

# RB152-16

## IRC: R316.5.14 (New).

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## 2015 International Residential Code

### Add new text as follows:

**R316.5.14 Below grade use.** Foam plastic insulation shall not be required to meet the flame spread index and smoke-developed index criteria of Section R316.3 and shall not be subject to oxygen index limits provided that it is marked for below grade use only and is installed in accordance with one of the following:

1. The insulation is located between a concrete slab on grade and its subgrade.
2. The insulation is separated from the building interior by a masonry or concrete wall or foundation. Such insulation installed vertically shall be not less than 6 inches (152 mm) below finished exterior grade. Where installed horizontally, it shall be protected in accordance with Section R403.3.2.

**Reason:** This proposal creates a new sub-section in R316.5 which enables the voluntary use of foam plastic insulation that is not subject to flame spread, smoke-developed, and oxygen index requirements in certain installations below grade. This proposed code section creates an option whereby foam plastic insulation without flame retardants can be safely used below grade; it does not mandate any alteration to current building practice. It maintains the same level of fire safety provided under the current code and increases consumer choice of insulation products for unexposed or buried applications.

**Figures 1 and 2** depict examples of installations where the proposed code section could be applied. These include insulation between a concrete slab on grade and its subgrade and exterior insulation for basement and foundation walls and frost-protected shallow foundations.

