<u>EIS Must Analyze In-Depth the *Consequences* of Future Leaks from Spent Fuel Pools</u>

5. The EIS must analyze the full range of potential consequences stemming from the probability that densely packed SFPs at reactor sites will leak toxic radionuclides to the environment after the cessation of plant operations.

As an initial matter, NRC's previous "approach" relating to assessing the impact of accidental radiological leaks from nuclear power plants cannot be relied upon or deferred to in lieu of the required full analysis.[35] In the past, NRC presumptively categorized inadvertent radiological leaks as "low risk" events that had no public health and safety significance.[36] Thus, the inquiry has historically focused upon whether or not such radioactive releases "stay below NRC dose limits."[37] This is an inappropriate baseline from which to analyze all relevant consequences of future SFP leaks. To begin with, as the Court of Appeals explained, "merely pointing to the compliance program is in no way sufficient to support a scientific finding that spent-fuel pools will not cause a significant environment impact during the extended storage period."[38] Indeed, "near-term health effects are not the only type of environmental impacts."[39] Moreover, the Court made eminently clear that NRC cannot make assumptions regarding the significance and impact of future SFP leaks based on conclusions about the harm of past leaks.[40] That is, NRC cannot simply assume and conclude that all contamination resulting from future incidents of SFP leakage will only present a low risk to public health and safety, and thereby, end the inquiry.

Instead, there are numerous considerations that must be taken into account in the EIS to determine all potential environmental impacts of future SFP leaks, including, but not limited to, the following:

a. <u>Consequences of Radiological SFP Leaks to Groundwater Resources</u>

The EIS must analyze in-depth the extent to which future SFP leaks will result in the contamination of groundwater resources, including groundwater that directly underlies reactor sites. In order to evaluate the significance of any groundwater contamination resulting from future SFP leaks, the EIS must properly frame and categorize the significance of contamination that may occur. In particular, NRC should not only assess potential groundwater contamination

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[35] *See generally id.*

[36] *See* SECY-11-0019 at Enclosure 2, page 5, *supra* Note 23 ("leaks have been of low significance with respect to public health and safety and the environment."); U.S. NRC Groundwater Task Force Final Report, June 2010, ADAMS Accession No. ML101680435, at 5 ("The low risk to public health and safety from these incidents . . . ."); Notice of Public Meeting, *Evaluation of the Groundwater Task Force Report, Public Meeting,* Nuclear Regulatory Commission, NRC-2010--0302, 75 Fed. Reg. 57987, 57989 (Sept. 23, 2010) (categorizing radioactive water leaks from nuclear power plants as "low risk, high public interest/confidence" events).

[37] *See* SECY-11-0019 at Enclosure 2, page 5, *supra* Note 23 ("Historically, the focus of the NRC's regulatory requirements has been to ensure that radioactive releases—including unintended leaks and spills—stay below NRC dose limits and design objectives, within the effluent limits that are approved for the plant.").

[38] *New York v. NRC*, 681 F.3d 471, 481 (D.C. Cir. 2012).

[39] *Id.*

[40] *Id.* ("the harm from past leaks—without more—tells us very little about . . . the harm such leaks might portend"; "we cannot reconcile a finding that past leaks have been harmless with a conclusion that future leaks at all sites will be harmless as well"; "That past leaks have not been harmful with respect to groundwater does not speak to . . . what the effects of those [future] leaks might be.").

in terms of NRC human dose exposure limits and potential impacts to public health. Rather, in order to determine the severity and significance of groundwater contamination, NRC must also take into account broader considerations, including, but not necessarily limited to, the following:

- NRC must consider whether and the extent to which radiological groundwater contamination results in violations of applicable state water quality standards adopted pursuant to the Clean Water Act ("CWA") or state environmental protection laws. This includes designated best usages of state groundwaters,[41] and any other established groundwater standards.

- NRC must consider the degree to which radiological groundwater contamination "threatens a violation of Federal, State, or local law or requirements."[42]

- NRC must consider the toxicity and characteristics of the radionuclides present in the groundwater, given the fact that future SFP leaks will result in ongoing groundwater impacts. That is, the EIS should assess how long-lived and persistent the radionuclides involved will be, and typical characteristics of differing radionuclides that may leak from SFPs. For example, the EIS must recognize and consider the relative half-lives of relevant radionuclides (for example, strontium-90 has a half-life of about 30 years and, thus, any plumes containing strontium may persist for upwards or over 300 years),[43] and the behavior of different radionuclides in the environment (for example, strontium-90 and cesium-137 adsorb to solid structures and partition in and out of groundwater and can therefore result in persistent and unpredictable legacy contamination).[44]

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[41] For example, the State of New York has designated the best use of the groundwater beneath the Indian Point nuclear power plant to be "as a source of potable water supply," and requires that the discharge of deleterious substances shall not impair the groundwaters for such best uses. *See* 6 NYCRR § 701.18; 6 NYCRR § 701.15; 6 NYCRR § 703.2.

[42] 40 C.F.R. § 1508.27(b); 10 C.F.R. § 51.71(d).

[43] *See, e.g.*, U.S. EPA, Strontium, http://www.epa.gov/rpdweb00/radionuclides/strontium.html (last visited December 17, 2012).

