# Background Information and Frequently Asked Questions about Spray Foam Insulation

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Covestro LLC provides highly efficient energy saving polyurethane spray foam wall and roof insulation systems. Covestro is committed to ongoing research and product improvement. We are also continually assessing spray polyurethane foam best practices, with an emphasis on health and safety. The outline below is a brief summary highlighting Covestro activities related to spray foam insulation.

### Contractor Accreditation

Covestro instituted an accreditation program for contractors applying spray foam insulation materials supplied by Covestro. This program was developed with industry groups and sets minimum requirements for applicator safety and proper installation of polyurethane spray foam insulation.

### Safe Handling and Installation

Covestro provides contractors with detailed printed materials covering site preparation and planning, spray foam application and post-spray procedures in order to help ensure job site safety for applicators and other non-applicator workers.

Because spray foam insulation application involves a chemical reaction where emissions are produced, precautions to help ensure worker safety are essential. The application area must be clear of non-applicator workers and well ventilated. Applicators must wear protective clothing and respirators.

These information materials offer specifics on safety equipment and personal protective equipment required when applying spray foam insulation. Post-spray procedure information includes recommended re-entry and re-occupancy times and proper precautions during trimming operations.

Information on proper disposal of waste and empty drums is also provided. The materials also direct applicators to industry and U.S. Environmental Protection Agency resources for additional safety information.

### Polyurethane Spray Foam Insulation Chemistry

Spray foam insulation is produced by combining, or reacting, two sets of chemicals, referred to as the A- side and B-side. The A-side is known as polymeric methylene diphenyl diioscyanate (PMDI); the B-side is a combination of polyols, catalysts, blowing agents, surfactants, flame retardants and other additives.

The A and B-side chemicals are both heated and forced by pressure through a spray gun during application onto the surface to be insulated such as a wall cavity.

During installation, the initial reaction of the chemicals occurs quickly forming the insulation product and creating an air and thermal barrier. After the foam is formed, any excess insulation is then removed by the contractor in areas where wallboard or sheathing is to be installed.

### Safety of Polyurethane Spray Foam Insulation

Covestro has conducted testing on samples of reacted Bayseal® closed cell and Bayseal® open cell spray foam insulation to study chemical emissions after application.

Testing was conducted by the Covestro Environmental Analytics Laboratory and the Covestro Industrial Hygiene Laboratory.

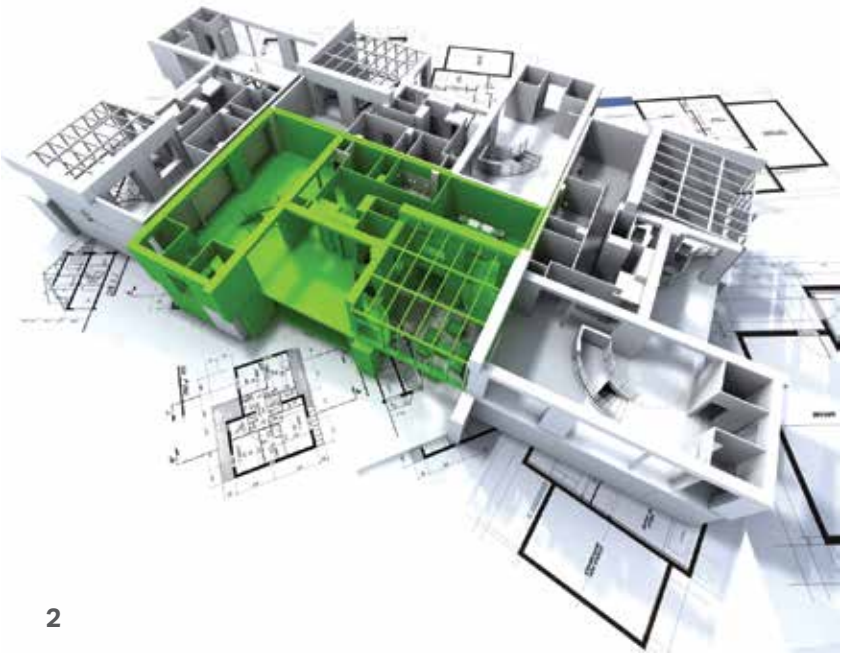
The Covestro Industrial Hygiene Laboratory is accredited by the American Industrial Hygiene Association (AIHA).

