

NEW YORK STATE  
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

In the Matter of a Renewal and Modification of a State  
Pollutant Discharge Elimination System (“SPDES”) Permit  
Pursuant to article 17 of the Environmental Conservation Law  
And Title 6 of the Official Compilation of Codes, Rules and  
Regulations of the State of New York parts 704 and 750 *et seq.*  
by Entergy Nuclear Indian Point 2, LLC and Entergy Nuclear  
Indian Point 3, LLC, Permittee,

**DEC # 3-5522-00011/00004**  
**SPDES # NY-0004472**

-and-

In the Matter of the Application by Entergy Nuclear Indian  
Point 2, LLC and Entergy Nuclear Indian Point 3, LLC,  
for a Certificate Pursuant to §401 of the Federal Clean Water  
Act.

**DEC # 3-5522-00011/00030**  
**DEC # 3-5522-00011/00031**

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**PREFILED REBUTTAL TESTIMONY OF**

**ARNOLD GUNDERSEN**

**ON BEHALF OF PETITIONERS RIVERKEEPER, INC., SCENIC  
HUDSON, INC., AND NATURAL RESOURCES DEFENSE COUNCIL, INC.**

**TO THE DIRECT TESTIMONY OF MATTHEW J. BARVENIK (SENIOR PRINCIPAL  
GZA GEOENVIRONMENTAL, INC.)**

**REGARDING RADIOLOGICAL MATERIALS**

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**INTRODUCTION**

**Q. Mr. Gundersen, please state the purpose of your rebuttal testimony.**

A. My testimony addresses key aspects of the prefiled direct testimony presented by Entergy witness Matthew J. Barvenik relating to the “Radiological Materials” issue being adjudicated in the above-captioned proceeding (hereinafter “Barvenik Prefiled Direct”). In particular, my testimony responds to Mr. Barvenik’s position with regard to (1) causes and sources of radiological leaks and discharges at the Indian Point nuclear power plant (“Indian Point”), (2) the extent and current status of radiological contamination at Indian Point, (3) the impact of such releases on groundwater and the Hudson River, and (4) Entergy’s ability to detect and respond to likely future leaks at Indian Point.

**Q. Have you reviewed Mr. Barvenik’s testimony?**

A. Yes.

**Q. Have you reviewed anything else in preparation of this rebuttal testimony?**

A. Yes. In addition to the many documents I previously reviewed as listed in my prefiled direct testimony (cited herein as “Gundersen Prefiled Direct”), and the New York State Department of Environmental Conservation’s (“NYSDEC”) Notice of Denial of Entergy’s application for a Water Quality Certification, I have reviewed the exhibits to Mr. Barvenik’s testimony as well as the most recent quarterly groundwater monitoring report, groundwater monitoring data, and data review checklists provided by Entergy. I have also reviewed Entergy and U.S. Nuclear Regulatory Commission (“NRC”) documents relating to safety evaluations and aging management programs at Indian Point.

1 **Q. Based upon your review, have you reached an opinion about Mr. Barvenik’s**  
2 **testimony?**

3 A. Yes, I have. In particular I conclude that:

4 (1) Mr. Barvenik fails to address all the causes and pathways of past, ongoing, and  
5 current radiological leaks at Indian Point;

6 (2) Mr. Barvenik inaccurately attempts to minimize the severity of the existing  
7 radiological contamination at Indian Point and ignores that fact that the contamination  
8 currently exceeds the U.S. Environmental Protection Agency’s (“EPA”) Maximum  
9 Contaminant Levels (“MCLs”), and will likely continue to do so in the future;

10 (3) Mr. Barvenik’s testimony mischaracterizes and downplays the impact of radiological  
11 leaks and discharges to the Hudson River and is largely irrelevant since the point is  
12 that Indian Point is currently and will continue for decades to release radiological  
13 materials to the river; and that

14 (4) Mr. Barvenik fails to show that Entergy has the ability to sufficiently detect and  
15 respond to likely future leaks. Mr. Barvenik suggests that allowing radioactive  
16 material to leak into the groundwater and then be detected by monitoring wells as it  
17 “flushes” into the Hudson River is the appropriate method to address contamination at  
18 Indian Point. However, Mr. Barvenik failed to examine and address more proactive  
19 remediation efforts (such as extraction, which Entergy is pursuing at other sites and  
20 which has been previously recommended specifically for Indian Point) that could  
21 easily be applied at Indian Point and that would significantly reduce the plant’s  
22 contamination of the groundwater and the Hudson River.

23

24 **SOURCES OF RADIOLOGICAL LEAKS AND DISCHARGES AT INDIAN POINT**

25

26 **Q. What does Mr. Barvenik describe as the cause(s) of groundwater contamination at**  
27 **Indian Point?**

28 A. Mr. Barvenik suggests that the radiological contamination found at the Indian Point site  
29 predominantly originated many years ago from leaks in the Spent Fuel Pools (“SFP”)

1 associated with Units 1 and 2.<sup>1</sup>

2  
3 **Q. How does Mr. Barvenik describe the current status of the leaking spent fuel pools?**

4 A. Mr. Barvenik correctly states that the sources of the Unit 1 spent fuel pool leaks are no  
5 longer active, as the problematic pool has been drained.<sup>2</sup> Mr. Barvenik also states that  
6 several leaks identified in the Unit 2 pool were successfully repaired.<sup>3</sup> In particular, Mr.  
7 Barvenik concludes that, “[a]s of December 2007, Entergy had repaired all then-  
8 identified imperfections in the IP2 SFP.”<sup>4</sup>

9  
10 **Q. Have all leaks in the Unit 2 SFP been identified and repaired?**

11 A. No, Entergy has not yet proven that active leaks from the Unit 2 SFP have ceased. In  
12 particular, it is impossible for Entergy to conclude that *all* leaks have been identified,  
13 because Entergy has never been able to inspect nearly half of the spent fuel pool liner.<sup>5</sup>  
14 As explained in the NRC’s 2009 Safety Evaluation Report (“SER”) relating to the  
15 proposed relicensing of Indian Point, “[t]he licensee stated that it completed, in 2007, a  
16 *one-time inspection* of the *accessible 40 percent* of the SFP liner above the fuel racks.”<sup>6</sup>  
17 Entergy, as well as GZA, GeoEnvironmental, Inc., have flatly admitted that “active leaks  
18 cannot be completely ruled out.”<sup>7</sup>

19  
20 Moreover, while Mr. Barvenik claims that the leaks in the Unit 2 SFP that were identified

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<sup>1</sup> Barvenik Prefiled Direct at 2:9-10; 5:22-23; 6:1, 6-7.

<sup>2</sup> Barvenik Prefiled Direct at 6:10-12; 9:7-12; 17:4-6.

<sup>3</sup> Barvenik Prefiled Direct at 8:3-17, 19-21.

<sup>4</sup> Barvenik Prefiled Direct at 8:15-17.

<sup>5</sup> See generally Gundersen Prefiled Direct at 15-16.

