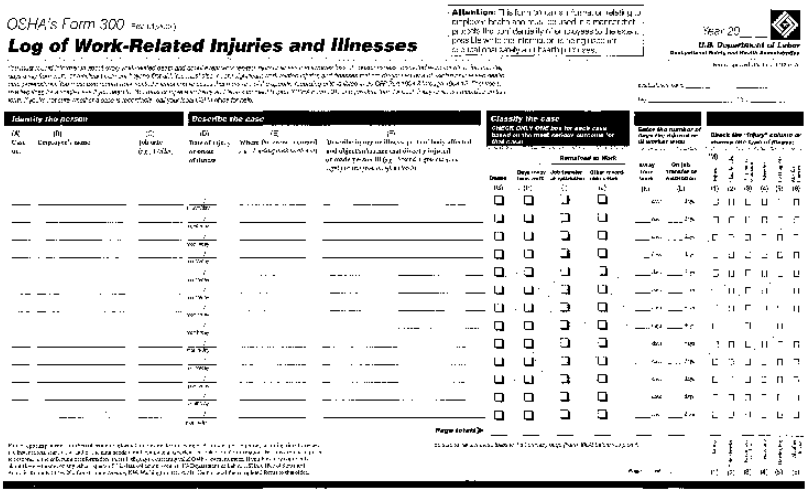
Written documentation for Hazard Prevention and Control according to OSHA would include:

- Preventive Maintenance Schedule
- Disciplinary program and records
- Site Rules
- Written Programs mandated by OSHA
- Maintenance records
- Emergency drill procedures and critiques
- Health surveillance and monitoring records
- Reports and investigations of near misses, first aid, and OSHA 300 logs

Training: As the topic suggests, all employees must receive safety and health training from their employer on all hazards that are anticipated with their job. The training should be conducted on a regular basis and documented. OSHA suggests that documentation should include the following:

- "List of yearly training topics with name of trainer and his/her qualifications
- Yearly training class schedule with attendance lists
- Individual training records with evidence of subject mastery"

Reporting Injuries:
OSHA has specific rules on what is an injury that must be recorded and how to record them. For companies with 10 or more employees, injuries must be recorded in an OSHA 300 Log.



OSHA's Form 300

Log of Work-Related Injuries and Illnesses

The log records any work related illness or injury that results in:

- Death
- Days lost due to injuries
- Reduced work function due to injury
- Transfer to another job
- Injury requiring treatment beyond first aid
- Loss of consciousness
- Injury or illness requiring continuing treatment by a physician or health care professional

Chapter 2 Chemicals

This chapter discusses the chemicals typically used in sprayfoam applications and how to use, store, ship and dispose of them. Items covered include

- Hazard Communication
- Chemicals
- MSDS (Material Safety Data Sheets)
- Health Concerns
- Storage
- Shipping
- Disposal
- Spills

Hazard Communication

Hazard communication as required by OSHA consists of 4 main parts:

- Ensure that the hazards of all chemicals produced or imported are evaluated,
- Information concerning their hazards is transmitted to employers and employees.
- Comprehensive hazard communication programs, which are to include:
- Container labeling and other forms of warning, material safety data sheets and employee training.

The 2 main chemicals used in every sprayfoam operation are the A side component, polymeric MDI (methylene diphenyl diisocyanate) and the B side component which consists of a polyol resin, blowing agents, surfactants, fire retardants and catalysts.

In addition other chemicals are used depending on the type of application. Most suppliers recommend a glycol ether solvent such as DPM (dipropylene glycol monomethyl ether) for cleaning the spraygun. Many roofing applications utilize solvent based coatings such as polyurethane or silicone coatings as protective coatings over SPF. Solvents associated with polyurethane coatings

include xylene, MEK and toluene, and silicone coatings use mineral spirits as their solvent.

Material Safety Data Sheets

OSHA requires that employers provide Material Safety Data Sheets (MSDS) sheets on all chemicals used on the jobsite. This constitutes the first phase of hazard communication. The MSDS sheets contain safety and health information pertinent to the use of the chemicals including:

- Name of chemicals
- Physical hazards
- Health hazards
- Exposure routes
- Permissible exposure levels (PEL)
- Appropriate PPE
- Handling, storage, spills, transportation, disposal information

OSHA further requires that MSDS must be readily accessible to all employees in the work area. *Note: MSDS should also be readily accessible at the company's home office, shop and on the work trucks.*

BASF
The Chemical Company

Safety data sheet
WALLTITE®US R RESIN

Revision date : 2007/05/03 Page: 1/6
Version: 1.4 (30262546/MDS_GEN_US/EN)

1. Substance/preparation and company identification

Company
BASF Polyurethane Foam Enterprises LLC
13630 Watertower Circle
Minneapolis, MN 55441

24 Hour Emergency Response Information
CHEMTREC: 1-800-424-9300
Hotline: 1-800-888-3342

Chemical family: resin
Synonyms: Urethane System Resin Component

2. Composition/information on ingredients

CAS Number	Content (W/W)	Chemical name
	< 75.0 %	Polyol
	< 12.0 %	Flame Retardant
	< 2.0 %	Surfactant
108-01-0	< 3.0 %	2-dimethylaminoethanol
	< 3.0 %	Catalyst
25265-71-8	< 2.0 %	Dipropylene Glycol
460-73-1	< 10.0 %	1,1,1,3,3-pentafluoropropane
107-21-1	2.0 %	ETHYLENE GLYCOL

3. Hazard identification

Emergency overview

CAUTION: MAY CAUSE EYE, SKIN AND RESPIRATORY TRACT IRRITATION.
SENSITIZER.
MAY CAUSE LIVER DAMAGE BASED ON ANIMAL DATA.
MAY CAUSE KIDNEY DAMAGE BASED ON ANIMAL DATA.
CONTAINS MATERIAL WHICH CAN CAUSE CENTRAL NERVOUS SYSTEM DAMAGE.
MAY ADVERSELY EFFECT THE DEVELOPING FETUS BASED ON ANIMAL DATA.

Potential health effects

Primary routes of exposure
Routes of entry for solids and liquids include eye and skin contact, ingestion and inhalation. Routes of entry for gases include inhalation and eye contact. Skin contact may be a route of entry for liquified gases.

Acute toxicity:
Ingestion may cause gastrointestinal disturbances.