This testing is used to determine the proper amount of time recommended before reentry or reoccupation of the space where the spray foam insulation has been installed.

Samples of spray foam insulation were placed in closed chambers under humidity and temperature conditions simulating those found in a typical residential structure.

Air samples were taken from the chambers at 4, 12 and 24 hours and 2 and 4 days following spraying of the foam. Air samples were taken from the open cell foam sample up to 20 days following spraying. These samples were tested for a variety of chemicals to determine their presence and rates of dissipation.

Results from these emissions tests indicate that workers may reenter the space 12 hours after application, and after 24 hours the space can be re-occupied by tenants or homeowners. This assumes the spray foam was installed in accordance with Covestro installation guidelines, the space was ventilated for at least 24 hours following the end of spraying, and the building has an outdoor air exchange rate consistent with ASHRAE standards.



# Frequently Asked Questions

## About High Pressure Application of Covestro Spray Polyurethane Foam (SPF) Insulation

The use of spray polyurethane foam (SPF) for residential insulation has grown significantly in recent years in the U.S. and Canada. SPF insulation must be installed by professional, qualified contractors using specialized high pressure spray equipment.

This document addresses some common questions about Covestro LLC SPF products applied by high pressure spray equipment in building interiors.

## A. SPF Chemicals and Potential Health Hazards

### 1. What chemicals are used to make SPF insulation?

Spray polyurethane foam (SPF) insulation consists of the combination of two liquid components, commonly referred to as an A-side and a B-side.

The A-side chemical is polymeric methylene diphenyl diisocyanate (pMDI).

PMDI is a brown-colored liquid which emits only a very low level of vapor at room temperature. The primary component in the B-side is referred to as a polyol. Polyols are large molecules with multiple sites called hydroxyls that react with the pMDI to create the polyurethane polymer or foam insulation.

The B-side will also typically contain various percentages of other chemicals such as amine catalysts to initiate the reaction between the polyols and the pMDI, as well as blowing agents to cause the foam to expand, flame retardants to meet the requirements of building codes, and other additives.

The B-side typically contains less than 10 percent amine catalysts. The specific catalysts used are proprietary but fall into a class of chemical referred to as "tertiary" aliphatic amines or alkanolamines. Tertiary amines are liquids which in their pure state have very distinct ammonia-like odors. For more information about amines, please refer to the American Chemistry Council (ACC) Center for the Polyurethanes Industry (CPI) document titled "Polyurethane Amine Catalysts: Safe Handling Guidelines." **(www.americanchemistrycouncil.com)**

Blowing agents make up approximately 10 to 20 percent of the B-side. Low density (open cell) SPF insulation uses water as the blowing agent.

Medium density (closed cell) SPF insulation uses a combination of water and a hydrofluorocarbon, HFC-245fa (1,1,1,3,3-pentafluoropropane).

The most common flame retardant used in the B-side is Tris-(1-chloro-2-propyl) phosphate (TCPP). TCPP content in the B-side is typically in the range of 5 to 25 percent. Other flame retardants may be used in certain formulations, such as brominated polyesters which become part of the polyurethane polymer.

SPF insulation is produced when the A-side and B-side components are processed through a high pressure pump to a spray gun where the components are mixed and sprayed. The sprayed mixture begins reacting immediately as it leaves the spray gun. This reacting mixture gives off heat as it rises and cures on the surface it is being applied to, forming the SPF insulation product.

### 2. Are there Health and Safety concerns with any chemicals used to make SPF?

Because the A- and B-side chemicals are both heated and forced by pressure through a spray gun, both chemical vapors and liquid aerosols (spray mist) are likely to be present during the application of SPF. The vapors and spray mist generated during application are a potential inhalation (breathing) and skin/eye contact hazard. It is necessary for SPF applicators to wear protective clothing and proper respiratory protection because of these hazards.

When the chemicals discharge from the spray gun, they are a reacting mixture of the A- and B-side chemical components. The chemical component typically considered to be of highest health concern is MDI (in the A-side material).

