Guidance for Selecting a Contractor for the Installation of Spray Polyurethane Foam (SPF) in School Buildings

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Purpose

This guidance is intended to provide useful information to school administrators, design planners, facilities managers and others about how to select and work with professional spray foam contractors to help achieve a successful SPF installation. This document provides tips and guidance to help everyone involved in the process and to inform decision makers about the benefits, potential hazards, and ways to achieve a successful SPF installation. This information may also be helpful for design professionals and energy service companies involved in roofing system or insulation selection for school building projects.

American Chemistry Council | Center for the Polyurethanes Industry

The Benefits of Spray Polyurethane in Schools

Since the 1970's, school districts all over the country have increasingly focused on ways to improve energy efficiency while reducing costs. Today it is more important than ever to consider ways to reduce our carbon footprints and enhanced thermal insulation is a very effective method for lower greenhouse gas emissions. When it comes to energy efficiency of buildings, one of the most important decisions that can be made is to specify a high quality insulation that is energy efficient such as spray polyurethane foam (SPF).

The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) says in its *Advanced Energy Design Guide for K-12 School Buildings*:

> "Many schools spend more money on energy each year than on school supplies. By using energy efficiently and lowering a school's energy bills, millions of dollars each year can be redirected into facilities, teachers' salaries, computers, and textbooks. Strategic up-front investments in energy efficiency provide significant long-term savings."

According to the U.S. Environmental Protection Agency (EPA), "approximately 20 percent of the U.S. population—nearly 55 million people—spend their days inside elementary and secondary schools."[1] It is imperative that schools be designed and maintained in a manner that provides a comfortable, healthy, and safe environment conducive to learning while making good use of schools' limited resources.

Spray polyurethane foam can help meet schools' evolving energy needs because of its excellent insulation value, air sealing properties and long-term performance. SPF has a 40 year plus history with use as an insulated roofing system (new and remedial) as well as building envelope applications such as insulation and air barrier applications for ceilings, walls and floors. Many SPF products meet various certifications, including the Greenguard Children and Schools certification, Greenguard Indoor Air Quality certification, U.S. Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) certification, Collaborative for High Performance Schools (CHPS) Low-Emitting Material Registry, among others.

SPF is an excellent insulation choice for new building construction. It is also commonly installed in existing buildings that may require energy efficiency upgrades, improved weatherization, or upgrades and repairs to roofing systems.

When SPF is installed in school buildings, it can lower energy costs, reduce greenhouse gas emissions, and improve indoor comfort, which can help create a better learning environment. A 2009 study by the Royal Institution of Chartered Surveyors (RICS) indicates that improving the indoor environmental quality in a building may result in enhanced occupant productivity.[2]

As with any construction or renovation project, good planning, scheduling and communication among those undertaking and affected by the work is essential for a successful insulation. For

example, hire an experienced contractor, have spray foam installation installed while students, teachers, and other staff are off site, and determine a safe re-occupancy time with the SPF contractor. The manufacturer of the SPF should be consulted for their recommendations concerning re-occupancy time. Take steps to control exposure to chemicals that can cause potential adverse health effects such as irritation of eyes and respiratory tract and can aggravate asthma.

During spray foam application, and shortly after, potentially hazardous chemicals may be emitted. For more information consult with the SPF manufacturer, and refer to the American Chemistry Council Center for the polyurethanes Industry website: www.spraypolyurethane.org.

You may also refer to additional guidance at www.greenguard.org.

Get to Know the Types of Spray Polyurethane Foam

Spray polyurethane foam is a spray-applied cellular plastic that forms a continuous insulation and air sealing barrier on walls and roofs, around corners and on all contoured surfaces. It is made by mixing and reacting specific liquid chemicals at the job site to create foam. The mixed liquids react, expanding on contact to create foam that can insulate, air seal and serve as a vapor retarder. SPF insulation can resist heat transfer extremely well, and it offers a highly effective solution in reducing unwanted air infiltration through cracks, seams and joints.

SPF can also act as a noise barrier: closed-cell foam can block transmission of low frequency sound, and open-cell foam can absorb mid to high frequency sound. A qualified SPF contractor, SPF consultant or material supplier will work with you and your designer to determine which SPF products will be most effective for your project.

Table 1 summarizes various types of spray polyurethane products that could be used in your school facility. Different products are used in different situations to take advantage of their different characteristics. You may see more than one type of SPF used for your project.