Example of a sprayfoam MSDS (courtesy of BASF)

HMIS and NFPA Identification

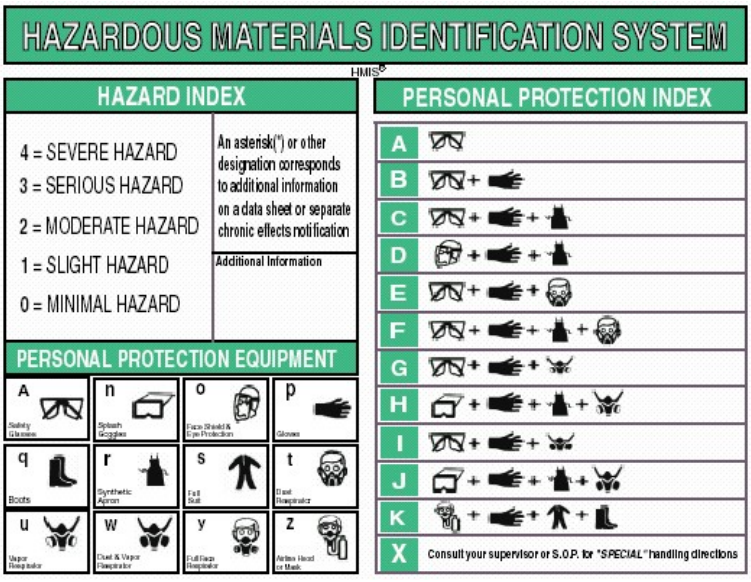
Another key component to hazard communication are the HMIS and NFPA identification labels on material drums and containers. The HMIS (hazardous materials identification system) provides hazard information important for a person working with the material.

HMIS Label

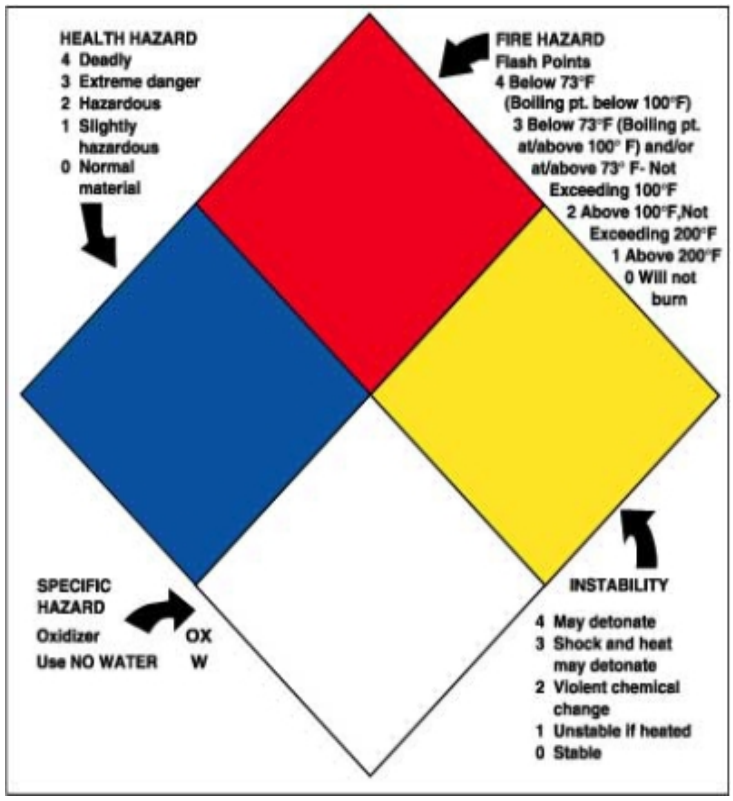
The HMIS label uses scale of 0 to 4, with 0 as the lowest hazard and 4 the highest. Categories rated include:

- Health (blue rectangle)
- Flammability (red rectangle)
- Reactivity (yellow rectangle)
- PPE (personal protection equipment) required (white rectangle)

The PPE section also will include a chart showing different types of PPE that may be required depending on the designation on the HMIS label.



The NFPA label is used to provide fire fighters with pertinent information on how the chemical reacts in a fire situation.



The NFPA label also uses a 0-4 scale with 0 the lowest hazard and 4 the highest as follows:

- Left diamond (blue): Health
- Top diamond (red): Fire
- Right diamond (yellow): Reactivity
- Bottom diamond (white): Special/specific hazards

SARA Title III:

OSHA requires that all EPA environmental reporting be conducted as needed. The main environmental reporting on chemicals is included in title III of the Superfund Amendments and Reauthorization Act (SARA) in the Emergency Planning and Right-to-know section (EPCRA) - known as EPCRA.

EPRCA Section 311 requires MSDS for any hazardous chemical on site in quantities greater than 10,000 lbs. go to:

- Local fire department,
- LEPC (Local Emergency Planning Committee) and
- SERC (State Emergency Response Commission

The reporting requirement must be met within 90 days of any new chemical being on-site at or above the threshold quantity. Note: For extremely hazardous chemicals, the threshold quantity is 500 lbs.

The penalties for non-compliance can be severe:

- Up to $25,000 per day
- Criminal penalties and Jail time for willful violations

ECRA uses OSHA's HAZCOM definition of hazardous chemicals which lists diisocyanates (A component) as hazardous. Therefore any sprayfoam contractor with 20 drums or more of A side component in their shop or warehouse would require reporting to the agencies listed above. *(Note: hazardous chemicals stored on the jobsite do not require reporting to the agencies since it would be temporary in nature.)*

Transporting and Handling SPF Chemicals

As stated earlier the 2 components of spray polyurethane foam consists of the A side component (MDI) and the B side component (polyol resin blend).

The B side components are not regulated by the Department of Transportation for shipping purpose.

The A side component requires hazardous material shipping regulations when the bulk quantity A-Side Components (PMDI) equals 10,000 lbs or more. *(Note: Other hazardous materials may have different threshold quantities beginning at 100 lbs.)*

Very few sprayfoam contractors have trucks or shipping tanks that equal or exceed 10,000 lbs of A side component. However many SPF manufacturers have tank trucks that would fall into this category and would need to adhere to the following OSHA and DOT requirements:

- Tank Truck must be designed to specifically carry MDI
- Record keeping is mandatory for all shipments
- Hazardous placards must be on the truck
- OSHA safety training is required for drivers (CFR 49.383)
- Commercial drivers license is required for all drivers

Working with the A Side (MDI)

As we reported above MDI is classified as "hazardous" for shipping & storage purposes. It will react with water creating a gas that can cause pressure that can rupture drums if they are sealed with water in them. Persons can be sensitized to the chemical by inhaling vapors or by skin contact. The OSHA required permissible exposure level for fumes and mists are 0.02 parts per million. The ACGIH TLV-TWA for MDI is 0.005 parts per million. While the ACGIH TLV-TWA exposure limit is not required by OSHA it may be included in some government contracts. So the sprayfoam contractor should read the contract documents to verify they are complying with the appropriate requirements.

MDI can require different PPE depending on the job. For example, moving drums of material with a fork lift would not require respirators or chemically resistant clothing, but pour-ups of the A side would.

And it should be noted that empty drums of MDI require special handling for disposal.