MDI is a skin, eye and respiratory tract irritant. Exposure to excessive airborne concentrations of MDI (above Occupational Exposure Limits or OELs such as OSHA permissible exposure limits and recommended

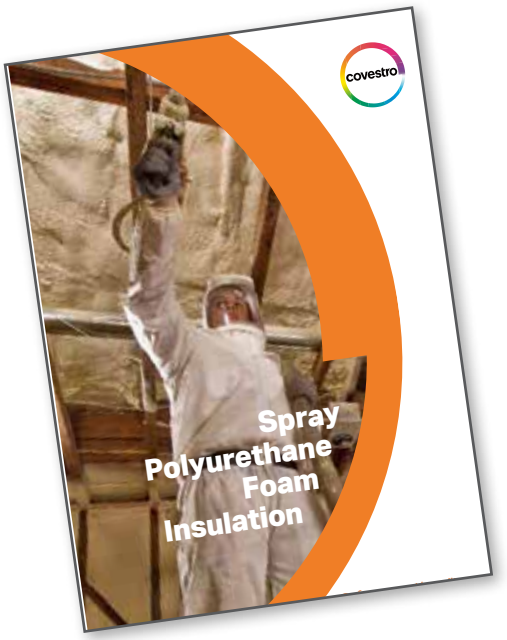
ACGIH threshold limit values) can lead to respiratory sensitization, which may result in occupational asthma. Prolonged direct skin contact can cause reddening, swelling, rash, and in some cases, skin sensitization. Research studies indicate that prolonged direct skin contact with MDI can play a role in causing isocyanate sensitization and respiratory reaction.

The majority of the B-side is comprised of polyols which, by themselves, may present minimal hazard from inhalation or skin contact. The other B-side ingredients considered potential health hazards include the hydrofluorocarbon blowing agent (HFC-245fa), amine catalysts, and the flame retardants.

HFC-245fa can result in irritation causing coughing, sore throat, and runny nose at concentrations above its Occupational Exposure Limit. Overexposure can also result in central nervous system effects, such as drowsiness or dizziness, and cardiac arrhythmia (irregular heartbeat). Skin contact is only slightly irritating. Eye contact with liquid or mist may result in slight irritation.

Exposure to elevated airborne levels of amine catalysts can result in irritation of the respiratory tract causing cough, sore throat, and runny nose. Skin contact can result in irritation, causing reddening, itching, swelling, and/or burns. In rare cases, some amine catalysts are also capable of causing respiratory tract and skin sensitization. The vapors of some amine catalysts may temporarily cause vision to become foggy or blurry, and halos may appear around bright objects.

Exposure to elevated airborne levels of flame retardants can result in irritation of the respiratory tract causing cough, sore throat, and runny nose. Skin contact can result in slight irritation, while eye contact is generally non-irritating.




For additional information on the hazards of each chemical component, review the applicable Bayseal® and Ecobay™ Safety Data Sheet (SDS) at the following website: **www.polyurethanes.covestro.com**

## B. Preparing for an SPF Installation Project

### 1. What are some important points to consider when planning an SPF installation project?

Because application of SPF insulation is a construction activity where conditions can change quickly as the project progresses, proper ***planning*** is essential for a safe and successful installation.

Before the application of SPF, it is recommended that the SPF contractor:

- Conduct a pre-job meeting with the owner/owner representatives and other contractors to discuss the nature of the chemical hazards and to properly schedule SPF application work.
- Request that everyone but SPF workers vacate the building during SPF application work.
- Plan to isolate and ventilate the SPF application area if others cannot vacate the building (see Section C for more information).
- Be knowledgeable of SPF health & safety resource information available from Covestro, the Center for the Polyurethanes Industry (CPI), and the Spray Polyurethane Foam Alliance (SPFA).
  - — Covestro: **www.polyurethanescovestro.com** or **www.productsafetyfirst.covestro.com**
  - — CPI: **www.spraypolyurethane.org**
  - — SPFA: **www.sprayfoam.org**
- Obtain Safety Data Sheets (SDSs) for the specific SPF product to be installed.

### 2. What are Covestro recommendations for contractors installing SPF insulation so the work can be completed safely and in accordance with Covestro installation guidelines?

It is important to ***select*** a qualified SPF contractor... one that is knowledgeable of proper safety and health practices as well as manufacturer application guidelines. Covestro has instituted an accreditation program for contractors applying interior Bayseal® or Ecobay™ spray foam insulation.