<sup>6</sup> NRC Safety Evaluation Report Related to the License Renewal of Indian Point Nuclear Generating Unit Nos. 2 and 3 (NUREG-1930) (November 2009), relevant excerpt attached to this rebuttal testimony as **Exhibit-AG-Rad-33**, at page 3-134.

<sup>7</sup> See **Exhibit AG-Rad-9** at page 2; **Exhibit-AG-Rad-18** at p.1-3, footnote 6 (GZA GeoEnvironmental, Inc. stating in its quarterly monitoring report for the second quarter of 2010, the most recent quarterly report that Entergy has provided, that “analyses cannot definitively and completely rule out the possibility of a remaining small leak which could then also be supplying Tritium to the groundwater . . .”).

1 in 2005 and 2007, and that he misnames “imperfections,” were eliminated,<sup>8</sup> Mr. Barvenik  
2 then testifies that a new leak of the Unit 2 SFP was identified recently in 2010, stating:

3 Beginning in the third quarter of 2010, we noticed increased  
4 tritium levels in a monitoring location adjacent to the IP2 SFP . . . .  
5 [T]he increased flow appears to be attributable to . . . a leak path  
6 from light boxes near the top of the SFP, allowing water to get  
7 behind the stainless steel liner plates on the face of the SFP.<sup>9</sup>  
8

9 It is unlikely that this newly identified leak suddenly emerged in 2010, rather, it most  
10 likely existed undetected for many years. Mr. Barvenik states that since its discovery,  
11 only a temporary repair to this leak path has been applied.<sup>10</sup> Mr. Barvenik acknowledges  
12 the unresolved nature of this new leak, stating that “additional evaluations continue, so as  
13 to fully understand this issue.”<sup>11</sup>  
14

15 Mr. Barvenik’s testimony shows that, despite Entergy’s claim of extensive investigations  
16 and inspections, leaks from the Unit 2 SFP have not been eliminated because the sources  
17 have not yet been adequately identified or remediated.  
18

19 **Q. Are leaks from the Unit 2 SFP likely to continue to occur in the future?**

20 A. Yes. The fact that new leaks were identified as recently as 2010, more than three years  
21 after all leaks were reportedly repaired and an alleged thorough examination of the Unit 2  
22 SFP was conducted, speaks to the lack of rigor that Entergy has applied to the inspections  
23 of the Indian Point Unit 2 SFP.  
24

25 Entergy was unable to identify the source of this new leak by either its inspection of the  
26 Indian Point site or its ongoing specific aging management and monitoring techniques  
27 currently applied to the Unit 2 SFP. The area where the 2010 leak occurred, unlike other  
28 portions of the SFP, was easily accessible during the 2007 inspection and it is likely that  
29 this newly identified leak existed undetected for many years. Additionally, the Unit 2

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<sup>8</sup> Barvenik Prefiled Direct at 8:3-17, 18-19.

<sup>9</sup> Barvenik Prefiled Direct at 11:3-9.

<sup>10</sup> Barvenik Prefiled Direct at 11:9-10.

<sup>11</sup> Barvenik Prefiled Direct at 11:12-13.

1 SFP leak-collection box installed in 2007 failed in 2010 to meet its intended design  
2 function to collect any radioactive leaks and prevent such contamination from entering  
3 the groundwater.

4  
5 The ongoing leaks call into question the thoroughness of the initial inspection in 2005 by  
6 Entergy's team and alert us to Entergy's ongoing failure to adequately address the serious  
7 aging management issues confronting the Unit 2 SFP, as well as the Indian Point site  
8 generally.<sup>12</sup> These circumstances make future undetected leaks from the already  
9 degraded Unit 2 SFP very likely.

10  
11 As a matter of fact, Mr. Barvenik's analysis of the 2010 leak substantiates Riverkeeper's  
12 previous statement that "Entergy has no preventative measures in place to be able to  
13 detect future leaks from the Unit 2 pool during the proposed relicensing term."<sup>13</sup> Instead,  
14 Mr. Barvenik's testimony makes it very clear that instead of enhanced inspections of a  
15 problematic plant component, Entergy will only rely upon its groundwater monitoring  
16 program to detect any problems with the Unit 2 SFP.<sup>14</sup>

17  
18 In fact, as early as 2009, the NRC approved (with a very narrow implication) Entergy's  
19 plan to simply monitor radionuclide levels in the groundwater as the method to detect any  
20 degraded condition of the pools:

21 Entergy made no commitment for augmented inspection during the  
22 extended period of operation. . . . Due to the lack of a leak-chase  
23 channel system at IP2 to monitor, detect and quantify potential  
24 leakage through the SFP liner, the staff is concerned that there has  
25 been insufficient time following the corrective actions to be certain  
26 that the leakage problems have been permanently corrected . . . .  
27 The licensee stated that it completed, in 2007, a one-time  
28 inspection of the accessible 40 percent of the SFP liner. . . . To

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<sup>12</sup> See generally Gundersen Prefiled Direct at 18-21.

<sup>13</sup> In the Matter of Entergy Nuclear Indian Point 2, LLC, Entergy Nuclear Indian Point 2, LLC, Entergy Nuclear Operations Inc.'s Joint Application for CWA § 401 Water Quality Certification, DEC Nos.: 3-5522-00011/00030 (IP2) and 3-5522-00105/00031 (IP3), Riverkeeper, Natural Resources Defense Council, and Scenic Hudson Petition for Full Party Status and Adjudicatory Hearing (July 10, 2010), at 39.

<sup>14</sup> See Barvenik Prefiled Direct at 1:18-22; 2:6-7; 3:1-3; 4:20-5:1; 5:8-11; 10:6-10; 13:15-21; 14:8-9;16:11-15;21:2-23 – 22:1-2; .

1 provide additional indication of potential spent fuel pool leakage,  
2 the applicant has committed to test the groundwater outside the IP2  
3 spent fuel pool for the presence of tritium . . . every 3 months. . . .  
4 Tritium in the groundwater would indicate leakage from the spent  
5 fuel pool, which may lead to degradation . . . . Based on . . .  
6 applicant's additional commitment to monitor the groundwater . . .  
7 there is reasonable assurance that any degradation of the IP2 spent  
8 fuel pool would be identified.<sup>15</sup>  
9

10 Entergy's approach will only discover leaks *after* they occur. This was precisely how the  
11 2010 Unit 2 SFP leak path was discovered.  
12

13 Given the already degraded condition of the Unit 2 SFP, currently ongoing leaks, and  
14 Entergy's remarkably insufficient preventative measures, it is my opinion that leaks from  
15 the Unit 2 SFP are likely to continue.  
16

17 **Q. What do you mean that the NRC's approval of a groundwater monitoring system**  
18 **has a narrow implication?**

19 A. NRC accepted Entergy's groundwater monitoring program with only one purpose in  
20 mind: according to NRC, this monitoring system is adequate for detecting conditions that  
21 have *safety implications* and which could result in a catastrophic meltdown in the event  
22 of an accident. In other words, the NRC has only evaluated this program in terms of  
23 whether or not the program will assure that the safety function of the spent fuel pools will  
24 be maintained and not result in a "loss of intended function" of the SFP.<sup>16</sup> The NRC did  
25 *not* approve the groundwater monitoring commitment as a system that stops components  
26 from leaking, and the NRC is not concerned about whether leaks enter the environment.  
27 To the contrary, from the NRC's perspective Entergy's monitoring program will work  
28 *despite* component leaks.  
29  
30  
31

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<sup>15</sup> Exhibit AG-Rad-33 at pages 3-134, 3-139.