[44] In the Matter of: Entergy Nuclear Indian Point 2, LLC, and Entergy Indian Point 3, LLC, For a State Pollution Discharge Elimination System Permit Renewal and Modification, DEC No.: 3-5522-00011/00004, SPDES No.: NY-0004472; Entergy Nuclear Indian Point 2, LLC, Entergy Nuclear Indian Point 3, LLC, and Entergy Nuclear Operations, Inc. Joint Application for CWA § 401 Water Quality Certification, DEC App. Nos. 3-5522-00011/00030 (IP2), 3-5522-00105/00031, Transcript ("Tr.") of Arbitration before Daniel P. O'Connell, ALJ, Maria E. Villa, ALJ, Reporter: Alan H. Brock, RDR, CRR, Farmer Arsenault Brock LLC (January 23, 2012, pages 3895-4125), at 3973:20-22 (Entergy Witness Barvenik Cross by Riverkeeper), Tr. 3975:5-11, 22-23, 3976:1-3, 7-12 (Entergy Witness Barvenik Cross by Riverkeeper) (Entergy witness explaining that partitioning relates to when radionuclides collect on the surface of "solid surfaces . . . natural or anthropogenic," such as "concrete foundations" or "the surface of pipes."). *See also* GeoEnvironmental, Inc. Hydrogeologic Site Investigation Report, Indian Point Energy Center (January 7, 2008), at 113 (Report commissioned by Entergy and explaining that, "[f]rom a contaminant plume perspective, these historic releases [those from the Unit 1 SFPs] still represent an ongoing legacy source of strontium in the groundwater to the south side of Unit 1. This is because strontium partitions from the water phase and adsorbs to solid materials, including subsurface soil and bedrock. The strontium previously adsorbed to these subsurface materials then partitions back to and continues to contaminate the groundwater over time, even after the storm drain releases have been terminated").

- NRC must consider the degree to which levels of radionuclides in any designated drinking water source exceed U.S. Environmental Protection Agency ("EPA") Maximum Contaminant Levels ("MCLs").[45] NRC should also consider EPA MCL standards even when groundwater is not used or designated for potable purposes because these standards constitute a recognized, highly conservative benchmark to assess the degree and severity of radioactive contamination. Indeed, NRC and plant owners who have commented upon groundwater contamination resulting from accidental radiological leaks have commonly cited to EPA MCLs in their analyses of such leaks to put the degree of leakage and contamination in context.[46]

- NRC must consider site-specific factors as they bear upon the likely behavior, fate, and effect of radiological contamination plumes resulting from future SFP leaks, including:
    - the varying geological landscapes underlying reactors and SFPs at different sites (e.g., the nature of the bedrock and the hydraulic gradient underneath and surrounding the site,);
    - the nature of nearby resources (including the presence of significant habitats and endangered resources);
    - the degree to which already existing groundwater contamination resulting from past radiological leaks may affect the behavior, fate, and effect of any new groundwater contamination resulting from new SFP leaks;
    - how external circumstances, including severe weather events and earthquakes, may affect the behavior, fate, and effect of radiological contamination plumes resulting from future SFP leaks. New information about local effects of such external circumstances, as discussed above, must be fully evaluated on a site-specific basis; and
    - the potential size of any groundwater contamination plumes. The EIS must give due consideration to the fact that future SFP leaks may occur for long periods of time undetected, and that such leaks will not be discovered until after they have caused measureable and sizeable impacts to the groundwater; this is as a result of the marked inability of licensees/ operators to detect future leaks and their reliance on *voluntary*, and not mandatory, groundwater monitoring, as discussed above.

- NRC must consider the degree to which radiological groundwater contamination is "likely to be highly controversial."[47] Radioactive contamination of any degree is

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[45] EPA's MCLs have been established for radionuclides in drinking water. EPA regulations implementing the Safe Drinking Water Act provide that "[t]he average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water must not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem/year (mrem/year)." 40 C.F.R. § 141.66(d). This dose converts to a maximum limit of radionuclides in water in terms of picocuries per liter (pCi/l), for particular radionuclides. *See* 40 C.F.R. § 141.66(d) (Table A); *See also* U.S. EPA, Radionuclides in Drinking Water: A Small Entity Compliance Guide (February 2002), *available at*, http://www.epa.gov/ogwdw/radionuclides/pdfs/guide_radionuclides_smallsystems_compliance.pdf, at 13.

[46] *See e.g.*, Indian Point Nuclear Generating Unit 2 – NRC Special Inspection Report No. 05000247/2005011, March 16, 2006 at 3, A1-3, A1-7, ADAMS Accession No. ML12335A615.

[47] 40 C.F.R. § 1508.27(b); 10 C.F.R. § 51.71(d).

inherently controversial and more so when it is occurring unseen and undetected for long periods of time, which may be the case in relation to future SFP leaks. Notably, inaccurate portrayals of the degree of groundwater contamination (i.e., presumptive categorization of contamination as "low-risk") is misleading, degrades public confidence, inhibits the public's ability to fully understand the relevant issues, and serves to exacerbate public concern and fear.

In sum, NRC must undertake an in-depth review of potential impacts of future SFP leaks on groundwater resources. NRC cannot presumptively or summarily determine that future levels of radiological groundwater contamination will be "low" and end the inquiry by portraying any such contamination as having "negligible" public health impacts. Such conclusions remain unsupported in light of the dearth of analysis concerning future SFP leaks, and entirely ignore the full range of relevant considerations relating to the potential impacts and significance of radiological groundwater contamination.

b. Consequences of Radiological SFP Leaks to Surface Water Resources

The EIS must fully consider the extent to which future SFP leaks will result in the contamination of surface water resources. Once again, the NRC must properly frame and evaluate the significance of any contamination affecting nearby surface water resources. That is, NRC cannot limit its analysis to determining only whether contamination will comply with NRC-calculated dose exposure limits. A broader array of considerations is necessary to determine the full range of potential impacts to surface waters that may occur as a result of SFP leaks during post-operation onsite storage. These considerations include, but are not limited to, the following:

- NRC must fully analyze the extent to which future SFP leaks will contaminate surface waters and the potential impact of such contamination on the aquatic ecology of such waters. The EIS must consider the length of time surface waters will be contaminated by, and thus, aquatic ecology exposed to, radiological contamination (again with due consideration for the fact that SFP leaks may occur for long periods of time undetected, as discussed above) and the various ways in which different radionuclides have the potential to bioaccumulate in the environment, e.g. in river sediments, sub-aquatic vegetation, shellfish, and finfish. NRC must determine the extent to which aquatic organisms may be impacted over long periods of time. An evaluation of the impacts of bioaccumulation and long-term exposure to low levels of radioactivity should be conducted by the NRC. NRC should focus attention on long-term exposure impacts to varying fish populations, as well as impacts to individuals within populations. NRC should not assume that a lack of impacts to date (at plants where SFP leaks have already contaminated surface waters) means that no future impacts will occur.[48] Rather, NRC must fully evaluate the potential future impacts to aquatic organisms from SFP leaks.