Requirements of the Contractor Accreditation Program include:

- Successful completion of the Center for the Polyurethanes Industry (CPI) High Pressure SPF Chemical Health and Safety Training. This training must be repeated at least every two years.
- Affirmation that the contractor has Hazard Communication and Respirator Programs that meet OSHA requirements.
- At least one employee per rig has completed the Covestro Applicator Information Program, or another SPF application information program from a Covestro-recognized provider.
- All application equipment meets minimum recommendations set by Covestro.
- The company credit account is maintained within agreed-upon terms.

Covestro is a leader in the spray foam industry in developing information programs for workers, publishing health and safety informational materials, and conducting research related to chemical emissions from the installation and use of SPF insulation. For more information about these activities, please access the Covestro website: **www.polyurethanes.covestro.com**

## C. SPF Application – Installation Considerations

### 1. What control measures should be used by the SPF contractor to protect their employees and other trade workers (non-SPF workers) from chemical hazards during SPF installation?

Traditional methods used to control potential health hazards in the construction industry also apply to field application of spray polyurethane foam insulation.

Methods to control SPF chemical hazards include:

- Engineering Controls
- Administrative Controls
- Personal Protective Equipment (PPE)

At SPF installation projects, a combination of all three control methods are frequently used to safely complete the job.

***Engineering controls*** are the most effective means to protect workers during SPF application at multi-employer worksites when other non-SPF workers (i.e. carpenters, electricians, plumbers, ironworkers) cannot vacate the building. Engineering controls recommended for SPF projects include isolation and ventilation. Isolation pertains to enclosing the SPF application work area using plastic sheeting or tarps (i.e., to create a physical barrier). Ventilation of the SPF work area pertains to using either general ventilation or active ventilation techniques. For example, general ventilation may be achieved by using windows/exit door openings on opposite sides of a room or structure to allow outdoor air to enter, move through the spray area, and escape out the other side. Of course, weather conditions and other factors at the site (e.g., wind speed/direction, proximity to other workers/bystanders, other buildings, vehicles, possible regulations) must be taken into consideration when using general exhaust or natural air movement as a control technique. Active ventilation (i.e., exhaust fans/blowers) attached to the enclosure via flexible duct work, and exhausting air outside the building/structure is usually a more effective control technique. Active ventilation is a more effective control because it creates a negative pressure within the spray application area that helps to contain and remove SPF chemical vapors/mist. When using exhaust fans, it is important to use a particulate filter before the fan and ensure the exhaust air is not directed toward other workers/bystanders or at building air intakes.
It is important to note that use of engineering controls (i.e., isolation and active ventilation) during SPF application does not sufficiently reduce chemical airborne concentrations of spray mist/vapors below safe levels needed to eliminate the use of PPE. While engineering controls can reduce airborne chemical concentrations in the spray area, they are primarily needed to protect other non-SPF workers from potential exposure to SPF chemicals.

For more information on implementing engineering controls during SPF installation, refer to EPA's Design for Environment document: Ventilation for SPF Application **(www.epa.gov/dfe/pubs/projects/spf/spray_polyurethane_foam.html)**. CPI also is a resource for information on control measures recommended during SPF installation and can be accessed at the following websites: **www.spraypolyurethane.org** or **http://polyurethane.americanchemistry.com/Spray-Foam-Coalition/Guidance-on-Best-Practices-for-the-Installation-of-Spray-Polyurethane-Foam.pdf**

***Administrative controls*** recommended for SPF projects include:

- Requiring SPF employees to complete Chemical Health & Safety Training available through CPI and SPFA at website links: **www.spraypolyurethane.org and www.sprayfoam.org**

- Holding pre-job meetings with building owners, their representative, and other contractors to properly schedule SPF application work (i.e., try to schedule SPF application work when it is less likely for other construction trades or bystanders to be at the site)

- Restricting access to the SPF work area (i.e., post signs, use physical barriers to keep others away); Protecting building surfaces, equipment, vehicles, and non-SPF workers from spray mist (i.e., installing wind screens, plastic or tarps)

***Personal protective equipment (PPE)*** is necessary for SPF workers to protect them from SPF chemical vapors and overspray particles (mist) generated from spraying the heated A and B-side materials. Appropriate PPE is needed to protect the skin, eyes, and respiratory system. PPE is needed even if engineering controls (i.e., isolation and ventilation techniques) are used during SPF application work.

Applicators should wear a NIOSH-approved full face or loose-fitting hood-type supplied air respirator, disposable coverall with hood, and fabric gloves coated with nitrile, neoprene, butyl, or PVC.

