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Denise M. Sheehan
Acting Commissioner

FIELD INVESTIGATION REPORT

Site Name: Indian Point Energy Center, Buchanan, NY

Date(s) of Visit: 10/20/05

Site Contact Name and Title: T.R. Jones, Licensing Supervisor
James Peters, Chemistry Program
James Noggle, NRC Senior Inspector
Vic Nutter, Environmental Manager

NYSDEC Staff: Tim Rice and Larry Rosenmann

Purpose:

On Tuesday, 10/18/05, Entergy held an update conference call with interested stakeholders regarding the status of their investigations into the Unit 2 spent fuel pool leak. During that conversation, both Rockland and Westchester County representatives "strongly requested" that the DEC become involved in the site groundwater investigation efforts, both to provide state involvement and to act as independent reviewers of the ongoing investigation. On 10/19, the NRC invited the DEC to participate in their special investigation of the event. In response to the counties request and the NRC's invitation, the Department sent an Environmental Radiation Specialist and an Engineering Geologist to the site to review Entergy's hydrology investigation plans, tour the site, and make arrangements for collection of groundwater samples.

Site Visit:

On Thursday, 10/20/05, Mr. Larry Rosenmann and myself (Tim Rice), from the Bureau of Hazardous Waste and Radiation Management, visited the Indian Point Energy Center (Nuclear Power Station). During the visit, we met with NRC resident inspectors, lead by Senior Inspector Mr. James Naggle, Entergy chemistry (analytical) staff, plant licensing staff, and a representative from their White Plains office, toured selected areas of the site, and arranged for the collection of split samples from a series of previously existing monitoring wells.

We first met with Mr. James Peters from the site Chemistry group who explained the

types of analyses that were taking place in support of this investigation. We then met with the NRC resident inspectors, who briefed us on the scope of their involvement so far, which includes consideration not only of the Unit 2 spent fuel pool as a potential source of the tritium in groundwater, but also the potential for contributions from the Unit 1 spent fuel pool and the various secondary cooling water systems around the site. Entergy staff then took us through a basic radiation safety course, procurement of TLD's, and a whole-body count, prior to our being allowed to enter radiation controlled areas. We visited the excavation adjacent to the spent fuel pool and observed the location of the seepage, and the seepage water collection system, with site staff. We then met with the NRC staff again, and they took us to visit the monitoring well locations and an exposed rock face to see an example of the bedrock fractures first hand. At the end of the visit we left 8 glass sample bottles with Mr. T.R. Jones, supervisor of the Entergy licensing group. He provided these to their environmental monitoring staff on Friday 10/21, who collected split samples from the 8 monitoring wells being used as part of this investigation. These samples are being sent to the DOH Wadsworth laboratory for analysis for tritium.

Hydrology:

General -

The site is located on the eastern shore of the Hudson River, in Westchester County. The property slopes fairly dramatically towards the river on its western boundary, with greater than 100 feet of elevation change. The foundations for the structures on site, including the reactors, spent fuel pools, and turbine buildings are all located in contact with bedrock. This bedrock is a highly metamorphosed limestone exhibiting at least three distinct fracture planes. During construction, the overburden was removed and the underlying rock blasted and removed to form what amount to terraces in the sloping surface of the bedrock, in order to provide adequate footing for these heavy structures. In most cases, it appears that blast rock and other fill materials were backfilled into the spaces between the poured concrete walls of the structures and the surrounding bedrock. The resulting topography is such that the land surface slopes towards the reactor complex from the North, South and East. Thus all surficial water drainage leads in towards the site and then to the Hudson River. The initial impression of groundwater flow is that this also flows in towards the site and then to the river.

Information from Site Visit -

Preliminary monitoring of this issue was conducted using wells that were previously installed to address non-radiological contamination on site. The data they provide, therefore, is only useful for a preliminary check for any widespread, high level impacts that may have occurred. Such impacts were not seen. However, because the wells were not targeted to the specific problem, at this time we do not know whether the contamination that has been identified originated exclusively from the Unit 2 leak, from elsewhere on-site, or is a mix of more than one source.

We have not yet received a copy of their proposed scope of work, but based upon discussions with the NRC and site officials, it appears that Entergy's Consultant, GZA

has proposed a multi-phase study designed to:

- Evaluate impacts directly adjacent to the leak;
- Determine the direction of groundwater flow from the area of the leak;
- Examine the influence of nearby site structures and tidal changes on groundwater migration; and
- Attempt to identify impacts from other activities that are not related to the leak.

The general approach appears to be well targeted towards the problem at hand and should be appropriate to characterize this release.

Tritium:

Potential Sources -

- The initial source of concern for groundwater contamination was the Unit 2 spent fuel pool, where a very small leak of water from the pool was discovered during excavation immediately adjacent to the pool wall. Also noticed on the walls was boron salt from the evaporation of boron dissolved in the pool water. The purpose of the excavation is to create a massive base for a crane to be used to transfer older spent fuel as part of the site plan to place all of their older fuel into dry-cask storage. During excavation, moisture was observed on the surface of the concrete wall and is associated with what a site engineer described as a concrete drying or curing crack, that has probably been in existence since shortly after the pool was constructed. This concrete pool is lined with a stainless steel liner that is in direct contact with the concrete itself. For the water to leak through the concrete, there has to be some breach of the liner. Based upon his experience at similar facilities, the project engineer believes that the pool investigation is likely to show that there is a defect or crack in one of the welds used to install the liner. Their tentative plan would be to seal the leak with a high-strength industrial epoxy. This epoxy would likely have to be put in place by a nuclear diver. The need for a diver to do this work has certain limitations due to the high dose rates in the pool from the stored spent fuel. Epoxy use will minimize residence time in the pool for the diver, rather than expose them to the high dose-rates for the extended period of time that underwater welding would require.