<sup>16</sup> Exhibit AG-Rad-33 at 3-139.

1 **Q. Does Mr. Barvenik describe other causes of groundwater contamination at Indian**  
2 **Point?**

3 A. Though he briefly discusses two additional leaks (a 2009 Unit 1 tank leak and a 2009  
4 Refueling Water Storage Tank leak<sup>17</sup>), Mr. Barvenik does not sufficiently discuss all  
5 other causes of groundwater contamination at the plant, and instead largely focuses on the  
6 leaks from the Indian Point Unit 1 and Unit 2 SFPs that occurred prior to 2007.<sup>18</sup>

7  
8 **Q. Please describe whether there have been or are currently other sources of**  
9 **radiological leaks to groundwater at Indian Point that Mr. Barvenik has failed to**  
10 **discuss.**

11 A. A review of Entergy's own data and documents shows that there have been numerous  
12 onsite leaks from pipes and other structures that have resulted in radiological  
13 contamination of the Indian Point site other than those identified by Mr. Barvenik. I  
14 discussed other numerous leaks in my prefiled direct testimony.<sup>19</sup>

15  
16 **Q. Does Mr. Barvenik identify other pathways by which radioactive leaks have further**  
17 **contaminated the Hudson River?**

18 A. No, Mr. Barvenik's narrow discussion focuses entirely on radioactive leaks to  
19 groundwater and completely ignores radioactive surface water runoff that enters directly  
20 into the Hudson River. Mr. Barvenik completely failed to review or address those  
21 additional occasions when radioactive material ran across roadways onsite and entered  
22 the Hudson River as surface contamination. I have addressed this surface water runoff  
23 into the Hudson River in my prefiled direct testimony.<sup>20</sup> In his testimony, Mr. Barvenik  
24 has simply neglected to address the "rainout" of radioactive material onto the site and  
25 into the Hudson River. In fact, Entergy's "Groundwater Monitoring Program Quarterly  
26 Integrated Review Checklist" for the fourth quarter of 2010 as well as the same report for  
27 the first quarter of 2011, both state that elevated levels of tritium were again detected in

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<sup>17</sup> Barvenik Prefiled Direct at 10:14-15; 10:20-21.

<sup>18</sup> Barvenik Prefiled Direct at 2:9-10; 5:22-23; 6:1, 6-7.

<sup>19</sup> See Gundersen Prefiled Direct at 10-12.

<sup>20</sup> See Gundersen Prefiled Direct at 11-12.



1 storm drains onsite; this is indicative of ongoing rainout, and/or leaks elsewhere onsite  
2 that have yet to be identified and addressed.<sup>21</sup> Copies of these two more recently  
3 disclosed checklists that I reviewed are attached to this rebuttal testimony as **Exhibit**  
4 **AG-Rad-34**.

5  
6 Additionally, Mr. Barvenik also fails to acknowledge or discuss Entergy's regularly  
7 planned discharges of radioactive liquid effluent into the Hudson River.<sup>22</sup> Interestingly,  
8 such releases are not an unavoidable result of standard nuclear power plant operations:  
9 for example, the Vermont Yankee nuclear power plant, which is also owned by Entergy,  
10 is a zero liquid release plant. This means that the plant does not discharge *any* liquid  
11 effluent into the adjacent waterway, the Connecticut River. Instead, such effluent is  
12 either treated and put back into the plant, or shipped offsite as waste that must be  
13 disposed.

14  
15 **Q. In addition to ongoing and likely future leaks from the Unit 2 SFP, are other future**  
16 **radiological leaks at Indian Point likely to occur?**

17 A. Yes, leaks are likely to continue. Mr. Barvenik readily admits that "sporadic releases . . .  
18 occur at any large industrial facility."<sup>23</sup> Additionally, the likelihood of future leaks  
19 occurring at Indian Point is high.

20  
21 The nuclear industry's historical record clearly indicates that aging nuclear plants leak  
22 more often than new nuclear plants.<sup>24</sup> As I discussed in my prefiled direct testimony, in  
23 light of Energy's generally reactive approach to leak management and completely  
24 inadequate aging management, inspection, and maintenance programs, as Indian Point  
25 Units 2 and 3 age, it is almost certain that there will be ongoing additional and significant  
26 radioactive groundwater and surface water leakage and contamination.<sup>25</sup> The recently

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<sup>21</sup> See Exhibit Gundersen Prefiled Direct at 11; **Exhibit-AG-Rad-16**.

<sup>22</sup> See Gundersen Prefiled Direct at 12; **Exhibit AG-Rad-17**.

<sup>23</sup> Barvenik Prefiled Direct at 11:20-21.

<sup>24</sup> See Gundersen Prefiled Direct at 7, 17.

<sup>25</sup> See Gundersen Prefiled Direct at 18-21.

1 discovered 2010 Unit 2 SFP leak is further evidence of this. As I discussed in my  
2 prefiled direct testimony, two bodies of experts have determined that Entergy has not  
3 applied adequate funds to the necessary maintenance of its aging nuclear power plants,<sup>26</sup>  
4 thereby creating the conditions for ongoing and future radioactive leaks.

5  
6 Additionally, I have reviewed a recent document generated by the NRC that articulates  
7 certain additional commitments related to the inspection of buried pipe and tank  
8 components at Indian Point beyond those indicated in the documents I reviewed in  
9 preparation of my direct testimony. The relevant excerpt of this NRC document is  
10 attached to this rebuttal testimony as **Exhibit AG-Rad-35**. According to this report, the  
11 NRC finds this program and Entergy's commitment to perform certain additional  
12 inspections of buried pipes and tanks acceptable to assure the safety function of its  
13 systems during and after accidents. However, it remains my opinion that, even as  
14 modified, Entergy's plans are not sufficient to identify and stop all potential radiological  
15 leaks from buried components. In fact, this program is not designed or intended to  
16 prevent any radiological leaks, since the NRC is only concerned with maintaining safety  
17 functions of the relevant plant components. As buried components have already been  
18 problematic sources of ongoing leaks at Indian Point, and only a limited number of  
19 components will be inspected using inferior inspection methods, future leaks from such  
20 components are very likely.

21  
22 **THE EXTENT AND CURRENT STATUS OF THE RADIOLOGICAL**  
23 **CONTAMINATION**

24  
25 **Q. How does Mr. Barvenik describe the extent of the radiological groundwater**  
26 **contamination at Indian Point?**

27 A. Mr. Barvenik describes the contamination in the groundwater as being at "low levels."<sup>27</sup>  
28

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<sup>26</sup> See Gundersen Prefiled Direct at 20-21.