An over exposure of the A component can cause sensitization that results in:

- coughing
- chest-tightness/discomfort
- shortness of breath
- reduced lung function

Respiratory sensitization can result from a massive overexposure or repeated exposure to airborne concentrations above the exposure limit. Skin exposure can cause skin irritation similar to a sunburn or chemical burn. Some studies indicate that skin exposure may also cause lung sensitization. Contact with the eyes will cause tearing and burning.

As a result of these health hazards MDI has the following HMIS ratings:

Health:	2
Flammability:	1
Reactivity:	1
PPE	X (*Note: X designates that the chemical requires different PPE for different job activities. Each activity must be evaluated to determine the appropriate PPE for the job.)*

<u>B Side (Polyol Resin)</u>

The B side consists of 5 main ingredients:

- Polyol resins
- Fire retardant (typically phosphorous ethers)
- Surfactants
- Blowing Agents
- Catalyst (tertiary amines or metal catalysts)

The B side is not regulated as a hazardous material for shipping and handling. However there are still health concerns with its use. For example inhalation exposure may cause respiratory irritation. Skin or eye contact may cause irritation. The most common concern associated with the use of the B side component is a foggy or “halovision” during application. This condition creates a blue haze or fog that narrows a person’s vision. Typically this is a temporary condition that goes away after a few hours.

While OSHA or ACGIH have not established exposure limits for the B-side component, it contains tertiary amine catalysts that have a fishy odor that may be objectionable to some persons.

Solvent:

Many contractors pay great attention to the hazards of the sprayfoam chemicals and forget that solvents may be even more hazardous to ones health. Most solvents are classified "hazardous" and some are classified "extremely hazardous" for shipping and storage purposes. Many are extremely flammable. As reported earlier, types of solvents typically used include:

- DPM (dipropylene glycol monomethyl ether) (gun cleaner)
- MEK (methyl ethyl ketone) (Polyurethane coatings)
- Mineral spirits (silicone coatings)
- Toluene/xylene (polyurethane coatings)

The health hazards of solvents can vary significantly depending on the type of solvent. Typical health hazards would include the following:

- Irritation of eyes, nose and throat
- Chemical pneumonia
- Dizziness
- Nausea
- Severe skin irritation
- Liver, kidney damage, etc

Solvents used in SPF roof coatings can create odors that linger for days after the application. So, it is important to reduce the potential for fumes entering an occupied building. Regardless of the permissible exposure levels, of the solvent, odors created can affect some persons more than others. The most common reaction to odors created from solvents are headaches, nausea and dizziness.

Hazardous Wastes and Disposal

Hazardous wastes and disposal definitions and requirements are listed in EPA 40 CFR Part 261. EPA defines 3 classes of hazardous waste generators:

- Large quantity generators (LQG) – unlimited quantities
- Small quantity generators (SWG) – 100 to 1000 Kilos/month
- Conditionally-exempt small quantity generators (CESQG) - less than 100 kilos/month

Hazardous wastes must be shipped to a permitted hazardous waste treatment, storage or disposal facility (TSDF) Disposal of hazardous wastes. The containers must be marked clearly as "hazardous" and a hazardous waste manifest must accompany the containers

Most SPF contractors would be considered small quantity generators. The hazardous wastes generated from sprayfoam operations would include MDI, solvents and solvent based coatings.

What about empty A side drums? The A side is considered a hazardous material, but if the drum is empty, it can be neutralized with a solution by filling them with water or a decontamination solution of 5-10% sodium carbonate and allowing them to stand unsealed for at least 48 hours. Decontamination can prevent exposure to residual MDI in containers destined for a scrap dealer or landfill. The decontaminated drums may then be disposed of in 3 ways:

- Sent to a container reconditioner
- Sent to a scrap metal dealer
- Taken to an approved landfill

Note: Storing other materials in containers that previously held MDI could lead to a chemical reaction and potential worker safety issues

If drums are sent to a scrap metal dealer or a landfill the drums should be crushed or have holes punched in them so they cannot be re-used as containers.)

NO cutting or hot torches should be used to cut used MDI containers.

Decontamination solutions and rinse water should be disposed of properly according to federal, state and local laws and regulations

Disposal of waste A and B Components:

Even thought the A side component is considered hazardous, excess A-side and B-side components may be reacted to form non-hazardous solids that may be disposed as regular trash. *(check with disposal facility before using this option)*

Mix in small amounts to minimize a possibility of the mixture producing excessive exothermic heat (possible spontaneous combustion).

Spills

Sprayfoam applicators should have spill containment materials and equipment at the job site and on the truck during transport of chemicals. The spill can be contained with sand, wet earth or absorbent clays. The spill area should be barricaded from the public or unprotected workers. The spill workers must use the appropriate PPE for the chemical spilled. Add neutralizer to the absorbent materials and safely transfer materials into an open top container. Dispose of materials in accordance with local, state and federal regulations

(Note: A side materials may react with water, causing excessive pressure within a sealed container. So, be sure to keep it is on open top container.)

Websites for Additional Information:

- OSHA General Industry 29 CFR 1910
  http://osha.gov/pls/oshaweb/owasrch.search_form?p_doc_type=STANDARDS&p_toc_level=1&p_keyvalue=1910

- OSHA Construction Industry 29 CFR 1926
  http://osha.gov/pls/oshaweb/owasrch.search_form?p_doc_type=STANDARDS&p_toc_level=1&p_keyvalue=Construction

- EPA links to information on permits, storage, disposal, recycling, and identification of hazardous materials www.epa.gov/epaoswer/osw

- EPA links to hazardous waste and RCRA information within EPA
  www.epa.gov/estpages/wasthazardouswaste.html

- Center for the Polyurethane Industry (CPI) Product Stewardship Literature http://polyurethane.org/s_api/sec.asp?CID=885&DID=3561

Chapter 3 Personal Protection Equipment (PPE) 1926.28a

Sprayfoam applications require the use of chemicals that can cause serious health problems if the proper PPE is not used. The type of PPE required varies considerably depending on the task. The PPE required for sprayfoam applications would create the greatest health hazards.

OSHA requires that the employer "is responsible for requiring the wearing of appropriate personal protective equipment in all operations where there is an exposure to hazardous conditions or where this part indicates the need for using such equipment to reduce the hazards to the employees".

"The personal protection equipment is to be provided by the employer at no cost to the employee".

When employees provide their own protective equipment, the employer is responsible to assure its adequacy, including proper maintenance, and sanitation of such equipment.

The employer is not required to pay for non-specialty safety-toe protective footwear (including steel-toe shoes or steel-toe boots) and non-specialty prescription safety eyewear, provided that the employer permits such items to be worn off the job-site."

PPE refers to any item that protects the face, eyes, ears, extremities, head and foot from injuries likely to occur on a jobsite. It includes equipment that prevents falls and protects the lungs such as respirators.

