RIV000099
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EXCERPT

United States Nuclear Regulatory Commission Official Hearing Exhibit

In the Matter of:	Entergy Nuclear Operations, Inc. (Indian Point Nuclear Generating Units 2 and 3)
ASLBP #: 07-858-03-LR-BD01	
Docket #: 05000247 | 05000286	
Exhibit #: RIV000099-00-BD01	Identified: 10/15/2012
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STATE OF NEW YORK
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

In the Matter of Entergy Nuclear Indian Point 2, LLC, Entergy Nuclear Indian Point 3, LLC, and Entergy Nuclear Operations Inc.'s Joint Application for CWA § 401 Water Quality Certification	DEC App. Nos. 3-5522-00011/00030 (IP2) 3-5522-00105/00031 (IP3)

COMBINED PREFILED REBUTTAL TESTIMONY OF THOMAS C. ESSELMAN, PH.D., MATTHEW J. BARVENIK, AND F. OWEN HOFFMAN, PH.D

RADIOLOGICAL - ISSUE FOR ADJUDICATION NO. 3

ENTERGY NUCLEAR INDIAN POINT 2, LLC, ENTERGY NUCLEAR INDIAN POINT 3, LLC, AND ENTERGY NUCLEAR OPERATIONS, INC.

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1 Unit 1 SFPs as a proactive measure, which was ultimately completed in 2008.
2 While the NCD and SFDS were not fully successful in containing all the leakage
3 from the IP1 SFPs (as described in Exhibit 33), they did, and currently still do,
4 contain the vast majority of this historical leakage and subsequent residual
5 contaminant migration.

6 More specifically, while the IP1 SFPs still contained spent fuel and water,
7 the NCD and SFDS were collecting 20 to 40 times more strontium than was
8 discharging to the river through the groundwater. These drains were then
9 particularly effective during the period when the water level in the IP1 SFPs had
10 to be raised to allow defueling. During this period of time, the two drains were
11 capturing nearly 300 times as much strontium as was discharging to the river
12 through the groundwater. In addition, even now that the IP1 SFPs have been
13 emptied and are no longer a source of releases, these collection drains are still
14 serving to capture residual contamination partitioning off of the subsurface
15 materials into the groundwater. Currently, the NCD and SFDS drains are still
16 capturing approximately ten times as much strontium as is discharging to the river
17 through the groundwater. As such, these drains function as a valuable ongoing
18 source control portion of the Monitored Natural Attenuation at the Indian Point
19 site, and routine sampling and analysis of their discharge is incorporated into the
20 Long-Term Monitoring Program.

21 **Q: On pages 9-10 of his testimony, Mr. Gunderson states that "leaks from the**
22 **Unit 2 refueling pool have also been a substantial problem." Do you agree**
23 **with this statement?**

1 Act has an identical provision, which prohibits any permit from authorizing the
2 discharge of high-level radioactive waste. *See* 33 U.S.C § 1311. While the Clean
3 Water Act does not define "high-level radioactive waste," EPA regulations define
4 "high-level radioactive waste" according to the definition contained in the
5 Nuclear Waste Policy Act of 1982. *See* 40 CFR 191.02(h) ("*High-level*
6 *radioactive waste,* as used in this part, means high-level radioactive waste as
7 defined in the Nuclear Waste Policy Act of 1982 (Pub. L. 97–425)"). The
8 Nuclear Waste Policy Act defines "high-level radioactive waste" as:

9 "(A) the highly radioactive material resulting from the
10 reprocessing of spent nuclear fuel, including liquid waste produced
11 directly in reprocessing and any solid material derived from such
12 liquid waste that contains fission products in sufficient
13 concentrations; and
14 (B) other highly radioactive material that the Commission,
15 consistent with existing law, determines by rule requires
16 permanent isolation."

17 42 U.S.C. § 10101(12). The water containing principally tritium and strontium
18 identified in GZA's 2008 Site Investigation Report is not "high-level radioactive
19 waste" as that term is defined by law.