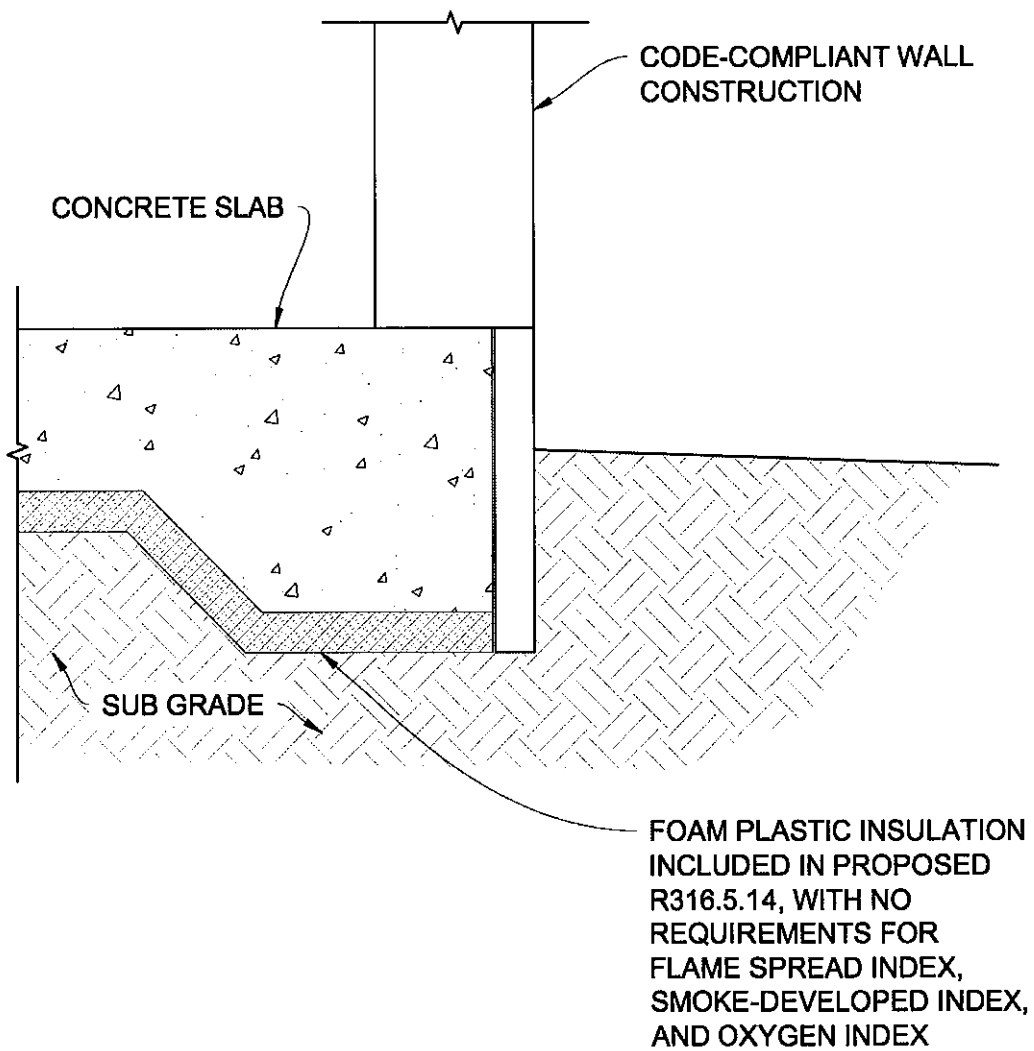


Figure 1: UNDER-SLAB BELOW-GRADE INSULATION  
 Proposed Code Section R316.5.14

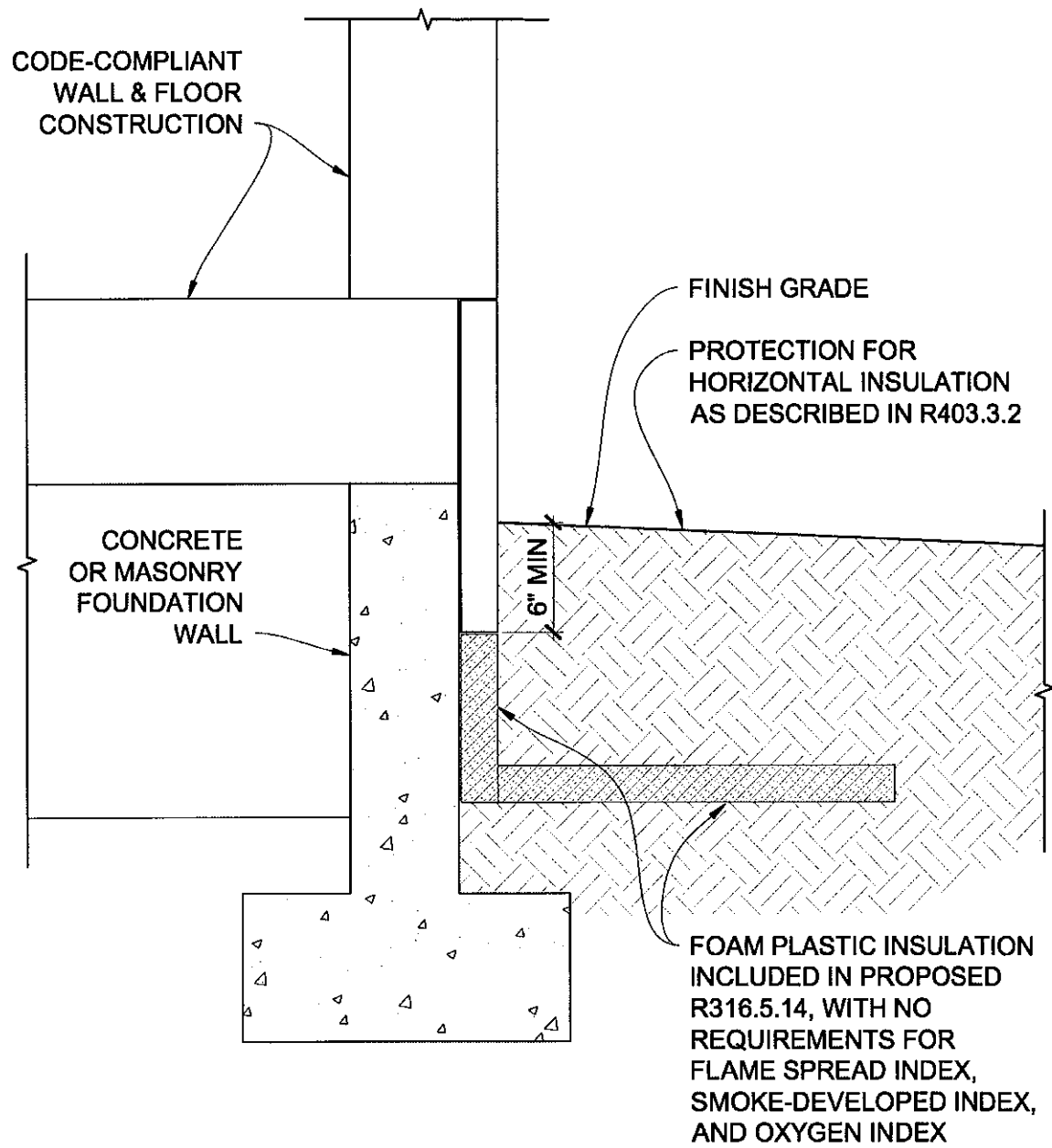


Figure 2: EXTERIOR BELOW-GRADE INSULATION  
 Proposed Code Section R316.5.14

The proposed code section maintains fire safety in the following ways:

- Insulation installed in accordance with this proposed code change is completely separated from the building interior.
- Insulation installed in accordance with this proposal has no exposure to a realistic source of ignition. It is protected either by a concrete slab having a minimum thickness of 3.5 inches (89 mm) as specified in IRC Section **R506 Concrete Floors (On Ground)**; or by a minimum of 6 inches of soil for exterior vertical insulation; or by a minimum of 12 inches of soil for horizontal exterior insulation unless additionally protected by concrete or asphalt as described in IRC Section **R403.3.2 Protection of horizontal insulation below ground**. These proposed protection requirements are based on existing code requirements for insulation protection and ensure that insulation covered by this proposal would not become exposed during the course of use. **Table 1** provides further details and references for proposed protection requirements.
- Insulation installed in accordance with this proposal does not have access to adequate oxygen to sustain a fire, as demonstrated by results from fire tests of below-grade foam plastic insulation. Fire testing is not regularly conducted on materials which are limited to buried applications only; however, the proponents conducted tests to address comments on similar proposals from the 2015 IBC-Fire Safety code committee that no fire test data had been submitted. These tests are described below.
  - **Description of Tests:** There is no established fire test method for the configurations covered by this proposed code section. The co-proponents are unaware of data on flame spread or smoke-developed between concrete and sub-grade material for foams of various material properties. Therefore, in response to requests for fire test data of relevant