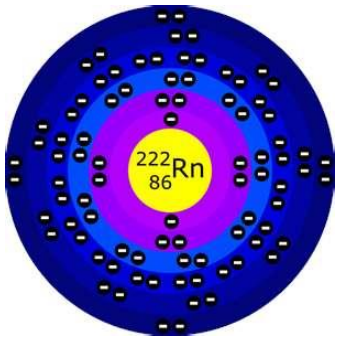
CASE STUDY:
UNIVERSITY OF ALBERTA
RADON-FREE CLEAN ROOM

PROJECT
University of Alberta Radon Free Clean Room

CONTRACTOR
Quantum Chemical.

OVERVIEW
Overview was submitted by Dr. Richard Soluk, Centre for Particle Physics, University of Alberta
"The goal was to create a clean room with as low a radon level as possible and turn it into a small machine shop where detectors components can be fabricated for very low rate particle physics experiments. These would be used in deep under-ground experiments, such as those at SNOLAB, to look for rare events such as interactions with dark matter. Exposure to normal room air radon levels would leave radioactive contamination on the detectors making them unusable. Some temporary low radon enclosures have been built in the past but I don't know of any clean room like this one. The product from Quantum provided the results we required. It neither emitted radon, nor allowed the passage of radon through it."



Radon is a radio-active, colourless, odorless, Nobel Gas occurring naturally as a decay product of Uranium or Thorium.

Radon is found everywhere from our basement foundation to the air we breathe.

SNOLAB is situated two kilometers below the surface in the Vale Creighton Mine near Sudbury, Ontario.

The Experimental Group at the U of A studies the fundamental constituents of matter and their interactions. Particle Physics is studied on the smallest scale possible, over 100 million times smaller than an atom. The experimental group builds and uses detectors to detect and measure particle interactions. One technique used, measures high energy particle collisions produced in the lab by accelerators. Exposure to air radon levels would leave radioactive contamination on the detectors, making them unusable, thus the requirements for a "Clean Room".

PRODUCT REQUIREMENTS
The project size was a 600 sq. ft. Radon Free Clean Room. The quantity of the product is based on a 2-3 mil thickness of **PRECIDIUM™ Primer** (2 gal.) and a 3/8" or 375 mil thickness of **PRECIDIUM™ Vapour/Particle Barrier** (1 drum set and 4 pail sets (145 gal.). The **PRECIDIUM™ Vapour/Particle Barrier** is a zero VOC, two-component aromatic polyurea, and would act as a protective membrane. Radon, like helium, tends to pass through a lot of materials, however, research has shown that a layer of polyurethane about 3/8" thick is enough to stop radon gas as was used to seal entire underground caverns at the SNOLAB facility in Eastern Canada.

For this project the floor of the clean room needed to be sealed to prevent radon from coming up through the concrete and entering the room. The product had to have excellent physical properties to ensure the heavy equipment that would be in the room wouldn't damage the membrane.

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INSTALLATION: Airlock Prototype

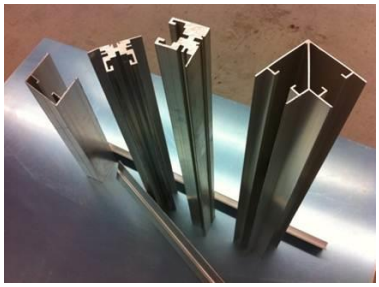
A prototype room was built first using the **PRECIDIUM™ Vapour/Particle Barrier**. The purpose of this prototype room was to ensure the effectiveness of the polyurea.

The outer 5'x10' airlock was built as the prototype room to test how well the clean room could be sealed.

Doors were hollow aluminum filled with polyurethane; prehung on welded aluminum frames with compression seals and additional dogs to increase clamping force between the door and frame.

The floor was sealed with a 1cm thick layer of **PRECIDIUM™ Vapour/Particle Barrier.** The room was monitored and tested over a three-month period.

INSTALLATION: Clean Room



Because the walls wouldn't be built when the floor was sprayed, aluminum U-channels were bolted to the unfinished concrete floor (20'x30') in a larger room. The area to be sprayed was tented off to prevent over spray in the outer area. Eventually the clean room would be sealed airtight and supplied with air that would have all the radon stripped from it.

The Clean Room was a modular design using mill finish aluminum extrusions and panels. Basic wall panels consisted of two sheets of aluminum sandwiching an aluminum foil honeycomb. Walls were 2" thick; ceiling panels used the same design but are ½" thick. The ceiling consisted of a top plenum cap 10' high which provides the outer air seal and an 8' suspended inner ceiling holding the lights and HEPA filters.

Because the U of A was concerned about the flooring material itself emitting radon, any unnecessary additives (like coloring agents) needed to be avoided. Plus, one week prior to the floor application, a sample of the actual product to be used on the floor was tested to ensure it was clean and the same batch used on the project because the amount of contamination can vary from batch to batch.

The selected batch was sprayed on a test piece of polyethylene about 2'x2' and 1/4" thick. This was tested for 10 days and once approved the floor was ready to be installed. The concrete floor was primed and sprayed normally and the only unusual thing about the project was the 3/8" thick membrane that required several passes to apply.

The quantity of product was based on a 2-3 mil thickness of **PRECIDIUM™ Primer** (2 gallons) and a 3/8" or 375 mil thickness of **PRECIDIUM™ Vapour/Particle Barrier** (145 gallons).

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