<sup>27</sup> Barvenik Prefiled Direct at 19:7.

1 **Q. Do you agree with Mr. Barvenik’s characterization of the radiological**  
2 **contamination at Indian Point?**

3 A. No. In my opinion, Mr. Barvenik continues Entergy’s attempt to minimize the  
4 significance of the severity of the radioactive contamination at Indian Point. Due to the  
5 size of the plumes, the varied range of radionuclides present in the groundwater, the  
6 dangerous toxicity of various radionuclides in the plumes (including Strontium-90 and  
7 Cesium-137), and the persistence of the plumes, I believe that the contamination at Indian  
8 Point, makes it one of the most contaminated operating nuclear power plant sites in the  
9 United States. At the time of my review, I have been unable to find any other operating  
10 U.S. nuclear power plant that is leaking such extensive amounts of tritium *and* strontium  
11 contamination into any major body of water like the Hudson River. The situation at  
12 Indian Point is clearly not merely the result of “sporadic releases, which occur at any  
13 large industrial facility,” as Mr. Barvenik implies.<sup>28</sup>

14  
15 While Mr. Barvenik discusses the contamination in terms of the amount of radionuclides  
16 reaching the Hudson River and whether such amounts comply with federal regulatory  
17 limits for radiological effluent releases,<sup>29</sup> he does not speak at all to the level of  
18 contamination actually in the groundwater, or address EPA Maximum Contaminant  
19 Levels (“MCLs”). Since the groundwater contamination at Indian Point was discovered,  
20 radionuclides have regularly been detected at high levels, well in excess of EPA MCLs.  
21 Riverkeeper’s attorneys have advised me that a New York State water quality standard  
22 requires that the groundwater beneath Indian Point be acceptable for potable uses.<sup>30</sup> My  
23 review of Entergy’s data reveals that the current contamination continues to exceed

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<sup>28</sup> Barvenik Prefiled Direct at 11:20-21.

<sup>29</sup> Barvenik Prefiled Direct at 2:14-15; 7:16-17;16:15; 22:5-6.

<sup>30</sup> In particular, Riverkeeper’s attorneys advised me that the following New York State laws and regulations are relevant and applicable to radiological material leaks from Indian Point:

- 6 NYCRR § 701.18, which classifies all fresh groundwaters of New York State as “GA fresh groundwaters.”
- 6 NYCRR § 701.15, which provides that the best usage of “GA fresh groundwater” is “as a source of potable water supply.”
- New York Environmental Conservation Law § 17-0807, which prohibits “(1) the discharge of any radiological, chemical or biological warfare agent or high-level radioactive waste . . .”

1 EPA's MCLs, and therefore, violates the State's standard. The most recent monitoring  
2 well sampling data that Entergy has provided, from the second quarter of 2011, is  
3 attached to this rebuttal testimony as **Exhibit AG-Rad-36**. This data shows that Entergy  
4 continues to detect excessive levels of contamination in numerous sample locations, as  
5 follows: Cesium-137 was detected in monitoring well ("MW")-42 at 21,500 pCi/l, more  
6 than 100 times the EPA MCL set at 200 pCi/l; Tritium was detected in MW-30, MW-56,  
7 and MW-57 at 113,000 pCi/l, 76,4000 pCi/l, and 20,300 pCi/l, respectively, all in excess  
8 of the EPA MCL for tritium set at 20,000 pCi/l; Nickel-63 was detected in MW-42 at 190  
9 pCi/l, almost four times the EPA MCL set at 50 pCi/l; and Strontium-90 was detected in  
10 eight monitoring wells and an additional sampling location in excess of the EPA MCL for  
11 Strontium-90 set at 8 pCi/l: MW-37 (8.72 pCi/l), MW-49 (12.6 pCi/l, 15.7 pCi/l and 16.2  
12 pCi/l), MW-50 (9.53 pCi/l and 26.3 pCi/l), MW-53 (35.5 pCi/l), MW-54 (12 pCi/l and 19  
13 pCi/l), MW-57 (31.1 pCi/l), MW-66 (10.6 pCi/l), MW-67 (12.5 pCi/l), and at sample  
14 location U1-CSS (16.1 pCi/l).

15  
16 **Q. How does Mr. Barvenik describe the current status of the plumes of radiological**  
17 **contamination?**

18 A. Mr. Barvenik states that the plumes of contamination at Indian Point have been  
19 decreasing, and will continue to decrease over time.<sup>31</sup>

20  
21 **Q. Please evaluate Mr. Barvenik's assessment of the current status of the radiological**  
22 **contamination plumes at Indian Point.**

23 A. Mr. Barvenik's assessment is not well-founded. Decades worth of contamination that is  
24 now underneath the site will bleed out slowly, and not rapidly, to the Hudson River. As a  
25 result, the few years of monitoring that have been completed are not likely to be enough  
26 to establish a definitive trend. GZA, GeoEnvironmental, Inc. flatly recognizes that years  
27 of monitoring are necessary in order to confirm the status of the plumes.<sup>32</sup> Also, over  
28 time, the contamination spreads wider and deeper, causing individual monitoring well

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<sup>31</sup> Barvenik Prefiled Direct at 2:15-19; 6:1-3; 8:19-21; 9:12-16; 16:20-23; 17:1-6.

<sup>32</sup> See **Exhibit AG-Rad-18** at page 1-3.

1 concentrations to decrease,<sup>33</sup> which may cast an inaccurate picture of the rate of any  
2 overall decline of these radiologically contaminated plumes.

3  
4 In any event, based upon my review of Entergy's quarterly monitoring well sample  
5 results to date, it is apparent that quarter to quarter, radionuclide levels in the wells vary  
6 upwards and downwards.<sup>34</sup>

7  
8 **Q. Does Mr. Barvenik dispute that the radiological contamination at Indian Point will**  
9 **remain in the groundwater?**

10 A. No, he does not. Mr. Barvenik explicitly states that the radiological contamination will  
11 remain onsite at Indian Point until it is "flushed" out into the Hudson River.<sup>35</sup> My nearly  
12 40-year experience as a nuclear engineer indicates that the process to completely  
13 eliminate any radioactive contamination by simply hoping it will eventually "flush" out  
14 into a nearby body of water will take many decades if not an entire century after the  
15 shutdown and dismantlement of Indian Point before the site is free of radioactive  
16 contamination.

17  
18 **Q. How will ongoing radiological leaks at Indian Point and future radiological leaks**  
19 **that are likely to occur at Indian Point, as you discussed above, affect the**  
20 **radiological plumes that are contaminating Indian Point and the Hudson River?**

21 A. Mr. Barvenik claims that recently identified leaks at Indian Point have not "resulted in  
22 any material increase in the tritium plume."<sup>36</sup> While Mr. Barvenik does not provide any  
23 scientific definition or measurable data detailing his usage of the term "material  
24 increase," the reality is that newly identified leaks will definitely add to the existing  
25 radionuclides in the groundwater. Mr. Barvenik's testimony plainly acknowledges that  
26 each newly discovered leak led to spikes in the levels of tritium found in Entergy's

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<sup>33</sup> See Gundersen Prefiled Direct at 13.