Helpers that work near SPF applicators or in the isolated spray area should wear the same PPE as applicators. In some cases, such as when the work area is well ventilated or when helpers are not working in the immediate vicinity of the applicator, helpers may be able to wear full face air purifying respirators with organic vapor/particulate (P100) cartridges instead of supplied air respirators. Professional judgment must be exercised in making this determination, taking into account the specifics of the job site and application.

## 2. What control measures should be established to protect building occupants from SPF chemical hazards during SPF installation?

Building occupants (i.e., residents, tenants, etc…) should vacate the building and not be near the SPF application work area. Possible exceptions may include multi-story buildings or multi-unit apartment buildings where the occupants are physically separated from the spray area. Even in these situations, the SPF contractor may need to consider using isolation and ventilation control methods depending upon the particular site conditions.

See the previous question for a broader explanation of engineering controls.

## 3. Can other workers (non-SPF workers) continue to work in the same area or building during SPF application work?

It is recommended that SPF application work be scheduled so that other trade workers (i.e., carpenters, electricians, plumbers, ironworkers) are not in the same area or building while spraying of foam is conducted. This is especially important in residential and smaller commercial buildings.

Exceptions to this recommendation may be applicable in large commercial building projects or multi-unit residential structures. However, the success of a safe SPF application depends on proper planning and implementation of control measures to protect other workers. Supervisors from the general contractor, subcontractors on-site, and the SPF contractor must meet prior to the day of application to discuss implementing controls such as:

- Isolating and ventilating the SPF application area

- Restricting access to the SPF application area

- Establishing a safe work zone around the SPF application area by using physical barriers, warning tape, and signs

- Informing all other trade workers to keep out of the safe work zone

- Closing or sealing off building openings (windows, doors, utility shafts, etc…) to prevent migration of SPF particles (mist) or vapors to adjacent areas or floors

## 4. What may cause an unwanted odor with SPF?

Unwanted odor may be caused by improper SPF installation including the following errors:

- Incorrect temperature or pressure settings on the foam application equipment. This can change the ratio of the two components, cause insufficient mixing, or cause the components to react improperly.

- Applying the foam too thick in a single application. The center of the foam may overheat, causing the components to react improperly.

- Applying a second layer of foam before the first layer of foam has cooled sufficiently. The excessive heat may cause the components to react improperly.

- Selecting the wrong seasonal product grade. For example, if a summer grade formula is applied in cold weather.

- Contaminated components. For example small amounts of open cell and closed cell formulations intermixed can cause the foam to react or rise improperly.

- Inadequate ventilation during and after application may allow chemical odors to accumulate.

## D. SPF Post-Spray Considerations

### 1. Should ventilation (i.e. exhaust fans) be used after SPF application?

SPF, like many other new building materials, can emit low levels of various chemicals (often referred to as volatile organic compounds or VOCs) for a period of time after installation. Covestro recommends that SPF contractors ventilate the spray area after application for at least 24 hours. For new home construction with no windows installed, natural air movement (i.e., wind) is typically sufficient ventilation to dilute any VOCs emitted from the SPF. For retrofit home SPF installations or where there is limited natural air movement through the structure, it is recommended that forced air (i.e. mechanical ventilation) be used to create air movement through the SPF application area. This can be accomplished using blowers or exhaust fans to establish air flow through the work area. When using exhaust fans, it is important to use a particulate filter before the fan and ensure the exhaust air is not directed toward other workers/bystanders or at building air intakes. During this 24 hour post-spray period, the spray area should be ventilated at a minimum of one air exchange per hour (ACH).

The purpose of ventilation is to create air movement through the spray area to dilute and remove chemical vapors emitted from SPF. Ideally, the spray area should be ventilated in a manner to encourage flushing of the entire spray area, for example by introducing air at one side and exhausting it at the other side via a fan(s).

### 2. When can other workers (non-SPF workers) re-enter the SPF application work area?

Other construction trade workers should not re-enter the spray area until 12 hours after spray operations are completed. Upon completion of SPF application work, Covestro recommends that the spray area is ventilated for at least 24 hours. Blowers or exhaust fans can be used to establish air flow through the work area. During the 24 hour post-spray period, the spray area should be ventilated at a minimum of one air exchange per hour (ACH).