- NRC must consider the degree to which radiological contamination of surface waters "threatens a violation of Federal, State, or local law or requirements."[49] In particular,

[48] *New York v. NRC*, 681 F.3d 471, 481 (D.C. Cir. 2012).
[49] 40 C.F.R. § 1508.27(b); 10 C.F.R. § 51.71(d).

the EIS must consider whether and the extent to which radiological contamination of surface waters results in violations of applicable state water quality standards adopted pursuant to the CWA or state environmental protection laws. This includes any prohibitions and limitations on the discharge of radiological materials to State surface waters,[50] designated best usages of surface waters, and other established surface water standards. For example, it is common for designated best usages established pursuant to the CWA to include recreational activities such as swimming, fishing, boating, etc.[51] NRC must consider the degree and extent to which future SFP leaks may interfere with such designated uses of impacted surface waters. In this regard, NRC cannot narrowly examine compliance with NRC dose limits; as such limits do not necessarily reflect the pathways of exposure contemplated by water protection standards.[52]

- NRC must fully analyze the potential impact of future SFP leaks on existing or reasonably foreseeable drinking water sources stemming from surface water resources.[53] In this regard, NRC should consider whether future leaks may result in violations of EPA MCLs, as discussed above. NRC should also examine the potential long-term impacts from low-level exposure to SFP leaks, in light of the conclusions of the Biological Effects of Ionizing Radiation VII report.[54]

- NRC must consider site-specific factors as they bear upon the likely impacts of radiological contamination resulting from future SFP leaks on surface waters, including:

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[50] For example, New York State law contains a provision that prohibits discharges of high-level radioactive waste as well as any discharges not permitted by NYS rules and regulations. *See* New York State Environmental Conservation Law § 17-0807(1), (4).

[51] For example, in New York, the Hudson River directly adjacent to the Indian Point nuclear power plant has been designated as suitable for recreational activities, including swimming and boating; State standards require that the discharge of deleterious substance shall not impair the waters for such best uses. 6 NYCRR § 701.11; 6 NYCRR § 700.1(a)(49); 6 NYCRR 700.1(a)(56); 6 NYCRR § 703.2.

[52] For example, at Indian Point, the plant owner only considers one exposure pathway, i.e., the consumption of fish and invertebrates from the Hudson River, when calculating NRC-doses. 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, at page 33 of 49, *available at*, ADAMS Accession No. ML11124A031 ("Liquid offsite dose calculations involve fish and invertebrate consumption pathways *only*") (emphasis added). This fails to capture exposure resulting from recreational uses of the waterway.

[53] For example, the upstream portions of the Hudson River, a surface water estuary that flows both ways and is adjacent to the Indian Point nuclear power plant, is already a source of drinking water to local residents. In addition, a current proposal for an additional drinking water intake from the Hudson River exists in which a desalination plant would be sited on the banks of the Hudson River within 3 miles of the Indian Point facility. *See* generally, Haverstraw Water Supply Project, http://haverstrawwatersupplyproject.com/index.php/ (last visited December 13, 2012).

[54] National Research Council, Health Risks from Exposure to Low Levels of Ionizing Radiation: BEIR VII – Phase 2 (2006), *available at*, https://download.nap.edu/catalog.php?record_id=11340 (concluding that every exposure to radiation, regardless of how small, and no matter what pathway, produces a corresponding increase in the likelihood of cancer; finding that the risk of cancer is linear with dose and that there is no level of exposure below which there is no proportional risk).

- the nature of the affected surface water (that is, is it an estuary that flows back and forth versus a static man-made pond?);
- the presence of nearby significant habitats and endangered species in surface waters affected by SFP leaks. This is necessarily a site-specific factor, as surface waterways adjacent to nuclear plants, and the ecologies contained therein, vary;
- the relevant status of the aquatic ecology in a given waterway in the absence of additional impacts due to nuclear power plant SFP leaks. That is, due consideration must be afforded to existing circumstances present in affected waterways, such as stressed fish populations[55];
- the degree to which already existing radiological contamination of surface waters resulting from prior SFP leaks may affect the level and degree of exposure to future SFP leaks;
- how external circumstances, including severe weather events and earthquakes, may affect the behavior, fate, and effect of radiological contamination in surface waters resulting from future SFP leaks. New information about local effects of such external circumstances, as discussed above, must be fully evaluated on a site-specific basis.

In sum, NRC must undertake an encompassing, in-depth review of potential impacts of future SFP leaks on surface water resources. As with prospective groundwater impacts, NRC cannot summarily conclude that future impacts on surface waters will be "low" and end the inquiry by portraying any such contamination as having "negligible" public health impacts. Once again, such conclusions remain unclear in light of the dearth of analysis concerning future SFP leaks, and entirely ignore the full range of relevant considerations relating to the potential impacts and significance of radiological surface water contamination.

c. *Long-Term Public Health Consequences of Radiological SFP Leaks to the Offsite Environment*

In addition to a full assessment of environmental impacts of future SFP leaks on groundwater and surface water resources, the NRC should also undertake a forward-looking, in-depth assessment of the potential total maximum radiological exposure to the public resulting from future SFP leaks. NRC has explained that it "lacks regulatory guidance for monitoring and evaluating both the immediate and *long-term* offsite dose or environmental impact of [] inadvertent releases."[56] Similarly, the Court of Appeals chastised the NRC for failing to look ahead and undertake any assessment of "the effect of the *additional* time in [pool] storage"

[55] For example, in the Hudson River, which is adjacent to the Indian Point nuclear facility, study has shown that 10 out of 13 critical fish species are in long-term decline, largely as a result of entrainment, impingement, and thermal impacts from power plant cooling water intake structures. *See* The Status of Fish Populations and the Ecology of the Hudson, Pisces Conservation Ltd., April 2008, *available at*, http://www.riverkeeper.org/wp-content/uploads/2009/06/Status-of-Fish-in-the-Hudson-Pisces.pdf; NYSDEC Hudson River Power Plants FEIS (June 25, 2003), Public Comment Summary at 57, http://www.dec.ny.gov/docs/permits_ej_operations_pdf/FEISHRPP5.pdf. NRC must consider how long-term exposure to radiological contamination from SFP leaks may impact already troubled fish populations.