<sup>34</sup> See **Exhibit AG-Rad-18**; Gundersen Prefiled Direct at 13.

<sup>35</sup> Barvenik Prefiled Direct at 9:14-15; *see also* **Exhibit AG-Rad-18** at page 1-3 (explaining that Entergy's chosen "remedial" approach is monitored natural attenuation).

<sup>36</sup> Barvenik Prefiled Direct at 10:18-19; 11:11-13.

1 monitoring well samples.<sup>37</sup> For example, the undetected 2010 Unit 2 SFP leak event  
2 further increased groundwater contamination in the vicinity of the Unit 2 SFP as  
3 determined by a nearby monitoring well.<sup>38</sup>  
4

5 New leaks, including the 2010 Unit SFP leak, and other likely future leaks from aging  
6 components at Indian Point, guarantee that the present groundwater contamination will  
7 not be abated -- and, to the contrary, will grow. GZA, GeoEnvironmental Inc.'s most  
8 recent quarterly monitoring report acknowledged that radionuclide levels in the  
9 groundwater will fluctuate and peak in the future "due to episodic releases to the  
10 groundwater."<sup>39</sup> It is, therefore, foreseeable that levels in the groundwater will remain  
11 high, and continue to exceed EPA MCLs.  
12

### 13 RADIOLOGICAL RELEASES TO THE HUDSON RIVER

14

15 **Q. Does Mr. Barvenik dispute the fact that the radiological contamination at Indian**  
16 **Point enters into the Hudson River?**

17 A. No, he does not dispute that fact. As a matter of fact, Mr. Barvenik explicitly  
18 acknowledges throughout his testimony that radioactive groundwater contamination does  
19 actually "flush" into the Hudson River from the Indian Point site.<sup>40</sup> Mr. Barvenik  
20 explains that all the radioactive contamination in the groundwater will move west into the  
21 Hudson River and none of it will migrate or be washed into any surrounding property  
22 located to the north, south or east.<sup>41</sup>  
23

24 Because the contamination at Indian Point will persist, likely grow, and migrate slowly, it  
25 will discharge to the Hudson River for decades. This is the result of Entergy's use of

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<sup>37</sup> Barvenik Prefiled Direct at 10:15-18; 10:20-22; 11:3-4.

<sup>38</sup> Barvenik Prefiled Direct at 11:3-4.

<sup>39</sup> See Gundersen Prefiled Direct at 13; **Exhibit AG-Rad-18** at page 1-3.

<sup>40</sup> Barvenik Prefiled Direct at 9:15.

<sup>41</sup> Barvenik Prefiled Direct at 2:13-15; 5:14-17; 6:15-18; 20:20-22; 22:3-6.

1 only Monitored Natural Attenuation to “manage the contamination,”<sup>42</sup> and the absence of  
2 any extraction or remediation of the contamination.

3  
4 Moreover, while Mr. Barvenik only appears to have discussed groundwater leakage into  
5 the Hudson River, the data and documents I reviewed in preparation of my prefiled  
6 testimony indicates that direct surface discharges are also a significant source of the  
7 radioactive contamination that migrates to the Hudson River.<sup>43</sup>

8  
9 **Q. How does Mr. Barvenik characterize and evaluate the releases of radiological**  
10 **contamination to the Hudson River?**

11 A. While acknowledging that Indian Point will continue to “flush” radiation into the Hudson  
12 River for many decades, Mr. Barvenik has attempted to minimize the impact of this  
13 radioactive contamination by comparing this migrating radioactive plume to NRC dose  
14 calculations of radiation exposure by consumption of contaminated fish.<sup>44</sup> As explained  
15 in Entergy’s annual Radiological Effluent Release Reports (“RERR”), Entergy’s “[l]iquid  
16 offsite dose calculations involve fish and invertebrate consumption pathways only.” The  
17 relevant excerpt of Entergy’s most recent RERR is attached to my rebuttal testimony as  
18 **Exhibit AG-Rad-37**. Mr. Barvenik repeatedly states that amounts of radionuclides  
19 going into the river are below NRC’s dose-related limits.<sup>45</sup>

20  
21 **Q. Please describe your opinion of Mr. Barvenik’s evaluation of radiological releases to**  
22 **the Hudson River.**

23 A. Mr. Barvenik’s evaluation is problematic for several reasons. First, Riverkeeper’s

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<sup>42</sup> See Gundersen Prefiled Direct at 21-22; **Exhibit AG-Rad-18** at page 1-3.

<sup>43</sup> See Gundersen Prefiled Direct at 10-12, 14.

<sup>44</sup> Barvenik Prefiled Direct at 9:5-6; 11:1-2; 11:14-15;

<sup>45</sup> Barvenik Prefiled Direct at 9:5-6; 11:1-2; 11:14-15. Barvenik lists the amounts of tritium and other radionuclides released to the Hudson River as a result of the contamination at Indian Point in terms of curies per year. Barvenik Prefiled Direct at 7. These values in terms of picocuries, which form the basis for EPA’s MCLs are as follows: for tritium: 190 billion pCi in 2006, 64 billion pCi in 2007, 200 billion pCi in 2008, 70 billion pCi in 2009, and 120 billion pCi in 2010; for “other” radionuclides, including strontium and cesium: 570 million pCi in 2006, 80 million pCi in 2007, 160 million pCi in 2008, 250 million pCi in 2009, and 42 million pCi in 2010. These levels are not insignificant.

1 attorneys have advised me that one applicable New York State law (NYS Environmental  
2 Conservation Law § 17-0807(1)) prohibits “the discharge of any radiological, chemical or  
3 biological warfare agent or high-level radioactive waste.” Therefore, Mr. Barvenik’s  
4 analysis and testimony miss the salient point that the Hudson River is currently and will  
5 continue for decades to be subjected to radiological releases from the groundwater  
6 contamination at Indian Point and from surface water discharges. Mr. Barvenik  
7 repeatedly states that the releases to the Hudson River have had “no discernible effect on  
8 the level of radionuclides contained in Hudson River water” and that the leaks have not  
9 caused a “material increase” in offsite dose analysis.<sup>46</sup> While Mr. Barvenik neglects to  
10 provide any definitions for his usage of the terms “discernable effect” or “material  
11 increase,” the bottom line is that such statements do not change the fact that radiological  
12 releases are occurring.

13  
14 However, even assuming the State of New York did not have this prohibition (which is  
15 not the case), Mr. Barvenik’s assessment is still defective. I reviewed NYSDEC’s Notice  
16 of Denial of Entergy’s request for a Water Quality Certification, which states that

17 the discharge of radiological substances (including, but not limited  
18 to, radioactive liquid, radioactive solids, radioactive gases, and  
19 stormwater) from the Indian Point site into . . . the Hudson River,  
20 are “deleterious substances” and could impair the water for their  
21 best usage . . . where, as here, primary and secondary contact  
22 recreation is concerned.<sup>47</sup>

23  
24 However, Mr. Barvenik’s testimony only discusses the impact of radiological releases to  
25 the Hudson River in terms of NRC dose calculations of radiation exposure by  
26 consumption of contaminated fish.