It includes (but is not limited to) items such as protective clothing

- Footgear
- Headgear
- Coveralls
- Gloves
- Respiratory devices
    - Air purifying respirators
    - Air supplied respirators
    - Dust masks

- Protective shields and barriers
- Safety harnesses and lanyards

OSHA requires PPE "wherever it is necessary

- by reason of hazards of processes
- or environment
- chemical hazards
- radiological hazards,
- or mechanical irritants"

"Encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact."

In other words, OSHA requires an employer to assess the potential dangers and determine if and what type of PPE is required for every job task likely to occur at a project.

Employer Requirements

Sprayfoam Specific Tasks and PPE
There are many tasks involved in sprayfoam operations. At the jobsite, these would include:

- Application
- Helper (Hose puller)
- Changing Drums or Pour Ups
- Shipping, handling storage
- Spill Containment
- Trimming

Air Purifying Respirators:
One of the key pieces of PPE used by a sprayfoam applicator is his respirator. This can be an air purifying respirator typically acceptable in exterior applications such as roofing or air supplied respirators typically required in interior applications.

Air purifying respirator with high particulate filter

In order to use an air purifying respirator, the employer must determine through reliable monitoring data that the PEL in the spray application area will not exceed the capabilities of the respirator. The sprayfoam industry recommends no more than 10 times the PEL in the area of application in order to use an air purifying respirator. The Center for the Polyurethanes Industry (CPI) estimates based on exterior monitoring of sprayfoam applications that in most roofing applications, this threshold would be not be exceeded and an air purifying respirator could be used.

OSHA determined that an air purifying respirator can be used if the following requirements are met:

- Reliable data is provided for the recommendation
- The respirator is designed to remove the appropriate contaminants (organic vapors with a HPE filter)
- A change out schedule is followed specific to the job task.
- Fit testing is conducted on all employees using air purifying respirators
- Medical evaluations are conducted on all employees using air purifying respirators

When OSHA first allowed the use of air purifying respirators with sprayfoam applications in the late 1990s, the change out schedule was 8 hours maximum of application or per day. Lately the polyurethane industry is conducted research to determine if longer change out schedules could be utilized based on different application scenarios. For example, in roof top applications, fumes and mists can be carried away from an applicator by light winds, reducing the amount of vapors that have to be filtered by the respirator. However, before extending a change out schedule beyond 8 hours, the employer must provide data demonstrating that a longer change out schedule is appropriate.

Chemically Resistant Gloves:

The most common glove used in the sprayfoam industry are nitrile gloves. This is based on testing conducted by CPI on a variety of gloves including, latex, PVC, butyl rubber, nitrile and others against MDI and solvent break through. The testing demonstrated that PVC, nitrile, butyl rubber gloves all had more than adequate protection (more than 4 hour break) from the solvents most commonly used with sprayfoam applications and the A side component (MDI).

The nitrile gloves are used frequently because of their dexterity and flexibility.

Sprayfoam applicators should use gloves that cover the wrist as well as the hand.

Chemically resistant gloves that protects both hand and wrist are required on many sprayfoam projects. This glove provides protection of both hand and wrist.

Eye Protection

Eye protection is required for all sprayfoam applicators. In roofing applications, wrap around safety glasses or goggles are sufficient to prevent fine particles from entering the eyes.

Chemically Resistant Coveralls

It is important to protect the skin against spills, leaks, overspray from sprayfoam applications. The most common way to accomplish this is by the use of chemically resistant coveralls. The most common types are Tyvek and Saranak. The suits come in a variety of resistance to chemicals so the manufacturer should be contacted for recommendations of the right type

Chemically Resistant Footwear:

It is equally important to protect the feet against spills and leaks of the foam materials. Rubber boots made of butyl offer very good protection against MDI and solvents, but can be bulky in certain sprayfoam applications (such as attics or crawl spaces). One option recently allowed by OSHA is to wrap existing work shoes with PVC duct tape and plastic. The PVC tape is chemically resistant to solvents and MDI and so long as it completely covers the shoes, it should offer good protection.

Air Supplied Respirators:

Air supplied respirators are typically used for interior applications, although some roofing applicators in hot climates use air supplied respirators that have air cooling devices on the units. Note that this respirator has a full face cover which also protects the eyes from fumes and mists.

The air supplied respirators must provide breathing air with the following properties:

Supply air equal to atmospheric air:

- 19.5 % to 23.5% oxygen
- Maximum 1000 ppm CO2
- Maximum 10 % CO

Diesel or gas powered air compressors must be constructed and designed to:

- Prevent entry of contaminated air into the air-supply system.
- Minimize moisture content so that the dew point at 1 atmosphere pressure is 10 degrees F (5.56 C) below the ambient temperature.
- Have suitable in-line air-purifying sorbent beds and filters to further ensure breathing air quality.
- Sorbent beds and filters shall be maintained and replaced or refurbished periodically following the manufacturer's instructions.
- Have a tag containing the most recent change date and the signature of the person authorized by the employer to perform the change. The tag shall be maintained at the compressor.

Reference: 29 CFR 1910.134(i)(5)

Oiless Air Compressor specifically for breathing Air Requirements:

1. These devices are not to be used in an atmosphere which is immediately dangerous to life or health.
2. Air used for this equipment must be drawn from an uncontaminated air source. Suitable filters and sorbents shall be installed and maintained when the need arises.
3. The air delivered by the compressor at the Breathing zone of the SAR wearer must meet the requirements of Grade D Breathing air as prescribed in 29 CFR 1910.134[(i)(1)(ii)].

Additionally the hoses, fittings, etc must be designed for air supplied respirators specific to that model.

Protective Head Gear:

Many construction jobs require hard hats to protect against falling objects or bumping your head on overhead obstructions. This is most likely to occur in attics and crawl spaces or in jobs where others are working overhead from the area of application. Note that this self contained air supplied respirator includes a hard hat.

PPE for Other Tasks

Changing drums and pouring up material is a common task for sprayfoam helpers and applicators. The following PPE would be required for these tasks:

- Chemically resistant coveralls
- Faceshield or other eye protection
- Air purifying respirator
- Chemically resistant footwear
- Safety shoes (when moving heavy drums or equipment)

What about back support equipment?

There is considerable debate whether back support is appropriate for workers who lift and move heavy objects. The following opinion by Gary Finch of Compliance Plus (a company specializing in OSHA compliance programs) best sums up the government policy on back support equipment.

"The National Institute for Occupational Safety and Health (NIOSH) does not recommend the use of back belts to prevent injuries among uninjured workers and together with the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) does not consider back belts to be personal protective equipment. NIOSH emphasizes that back belts do not mitigate the hazards to workers posed by repeated lifting, pushing, pulling, twisting or bending. Despite inconclusive evidence, some individuals perceive a benefit from wearing a belt, but they are not a substitute for a comprehensive back injury prevention program." (source: http://www.kisscompliance.net/qna.php)

Is there any additional PPE typically used with sprayfoam applications?