[56] NRC 2006 Radioactive Release Lessons Learned Report at 13, *supra* Note 15 (emphasis added).

contemplated by the Waste Confidence rule, and potential *future* harm to the public.[57] Thus, NRC's EIS must include a comprehensive evaluation of the risks to public health posed by potential *future* SFP leaks and *long-term* exposure to such leaks. In this regard, NRC should examine the long-term impacts from low-level exposure to SFP leaks in light of the conclusions of the Biological Effects of Ionizing Radiation VII report.[58]

EIS Must Analyze In-Depth the Probability and Consequences of the *Cumulative* Environmental Impacts of SPF Leaks and Past, Present, and Future Radiological Leaks from non-SFP Systems, Structures, and Components

6. In order to accurately discern, and portray a realistic picture of, the probable impacts of future SFP leaks, NRC's EIS must consider cumulative environmental effects. The Court of Appeals explained that "a proper analysis of the risks [of SFP leaks] would necessarily look *forward* to examine the effects of the additional time in storage, *as well as examining past leaks*."[59] Indeed, a critical aspect of any environmental review conducted pursuant to NEPA is the consideration of "the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions."[60] This is because cumulative impacts "can result from individually minor but collectively significant actions taking place over a period of time."[61] As numerous courts have explained, a meaningful cumulative impact assessment must therefore identify (1) the affected area, (2) the expected impacts of the project, (3) other past, present, proposed, and reasonably foreseeable actions that are expected to have impacts in the same area, (4) the impacts or expected impacts from such other actions, and (5) the overall expected impact in light of the accumulation of the individual impacts.[62] In other words, the agency "cannot treat the identified environmental concern in a vacuum."[63]

In relation to SFP leaks, NRC must fully analyze the cumulative impacts resulting from past, present, and reasonably foreseeable future radiological leaks from non-SFP systems, structures, and components.[64] Such non-SFP leaking plant components at facilities around the country have

[57] *New York v. NRC*, 681 F.3d 471, 481 (D.C. Cir. 2012) (emphasis added).
[58] *See supra* Note 54.
[59] *New York v. NRC*, 681 F.3d 471, 481 (D.C. Cir. 2012) (first emphasis in original; second emphasis added).
[60] *See* 40 C.F.R. § 1508.7,10 C.F.R. §51.45(c); *see also* 10 C.F.R. § 51.75, 10 C.F.R. § 51.45.
[61] *See* 40 C.F.R. § 1508.7
[62] *See Grand Canyon Trust v. FAA*, 290 F.3d 339, 345-46 (D.C. Cir. 2002).
[63] *Id.* at 346.
[64] It can logically be expected that future (and/or existing) leaks and contamination from SFPs will interact with and cause cumulative impacts with any past, current, and likely future leaks from other, non-SFP components. As one NRC licensing board has aptly explained, "if releases from SFP leaks encounter groundwater, then the radionuclides would co-mingle and coalesce with any impacts that might be present from other sources" and "it is unlikely" that "concentration levels" in groundwater "can be parsed into relative contributions from the separate sources that contribute to the overall groundwater contamination at the site, and that "[b]y necessity" "the impacts to groundwater from SFP leaks and the subsequent discharges into" adjacent surface waters must be considered "on a site-wide basis." In the Matter of Entergy Nuclear Operations, Inc. (Indian Point Nuclear Generating Units 2 and 3), Docket Nos. 50-0247-LR and 50-286-LR, ASLBP No. 07-858-03-LR-BD01, Order (Granting in Part and Denying in Part Applicant's Motions *in Limine*) (March 6, 2012), at 29, ADAMS Accession No. ML12066A170. Thus, such cumulative radiological leakage impacts must be fully assessed in NRC's EIS.

already contaminated on-site and off-site groundwater and public waterways.[65] As of June 2011, NRC reported that 42 of 65 reactor sites, i.e., 65%, have experienced problems with radiological leaks.[66] The trend of accidental radiological leaking can be expected to continue and even increase as America's original nuclear fleet continues to age. Indeed, the basic engineering principle of the "bathtub" curve indicates that as these aging nuclear plants reach the end of their operating lives, problems, such as component degradation and resulting leaks, can be expected to sharply increase.[67]

Historically, U.S. nuclear power plants have had leakage problems with difficult to inspect buried pipes and components. The U.S. GAO conducted a study that concluded in 2011 that, "[t]he occurrence of leaks at nuclear power plants from underground piping systems is *expected to continue* as nuclear power plants age and their piping systems corrode."[68] GAO confirmed that because "underground piping systems tend to corrode" and are "largely inaccessible and difficult to inspect," the "*severity of leaks could increase* without mitigating actions."[69] Plant owners' aging management programs and more recent industry initiatives that allegedly are designed to "handle" leaks from the miles and miles of buried and inaccessible buried components fall far short of providing the necessary assurances the radiological leaks will be properly detected and prevented in the future.[70] The NRC must consider and account for this in its EIS.

In addition, accidental spills and releases caused by human error have also resulted in releases of radioactivity to the environment at nuclear power plants.[71] Such incidents will likely continue to occur, and NRC must consider cumulative impacts that may result from such accidental spills and releases.

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[65] *See generally* NRC 2006 Radioactive Release Lessons Learned Report, *supra* Note 15; *see also* Riverkeeper Statement of Position Regarding SFP Leaks Contention at 41-43, *supra* Note 1 (describing various non-SFP component leaks that have occurred at Indian Point).

