Polyurea Coating on a Nuclear Waste Storage Facility Concrete Decontamination Pad

In early 1945, the World War II allies were pushing the German armies across Europe back toward Germany. From the West came the United States, Britain, Canada and France from the East came the Red armies of the Soviet Union. As the common enemy of Germany was collapsing in defeat, the victors, especially the U.S. and Soviet Union began to look at each other as potential adversaries. The most highly classified secret that the United States had was the Atomic bomb. Joseph Stalin, the premier of the Soviet Union already knew about it, and was pushing his scientific community to develop its own. Thus began the arms escalation and the Cold War.

Weapons grade nuclear materials grew from Uranium. Uranium is the only naturally occurring fissionable element. Beyond Uranium (Atomic Number 92), are the synthetic fissionable materials called trans-uranic elements like Plutonium. The synthetic elements and are incredibly toxic. In the U.S., scientists working with these materials were aware of the enormous dangers. For the past 55 years, the U.S. and the other five countries engaged in nuclear weapons manufacture have generated enormous stockpiles of transuranic contaminated waste. Clothing, boot covers, tools even, sweatbands and gloves. Everything ever used to turn a screw or sweep the floors, including the sweepings were highly toxic and had to be warehoused.

During the 1950's the National Academy of Sciences and the Department of Energy began a nationwide search for geological formations stable enough to contain wastes for thousands of years. In 1955, after extensive study, salt deposits were recommended as a promising medium for the disposal of radioactive waste. There are four basic advantages to salt formations. First, salt deposits are found in geologically stable areas with very little earthquake activity. Salt deposits demonstrate the absence of flowing water that would dissolve the salt if present. Salt is relatively easy to mine, and rock salt "heals" it own fractures due to its inherent "plastic" quality. Because of the plasticity, the salt formation will slowly and progressively move in to fill the mined areas and seal the radioactive waste from the environment.

Between 280 and 225 million years ago the world looked quite different. The continents had not broken apart yet, and existed as one super continent, Pangea. Surrounding Pangea was a super ocean called the Permian Ocean. A narrow inlet, the Hovey channel cut into Pangea and formed a shallow, three lobed inland sea called the Permian basin. The middle lobe was called the Delaware basin and was 150 miles long by 75 miles wide. The Delaware basin covered what is today southwestern New Mexico and west Texas.

Over millions of years the Permian basin dried up depositing a 2000-foot layer of crystalline rock salt called the Salado formation.

The Salado formation lies between 850 feet to 3000 feet deep under west Texas and New Mexico. The Salado formation was chosen in the 1970's as a candidate for the DOE to build a test facility to store low-level tranuranic waste that was rapidly accumulating.

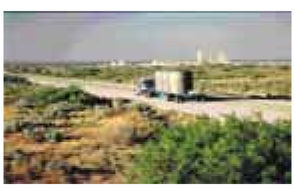
The two-color scheme will facilitate inspections of the polyurea coating for any cuts or tears in the top polyurea coat.

The DOE designed the Waste Isolation Pilot Plant (WIPP) to demonstrate the safe handling and disposal in deep salt beds.

The facility consists of above ground support facilities connected to an underground facility by a series of shafts and ventilation ducts. The principal mode of transport to the underground is a 75-ton two-deck lift.

Access to the WIPP site can be either train or truck.

The underground facility consists of a series of rooms called panels that have been cut out of the salt. The panels are joined by a series of tunnels and support rooms. The panels, tunnels and support rooms are isolated from each other and the surface facility by strategically located air locks and automatic doors.



The underground facility is very large consisting of hundreds of panels. The facility will provide 95 million cubic feet of safe storage. The main mode of transport is golf carts and heavy lifting equipment. One of the most important areas underground is the decontamination bay. Because water will dissolve salt, the DOE wanted a waterproofing membrane on the concrete of the decontamination bay. The bay is constructed of concrete and has a surrounding berm of sealed railroad ties. The DOE specified polyurea as the waterproofing membrane because it was fast curing, 100% solids, environmentally friendly and seamless.

The first step of the coating application was to prepare the concrete and berm of the containment. The rail ties were sealed using polystyrene "rope" and a slow polyurea sealant under the ties.

The polyurea sealant cures quickly and keeps the breaker rod in place. It was very important to keep any water from leaking away from the decontamination bay. The sealant was applied to both the front and back joint of the rail tie, in addition to the seam where one tie butted against the next tie.

When the sealant was cured the concrete was prepared using a shot blaster and vacuum. The next step is to use a low viscosity, 100% solids primer. The importance of low viscosity is to assist the primer in penetrating the concrete surface. The primer was applied using a pump-up pressure sprayer.

When the concrete was properly prepared it was time for the polyurea. Due to the critical nature of a decontamination bay and the ability of escaped water to dissolve salt, a two-color scheme was devised for the polyurea. The first coat would be 50 mils minimum of a high visibility yellow aromatic polyurea. The polyurea would have a tensile strength of 2600 psi, and an elongation of 500%. The topcoat of polyurea was 50 mils of a dark gray aromatic with the same physical properties as the yellow polyurea.

The two-color scheme will facilitate inspections of the polyurea coating for any cuts or tears in the top polyurea coat.

On March 26,1999 after years of debate and demonstration, the Waste Isolation Pilot Plant took its first load of low level, trans-uranic waste for permanent deep storage.

BIO

Greg is a 1978 graduate of Kent State University in Biology. He has worked in technical sales and marketing in both polymer and pharmaceutical new product development. In 1986 he joined Texaco Chemical Company in the Specialty Chemical group, which was responsible for polyurea development. In 1989, Greg left Texaco Chemical and started Structural Polymer Systems to commercialize polyurea coatings in manhole rehabilitation. Greg is a director on the Polyurea Development Association and has written numerous articles and technical papers about polyurea technology and applications. Greg holds 3 US patents in the use of polyurea coatings in Infrastructure rehabilitation.