27  
28 Mr. Barvenik fails to acknowledge other potential impacts that radioactive releases to the  
29 Hudson River may have upon the health of residents in proximity to the Hudson River.

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<sup>46</sup> Barvenik Prefiled Direct at 2:22-23; 10:18-19; 11:11-12; 11:14-15.

<sup>47</sup> Joint Application for CWA § 401 Water Quality Certification NRC License Renewal – Entergy Nuclear Indian Point Units 2 and 3 DEC Nos.: 3-5522-00011/00030 (IP2) and 3-5522-00105/00031 (IP3), Notice of Denial (April 2, 2010), at 11.



1 The Biological Effects of Ionizing<sup>48</sup> Radiation (BEIR) VII Report, issued by the National  
2 Academy of Science on June 29, 2005, reaffirmed the conclusion of the prior report that  
3 every exposure to radiation, regardless of how small, produces a corresponding increase  
4 in the likelihood of cancer.<sup>49</sup> Based upon the BEIR VII report by the National Academy  
5 of Science, the radioactive releases “flushed” into the Hudson River via ground and  
6 surface water from the Indian Point site could increase the incidence of cancer to those  
7 exposed through primary and secondary contact activities, such as swimming.

8  
9 Additionally, Mr. Barvenik states that a 2009 NYSDEC report suggests that the  
10 Strontium-90 concentrations in fish near Indian Point are no different than Strontium-90  
11 concentrations in fish upstream from the plant, and that this “finding[] support[s] the  
12 conclusion that there is no effect on [Hudson River] fish from the radionuclide releases to  
13 groundwater” at Indian Point.<sup>50</sup> And, therefore, according to Mr. Barvenik, radioactive  
14 leakage from Indian Point into the Hudson River has no radiological impact upon aquatic  
15 species or the public using the river and its water.

16  
17 This report is not conclusive for several reasons. Entergy’s own Indian Point monitoring  
18 wells have clearly determined that Strontium-90, tritium, and other toxic radionuclides  
19 contaminate the Indian Point site and flush directly into the Hudson River. These  
20 radionuclides have the potential to impact fish in the river during Entergy’s proposed  
21 period of extended operation. For example, in January 2007, Entergy shared data with  
22 the NRC from the 1970s and 1980s (generated before NRC discontinued the requirement  
23 that nuclear licensees test for Strontium-90 in the offsite environment) that showed that  
24 both fish and shellfish showed detectable levels of not only Strontium-90, but also of  
25 Strontium-89, a shorter lived isotope that is not found in residual background radiation  
26 resulting from nuclear weapons testing. A copy of this correspondence is attached to this  
27 rebuttal testimony as **Exhibit AG-Rad-38**. This supports the need for further and

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<sup>48</sup> Ionizing radiation are alpha, beta, gamma, and neutrons that cause cellular damage by ionization, that is the process that breaks atomic bonds and creates negative and positive ions.

<sup>49</sup> See **Exhibit AG-Rad-20**.

<sup>50</sup> Barvenik Prefiled Direct at 18:5-6, 9-11.

1 ongoing assessment of the effect that Strontium-90 and other radionuclides may have on  
2 Hudson River biota and nearby Haverstraw Bay. Riverkeeper's attorneys have advised  
3 me that Haverstraw Bay is a New York State designated Essential Fish Habitat and  
4 Significant Coastal Fish and Wildlife Habitat, which is a major nursery and feeding area  
5 for many critical fish species in the Hudson River.<sup>51</sup>

6  
7 NYSDEC's report also fails to note that other possible upstream sources of Strontium-90,  
8 especially the Knolls Atomic Power Lab (KAPL), may have affected the NYSDEC's  
9 assessment of other non-fallout related sources of Strontium-90. Finally, the NYSDEC  
10 2009 study appears to have been a one-time investigation. Strontium contaminates the  
11 environment for decades and is a bone seeker that bioaccumulates instead of dissipating;  
12 it is, therefore, possible that Strontium-90 and/or other radionuclides could impact  
13 Hudson River fish in the future.

14  
15 **ENERGY'S INABILITY TO DETECT AND RESPOND TO POTENTIAL FUTURE**  
16 **RADIOLOGICAL LEAKS**

17  
18 **Q. Please describe Mr. Barvenik's explanation regarding how Entergy will detect**  
19 **future radiological leaks at Indian Point.**

20 A. Mr. Barvenik's testimony reveals that Entergy intends to exclusively rely upon its  
21 existing groundwater monitoring program to detect leaks after they occur, rather than  
22 apply proven proactive mitigation techniques that should be implemented as a key  
23 component to a sound aging management program. Throughout his testimony Mr.  
24 Barvenik maintains that Entergy will allow the leaks to occur, identify the leaks when  
25 they finally contaminate the groundwater, and only then attempt to find the origin of such  
26 leaks somewhere at Indian Point.<sup>52</sup>

27  

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<sup>51</sup>See Coastal Fish & Wildlife Habitat Rating Form, Haverstraw Bay, *available at*,  
[http://nyswaterfronts.com/downloads/pdfs/sig\\_hab/hudsonriver/Haverstraw\\_Bay.pdf](http://nyswaterfronts.com/downloads/pdfs/sig_hab/hudsonriver/Haverstraw_Bay.pdf) (last visited Sept. 29, 2011).

<sup>52</sup> Barvenik Prefiled Direct at 1:20-22; 2:6-7; 3:1-3; 5:8-10; 10:6-10; 13:15-17, 18-21; 14:8-9; 16:10-17; 21:20-23,  
22:1-2, 6-8; 23:11-16.

1 **Q. Please evaluate Entergy’s approach for detecting future radiological leaks at Indian**  
2 **Point, as described by Mr. Barvenik.**

3 A. Entergy’s lax process relies solely upon a groundwater-monitoring plan that has  
4 previously taken months to detect leaks, while such leaks continually contaminated the  
5 groundwater and ultimately “flushed” into the Hudson River. Reliance on this after-the-  
6 fact monitoring program will fail to prevent leaks *before* they occur.

7  
8 Entergy’s plan continues to be the same as it has been in the past, and that is to attempt to  
9 repair leaks once the source is ever uncovered. Mr. Barvenik outlines three such  
10 incidents where releases to groundwater were discovered well after a leak had occurred.<sup>53</sup>

11  
12 Throughout his testimony, Mr. Barvenik does not detail any proactive or preventative  
13 steps that Entergy would undertake that would protect the Hudson River, aquatic life, and  
14 public health and safety. In fact, Entergy has inadequate plans, programs, practices, and  
15 commitments for inspecting and maintaining components that are currently faulty, and  
16 will most likely leak in the future. Entergy’s aging management programs are seemingly  
17 incapable of preemptively addressing leaks (as described above and in my prefiled direct  
18 testimony<sup>54</sup>). Therefore, under Entergy’s chosen wait-and-see approach, leaks from  
19 degraded and aging components at Indian Point will not be prevented from occurring in  
20 the future.