Yes, but it would be dependent on the job conditions. For example, ear protection may be required by workers who are close to loud equipment such as:

- Generators or compressors
- Coating pumps or proportioners
- Air blowing equipment
- Power tools and trimming equipment

Written Respiratory Program **29 C.F.R. §1910.134**

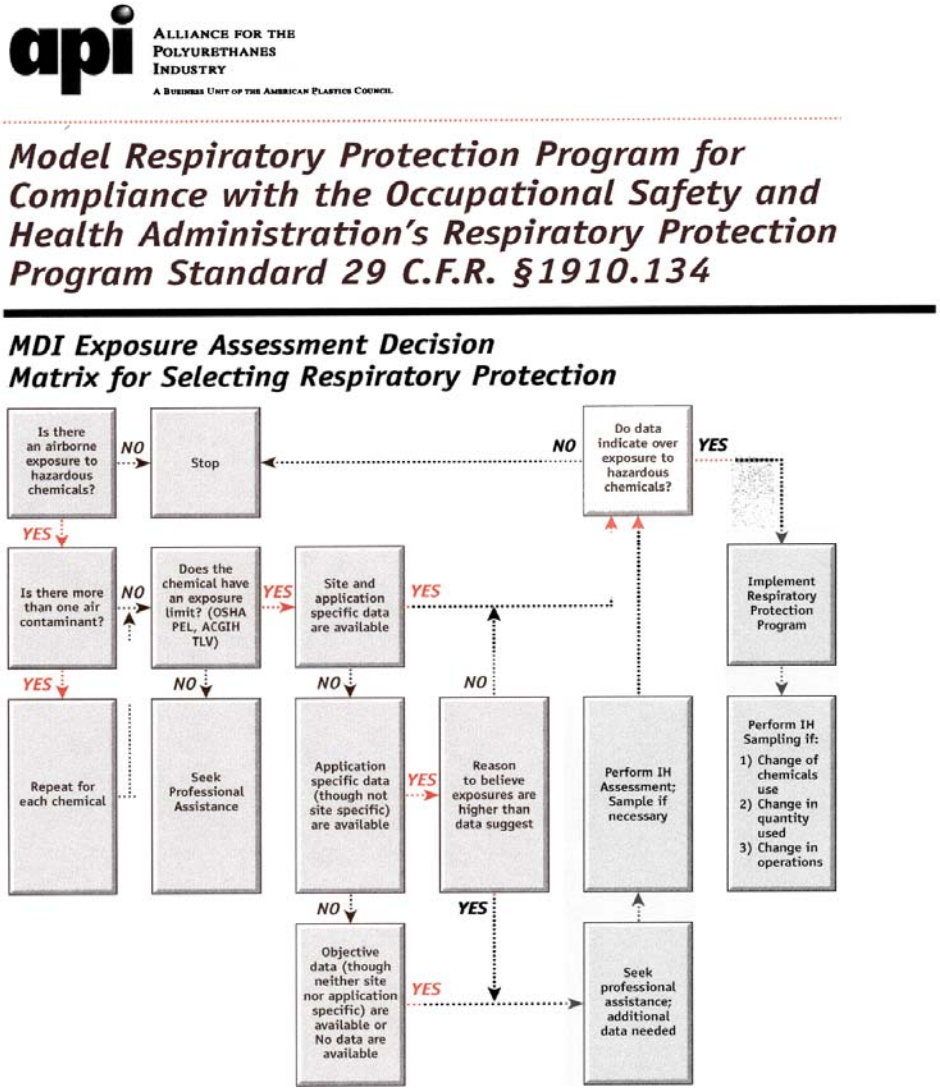
OSHA's requires a written respiratory program for use of respirators. Elements of an OSHA required program include:

- Identify where respirators are needed
- Learn about appropriate respiratory protection options
- Administer medical evaluation for workers wearing respirators
- Conduct fit testing
- Train respirator users
- Maintain written documentation of program

Center for the Polyurethane Industry Model Respiratory Protection Program

The Center for the Polyurethane Industry (CPI) compiled thousands of MDI monitoring studies conducted by their member companies and others and used that data to develop a Model Respiratory Protection Program. The program is available online at polyurethane.org and is used to assist companies to protect their employees from respiratory hazards and ensure compliance with OSHA's Respiratory Protection Program Standard.

The program can be downloaded from their website at http://www.polyurethane.org/s_api/bin.asp?SID=3&DID=3990&CID=885&VID=160&DOC=File.PDF



Program Administrator

The written respirator protection program requires a program administrator whose duties are:

- Identifying work areas, processes, or tasks requiring respirators
- Selecting appropriate respiratory protection options
- Monitoring respirator use
- Arranging for and or conducting training
- Ensuring proper storage and maintenance
- Conducting qualitative fit testing
- Administering the medical surveillance program
- Maintaining required program records
- Evaluating the respiratory protection program
- Updating the written program, as necessary.

Chapter 4: Fall Protection, Scaffolds/Ladders, Attics and Crawlspaces

Fall Protection: 1926.501 – 1926.502

OSHA requires fall protection for any working surface with an unprotected side or edge 6 ft high. This can take the form or guardrails systems, safety net systems or personal fall arrest systems. Alternative forms of fall protection may be accepted on specific types of work related tasks and conditions.

Roofing Fall Protection

In roofing applications you are required to use the guardrail system, safety net systems or personal fall arrest systems. However, in low slope roofing applications, you may also use a warning line system with safety monitoring as an alternate means of fall protection. This system allows greater production while still providing in OSHA's opinion sufficient protection against falls.

If the roof is less than 50 foot in width, you may use a safety monitoring system alone.

Warning Line System

A warning line system consists of a rope, wire or chain that is 34 to 39 inches from the surface of the roof. It is set 6 ft from the edge of the roof and has flags attached to the wire, rope or chain at 6 ft intervals or less. Plus the stanchions (after being erected) must be capable of resisting 16 lbs of horizontal force at 30 inches above the walking surface of the roof (perpendicular to the rope, chain or wire).

The rope, wire, or chain also must have a minimum tensile strength of 500 pounds after being attached to the stanchions.

Only persons performing roofing work in that area are permitted between the warning line and the edge of the roof.

Examples of warning line systems and stanchions

Safety Monitor

As discussed earlier, the warning line system can only be used with a safety monitor. The safety monitor is a member of the work crew that has been trained in fall protection. He warns workers of fall hazards or unsafe practices. He has to be within visual sight of the worker and be able to orally communicate with him. He cannot have other duties that would distract him from the primary safety monitoring duties.