[66] *See* Leaks and Spills of Tritium at U.S. Commercial Nuclear Power Plants, Rev 9 (June 7, 2012), ADAMS Accession No. ML101270439; *see also* Union of Concerned Scientists, *Groundwater Events Sorted by Date*, September 27, 2010, *available at*, http://www.ucsusa.org/assets/documents/nuclear_power/Groundwater-Events-Sorted-by-Date.pdf; Jeff Donn, Radioactive tritium leaks found at 48 US nuke sites (June 21, 2011), *available at*, http://www.msnbc.msn.com/id/43475479/ns/us_news-environment/t/radioactive-tritium-leaks-found-us-nuke-sites/ (last visited Dec. 13, 2012).

[67] *See supra*, Note 18.

[68] June 2011 GAO Report at 22, *supra*, Note 6 (emphasis added).

[69] *Id.* at 1.

[70] Plant programs and industry initiatives are simply not designed to identify or stop *all* potential radiological leaks; alleged "enhanced" inspection commitments still only cover a small fraction of total amounts of onsite buried piping. *See, e.g.*, 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 # NYS000164-00-BD01, Pre-Filed Written Testimony of Dr. David J. Duquette, Ph.D Regarding Contention NYS-5, ADAMS Accession No. ML12334A699 (explaining deficiencies in the "aging management program" at Indian Point for preventing and detecting corrosion of buried pipes and components).

[71] NRC 2006 Radioactive Release Lessons Learned Report at 34, *supra* Note 15; Riverkeeper Statement of Position Regarding SFP Leaks Contention at 42, 53, *supra* Note 1; GZA, GeoEnvironmental, Inc. Final IPEC Quarterly Long-Term Groundwater Monitoring Report, Quarter Two 2010 (Report No. 10) (February 15, 2011), IPEC00227561, at p.1-2, ADAMS Accession No. ML12275A555 (hereinafter "GZA IPEC Quarter 2 Groundwater Report") (Entergy's vendor describing a spill from a Reactor Waste Storage Tank ("RWST"), that resulted in a marked increase in the tritium plume present at the Indian Point site that Entergy attributes to the Unit 2 SFP leaks; this spill resulted in an increase in radionuclide levels in the groundwater that lasted for many months).

In sum, it is reasonably foreseeable that non-SFP components will continue to contaminate the environment around U.S. nuclear power plants during periods of initial and/or extended operations, and during post-operation timeframes, and thereby result in cumulative impacts. Such other radiological leakage issues have already resulted in cumulative impacts.[72]

Thus, NRC must analyze the cumulative impacts of SFP and non-SFP leaks.[73] In its analysis, NRC should consider the potential impacts to groundwater resources, surface water resources, and public health, in the manner discussed in detail above.

EIS Must Analyze In-Depth All Relevant Measures to Mitigate Adverse Environmental Consequences of Future SFP Leaks and Resulting Contamination

7. The EIS must include a comprehensive assessment of all relevant measures that may mitigate adverse environmental consequences of future SFP leaks and any contamination of the environment resulting therefrom. Indeed, NEPA mandates that in undertaking environmental reviews, agencies must "discuss the extent to which adverse effects can be avoided" so that "the agency [and] other interested groups and individuals can properly evaluate the severity of the adverse effects."[74] Without such a discussion, it is patent that the agency has failed to take the requisite "hard look" at the environmental consequences of a proposed action.[75] Regulations implementing NEPA are likewise instructive. In particular, federal regulations require that reviewing agencies consider and assess mitigation measures in an EIS.[76] These regulations define mitigation as:

> (a) Avoiding the impact altogether by not taking a certain action or parts of an action.

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[72] For example, at Indian Point, SFP leaks have resulted in extensive contamination plumes that underlie the facility and leach to the Hudson River; numerous leaks from non-SFP structures and components have resulted in cumulative impact by contributing to the existing contamination and preventing the contamination plumes from abating. *See* Riverkeeper Statement of Position Regarding SFP Leaks Contention at 41-43, 53-54, *supra* Note 1; Riverkeeper and Hudson River Sloop Clearwater Revised Statement of Position Regarding Consolidated Contention RK-EC-3/CW-EC-1 (Spent Fuel Pool Leaks) (July 13, 2012), at 18-23, *available at* ADAMS Accession No. ML12195A343; GZA IPEC Quarter 2 Groundwater Report at pp.1-2, 1-3.

[73] Notably, the cumulative impact assessment described should, of course, also consider the cumulative impacts resulting from probable SFP leaks that may occur while reactors are still operating.

[74] *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 351-52 (1989) (citations omitted) ("One important ingredient of an EIS is the discussion of steps that can be taken to mitigate adverse environmental consequences. . . Implicit in NEPA's demand that an agency prepare a detailed statement on 'any adverse environmental effects which cannot be avoided should the proposal be implemented,' is an understanding that the EIS will discuss the extent to which adverse effects can be avoided. More generally, omission of a reasonably complete discussion of possible mitigation measures would undermine the 'action forcing' function of NEPA. Without such a discussion, neither the agency nor other interested groups and individuals can properly evaluate the severity of the adverse effects. . . Recognizing the importance of such a discussion in guaranteeing that the agency has taken a 'hard look' at the environmental consequences of proposed federal action, CEQ regulations require that the agency discuss possible mitigation measures in defining the scope of the EIS, in discussing alternatives to the proposed action, and consequences of that action, and in explaining its ultimate decision.")

[75] *See id.*

[76] 40 C.F.R. § 1508.25(b)(3); *see also* 10 CFR Part 51, Subpart A, App. A ("appropriate mitigating measures of the alternatives will be discussed").