assemblies, Dr. David Rich at Reax Engineering Inc., and Dr. Donald Lucas (Lawrence Berkeley National Laboratory) and Avery Lindeman (Green Science Policy Institute), conducted tests to evaluate how different foam plastic insulation materials installed below grade would react when subjected to a range of fire spread scenarios.

The insulation materials were sandwiched between concrete pavers (2 inches thick) and earth or other non-combustible surface. Tests were conducted with and without an externally applied radiant heat flux comparable to a post-flashover fire condition. Two types of insulation were tested: one that complied with the requirements of International Residential Code (IRC) Section **316.3 Surface burning characteristics**; and a similar below-grade insulation material that did not comply with Section 316.3 requirements. Ignition was achieved at an opening in the pavers to observe fire spread beneath the simulated concrete slab. This was necessary because when there were no openings between the pavers, neither sample of foam plastic insulation ignited, even at conditions where melting occurred. When there were significant openings (16 square inches) or gaps (2.5 inches) between the concrete pavers, and insulation was subjected to an open flame ignition source and an external heat flux, both samples ignited and burned comparably; however, without an external heat flux, ignition of insulation was followed by limited flame spread, and flames self-extinguished due to restricted access to oxygen as the flame burned away from the opening in the pavers.

- Insulation installed in accordance with this proposed code change is still subject to the labeling and identification requirements of Section **R316.2 Labeling and identification** which ensures that foam plastic insulation is labeled with the product identification and sufficient information to determine that the end use complies with code requirements. This proposal would additionally require that materials for use in the allowed below-grade applications be clearly labeled for below grade use only as specified in the proposed Section R316.5.14.