Many companies ask OSHA if the hose puller can be the safety monitor for the spray applicator. Opinions may vary depending on the OSHA inspector. However, if it can be demonstrated that the hose puller would not be distracted by other duties (such as communicating with the job trailer on heat and

pressure of the equipment) and can keep a constant eye on the sprayer then he may be allowed to be the safety monitor.

Holes:

Open holes are common on roof tops. Skylights are considered open holes by OSHA and must be protected with covers or guardrails. Covers must be capable of supporting twice any anticipated load from employees or equipment, be secured in place, and be labeled “HOLE” or “COVER” in accordance with the requirements of 1926.502(i).

Roof Access:

Access to the roof on a typical roofing project will be by way of the building roof hatch, a safety scaffold stair tower, or (most often) by a ladder. When ladders are used, the following precautions must be observed:

- Inspect the ladder carefully for worn or damaged parts.
- Use only Type I Commercial/Industrial rated ladders.
- Stand the ladder up using the proper technique.
- The ladder must extend three (3) feet above the top of the roof edge or parapet.
- The ladder must be set up on level ground and at the proper angle.
- The ladder must be tied off at the top of the wall.

Scaffolds & Ladders

Scaffolding is used frequently in interior sprayfoam applications, particularly in commercial projects.

A project may require a stationary type of scaffolding similar to the type used by plasterers or a rolling scaffold used most often by spray painters. Each type has its own set of rules for the construction and use.

Scaffold Requirements:

The following are some of the key requirements for scaffolds:

- It must be capable of supporting 4 times the anticipated load
- The Load-carrying timber members of scaffold framing must be a minimum of 1,500 f. (Stress Grade) construction grade lumber.
- The planking must be Scaffold Grade and sized according to the table in 1910.28(a) (9)
- All planking or platforms must be overlapped (minimum 12 inches) or secured from movement.
- An access ladder or equivalent safe access must be provided.
- Scaffold planks must extend over their end supports at least 6 inches and not more than 18 inches
- The poles, legs, or uprights of scaffolds have to be plumb, and securely and rigidly braced to prevent swaying and displacement.
- Materials being hoisted onto a scaffold must have a tag line.
- Overhead protection must be provided for men on a scaffold exposed to overhead hazards. (nets or similar equipment to catch falling objects that is constructed in accordance with OSHA standards)

Tubular Scaffolds

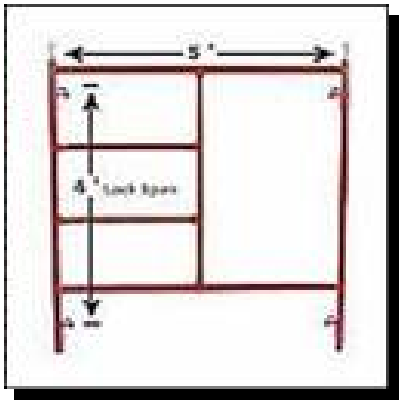
The most common scaffolds used by sprayfoam applicators are tubular scaffolds. They can be stationary or movable. They are categorized as light duty, medium duty and heavy duty with the following descriptions:

- Light - Designed and constructed to carry a working load of 25 pounds per square foot.
- Medium - Designed and constructed to carry a working load of 50 pounds per square foot.
- Heavy - Designed and constructed to carry a working load of 75 pounds per square foot.

Light duty scaffolds have posts 6 ft x 10 ft apart. Medium duty scaffolds have posts 5 ft x 8 ft apart and heavy duty have posts 6 ft x 6.5 ft apart.

Light duty scaffold

Medium duty scaffold



Heavy duty scaffold

Tubular Scaffold Requirements:

Some of the key requirements of tubular scaffolds include:

- Guardrails must be at least 2 x 4 inches and between 36 inches and 42 inches high,
- Guardrails must have a mid-rail, when required, of 1- x 4-inch lumber or equivalent,
- Toeboards must be installed at all open sides on scaffolds more than 10 feet above the ground or floor.
- Toeboards shall be a minimum of 4 inches in height.
- Wire mesh must be installed if persons will be working below the scaffold in accordance with OSHA regulations

Manually Propelled Scaffold Requirements

Many times a sprayfoam contractor will use scaffolds that are manually propelled. The applicator may be spraying ceilings or walls and it would be inefficient to climb down from the scaffold before moving it.

If the scaffolds are to be manually propelled then the following requirements apply:

- Maximum work level height can be no more than four (4) times the minimum or least base dimensions of any mobile ladder stand or scaffold.
- The minimum platform width for any work level can be no less than 20 inches for mobile scaffolds (towers).
- The ladder stands must be a minimum step width of 16 inches.
- Fall protection is required for each employee on a scaffold more than 10 feet (3.1 m) above a lower level as either a fall arrest system or guard rails
- The work level platform of scaffolds (towers) must be constructed of wood, aluminum, or plywood planking, steel or expanded metal, for the full width of the scaffold, except for necessary openings.
- All planking must be 2-inch (nominal) scaffold grade minimum 1,500 f. (stress grade) construction grade lumber
- All scaffold work levels 10 feet or higher above the ground or floor must have a standard (4-inch nominal) toeboard.
- All work levels 10 feet or higher above the ground or floor must have a guardrail of 2- by 4-inch nominal or the equivalent installed no less than 36 inches or more than 42 inches high, with a mid-rail, when required, of 1- by 4-inch nominal lumber or equivalent.
- The casters must have positive wheel and/or swivel lock to prevent movement
- Wheels or casters must be designed to support four (4) times the design working load

If using a lifeline, then each workman protected by a safety lifebelt attached to a lifeline must have the lifeline securely attached to substantial members of the structure (not scaffold), or they must secure the lifeline to securely rigged lines, which will safely suspend the workman in case of a fall.

Ladders 29 CFR 1926 subpart X and subpart M

At the present time, OSHA does not require fall protection for workers climbing or working on portable ladders as long as it is below 24 feet. But there is some debate on this issue and changes may be in the works.

Although the OSHA standards do not require fall protection for workers on fixed ladders below 24 feet or on portable ladders, they do encourage employers to provide additional protection.

Some general contractors are attempting to require fall arrest systems for their subcontractors working on ladders 6 feet or higher. This is being driven by insurance company assessments of jobsite conditions.

Individual states OSHA regulations may differ from the national OSHA regulations. For example OSHA in the state of Georgia is considering the use of fall arrest systems for workers climbing or working on ladders at 6 feet or higher.

So this is a requirement that might become part of a specification or a statewide regulation. It is up to the contractor to find out what is required for their project and to keep up with the regulations on fall protection for ladder use.

Attics and Crawl Spaces

Attics and crawl spaces due to the variety of conditions can also have a variety of regulations to follow.
For example attics and crawls spaces may or may not be classified as confined spaces. You may or may not need fall protection and protective headgear may or may not be required.