Documentation on how the re-entry period of 12 hours for trade workers was established is contained within a paper presented by Covestro at the CPI Conference in 2010. The paper is titled "A Proposed Methodology for Development of Building Re-Occupancy Guidelines Following Installation of Spray Polyurethane Foam Insulation." In addition, Covestro has prepared a letter for contractors, home builders, and building owners that summarizes the findings from this paper and includes recommended work practices, re-occupancy times, ventilation rates, etc… Both documents may be obtained through the Covestro website link: **(www.polyurethanes.covestro.com)**

### 3. When can building occupants return to the structure after SPF application?

Building occupants should not re-enter the spray area until 24 hours after spray operations are completed. Upon completion of SPF application work, Covestro recommends that the spray area is ventilated for at least 24 hours. Blowers or exhaust fans can be used to establish air flow through the work area. During the 24 hour post-spray period, the spray area should be ventilated at a minimum of one air exchange per hour (ACH).

Documentation on how the re-entry period of 24 hours for occupants was established is contained within a paper presented by Covestro at the CPI Conference in 2010. The paper is titled "A Proposed Methodology for Development of Building Re-Occupancy Guidelines Following Installation of Spray Polyurethane Foam Insulation." In addition, Covestro has prepared a document for contractors, home builders, and building owners that summarizes the findings from this paper and includes recommended work practices, re-occupancy times, ventilation rates, etc… Both documents can be obtained through the Covestro website link: **(www.polyurethanes.covestro.com)**

### 4. How long does it take for SPF insulation to cure?

SPF is formed when two liquid components mix under high pressure and expand while reacting with each other. Although the surface of most SPF insulation is tack free within 15 to 20 seconds after application onto the desired substrate (e.g., oriented strand board within a wall cavity), the product is only beginning to cure. The foam is considered cured when the reaction between the two components is completed, the foam has expanded to its full volume, and the core temperature of the foam cools to room temperature. Depending on the type of foam, the thickness that is applied, and other factors, the foam is typically fully cured within 24 hours of application.

## E. SPF Chemical Emissions

### 1. What chemicals off-gas from SPF and for how long after installation?

Most studies have demonstrated that the A-side chemical (MDI) is not detected within a short time after application. The MDI chemically reacts within the foam matrix to form the polyurethane insulation material. Air sampling performed after application has demonstrated that airborne MDI is not detected in most samples at 2 hours after SPF application. Surface wipe samples collected from newly-installed foam surfaces indicated that unreacted MDI was not detected 15 minutes after application.

Covestro has conducted environmental chamber studies on several of its SPF insulation products to determine emissions characteristics, predict indoor air concentrations, and establish re-occupancy times. The testing has been done on newly-made SPF; samples are placed in an environmental chamber within a few hours of being sprayed and then studied for emissions for up to 30 days. Chemicals that have been identified in emissions studies conducted on two Covestro SPF products include low levels of blowing agent, amine catalysts, aldehydes, and a few other VOCs. These SPF chemical emissions decline with time during the typical 30 day post-application test period. Some chemicals are no longer measurable after a day or two, while others such as blowing agents may persist up to 30 days. Please refer to a Covestro paper titled "A Proposed Methodology for Development of Building Re-occupancy Guidelines Following Installation of SPF Insulation" for more details. This can be found at the Covestro website: **www.polyurethanes.covestro.com.**

### 2. Are the chemicals that off-gas in excess of any health standards?

The re-occupancy times that have been established by Covestro were developed, in large part, by comparing the predicted indoor air concentrations to the relevant occupational and non-occupational health-based thresholds that have been established by various organizations. Therefore, for Covestro SPF products, Covestro recommends that non-SPF workers not re-occupy a building for 12 hours following the end of SPF application, while all others can re-occupy 24 hours following the end of application. Please note that these re-occupancy times assume the SPF was installed in accordance with Covestro recommendations. Please refer to a Covestro paper titled "A Proposed Methodology for Development of Building Re-Occupancy Guidelines Following Installation of SPF Insulation" for more details.

It is also worth noting that Covestro SPF products including Bayseal® CCX, Bayseal® CCXP, Bayseal® OC, Ecobay™ CC, and Ecobay™ CC Arctic have been tested by the California Department of Public Health, *Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers (CDPH/EHLB/Standard Method Version 1.1, 2010)*, which is the emission testing method for California Specification 01350. The Covestro SPF products that have been tested have been certified as meeting the VOC emission requirements of Specification 01350.

