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Groundwater Investigation Executive Summary

Entergy

Indian Point Energy Center Buchanan, N. Y.

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EXECUTIVE SUMMARY

This report presents the results of a two-year comprehensive hydrogeologic site investigation of the Indian Point Energy Center (Site) conducted by GZA GeoEnvironmental, Inc. (GZA). The study was initiated in response to an apparent release of Tritium to the subsurface, initially discovered in August of 2005 during Unit 2 construction activities associated with the Independent Spent Fuel Storage Installation Project. These investigations were subsequently expanded to include areas of the Site where credible potential sources of leakage might exist, and encompassed all three reactor units. Ultimately, these investigations traced the contamination back to two separate structures, the Unit 2 and Unit 1 Spent Fuel Pools (SFPs). The two commingled plumes, resulting from these SFPs releases, have been fully characterized and their extent, activity and impact determined. The two primary radionuclide contaminants of interest were found to be Tritium and Strontium. Other contaminants, Cesium, Cobalt, and Nickel, have been found in a subset of the groundwater samples, but always in conjunction with Tritium or Strontium. Therefore, while the focus of the investigation was on Tritium and Strontium, it inherently addresses the full extent of groundwater radionuclide contamination. The investigations have further shown that the contaminated groundwater can not migrate off-property to the North, East or South. The plumes ultimately discharge to the Hudson River to the West.

Throughout the two years of the investigation, the groundwater mass flux and radiological release to the Hudson River have been assessed. These assessments, along with the resulting Conceptual Site Model, have been used by Entergy to assess dose impact. At no time have analyses of existing Site conditions yielded any indication of potential adverse environmental or health risk. In fact, radiological assessments have consistently shown that the releases to the environment are a small percentage of regulatory limits.

SOURCES OF CONTAMINATION

As stated above, the investigations found that the groundwater contamination is the result of releases from the Unit 2 and the Unit 1 SFPs. Our studies found no evidence of any release from Unit 3.

The predominant radionuclide found in the plume from the Unit 2 SFP pool is Tritium. The releases were due to: 1) historic damage in 1990 to the SFP liner, with subsequent discovery and repair in 1992; and 2) a weld imperfection in the stainless steel Transfer Canal liner identified by Entergy in September 2007, and repaired in December 2007. To the extent possible, the Unit 2 pool liner has been fully tested and repairs have been completed. The identified leakage has therefore been eliminated and/or controlled by Entergy. Specifically, Entergy has: 1) confirmed that the damage to the liner associated with the 1992 release was repaired by the prior owner and is no longer leaking; 2) installed a containment system (collection box) at the site of

the leakage discovered in 2005, which precludes further release to the groundwater; and 3) after an exhaustive liner inspection, identified a weld imperfection in the Transfer Canal liner that was then prevented from leaking by draining the canal. The weld was then subsequently repaired by Entergy in mid-December 2007. Therefore, all identified Unit 2 SFP leaks have been addressed. Water likely remains between the Unit 2 SFP stainless steel liner and the concrete walls, and thus additional active leaks can not be completely ruled out. However, if they exist at all, the data indicate they must be small and of little impact to the groundwater.

The Unit 1 plume is characterized by Strontium from legacy leakage of the Unit 1 fuel pools. At present, the Unit 1 pools have been drained with the exception of the Unit 1 West Fuel Pool which still contains spent fuel. This West Pool leaks water under the fuel building and is responsible for the Unit 1 Strontium groundwater plume discovered in 2006. Prior to that time, the previous owner had identified leakage from the West Fuel Pool in the 1990's and was managing the leakage by collecting it from a re-configured footing drain that surrounded the fuel building. However, based on the groundwater investigation, it has been determined that the pool leakage management program was not successful in collecting all of the leakage. As a result, uncollected contaminants released from the Unit 1 Spent Fuel Pools, past and present, have been observed during the groundwater investigation effort at various locations near the site of Unit 1. In response to the finding that the leak collection system was not functioning as believed, Entergy promptly initiated a program to reduce the concentration of radionuclides in the Unit 1 West Pool's water, beginning in April 2006, via enhanced demineralization water treatment. The planned fuel removal and pool draining will completely eliminate this release source by year end 2008.

EXTENT OF CONTAMINATION

The groundwater contamination is, and will remain, limited to the Indian Point Energy Center property, because the migration of Site contaminants is controlled by groundwater flow, which, in turn, is governed by the post-construction hydrogeologic setting. Plant construction required reduction in bedrock surface elevations and installation of foundation drains. These man-made features have lowered the groundwater elevations beneath the facility, redirecting groundwater to flow to the West towards the Hudson River; and not to the North, East or South. Because of the nature and age of the releases, groundwater contaminant migration rates, and interdictions by Entergy to eliminate/control releases, the groundwater contaminant plumes have reached their maximum spatial extent and should now decrease over time.

LONG-TERM MONITORING

Long term groundwater monitoring is ongoing; a network of multi-level groundwater monitoring installations has been established at the facility. These "wells" are located down gradient of, and in close proximity to, both

existing and potential release locations. Groundwater testing is performed quarterly on the majority of these wells, with the rest remaining on standby to provide added detail, if required. The resulting information is provided on a yearly basis to the Nuclear Regulatory Commission (NRC). The information is used to assess changes in groundwater relative to dose impact assessment and to detect future releases, should they occur.

In addition to the groundwater samples from the network of monitoring wells, Entergy obtained various off-Site samples of environmental media including off-Site wells, reservoirs and the Hudson River. In addition, Entergy participated in a fish sampling program with the NRC and New York State Department of Environmental Conservation (NYSDEC). None of the samples analyzed, including the samples split with regulatory agencies, detected any radioactivity in excess of environmental background levels.

GZA believes that the recommended remediation technology discussed below will cause the concentrations of radionuclides in the groundwater plumes to decrease over time. The continued monitoring of groundwater is expected to demonstrate that trend and support the conclusion that the identified leaks have been terminated. However, GZA expects that contaminant concentrations will fluctuate over time due to natural variations in groundwater recharge and that a potential future short term increase in concentrations does not, in and of itself, indicate a new leak. It is further emphasized that the groundwater releases to the river are only a small percentage of the regulatory limits, which are of no threat to public health

PROPOSED REMEDIATION

GZA has recommended the following corrective measures to Entergy, which they are implementing:

- Repair the identified Unit 2 Transfer Canal liner weld imperfection (completed December 2007).
- Continue source term reduction in the Unit 1 West Pool via the installed demineralization system (ongoing until completion of No. 3 below).
- Remove the remaining Unit 1 fuel and drain the West Pool (in-process).
- Implement long term groundwater monitoring (in-process).

The proposed remediation technology is source elimination/control (Nos. 1 and 3 above) with subsequent Monitored Natural Attenuation, or MNA. MNA is a recognized and proven remedial approach that allows natural processes to reduce contaminant concentrations. The associated monitoring is intended to verify that reductions are occurring in an anticipated manner. The Indian Point Energy Center Site is well suited for this approach because: 1) interdictions to eliminate or reduce releases have been made; 2) the nature and extent of contamination is known; 3) the contaminant plumes have reached their maximum extent; and 4) the single receptor of the contamination, the Hudson River, is monitored, with radiological assessments consistently

demonstrating that the releases to the environment are a small percentage of regulatory limits, and no threat to public health or safety.