(b) Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
(c) Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
(d) Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
(e) Compensating for the impact by replacing or providing substitute resources or environments.[77]

Various feasible measures are available that would avoid, minimize, rectify, reduce, or eliminate the environmental impacts of future radiological SFP leaks and contamination associated with such leaks. The EIS should include an assessment of the feasibility and efficacy of all reasonable measures to mitigate the impacts of future SFP leaks on the environment, including, but not limited to, the following:

- *Immediate clean-up activities associated with groundwater contamination resulting from SFP leakage*. NRC must fully consider the degree and extent to which immediate clean-up activities may reduce environmental impacts of future SFP leakage. In particular, NRC must assess the feasibility and efficacy of extracting (via extraction wells) any contaminated groundwater, treating and/or excavating any contaminated soil, and any other remedial clean-up measures that could address contamination resulting from future SFP leaks. A complete analysis will necessarily require consideration of site-specific factors. NRC must analyze the relative advantages and disadvantages of relevant clean-up measures, taking into account what may be known about the feasibility of given measures at particular reactor sites. For example, NRC must analyze the degree to which groundwater extraction may prevent the migration of radiological contamination into adjacent surface waters and thereby avoid impacts to aquatic ecologies. Notably, NRC should not simply accept, or draw conclusions based upon, activities licensee's may have (or have not) already taken in response to previous radiological leakage and groundwater contamination circumstances. Instead, NRC should evaluate the efficacy of groundwater extraction, soil remediation, and other clean-up measures on an independent basis.

- *Mandatory comprehensive groundwater monitoring*. NRC must assess the efficacy of *mandatory* groundwater monitoring for minimizing the environmental harm of any future SFP leaks. To the best of my knowledge, NRC currently has no plans to impose any such mandatory requirements, but instead continues to rely on a purely voluntary industry program.[78] The benefits of mandatory monitoring are patent. Mandatory, as opposed to voluntary, monitoring can clearly assist in minimizing the impacts of potential future SFP leaks, and, therefore, must be fully considered in the EIS.

- *Preventative measures to proactively find SFP leaks before they occur and cause measureable environmental impacts*. As discussed above, the degree to which

[77] 40 C.F.R. §§ 1508.20.
[78] SECY-11-0019 at 3-4, *supra* Note 23.

licensees are currently committed to, or will be required to, inspect SFPs is unclear at best. NRC must assess the feasibility and efficacy of regular inspections of SFPs while plants continue to operate and during the post-operation pool storage timeframes. NRC should consider the practicality and usefulness of physical/mechanical inspections of SFP liners, walls, floors, transfer canals, and other portions, at recurring frequencies. To the extent spent fuel is too densely packed to allow for full inspection, NRC must assess the feasibility and efficacy of reducing the density of pools to allow for such full inspections.

- *Measures to prevent initiation or exacerbation of future SFP leaks*. NRC should analyze the feasibility and efficacy of measures that could be undertaken to enhance the integrity or robustness of SFP structures and prevent the initiation or exacerbation of future SFP leaks. NRC should consider newer technologies, materials, or "upgrades" that may minimize the potential for SFP leaks and environmental contamination as a result thereof. For example, NRC should consider whether existing SFPs have "tell tale" drain collection systems that prevent environmental harm, and, to the extent SFPs do not have such systems, the efficacy of retrofitting SFPs with such systems. NRC should also consider the impacts of new seismological information on the integrity of SFPs in the event of earthquakes in the future and available "upgrades" to account for such circumstances.

- *Preventative measures to proactively prevent future leaks from leaking non-SFP components*. NRC must assess the steps that it could take to prevent or reduce future leaks from non-SFP components (e.g., other plant systems, structures, and components such as buried pipes), which, as discussed above, if not addressed are likely to result in cumulative environmental impacts in conjunction with future SFP leaks. NRC should also consider all reasonable measures that licensees could take to reduce or minimize the likelihood of future component leaks and impacts to groundwater, such as the feasibility and efficacy of moving buried pipes and structures above-ground so as to be able to better monitor such components, and substantially increasing the number of inspections of components that are known to be prone to leakage.

- *Measures to mitigate impacts to aquatic ecologies in adjacent affected waterways*. NRC must give due consideration to the fact that aquatic ecosystems may be exposed to contamination from SFP leaks for centuries. Even low levels of any such contamination may result in impacts over time. Therefore, NRC must fully assess all measures that will minimize environmental harm to aquatic ecologies resulting from radiological SFP leaks. This includes, but is not limited to, an assessment of the feasibility and efficacy of enhanced/robust environmental monitoring of the impacts of future SFP leaks to these ecosystems. NRC cannot simply assume that existing NRC radiological effluent and environmental monitoring programs are adequate to capture all environmental impacts that may occur as a result of future SFP leaks. NRC should consider the degree to which enhanced programs will be able to more accurately detect any impacts, and, therefore assist in minimizing environmental harm. NRC should consider a wide portfolio of monitoring measures that licensees may not currently undertake, including, but certainly not limited to, the analysis of fish bone and shellfish shells in order to monitor for certain "bone seeking" radionuclides such as strontium-90, the sampling of benthic organisms, sampling at additional control locations, sampling of specific species as opposed to only opportunistic sampling, sampling more frequently, and sampling of additional analytes to ensure detection of particular radionuclides. Site-specific considerations will necessarily be relevant to NRC's assessment.

- *Measures to increase public access to information concerning future SFP leaks and groundwater contamination that occurs as a result.* NRC must fully analyze the extent to which more openness and transparency regarding SFP leaks and groundwater contamination will reduce environmental impacts. Indeed, an assessment of the significance of an environmental impact includes the degree to which it is highly controversial.[79] To the extent SFP leaks may be considered controversial,[80] they are "significant" as contemplated by NEPA. Thus, measures to alleviate public concern would assist in minimizing the overall impacts of any future SFP leaks. Accordingly, NRC should consider mitigation measures related to openness and transparency in relation to SFP leaks. For example, NRC should consider the feasibility and efficacy of full and regular public disclosure and publication of licensee radiological groundwater monitoring results to keep the public fully informed of existing circumstances. This is in relation to any results that are not already currently made publicly available via NRC's ADAMS. NRC should contemplate the usefulness of such disclosures as results are generated, i.e., on a monthly or quarterly basis, depending on specific circumstances. In addition, measures to provide the public with easier access to site-specific annual radiological monitoring reports, which are available in NRC's document system, ADAMS, should also be considered.