Confined Space

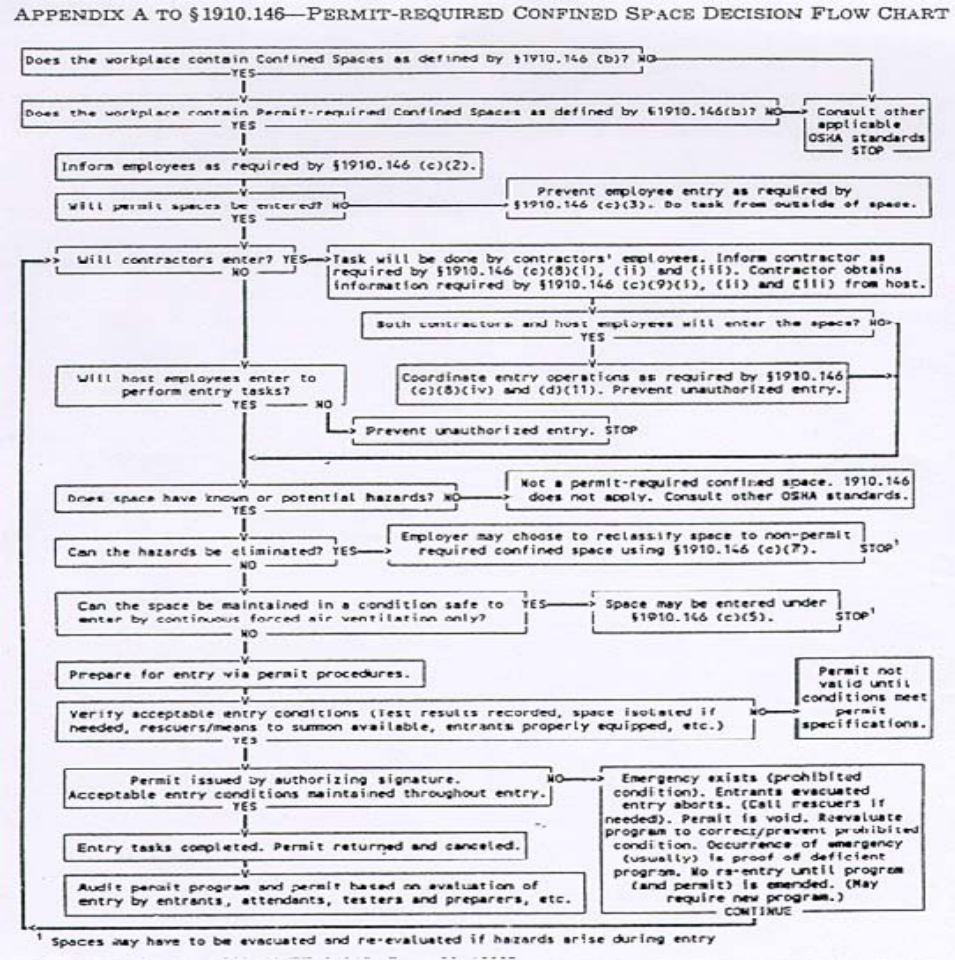
OSHA defines a confined space as a space that:

- Is large enough and so configured that an employee can bodily enter and perform assigned work
- Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry.)
- Is not designed for continuous employee occupancy.

A permit defined confined or enclosed space also means any space having a limited means of egress, which is subject to the accumulation of toxic or flammable contaminants or has an oxygen deficient atmosphere i.e., less than 23.5% oxygen.

So, an attic or crawl space that under normal circumstances has sufficient oxygen and has a hatch with limited access can have an oxygen deficient atmosphere if a large volume of sprayfoam is applied in a short period of time. In order to prevent an attic or crawl space from becoming a confined space, ventilation can be added to increase the amount of oxygen in the space and to remove fumes and mists that would normally build up in the area.

The decision tree on the next page (published by OSHA) can help determine if your work area is a confined space



Attic Fall Protection 1926 Subpart M Appendix E

OSHA addresses fall protection in attics in this way “Employers engaged in residential construction work who can demonstrate that it is infeasible or creates a greater hazard to use conventional fall protection systems must develop and follow a fall protection plan.”

In attics where the floor is composed of fragile building materials such as drywall and when workers are over 6 ft high in spaces non-supported by ladders or scaffolds, the contractor must provide a fall protection plan.

Examples of an attic fall protection plan may include the use of temporary floors made of plywood or OSB over the floor joists to prevent falling through a drywall ceiling. The solution must provide a reasonable amount of fall protection without increasing risk. If in doubt about your plan contact an OSHA

representative for their opinion. They will not specifically approve a plan, but they will let you know if following it would cause them to issue a citation.

Chapter 5 Fire Prevention Plans 1910.39

Fire Prevention Plans, Written & Oral

OSHA requires a written fire prevention plan (per jobsite) required for companies with 10 or more employees.

An oral plan acceptable for companies with less than 10 employees

In either case the plan(s) should be part of the company's written safety and health program and policies.

Elements of a fire prevention plan consist of:

- List of all major fire hazards
- Proper handling and storage procedures for hazardous materials,
- Potential ignition sources and their control
- Type of fire protection equipment necessary to control each major hazard
- Procedures to control accumulations of flammable and combustible waste materials
- Procedures for regular maintenance of safeguards installed on heat-producing equipment to prevent the accidental ignition of combustible materials
- Name or job title of employees responsible for maintaining equipment to prevent or control sources of ignition or fires; and
- The name or job title of employees responsible for the control of fuel source hazards.

Sprayfoam Specific Fire Hazards

There are a number of fire hazards associated with sprayfoam applications including:

- Spontaneous combustion due to exothermic heat build-up
- Flash fires from "hot work"
- Static sparks from sprayfoam applications (walking across a SPF covered roof)
- Fires from flammable liquids
    - Gas/diesel and other fuels
    - Solvents & solvent based coatings

Spontaneous Combustion of Foam.

Closed cell sprayfoam develops exothermic heat during the chemical reaction when it is mixed. This heat helps to mix the foam and create a product with desirable physical properties. But, if the foam is sprayed too thick or if the foam is sprayed too soon on to freshly sprayed foam, then excessive exothermic heat will build up inside the foam. The most common problem with excessive exothermic heat is poor physical properties of the foam and potentially strong odors. But heat can build up to the degree where it can spontaneously catch on fire. This is a serious issue that should be recognized and prevented by installing the foam in thickness so that the internal temperature of the foam does not exceed 220 degrees F. Typically this is 1.5 inches with at 10 -15 minutes between lifts. Some foam systems are formulated to exceed this thickness with one lift.

But it should be noted that conditions on the jobsite such as temperature, temperature of the foam, spray gun configuration can affect the internal temperature of the foam. It is the responsibility of the foam contractor to determine what thickness is suitable and how soon they can install another lift of foam.