20 **Q: While Entergy believes that NYSDEC's legal position that Entergy's**
21 **unplanned radionuclide releases are proscribed by law is erroneous, are**
22 **there measures that could be taken during the license renewal term to**
23 **provide reasonable assurances that groundwater containing these**

1 **radionuclides will not reach the Hudson River?**

2 A: (MJB) Yes. As set forth in my initial prefiled testimony, the Indian Point site is
3 primarily underlain by bedrock. As such, the volume of groundwater moving
4 beneath the site toward the Hudson River is constrained to flow through relatively
5 thin fractures in the bedrock. This, in part, accounts for the small total
6 radionuclide activity actually reaching the Hudson River from groundwater on an
7 annual basis. Further, as demonstrated in the Site Investigation Report (Ex. 33),
8 the groundwater containing the identified tritium and strontium plumes discharges
9 to the river through a relatively small section of waterfront along the perimeter of
10 the site.

11 Based on my knowledge of the Indian Point site hydrogeology, and my
12 experience with groundwater remediation, I have performed an analysis of
13 possible measures that could be taken to prevent these radionuclides from
14 reaching the Hudson River. Based on that analysis, I have concluded that Entergy
15 could install a sufficient number of groundwater extraction wells so as to contain
16 these radionuclides on-site by establishing a groundwater gradient reversal. A
17 gradient reversal in this context refers to a change in the direction of groundwater
18 flow; rather than the current flow from the site to the Hudson River, the extraction
19 wells would result in groundwater flowing from the Hudson River toward the
20 wells located on-site. Entergy would then extract the groundwater containing
21 radionuclides from the subsurface, and process that groundwater in an appropriate
22 manner. I believe that the installation of such extraction wells would provide
23 reasonable assurances that groundwater containing these radionuclides will not

1 reach the Hudson River as a result of the operation of Indian Point during the
2 license renewal term.

3 **Q: Are extraction wells a proven, reliable method for creating a gradient**
4 **reversal in order to prevent groundwater containing contaminants from**
5 **moving away from a site?**

6 A: (MJB) The use of extraction wells specifically to prevent groundwater from
7 moving away from a site is, and has been a commonly employed technique for
8 approximately 40 years, including at EPA superfund sites, as well as many other
9 non-superfund sites. In its Report No. 2003-P-000006 dated March 27, 2003,
10 EPA concluded that: "Pumping contaminated groundwater from the subsurface and
11 treating the water to rid it of contamination has been a generally accepted means of
12 remediation in the Superfund program. In January 2002, EPA reported that although
13 the number of Records of Decision selecting the pump-and-treat remedy decreased
14 from 92 percent in 1986 to 30 percent in 1999, pump-and-treat remedies are still the
15 most common groundwater cleanup remedies used at National Priority List [NPL]
16 sites. . . . EPA estimates that over 700 groundwater pump-and-treat systems are
17 operating at National Priority List sites." (Ex. 83). This equates to the use of
18 groundwater extraction for containment and/or cleanup at 57 percent of the NPL sites
19 (700/1233). In this regard, I have been personally involved in the investigation
20 and remediation design for a number of superfund sites, as well as state-led
21 remediation sites, employing this technique, beginning in the 1970s. One such
22 site, Grace Chemical and the Town of Acton, Massachusetts, was the second EPA
23 NPL enforcement action in the nation resulting in a remedial action consent

1 decree. Another such site, the Gilson Road/Sylvester Site, was the nation's first
2 cooperatively funded Superfund hazardous waste site hydrodynamic
3 isolation/cutoff wall remediation. As part of this remediation of chlorinated
4 solvents in groundwater, GZA used extraction wells to capture and contain the
5 contaminated groundwater flowing through the bedrock on site. This work was
6 completed on behalf of the State of NH and the EPA. In recognition of this work,
7 GZA was awarded the ASCE Outstanding Engineering Achievement Award, the
8 ACEC New England Grand Conceptor Award and the National ACEC Grand
9 Award for Engineering Excellence, as well as a $250,000 sole-source R&D full-
10 scale test section contract by EPA.
11
12 **END OF TESTIMONY**