21  
22 Mr. Barvenik’s testimony confirms that Entergy will continue to employ a completely  
23 reactive approach to dealing with radiological leakage issues at Indian Point. I explained  
24 this reactive approach in my prefiled direct testimony.<sup>55</sup> This cavalier attitude with  
25 regards to *preventatively* detecting future leaks is perfectly exemplified by Mr.  
26 Barvenik’s discussion of why an investigation into radiological leaks needed to be  
27 initiated several years ago, as memorialized in an Entergy document that was attached to

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<sup>53</sup> Barvenik Prefiled Direct at pp.10-11.

<sup>54</sup> Gundersen Prefiled Direct at 18-21.

<sup>55</sup> Gundersen Prefiled Direct at 20.

1 my prefiled direct testimony as **Exhibit AG-Rad-26**. In this document, Mr. Barvenik  
2 explained why he had become involved in the leakage issue on behalf of Entergy: “the  
3 issue clearly got Bill and Hillary [Clinton]’s attention and they are pissed (they have a  
4 house in the 10 mile ‘your [sic] screwed zone’), were apparently out at the plant  
5 yesterday while we were there and threatening Congressional hearings.”<sup>56</sup>  
6

7 **Q. Mr. Barvenik repeatedly claims that Entergy can and will “respond rapidly and**  
8 **appropriately to such releases.”<sup>57</sup> Do you believe that assessment to be accurate?**

9 A. No. Mr. Barvenik admits that Entergy only learns of the leaks *after-the-fact*, yet  
10 incongruously he claims that Entergy can respond “quickly.”<sup>58</sup> This is illogical. Relying  
11 upon a groundwater-monitoring program that will only detect leaks days, weeks, or even  
12 months after they occur, clearly undermines the ability to “respond *rapidly*” to  
13 radiological leaks and contamination.  
14

15 Additionally, my own direct experience with Entergy’s corporate personnel and  
16 management and its programs to detect and mitigate leaks indicates that Entergy’s  
17 assumptions that it will be able to respond rapidly and appropriately to radioactive  
18 releases are unfounded and incorrect. In my experience, Entergy’s programs have not  
19 allowed for rapid assessment and/or rapid mitigation intervention.  
20

21 Specifically, in my role as a legislative appointee to the State of Vermont’s Vermont  
22 Yankee Public Oversight Panel, I became involved with Entergy’s attempts to identify,  
23 quantify and mitigate a series of leaks at the Vermont Yankee (VY) nuclear power plant.  
24 While leaks at VY began during the 1980s and increased further in 2007, Entergy was  
25 unable to identify any leaks until January 2010, after which it took six more weeks for  
26 Entergy to locate the source of the contamination. At that time, it was discovered that  
27 Entergy was aware of sinkholes in the ground at the source of the leak for at least 18-

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<sup>56</sup> See **Exhibit AG-Rad-26** at page 4.

<sup>57</sup> See Barvenik Prefiled Direct at 3:1-3; 22:6-8.

<sup>58</sup> Barvenik Prefiled Direct at 22:6-8.

1 months prior to the leak's migration in a plume toward the Connecticut River. Instead of  
2 investigating the onsite sinkholes, Entergy chose to simply fill in the holes and not pursue  
3 the cause of these significant changes to site topography.

4  
5 Once the apparent source was identified, months passed and Entergy was still unable to  
6 determine how or why radioactive contamination that included both Cesium-137 and  
7 Strontium-90, found 17-feet underground and adjacent to the radioactive tritium leak, had  
8 contaminated the site's groundwater. In a meeting held on March 31, 2010 with Entergy  
9 Vice President John McCann, the State of Vermont, and the Public Oversight Panel,  
10 Entergy surmised that Cesium-137 probably originated from bomb testing or Chernobyl  
11 releases. Given my expertise and study of Cesium-137 and Strontium-90 releases from  
12 Boiling Water Reactors (BWR's) for almost a decade, it was evident to me that Cesium-  
13 137 and Strontium-90 were created by fuel failures that occurred early in the life of the  
14 plant; the Cesium-137 and Strontium-90 had built up during VY's 38 years of operation  
15 and stuck to the walls of the pipes until those pipes cracked and failed. I explained to  
16 Entergy that the cesium likely came from inside the broken pipe and had leaked out along  
17 with the tritium into the pipe vault, and suggested that Entergy's staff sample inside the  
18 pipe, which Entergy agreed to do. The next day, Entergy announced that, indeed,  
19 Cesium-137 had leaked out with the tritium when the pipe failed, proving my hypothesis  
20 was correct. In response to an e-mail thanking him for running the test I had  
21 recommended, Mr. McCann responded "*My hat's off Arnie. Like I said at our meeting,*  
22 *that was a good idea. That should certainly help us understand that it isn't something*  
23 *new anyway. The disconnect between the condensate sample and soil sample was*  
24 *perplexing. This helps clear it up.*" A copy of this e-mail is appended hereto as **Exhibit**  
25 **AG-Rad-39.**

26  
27 While I appreciate Mr. McCann's e-mail, it is perplexing to me that Entergy was unable  
28 to discover the location of the contamination without the assistance of an independent  
29 expert whom they had not sought out. My experience starkly exemplifies how  
30 complacent and slow Entergy has proven to be when it comes to managing radiological  
31 leaks at its nuclear plants.

1  
2 The experience at Indian Point has proved to be no different: leaks occur and accrue for  
3 years without detection or an “appropriate response,” most recently with the Unit 2 SFP  
4 light box-related leak described above. Notably, this most recent leak was discovered  
5 more than three years after all leaks were reportedly repaired and after an alleged  
6 thorough examination of the Unit 2 SFP was conducted. And even though this latest leak  
7 was discovered almost two years ago in 2010, Entergy has not yet undertaken a  
8 permanent repair. As Mr. Barvenik explains, “additional evaluations continue, so as to  
9 fully understand this issue.”<sup>59</sup> By way of another example, increased levels of tritium in  
10 storm drains were detected in numerous sampling results in 2009, and Entergy could not  
11 definitively determine all potential causes.<sup>60</sup> Recent sampling data from 2011 continues  
12 to show elevated levels of tritium in onsite storm drains.<sup>61</sup>

13  
14 In my opinion, Entergy has failed to demonstrate that it can “respond rapidly and  
15 appropriately” to likely future radiological leaks at Indian Point.

16  
17 Finally, whether Entergy can “respond rapidly and appropriately” to leaks does not  
18 change the fact that leaks and resulting releases to New York State waters can and will  
19 occur at Indian Point. Additionally, Mr. Barvenik’s testimony actually confirms  
20 Entergy’s tolerance of such leaks, in lieu of leak prevention.