Flash Fires:

Sprayfoam both open and closed cell foam are a fire hazard if significant surface areas are left exposed due to their tendency to flash. The flash is typically brief but produces large volumes of smoke and heat. The danger is if someone is in the room (such as a HVAC worker welding a duct or pipe) and they do not have

time to get out of the before being overcome by smoke. There are some foam and coatings over foam specifically formulated to reduce this potential to produce flash fires. It is up to the contractor to examine the fire tests of the foam supplier's foam to determine what type of fire resistant barrier is required for the specific application. (refer to SPFA Technical Document AY 126 Thermal and Ignition Barriers for the SPF Industry)

A brochure was developed by the Center for the Polyurethane Alliance to inform other trades of the flash fire danger of polyurethane foam and is most helpful to better understand the dangers of flash fires.

polyurethane & polyisocyanurate foam

Six Steps for Fire Safety During Construction

Fire is a serious concern during construction, repair and retrofit projects because there may be exposed polyurethane/polyisocyanurate foam and the potential for exposure to open flame from welding and cutting torches from allied trades during certain construction sequences. While fires involving polyurethane/polyisocyanurate foam during construction are rare, they do happen and steps can be taken to help prevent these accidents. The following safety precautions are suggested for the construction site. However, if a fire does occur and cannot be extinguished immediately, evacuate the area at once.

CAUTION

ALL "HOT" WORK SHOULD BE COMPLETED BEFORE INSTALLING FOAM INSULATION. DO NOT WELD OR CUT UNLESS PROTECTION HAS BEEN PROVIDED TO MINIMIZE THE POSSIBILITY OF ACCIDENTAL IGNITION.

api Alliance for the Polyurethanes Industry

Signs, Barricades and Warnings 1926.200

OSHA recognizes signs, barricades, warnings and signals to communicate jobsite hazards. There are specific rules on the use of each device and its form and color

- *Barricade* means an obstruction to deter the passage of persons or vehicles.
- *Signs* are the warnings of hazard, temporarily or permanently affixed or placed, at locations where hazards exist.
- *Signals* are moving signs, provided by workers, such as flagmen, or by devices, such as flashing lights, to warn of possible or existing hazards.
- *Tags* are temporary signs, usually attached to a piece of equipment or part of a structure, to warn of existing or immediate hazards.

Signs:

There are many signs to indicate a hazard, the most commonly used signs are shown below.

Danger signs

A danger sign has red as predominant color with black outline on border. It contains a white lower section for additional wording. It is used to designate an immediate hazard.

Caution Sign

A caution sign is yellow with black letters. It warns against hazards and cautions against unsafe practices.

Safety Instruction Sign

A safety instruction sign is white with an upper green panel. The sign conveys a principle message with additional instructions written in black w/ white background

A few signs that might be seen on a sprayfoam jobsite would include:

- No “hotwork” on uncovered foam
- No non-authorized personnel in area
- Proper PPE required in this area
    - Respirators
    - Chemically resistant coveralls, gloves, footwear, etc
    - Eye protection

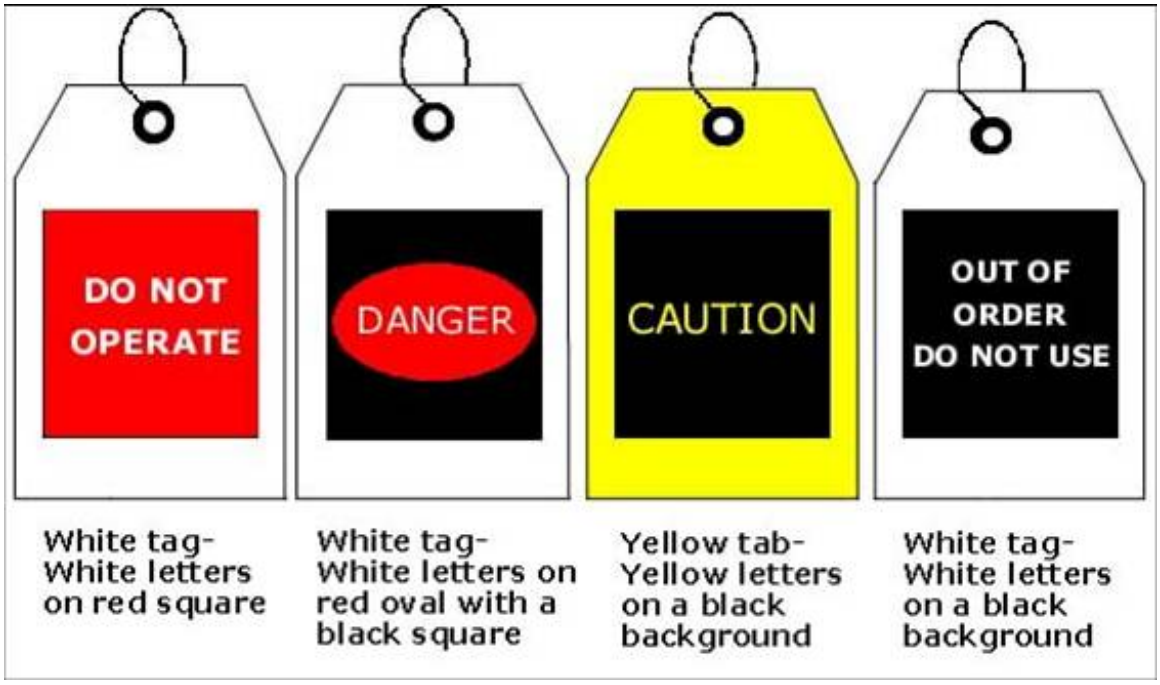
Barricades:

Barricades are often used on sprayfoam roofing projects to mark off parking areas that may get overspray. According to OSHA, Barricades must conform to ANSI D6.1-1971, *Manual on Uniform Traffic Control Devices for Streets and Highways*

Tags:

Tags are used as a temporary means of warning employees of an existing hazard, such as defective tools, equipment, etc.

Examples of tags



A sprayfoam contractor should have a variety of tags to place on equipment that is broken, out of order or should not used. Then the equipment should be removed from the jobsite at the earliest opportunity.

Chapter 6: In Conclusion:

This manual was designed to provide basic safety and health information required by OSHA as it relates to sprayfoam applications. But, it does not address every type of hazard that may be found at a jobsite.

There are dozens of other safety issues that require the attention of the sprayfoam contractor that are not discussed in this course. For example we have not discussed:

- Hazards caused by high pressure spray equipment
- Electrical shock from broken cords or short circuited electrical equipment
- Power lines
- Gas lines
- Hot stacks
- Power tools

It is the responsibility of the contractor to identify all of the potential hazards expected and to specifically take measures to eliminate them, or to reduce their potential for causing injury or illness both for the worker and the public.