**Table 1: Comparison of existing codes and standards with proposed provisions for insulation protection.**

Existing Code Section	Description of Protection Requirements	Relevance for Proposed Section
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IECC Section  
C303.2.1

"Insulation applied to the exterior of basement walls, crawlspace walls and the perimeter of slab-on-grade floors shall have a rigid, opaque and weather-resistant protective covering to prevent the degradation of the insulation's thermal performance. The protective covering shall cover the exposed exterior insulation and extend a minimum of 6 inches (153 mm) below grade."

IECC Section **C303.2.1 Protection**  
weather-resistant protective covering" for exterior  
sources of deterioration. At depths greater than 6  
code section remains protected throughout the cc

IRC Section  
R403.3.2

"Horizontal insulation placed less than 12 inches (305 mm) below the ground surface or that portion of horizontal insulation extending outward more than 24 inches (610 mm) from the foundation edge shall be protected against damage by use of a concrete slab or asphalt paving on the ground surface directly above the insulation or by cementitious board, plywood rated for below-ground use, or other *approved* materials placed below ground, directly above the top surface of the insulation."

According to the 2015 IRC Co  
*purposes*)." "

Thus, the proposed protection of insulation as de  
throughout the course of use.

Oxygen index is not currently limited in Chapter 3 of the IRC. However, testing to ASTM C578, which limits the permitted oxygen index of polystyrene insulation materials, is required by Section **R403.3 Frost-protected shallow foundations** for materials used below grade for the purpose of insulating footings against frost. In addition, the acceptance criteria for certain types of foam plastic insulation (AC12: Acceptance Criteria for Foam Plastic Insulation) require testing to ASTM C578. The purpose of this index is to measure the percent of oxygen in air needed to sustain combustion in a candle-like fire. As described in the standard:

"The values obtained by the oxygen index test...do not necessarily indicate or describe the fire risk of the materials and are used in this specification primarily to distinguish between insulations formulated with flame retardants and those not so formulated." (ASTM C578-14)

Oxygen index is not indicative of actual fire performance or safety of these materials. In the below grade applications covered by this proposal, the oxygen index of insulation materials is irrelevant. The proposed code section therefore does not limit the permitted oxygen index for insulation installed as specified.

The proponents are aware of concerns that this proposed code change may increase the fire hazard of foam plastic insulation materials during the transportation, storage, and installation stages of the product lifecycle. It is important to note that foam plastics are currently manufactured, transported, stored, and used safely in large quantities without added flame retardants in many other applications. In addition, current practices will maintain fire safety throughout these stages as described below:

- **Transportation:** The U.S. Department of Transportation does regulate the transportation of foam plastics. Special safety measures are not required for the bulk shipment of foam plastics, including food-grade materials and other foam plastics with varying material properties. Approval of the proposed code section will not create a new transportation fire hazard or increase the transportation fire hazards for foam plastic insulation materials.
- **Storage and Installation:** As stated in a 2003 Technical Bulletin from the Alliance for the Polyurethanes Industry, "All organic foam insulations, regardless of whether they contain fire retardants, should be considered combustible and handled accordingly. Certain precautions must be taken to minimize any potential for fire through accidental ignition in handling, storage, and use." The surface burning characteristics required in Section R316.3 are not sufficient to provide fire safety. Approval of the proposed code section will not create new storage and installation fire hazards, and the following practices – which pertain to any combustible or flammable material, not just foam plastics – should be followed regardless of the flame spread index and smoke-developed index of insulation materials on the jobsite
  - In accordance with OSHA Regulations for Occupational Safety and Health and Construction, worksite storage of foam plastics and other flammable materials should be done safely and in a way that does not block exits. The Alliance for the Polyurethanes Industry recommends that foam boardstock be stored "in limited quantities, in an accessible location, and free from ignition hazards."
  - OSHA regulations also require that hot work adhere to NFPA 51B, which stipulates that activities

like welding and cutting should only be performed when appropriate precautions are taken. These include removal or proper protection from sparks, heat, or hot metal of any flammable materials in the vicinity of the work.