- A second potential source for the tritium in the groundwater is the Unit 1 spent fuel pool complex. There is a 10+ years history of leakage from this set of interconnected pools dating back to the mid-90's. These are unlined concrete pools. The concrete for a portion of the walls of several of these pools was poured directly against the concrete of the Unit 1 dome. When first identified, the leakage from at least some of these pools was being transmitted through both of these concrete walls. Fuel pool water was detected: seeping through the inner surface of the Unit 1 reactor's protective dome, in the drain systems in the annular space between the concrete dome and the inner steel containment sphere, and in the french drain system on the north side of the dome, known as the north curtain drain. Eventually, the water was removed from all but one of the spent fuel pools, and the now quite old (and both radiologically and thermally cooler) spent fuel was

maintained beneath a significantly reduced level of pool water. These actions limited the potential leakage source to only one pool, and greatly reduced the hydraulic head driving the leakage. These actions reduced the detectable leakage rate to a few gallons per day. During our involvement in the original investigation of the Unit 1 spent fuel pool leak, Con Edison, the owner of this reactor, informed us that they were convinced that since the completion of their remedial actions, they have been collecting all leakage that is occurring.

On September 18, the water level in the Unit 1 pool was raised considerably to provide space to move the spent fuel elements around within the pool in support of a fuel element cleaning and inspection process. This process is in preparation for an eventual dry-cask storage project for this fuel. This project will eventually result in the complete de-watering of the Unit 1 pool complex. As a result of the water level increase, the detectable leakage rate has increased to approximately 500 gallons per day. Most of this leakage is flowing from the in-use pool through the walls into the other empty pools. Water from the annular space drains and the north curtain drain continues to be collected and treated. Since there is only a perimeter french drain around a small portion of the Unit 1 fuel pool complex, and the south curtain drain for the dome shows no flow at all (NRC engineers believe it may be plugged and are strongly encouraging Con Ed to do a visual camera inspection) there remains a potential that water from this system is still contributing to groundwater contamination on-site.

- A third potential source for tritium contamination in groundwater is the secondary cooling water systems from the operating reactors (Units 2 and 3). Since tritium is known to be present in secondary cooling water at light-water reactors, Entergy is looking for ways to discriminate between potential sources of groundwater contamination. Their chemistry staff are going to analyze the well samples collected Friday, 10/21, for mono ethyl amine (ETA), which is used as a pH control chemical and is present in the secondary water, but not in the pools. This is an initial attempt to use ETA as a way to discriminate between secondary water and pool water as sources of groundwater tritium. However, Entergy has not yet acquired much information on how it moves in the environment. Therefore, if it does show up in well water, it confirms that the secondary water is at least a contributor to the groundwater contamination, but its absence does not rule out the secondary water as a source, since it may be bound up in concrete or soil and not end up in solution. (Note: Information subsequently gathered by Mr. Rosenmann indicates that ETA is fairly mobile in the environment.)

- Another potential source is the Unit 3 fuel pool. However, this pool is lined with stainless steel and has a "tell-tale" system consisting of channels running between the steel liner and concrete, which are monitored for leaks. To date, no water has been detected in these tell-tale spaces. The NRC has encouraged Entergy to inspect these channels by running a bore-scope through them to ensure that they are not plugged anywhere. At present, this does not appear to be a likely source for groundwater contamination.

(NOTE: Boron is another potential confirmatory analyte, however since it binds relatively strongly with concrete and soil, and will accumulate as a salt when water carrying it evaporates, it is not very useful to rule out or verify fuel pools as a source of groundwater contamination. Its presence in the water from the Unit 2 pool seep does, however, help to verify that the water originates from within the pool.)

Data:

The following data has been consolidated from several sources, including data e-mailed to various State agencies, and verbal estimates of concentrations provided by Mr. James Peters and by the NRC inspectors.

Locations and Concentrations (in µCi/ml) -

	H-3	Cs-134	Cs-137	Co-60	Boron (ppm)
Drinking Water Std	2E-5				
Background	1-4E-7				
Unit 2 fuel pool	2-6E-2	MDA	E-3>E-4	E-4>E-5	2,300
Unit 2 seepage		MDA	E-5>E-6	MDA (E-7)	~2,000
Unit 1 fuel pool	4E-4				~ 200
Secondary water	1-4E-6				
Well 111	2E-4				~ 8
Well B 108	H-3 Range is 4.7E-7 to 1.6E-6				
Well B 109	"				
Well U3-1	"				
Well U3-2	"				
Well U3-3	"				
Well U3 T-1	"				
Well U3 T-2	"				

Completed Actions

- Mr. Rosenmann followed up on a commitment made to Entergy staff and provided information to Mr. Peters on how ETA moves in the environment. He also provided the Mr. James Noggle of the NRC with contact information for the USGS group that has done detailed groundwater hydrology characterization work at the Watervleit Arsenal.
- I coordinated contacts between Mr. James Peters and the DOH Bureau of Environmental Radiation Protection, who arranged for shipping of the split samples collected for us by Entergy, to the DOH Wadsworth Laboratory. Wadsworth has agreed to perform expedited tritium analysis on these samples.

Timothy B. Rice, ERS II — Date of Report