21  
22 **Q. Will the network of monitoring wells Entergy has installed at Indian Point detect all**  
23 **sizes of radioactive leaks?**

24 **A.** No, the network of wells will not detect all leaks. Mr. Barvenik repeatedly indicates that  
25 the monitoring wells will only detect future leaks that are “comparable” to the  
26 extraordinarily large leaks that have occurred in the past. In fact, GZA,  
27 GeoEnvironmental, Inc. has acknowledged that certain minimum leaks remain

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<sup>59</sup> Barvenik Prefiled Direct at 11:12-13.

<sup>60</sup> See Gundersen Prefiled Direct at 11; **Exhibit AG-Rad-16**.

<sup>61</sup> See **Exhibit AG-Rad-34**.

1 undetectable by the groundwater monitoring system at Indian Point.<sup>62</sup> Therefore,  
2 Entergy's ability to detect smaller, longer lasting leaks apparently is excluded by Mr.  
3 Barvenik's testimony.

4  
5 **Q. Mr. Barvenik also references that Entergy has a "remediation" plan concerning the**  
6 **radiological contamination at Indian Point.<sup>63</sup> Can you describe Mr. Barvenik's**  
7 **explanation of Entergy's plan?**

8 A. No, I cannot. From the documentation I have seen and reviewed, Entergy has not  
9 revealed any plan for "remediation" of radiological contamination at Indian Point. What  
10 Mr. Barvenik incorrectly labels as a plan is simply Entergy's ongoing methodology of  
11 "flushing" its radioactively contaminated groundwater into the Hudson River in an  
12 attempt to dilute the contamination rather than mitigate the contamination by installing  
13 extraction wells.

14  
15 Disturbingly, Mr. Barvenik ignores other viable mitigation and remediation options  
16 available to Entergy rather than simply leaving the growing radiological contamination to  
17 reach the Hudson River.<sup>64</sup> Such mitigation processes would clean the site much faster  
18 and more thoroughly than allowing the groundwater to "flush" radiological  
19 contamination directly into the Hudson River. In my prefiled direct testimony, I  
20 discussed the fact that other nuclear power plants owned by Entergy are using extraction  
21 wells in order to remove radioactive contamination and prevent it from migrating into the  
22 groundwater, the water table, nearby bodies of water, and possibly contaminating  
23 precious aquifers.<sup>65</sup> Entergy already knows that the installation and application of  
24 extraction wells is a successful remediation technique: the extraction process currently  
25 applied by Entergy at some of its other operating nuclear power plant sites physically  
26 extracts radioactive water from underground leaks and deposits it into above-ground  
27 tanks. This radioactive water is then treated and processed.

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<sup>62</sup> See **Exhibit-AG-Rad-18** at page 1-3, footnote 6.

<sup>63</sup> Barvenik Prefiled Direct at 4:8; 20:10.

<sup>64</sup> See *generally* Gundersen Prefiled Direct at 22-26.

<sup>65</sup> See Gundersen Prefiled Direct at 24.

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Mr. Barvenik’s testimony fails to address why Entergy has not pursued removal of the radiological contamination from the groundwater at Indian Point, and has instead chosen a process that further contaminates the Hudson River. At other Entergy sites, extraction wells are used to continuously remove the contaminating radiological hazard from the surrounding groundwater in order to mitigate environmental damage and/or prevent the harmful migration of radioactivity.

**Q. Does Mr. Barvenik’s testimony address any additional alternatives other than Entergy’s reliance upon a groundwater monitoring program?**

A. No it does not. As I stated above and in my prefiled direct testimony, Entergy has always had the opportunity to remediate the contamination at Indian Point by installing extraction wells, and yet Entergy has chosen not to do so.

**Q. Based upon your review of Mr. Barvenik’s testimony, please summarize your opinion regarding Entergy’s plans for detecting future radiological discharges from Indian Point.**

A. Mr. Barvenik’s direct testimony, as well as the documents I have examined in the preparation of my direct testimony and this rebuttal testimony, show that Entergy only plans to monitor for future leaks and has failed to design or effectively implement any preventative methodologies or mitigation and remediation techniques in the event of a new leak or to deal with its current ongoing leaks. The approach as outlined and proposed by Mr. Barvenik will almost certainly result in current and future radioactive leaks at Indian Point, continued groundwater contamination at persistently high levels, and ongoing discharges of radionuclides into the Hudson River.

**CONCLUSIONS**

**Q. Please describe your conclusions related to the Mr. Barvenik’s direct testimony.**

A. Mr. Barvenik’s testimony leads me to draw the following conclusions:  
(1) Leaks at Indian Point are varied and ongoing, and there will likely be future radiological leaks from Entergy’s Indian Point nuclear power plant.



1 (2) Leakage will continue to cause extensive plumes of contamination that will likely  
2 persist at high levels and continue to enter the Hudson River.

3 (3) Remediation is possible at Indian Point but Entergy has failed to consider its use at  
4 the plant. Instead, radiological contamination at Indian Point will remain in the  
5 groundwater and “flush” to the Hudson River for decades.

6 (4) Entergy does not have adequate remediation and mitigation measures in place to  
7 preventively detect future leaks and avoid ongoing violations of state water quality  
8 standards.

9

10 **Q. Does this conclude your rebuttal testimony?**

11 A. Yes.

### Supplemental Exhibit List/Bibliography

- Exhibit AG-Rad-33: Excerpt of NRC's Safety Evaluation Report Related to the License Renewal of Indian Point Nuclear Generating Unit Nos. 2 and 3 (NUREG-1930), November 2009 (Full report available at <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1930/initial/index.html>, last visited Oct. 4, 2011)
- Exhibit AG-Rad-34: IPEC Site Management Manual, IP-SMM, CY-110, Rev. 3, 8.6 RGWMP Quarterly Integrated Review Checklist (Quarter 4, 2010); IPEC Site Management Manual, IP-SMM, CY-110, Rev. 4, 10.7 RGWMP Quarterly Integrated Review Checklist (Quarter 1, 2011)
- Exhibit AG-Rad-35: Excerpt of NRC's Safety Evaluation Report Related to the License Renewal of Indian Point Nuclear Generating Unit Nos. 2 and 3 (NUREG-1930, Supplement 1), August 2011 (Full report available at <http://pbadupws.nrc.gov/docs/ML1124/ML11242A215.pdf>, last accessed Oct. 4, 2011)
- Exhibit AG-Rad-36: Entergy Groundwater Monitoring Well Data, Quarter 2, 2011
- Exhibit AG-Rad-37: Excerpt of Entergy Nuclear Operations, Inc., Indian Point Unit 1, 2 and 3 Nuclear Power Plants, Docket Nos. 50-03, 50-247, and 50-286, Radioactive Effluent Release Report: 2010 (Full report available via NRC's Agencywide Document Access and Management System (ADAMS), Accession No. ML11172A042)
- Exhibit AG-Rad-38: E-mail from Dara Gray (Entergy) to James Noggle (NRC), with attached table entitled "Historic Strontium Tritium Results" (January 24, 2007)
- Exhibit AG-Rad-39: E-mail from John McCann (Entergy) to Arnie Gundersen (Fairewinds), Re: Thank You (April 1, 2010)