NRC has the unequivocal obligation to *consider and discuss* relevant mitigation options that are available, and to weigh the costs and benefits of such options.[81] Thus, pursuant to the basic tenets of NEPA, NRC must assess the foregoing measures, as well as any and all other relevant potential mitigation measures.

EIS Must Analyze In-Depth the Impact of Decommissioning Activities on SFP Leaks and Contamination that Occurs as a Result

8. NRC must assess the extent to which all of the matters discussed above, including the probability and environmental consequences of SFP leaks, may be affected by licensee decommissioning activities that are, or may be, undertaken during post-operation timeframes. NRC must assess (1) how future SFP leaks (and the direct, indirect, and cumulative impacts of these leaks) will affect the overall feasibility and cost of decommissioning reactor sites; (2) the impacts of any residual SFP leak contamination that may be left unremediated after

[79] 40 C.F.R. § 1508.27(b).
[80] For example, since leaks at Indian Point were "discovered," there has been a high level of public concern, which continues today. *See* NRC 2006 Radioactive Release Lessons Learned Report at ii, *supra* Note 15.
[81] *See Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 351-52 (1989).

decommissioning; and (3) the extent to which decommissioning actions are relevant to the consideration of potential mitigation measures.

The facts above are true to the best of my knowledge and the opinions contained herein represent my best professional judgment.

Phillip Musegaas

Phillip Musegaas, Esq.
January 2, 2013

COMMENTS BY INSTITUTE FOR ENERGY AND ENVIRONMENTAL RESEARCH, BLUE RIDGE ENVIRONMENTAL DEFENSE LEAGUE, NATURAL RESOURCES DEFENSE COUNCIL, RIVERKEEPER, AND SOUTHERN ALLIANCE FOR CLEAN ENERGY ON NRC REPORT UPDATING PRELIMINARY ASSUMPTIONS FOR AN EIS ON LONG-TERM SPENT FUEL STORAGE IMPACTS

I. INTRODUCTION

As provided by the U.S. Nuclear Regulatory Commission's ("NRC's") press release of January 3, 2012, Blue Ridge Environmental Defense League ("BREDL"), the Institute for Energy and Environmental Research ("IEER"), Natural Resources Defense Council ("NRDC"), Riverkeeper, and Southern Alliance for Clean Energy ("SACE") hereby submit comments on the NRC's draft report, *Background and Preliminary Assumptions for an Environmental Impact Statement – Long-Term Waste Confidence Update* (December 2011) ("Draft Report"). The Draft Report should be withdrawn because the assumptions it proposes are inconsistent with the National Environmental Policy Act ("NEPA") and NRC regulations. In addition, by indicating that the NRC plans to prepare an EIS that discusses the environmental impacts of long-term SNF disposal without also discussing the impacts of SNF disposal in a repository and the impacts that may occur if SNF disposal is never achieved, the NRC unlawfully segments the environmental analysis for SNF disposal. Finally, the NRC's decision to issue the Draft Report without publishing a notice in the Federal Register is inconsistent with the NRC's open government policy and long-established practice.

II. DESCRIPTION OF COMMENTERS

BREDL, NRDC, Riverkeeper, and SACE are public interest environmental organizations whose members include neighbors of nuclear reactors, nuclear factories, and nuclear waste storage and disposal facilities. They submitted comments on the related Waste Confidence Decision ("WCD") and Waste Confidence Rule ("WCR") that were published in the Federal Register on December 23, 2010. 75 Fed. Reg. 81,032, 81,037. They are also parties to a lawsuit challenging the Waste Confidence Decision and Waste Confidence Rule in the D.C. Circuit, *State of New York v. NRC,* D.C. Cir. No. 11-1045 (consolidated with D.C. Cir. Nos. 11-1051, 11-1056, 11-1057.

IEER is a nonprofit organization that provides policymakers, journalists and the public with understandable and accurate scientific and technical information on energy and environmental issues. IEER commented on the WCD and WCR and also provided expert support for comments filed by BREDL, Riverkeeper, and SACE.

III. FACTUAL BACKGROUND

In the 2010 WCD, the NRC declared that it intends to "update" the WCD and WCR by analyzing, in an environmental impact statement ("EIS"), the effects of storing SNF from U.S. nuclear reactors for as long as 200 years. WCD, 75 Fed. Reg. at 81,040. On January 3, 2012, the NRC issued a press release regarding this proposal (PR No. 12-001) and attached the Draft Report for comment. According to the Press Release, the Draft Report:

> discusses several storage scenarios, including at nuclear power plants, regional or centralized storage sites or a combination of storage and reprocessing of spent fuel. A key assumption is that extended storage would be managed under a regulatory program similar to current regulation of spent fuel. To analyze the impacts associated with the scenarios, the staff will develop generic, composite sites for each scenario, and these sites will account of a range of characteristics of actual reactor and storage sites.

Id.

While the WCD and the Press Release state that the length of SNF storage time to be analyzed in the EIS is 200 years, the Draft Report itself states that the time period is 300 years: the new time period would be added on to the 100 years that SNF from the oldest reactors will have been in storage:

> The staff plans to develop the EIS to analyze impacts of storage from approximately the middle of this century for a period of 200 years. The staff selected mid-century as the starting point for the impacts analysis because it represents the time when some spent fuel will begin to reach the minimum storage periods accounted for in the current Waste Confidence rule (60 years after the expiration of licensed life). In other words, the oldest spent fuel will have been stored for about 100 years by the middle of the century. *The staff selected a 200-year span for the EIS because that is approximately when this oldest fuel will approach 300 years of storage.* The 200-year period is the timeframe being used by NRC and others in technical analyses to identify spent fuel aging issues.

Id. at 6 (emphasis added).

As part of the NRC's preliminary process for scoping for long-term SNF storage for periods up to 300 years, the Draft Report proposes a series of assumptions regarding the circumstances under which spent nuclear reactor fuel ("SNF") may be stored for an extended period of time that lasts as long as 300 years. These circumstances include the nature of future nuclear reactor operations, the length of time that active institutional controls and regulatory oversight will be maintained, and other aspects of SNF storage, transportation, and handling. The assumptions proposed by the NRC in the Draft Report will "define the scope of the EIS and preliminary scenarios for analysis." *Id.* at 9.