Table 1: Information on the Various Types of Spray Polyurethane Foam Products

SPF Types	**Two-component High-Pressure** Open-Cell (low density, half lb.) Closed-Cell (medium density, 2 lb.) Closed-Cell (high density, 3 lb.)	**Two-component Low-Pressure** Kits and Refillable Systems	**One Component Foam**
Uses	Generally used to insulate large areas on new construction or major renovations on walls and roofing systems.	Generally used to insulate and air-seal small to mid-sized areas, working in conjunction with primary insulation to fill small holes, seams or gaps and roof repairs.	Generally used for small "bead-type" projects, such as sealing windows, doors and filling gaps and cracks.
Applicator	This type of spray foam is usually used for larger projects and installed by a trained professional applicator. For a typical high-pressure SPF application, a spray rig (truck or trailer), which houses the spray foam ingredients, air supply and other tools, is parked near the building to be sprayed. Heated hoses (up to about 300 ft. in length) deliver the liquid mixture to the application area. A professional applicator using this type of product is required by OSHA to follow the recommendations for Personal Protective Equipment discussed in the product MSDS and the agency's requirements.	This type of spray foam is used by professional applicators also called weatherization workers. Users of this product are required by OSHA to follow the recommendations for Personal Protective Equipment discussed in the product MSDS and the agency's requirements.	Professional applicators often finish insulating small areas by using one-component foams. Users of this product are required by OSHA to follow the recommendations for Personal Protective Equipment discussed in the product MSDS and the agency's requirements.
Container size	Typically, available in two 55 gallon drum containers.	Typically, three to five gallons per container, but can be dispensed from a larger refillable containers.	Typically, available in a variety of sizes ranging from 12 oz. to 24 oz. cans.

Both open and closed cell spray foam insulation[3] can be installed as part of a system to help control moisture and condensation in the building, thereby reducing the potential for mold and mildew growth. The ability to help manage moisture and reduce mold growth is especially impactful for schools. According to the EPA, "schools have become increasingly concerned about indoor exposure to mold, which can lead to a variety of health effects, including allergic reactions. Exposure to mold has been associated with increased severity of asthma symptoms."[4]

Schools located in areas prone to flooding may see an additional benefit from closed-cell spray foam, which is considered by the U.S. Federal Emergency Management Agency (FEMA) to be a flood resistant construction and insulation material.[5] SPF may also serve as a possible barrier to building entry of pests, insects, dust and pollen which can be irritants to children who suffer from allergies as well as have a negative impact on the learning environment.

Large Projects

Some common areas where SPF may be used include roofing systems and any large surface areas where insulation is being added. SPF roofing systems (new construction or to recover or replace existing roofs) are often combined with elastomeric roof coatings and can qualify for an ENERGY STAR rating. The roofing systems typically consist of SPF insulation covered with a weather resistant or UV protective coating based on acrylic, silicone, urethane or other materials. In addition to improved energy efficiency, SPF roofing systems provide a continuous covering that can prevent leaks and flooding and can reduce maintenance costs.

SPF is also frequently used on exterior surfaces of perimeter walls to insulate and stop air infiltration. Another common use is for interior surfaces of walls, ceilings and other areas. These interior surfaces are later covered with interior cladding or finish systems (e.g. dry wall) between the finished foam and occupied space.

Small Projects

Some common applications of spray foam to mid-sized surface areas help to prevent leakage of heated or cooled air. SPF is frequently used in conjunction with other insulation or materials to fill small holes, seams or gaps. It enhances other insulations or materials by air sealing and therefore contributing to a more energy efficient structure. Spray foam is also used to air seal around rim joists, pipes, wires, other penetrations, and on roofs to seal around protrusions, faulty flashings, vents or equipment. It can also be used for polyurethane roof repair to fill cracks and insulate against heat loss, such as after HVAC equipment changes.

For more information about the benefits of SPF insulation, visit www.whysprayfoam.org.

Consider HVAC Optimization

Depending on the scope of the SPF installation, especially during new construction, it may be beneficial to consult with your SPF contractor and Heating, Ventilation and Air Conditioning (HVAC) contractor to determine proper sizing of the HVAC system, but it is also very important to consult with HVAC representative when retrofitting/renovating. SPF insulation may allow for a reduction in HVAC size requirements, may increase need of mechanical ventilation (i.e., to provide sufficient outdoor air) and can result in significant cost savings. In a coordinated approach, you can discuss mechanical air ventilation and air exchange levels appropriate for the SPF project being planned. Coordinating your insulation and HVAC needs can help maximize indoor air quality and comfort while potentially lowering heating and cooling costs.

ENERGY STAR provides additional information about air sealing and encourages contractors to "Build it Tight and Ventilate Right."