### 3. Why have there been Indoor Air Quality (IAQ) complaints (odor, irritation) within the SPF Industry after installation at some project sites?

There are a number of possibilities, including: 1) building occupants did not vacate the building during application; 2) building occupants returned to the building prior to the recommended re-occupancy time; 3) the building was not properly ventilated following application; 4) the SPF was not applied in accordance with the manufacturer's recommendations.

## F. Building Science - Design Considerations

### 1. Does installation of SPF require adjustments to traditional HVAC system design for homes/ commercial buildings?

When spray polyurethane foam insulation is used to seal and insulate a home, it is important to properly calculate the heating and cooling loads using Air-Conditioning Contractors of America (ACCA) Manual J and Manual S, taking into account the air tightness of the home and whether the duct work is within the conditioned space. Using the calculated loads, HVAC equipment needs to be sized accordingly. Oversized HVAC systems may cause insufficient ventilation, reduced indoor air quality, and increased humidity.

Because of the air sealing properties of SPF, it is necessary to determine whether outside air needs to be introduced into the home through mechanical ventilation. The ventilation should meet the requirements of the American Society of Heating Refrigeration and Air-Conditioning Engineers (ASHRAE) Standard 62.1-2010, Ventilation for Acceptable Indoor Air Quality, and Standard 62.2 – 2010, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings. Unlike air that leaks into the home, air introduced through mechanical ventilation is controlled, conditioned and filtered.
The air tightness of the home may affect the ability of vented combustion appliances such as furnaces, water heaters, and fireplaces, to properly vent exhaust gases to the outside. Improper ventilation and exhaust systems may result in exhaust gases back-drafting into the home. The house should be evaluated for combustion safety by a Residential Energy Services Network® (RESNET) or Building Performance Institute, Inc. (BPI) professional. This does not apply to sealed combustion appliances.

### 2. Are adverse moisture issues created when SPF is installed?

As with any material that reduces air infiltration, it is important that the HVAC system is designed to control indoor humidity through proper sizing, adequate ventilation, and possibly supplemental dehumidification.

Consideration needs to be given to the potential for condensation. It is important that adequate thicknesses be applied to reduce the possibility of condensation on the warm and humid surface side of the insulation. When applying SPF in structures or climates where moisture is an issue, it may be necessary to include an additional vapor retarder/barrier.

### 3. Can SPF trap water/water vapor to support mold growth?

Mold requires a food source, water and air to grow. Unless treated, most wood or paper based building products are food sources for mold. When those materials become wet, mold can easily grow. SPF itself is not a food source for mold and does not support its growth. Bayseal® CC is considered a Class II semi impermeable Vapor Retarder according to the IECC definition of a vapor retarder. Appropriate building science consultants can address important options for the proper application of SPF in structures or climates where moisture is a concern.

## G. Flame Retardants in SPF

### 1. Does SPF contain flame retardants?

Yes. Like most building products, SPF must meet stringent test requirements for flammability. Manufacturers of SPF add flame retardants to meet these test requirements and ensure that spray foam performs adequately in the event of a fire.

The Covestro SPF formulations primarily contain Tris-(1-chloro-2-propyl) phosphate (TCPP) in the range of 5 to 25 percent. Other flame retardants may be used in certain formulations, such as brominated polyesters which become part of the polyurethane polymer.

## 2. Do the flame retardants off-gas after application?

Covestro has not conducted laboratory (chamber emission) or field (air monitoring) studies pertaining to the primary flame retardant contained within our formulations (TCPP). Studies are planned for 2013.

## 3. What are the building code requirements for SPF pertaining to fire resistant construction?

Model building codes published by the International Code Council (ICC), International Residential Code – 2009 Section R302; and International Building Code – 2009 Chapter 6 require that all foam plastic insulation products, including spray foam, meet certain fire performance requirements. These requirements are based on established test methods including:

- ASTM E84: measures the speed that a flame spreads across the surface of the foam and the amount of smoke that the burning foam generates
- NFPA 286: measures the rate of flame spread, but in a specific room configuration to simulate the end use application.
- ICC-Evaluation Services has developed specific acceptance criteria (AC 377) for testing SPF products, including fire performance. ICC-ES issues reports to confirm that manufacturers' products meet the appropriate acceptance criteria and the requirements of the building code for the use of the product.