IV. DISCUSSION

A. NRC Should Publish the Draft Report in the Federal Register

As a preliminary matter, the NRC's process for seeking public input on the proposed assumptions for the EIS on long-term SNF disposal is inadequate. Given the enormous safety and environmental significance of the Draft Report's subject matter of long-term SNF storage and given its purpose and effect of defining the scope of the NRC's proposed EIS for long-term

SNF storage, the Draft Report should have been published for public comment in the Federal Register. The NRC's decision to use only a press release to notify the public of its proposed assumptions is inconsistent with its long-established practice of publishing even "preliminary" rulemaking notices. *See, e.g.,* Final Rule, Licensing Requirements for Land Disposal of Radioactive Wastes, 47 Fed. Reg. 57,446 (Dec. 27, 1982) (discussing previous publication of both a proposed rule and a "preliminary draft regulation"). The use of a press release to notify the public about the NRC's proposed assumptions is also inconsistent with the Commission's stated commitment to openness in decision-making. *See* NRC Strategic Plan for FY 2008-2013 at 16 (as part of NRC's commitment to "appropriately inform[] and involve[] stakeholders in the regulatory process," copies of "key documents and notifications" are "published in the Federal Register" in addition to being "made available electronically on the NRC Web site.") http://www.nrc.gov/public-involve/open/philosophy.html

The Draft Report clearly constitutes a "key document" with respect to the preparation of an EIS on long-term SNF storage impacts. Therefore, in order to ensure that the report reaches a broad enough audience, the NRC should withdraw the Draft Report and re-publish it for comment in the Federal Register.

B. The Scope of the EIS Should Include SNF Disposal in Addition to SNF Storage and Should be Integrated into Reactor Licensing Decisions.

By restricting the proposed scope of the EIS to the impacts of long-term SNF storage, the NRC segments the environmental analysis of nuclear reactor operation, in violation of NEPA. The NRC may not consider a segment of a project separately where it will result in the irreversible or irretrievable commitments to the remaining segment of a project. *United States Dept. of Energy, Project Management Corp., Tennessee Valley Authority* (Clinch River Breeder Reactor Plant), CLI-82-23, 16 NRC 412, 424 (1982). Here, the long-term above-ground storage is a risky response to the failure of the proposed Yucca Mt. project as a SNF repository and the lack of any other viable disposal options on the horizon. The NRC's proposal to store SNF for 200-300 years must be acknowledged as a measure of last resort to compensate for the federal government's failure to site a SNF repository, and the uncertainties and costs of the combined failure of repository siting and resort to long-term SNF must be integrated into the cost-benefit analyses for reactor licensing decisions.

C. The Draft Report's Key Assumption Regarding the Longevity of Institutional Controls is Inconsistent with NRC and EPA Regulations and Therefore is Impermissible.

One of the Draft Report's key assumptions is that active institutional controls over SNF storage will remain effective over a period of several hundred years. *Id.* at 11. The NRC proposes to assume, for instances, that "[l]ong-term storage and handling facilities will operate under a framework of aging management that is designed to monitor, detect, and mitigate significant aging impacts." *Id.* at 11. In addition, the NRC proposes to assume that:

> [t]he storage of spent fuel will remain under a regulatory program comparable to the current program. Regulatory oversight and maintenance of storage facilities and activities, such as spent fuel repackaging, will continue, as appropriate.

Id. at 11. Finally, the Draft Report proposes to assume that either licensees or the U.S. government "will provide sufficient resources and protection to ensure continued safe and secure storage." *Id.*

These assumptions regarding the long-term effectiveness of active institutional controls are contradicted by federal regulations governing the storage and disposal of radioactive waste. *See* 40 C.F.R. 191.14(d) (SNF, high-level waste and transuranic waste disposal) and 10 C.F.R. 61.59(b) (low level radioactive waste ("LLRW") disposal. These regulations were promulgated by the NRC and the U.S. Environmental Protection Agency ("EPA") after years of extensive study, mutual consultation, and gathering of public comments.

As a matter of law, these regulations establish a presumption that 100 years is the maximum length of time that institutional controls may be assumed to be effective. If the NRC wants to change that presumption and assume that institutional controls will be in effect for a period of 200-300 years, it must re-examine and update the extensive studies on which the NRC and EPA relied in establishing their regulations. As required by NEPA, it must also publish this analysis for comment by the public and by the EPA, with whom it cooperated in establishing the 100-year presumption.

D. In General, the NRC Proposes to Assume Many Important Facts That Should be the Subject of the EIS.

The proposed EIS for long-term SNF storage necessarily will involve a number of long-range predictions regarding a range of circumstances that will affect the feasibility, safety and environmental impacts of SNF storage hundreds of years from now. These circumstances include the number of nuclear reactors in operation, the size and vigor of the nuclear industry, the effectiveness of institutional controls by licensees, and even the continued existence of the NRC.

The NRC asserts that its assumptions are based on "present-day attributes, current scientific knowledge, and documented trends for potential growth in the use of nuclear power and spent fuel generation rates." Draft Report at 9. While it may be reasonable to forecast trends for twenty years, the NRC offers no basis – nor is any conceivable – for making 200 to 300-year forecasts and then assuming they are correct in an EIS. The irrationality of the NRC's approach is clear when one contemplates the violent and unpredicted events that occurred over the last 200-300 years in North America and that caused major upheavals in government, business and society: the Revolutionary War, the War of 1812, the Civil War, and the attacks of 2001 on U.S. facilities. The NRC simply has no basis to assume *any* of the facts that are asserted on pages 9 through 11.

V. CONCLUSION

For the foregoing reasons, -the NRC should withdraw the Draft Report and revise it to be consistent with NEPA and its regulations. Then the NRC should publish it for comment in the Federal Register and on its website.

Respectfully submitted,

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