The proposed code section is similar in scope to two code change proposals submitted during the 2015 Code Development Cycle (designated FS 170-15 and FS 171-15) that were disapproved by the 2015 IBC-Fire Safety code committee. The proponents have addressed that committee's reasons for disapproval as discussed below :

1. **Committee Reason for disapproval of FS 170-15 and FS 171-15:** Hazards can increase based on misuse of products on the jobsite and during storage and handling of the material to get it manufactured, stored, and delivered to the jobsite.

**Response:** This proposal explicitly requires insulation materials manufactured for use under the proposed code section to be labeled for below grade use only. This will enable inspectors and workers to identify foam plastic insulation materials for use with this code section and prevent the accidental installation or misuse of such materials in other, unapproved applications. Furthermore, as discussed above, existing specifications for the safe storage and handling of foam plastics do not differentiate between materials with and without flame retardant chemicals. Flame retardants used in foam plastic insulation may provide only a limited benefit against a narrow range of possible ignition sources. Once ignited, foam plastics with and without flame retardants behave similarly.

2. **Committee Reason for disapproval of FS 170-15 and FS 171-15:** No fire test data has been submitted on the product used in this application – fire can get below ground and protection by the slab or by masonry or concrete wall or foundation may not always be enough.

**Response:** This reason statement provides fire test data for the proposed applications. It is important to note that there is no established fire test method for insulation in the configurations covered by this proposed code section. There is also no fire loss history to indicate that these configurations pose a particular fire hazard. As stated in the code commentary for the 2015 IRC Section **R316.5.13 Floors**, "*...in the event of an interior fire, the floor is typically the last building element to be significantly exposed by the fire.*" Nevertheless, fire tests were conducted and the results confirmed that protection of insulation by a concrete slab or by a masonry or concrete wall or foundation is more than sufficient to provide fire safety for inhabitants and first responders. The results further demonstrated that insulation installed as allowed by this proposed code section behaved comparably with and without added flame retardants, confirming that current levels of fire safety will be maintained.

3. **Committee Reason for disapproval of FS 170-15 and FS 171-15:** Proposed provision for insulation depth is arbitrary and may allow insulation to become exposed after occupancy, which could then increase flame spread to other portions of the exterior of the building

**Response:** This proposal provides references for the proposed insulation protection requirements. Depths below grade and additional protection requirements are based on existing standards for protection of below-grade insulation which have already been approved and incorporated into the IRC as adequate for protecting insulation throughout the course of use.

4. **Committee Reason for disapproval of FS 170-15 and FS 171-15:** Proponents raised a perceived toxicity problem with fire retardant-treated foam plastic but provided no data showing the health risks of fire retardant-treated products.

**Response:** This proposal does not ask the code committee to evaluate or to make a decision based on possible health risks of fire retardant-treated products. Rather, it describes specific installation conditions for below-grade foam plastic insulation where fire retardants are not needed to provide fire safety. Because there is no fire safety benefit from the use of flame retardants in insulation in these applications, the code should allow for a choice of insulation materials without flame retardants that can be used safely.

The proposed code section does not prohibit the use of foam plastic insulation that meets the requirements of Section R316.3, nor does it prohibit the use of foam plastic insulation that contains flame retardants. It does not mandate any change to current building practice. Instead, it describes specific applications below-grade where foam plastic insulation that does not contain flame retardants, and therefore does not meet the requirements of Section R316.3, can be safely used if desired. This proposed code section would maintain current levels of fire safety.

**Cost Impact:** Will not increase the cost of construction

The proposed code change will not require any action that increases construction costs since it does not mandate any change from current practice. Utilizing the proposed code change would be optional: it would not require any alteration to design or construction practices. The proposed change would enable voluntary manufacture and use of alternative foam plastic insulation products that do not contain flame retardant chemicals. The cost of using these alternative insulation products may be higher, lower, or the same as the cost of using currently available insulation depending on formulation costs, production volumes, consumer demand, and level of competition.

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