Selecting an SPF Contractor with Experience

When having SPF insulation installed at your school, it is important to work with a qualified, professional SPF contractor. Choose an SPF contractor who is knowledgeable, trained and experienced in installing the type of SPF you have selected. Consider asking for evidence that your contractor has had training by an SPF manufacturer or distributor. Several associations and organizations offer training, such as the Spray Polyurethane Foam Alliance (SPFA) accreditation program or the Center for the Polyurethanes Industry (CPI) SPF Chemical Health and Safety Training. Ask the contractor to provide a record of completion of the CPI SPF Chemical Health and Safety Training.

An important reason to select a trained and experienced contractor is that incorrect mixing ratios or incorrect application techniques of the materials by applicators could have an adverse effect on the spray foam produced in the field. Improper processing of the materials could result in odor issues, possible negative health impacts, and improper physical properties of the products installed.

Here are some questions you may wish to ask a prospective SPF contractor before selection:

- ✓ What references do you have for similar jobs?
- ✓ Who will be supervising the job?
- ✓ Describe your company's safety record.
- ✓ Has the supervisor been trained or accredited for high- and/or low-pressure two-component spray polyurethane foam installation? Is the accreditation current or training recent?
- ✓ How much experience do you have in installing spray polyurethane foam for this application?
- ✓ Under what conditions (temperature and humidity) can you apply this SPF blend?

- ✓ What environmental conditions would force you to stop the SPF application?
- ✓ Have all the workers, including applicators and helpers had training?
- ✓ Do you keep Material Safety Data Sheets (MSDS) for the SPF products readily available?
- ✓ Do you have adequate insurance?
- ✓ Do you have a Respiratory Protection Program for workers and can you share a copy?
- ✓ Has someone on the worksite received the U.S. Occupational Safety and Health Administration (OSHA) 10-hour training?
- ✓ What safety precautions do you typically undertake to protect the general population and nearby property?
- ✓ When can the general public (including school children) re-enter the building following application?
- ✓ How can I reach you if I have questions after the job is completed?

CPI also offers additional guidance that may be helpful when selecting an SPF contractor. Visit the www.spraypolyurethane.org website and click on Selecting and Working with Your SPF Contractor.

Ways to Manage Occupant Safety and Indoor Air Quality (IAQ) from Emissions and Overspray

SPF is an effective insulation because it creates still air spaces within the body of the foam that may not allow convective heat flow to occur. The chemical ingredients react and are polymerized during this process. During the spraying process, and for a set period of time afterward, follow the SPF manufacturer's instructions and OSHA requirements to address any potential hazards caused by airborne mists (high pressure spray), fumes, vapors or dusts to workers and building occupants.

Exposure to these chemical ingredients while they are reacting can cause potential health hazards to those not wearing PPE, such as irritation of the eyes and respiratory tract, respiratory sensitization or aggravation of asthma. It is recommended that the work area be vacant and the applicators/workers wear appropriate PPE in the application area to avoid health and safety concerns. Appropriate controls need to be taken during the application and for some time afterward to manage possible exposures to both workers and any bystanders. After the chemicals are fully reacted, they form a spray polyurethane foam product. EPA says that fully reacted polyurethane products are considered relatively inert.

The amount of time it takes for the sprayed-on SPF to fully harden into finished foam (and for fumes and vapors to adequately dissipate after it is installed) depends on variables such as temperature, humidity, spray thickness and SPF application process. Generally, interior SPF installations require greater engineering controls (such as mechanical ventilation and exhaust systems, plastic sheeting to isolate spray zones, etc.) than exterior applications where more ventilation occurs naturally. It is important to discuss with your SPF contractor the measures he or she will take to address chemical fumes or vapors (see "Discuss reoccupancy time").

Coatings and primer applications should also be discussed, along with their potential for fumes or vapors.

Potential health effects can be found in product material safety data sheets and in the websites listed in the Additional Information section of this guidance document.

Work Together to Achieve a Successful SPF Installation

Pre-planning and communication among all interested parties including school administration, building management, design professionals, consultants, the SPF contractor and building occupants is key to a successful spray polyurethane foam installation. Before beginning an SPF installation or any other significant building or construction project, you may want to refer to the EPA's *IAQ Tools for Schools Program* for general information and resources. Visit: www.epa.gov/iaq/schools.

Planning and Scheduling

As you discuss and plan for the responsibilities of your SPF contractor as well as those of the building owners' representative during various stages of the work, here are a few considerations:

- Discuss steps that will be taken to prevent potential exposure to chemical vapors, fumes, and dust during and after the SPF installation. A good idea is to do a "site inspection" of the job site with your contractor in advance of the installation to review the HVAC location and other considerations.

- In order to address any potential indoor air quality (IAQ) issues during application it is best to have the SPF installation completed when the building is not occupied. Consider doing SPF installations when school is not in session, during summer vacation, holiday breaks, weekends, and after hours.