The ICC-ES Reports for Covestro products are:

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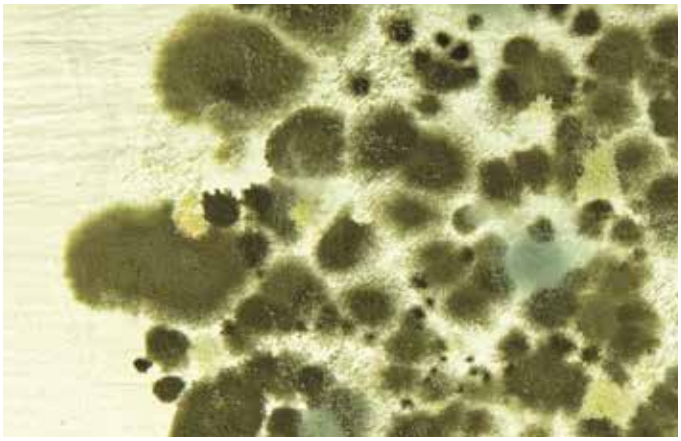
|---|---|
| **ESR-1655** | Bayseal® Open Cell Spray-applied Polyurethane Foam Insulation |
| **ESR-2702** | Bayseal® Closed Cell Spray-applied Polyurethane Foam Insulation |
| **ESR-3076** | EcoBay™ Closed Cell Spray-applied Polyurethane Foam Insulation |



Although uncommon, fires can occur during construction. The risks of fire during construction may be reduced through safe practices such as not allowing open flames or hot work including torch cutting, soldering or welding near building products that may easily ignite. Building codes require that an approved thermal barrier separate the SPF insulation from the occupied space in the building. Covestro recommends that the thermal barrier be installed shortly after the recommended re-occupancy time for non-SPF workers of 12 hours to reduce the risk of accidental ignition. For more information on fire safety precautions when working with or around SPF insulation, please consult the following document:

Fire Safety Guidance: Working with Polyurethane Foam Products, During New Construction, Retrofit, and Repair **(http://polyurethane.americanchemistry.com/Resources-and-Document-Library/11365.pdf)**

## 4. Are there building codes that would prohibit installation of SPF insulation?

Even though the model building codes allow for the use of foam plastic insulation, local codes or code officials may add further restrictions or prohibit the use of SPF insulation.

## Summary of Websites Referenced in FAQ:

- Covestro: **www.polyurethanes.covestro.com**
- Covestro: **www.productsafetyfirst.covestro.com**
- Center for Polyurethanes Industry (CPI): **www.spraypolyurethane.org**
- Spray Polyurethane Foam Alliance (SPFA): **www.sprayfoam.org**
- American Chemistry Council (ACC): **(www.americanchemistrycouncil.com)**
- Environmental Protection Agency (EPA): **(www.epa.gov/dfe/pubs/projects/spf/spray_polyurethane_foam.html)**
- CPI Spray Foam Coalition: **http://polyurethane.americanchemistry.com/Spray-Foam-Coalition/Guidance-on-Best-Practices-for-the-Installation-of-Spray-Polyurethane-Foam.pdf**
- ACC/CPI – Fire Safety Guidance Document: **http://polyurethane.americanchemistry.com/Resources-and-Document-Library/11365.pdf)**

## SPF Literature available at Covestro websites:

1. High Pressure SPF Chemical Health and Safety Training (web based training that is also available on-line through CPI and SPFA).
2. Spray Polyurethane Foam Insulation: Safe Use and Handling Guidelines for Installers (2009).
3. A Proposed Methodology for Development of Building Re-Occupancy Guidelines Following Installation of SPF Insulation, CPI Conference 2010 (Lambach, Thompson, Karlovich).
4. Covestro Re-Occupancy Letter (dated October 25, 2011)
5. Education About Spray Foam, Foam Book 2.
6. Spray Polyurethane Foam Chemicals: Protective Measures, Potential Health Effects & Medical Surveillance Recommendations.
7. CPI/SPFA Guidance Document: Interior SPF Insulation Health & Safety Q&A.
8. CPI/SPFA Guidance Document: Interior Applications Using SPF Containing MDI/PMDI: Seven Important Points for SPF Contractors.
9. Safety Poster (2012): SPF Insulation – Important Safety Information for Interior Applications.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