- Seal the HVAC system off during SPF application and curing process to prevent vapors, mists, and dusts from entering the HVAC duct work. An independent means of ventilation must be provided during the application and curing process.

- Material Safety Data Sheets (MSDS) are available from your contractor for any chemical product being used on the job site that has an identified hazard, in accordance with government (e.g., OSHA) regulations. You may wish to discuss product information provided in the MSDS or other product instructions with your contractor.

- For SPF roofing system installations, it is important for the contractor to identify and close off fresh air intakes. This is suggested even if the school is unoccupied to help prevent vapors, fumes, or dust from entering the building during the project.

- Work with your contractor to control the location of spray trucks, rigs, SPF materials and accessories. Clearly identify the work area with warning signs or caution tape for anyone not wearing PPE.

- For roofing systems, the school's asbestos survey can be a useful resource to determine if asbestos-containing roofing materials (ACM) will be disturbed. Special procedures may be required if ACM is present. Consult with an ACM consultant for additional details.

- Communication before and during the SPF project can include the SPF contractor, school officials and facilities management. For existing schools undergoing a retrofit, this also includes any impacted parties, e.g. school staff, cleaning, maintenance personnel, students and parents. Consider giving ample advance notification about the SPF installation, including an explanation of the benefits, potential hazards, and best practices of the project. Proactive communication about precautions to be taken can prevent concerns from developing and escalating. Allow time before beginning the project to address questions that may include:

    - What types of SPF products will be used?
    - Where will the work be performed?
    - Will it occur during occupied periods?
    - Are the required OSHA safety measures being taken for SPF workers and others who may be on the job site?
    - Whom do I contact if I have concerns or questions?

- Throughout the project, ask the SPF contractor to provide building management with regular progress reports. The responsible parties for the school can then, in accordance with good advance planning and any applicable school policy, keep the interested parties up-to-date on project status and provide them with an opportunity to ask questions.

Logistics

- Engineering controls, such as isolating the application area and providing adequate ventilation, are important to have in place before work begins. During and for a period of time after the SPF installation, your contractor will limit access to the site only to workers equipped with proper personal protective equipment (PPE), including eye protection, gloves, full-coverage clothing and respirators. Work with your contractor to address ventilation needs, such as opening windows, setting up fans and venting fan exhaust to unoccupied areas. EPA has provided some best practices on Ventilation Guidance for SPF Application.

- After the SPF installation is complete, it is important for the job site to be thoroughly cleaned by your contractor's personnel wearing proper PPE for that activity. Your contractor is responsible for disposing of used SPF chemical drums, foam trimmings and dust in accordance with all applicable laws and regulations.

- Discuss reoccupancy time with your SPF contractor. Re-entry time for unprotected occupants following an SPF installation varies depending on a number of factors (e.g. interior or exterior application, type of SPF product(s), amount of foam applied per volume of space, temperature, humidity, the degree of ventilation and other variables). The SPF manufacturer can also be consulted to obtain reoccupancy recommendations.

Protecting Property, Planning and Scheduling

- During spraying, it is suggested that your contractor take steps to minimize overspray and ensure appropriate application(s) are made. It is important to implement a plan to keep the area clean and free of debris during work. For exterior applications, such as roofing systems, consider cordoning off the downwind side of the building from any spray activity. It is also a good idea to relocate automobiles and protect surfaces from airborne SPF overspray by masking them off. Once cured, SPF is very difficult to remove from vehicles.

Closing Considerations

Spray polyurethane foam can provide your school with excellent insulating capability, stability, air sealing and moisture management benefits. Like many other building and construction products, the SPF manufacturers' safe use and handling guidance and Material Safety Data Sheet instructions must be carefully followed. By selecting and working with a qualified spray polyurethane foam contractor, you can work together to plan a high-quality SPF installation at your school to avoid mistakes. Work to understand, set-up and plan for a successful project.

Additional Information

The Center for the Polyurethanes (CPI) of the American Chemistry Council (ACC) Spray Polyurethane Foam Health and Safety Website: www.spraypolyurethane.org

Spray Polyurethane Foam Health and Safety Training: www.spraypolyurethane.org/SPF-Chemical-Health-and-Safety-Training

The Spray Foam Coalition (SFC): www.whysprayfoam.org

The Spray Polyurethane Foam Alliance (SPFA): www.sprayfoam.org

The Environmental Protection Agency (EPA) Healthy Schools Environments: http://www.epa.gov/schools

EPA – Indoor Air Quality (IAQ) Tools for Schools Program: www.epa.gov/iaq/schools

EPA – Design for the Environment SPF Home: www.epa.gov/dfe/pubs/projects/spf/spray_polyurethane_foam.html

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This document may be updated. For the most current version of this document, see www.spraypolyurethane.org.

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