

April 7, 2008

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION
ATOMIC SAFETY AND LICENSING BOARD

DOCKETED
USNRC

April 8, 2008 (8:00am)

Before Administrative Judges:
Lawrence G. McDade, Chairman
Dr. Richard E. Wardwell
Dr. Kaye D. Lathrop

OFFICE OF SECRETARY
RULEMAKINGS AND
ADJUDICATIONS STAFF

In the Matter of)	
)	
Entergy Nuclear Operations, Inc.)	Docket Nos.
(Indian Point Nuclear Generating)	50-247-LR
Station, Units 2 and 3))	and 50-286-LR
)	

**RIVERKEEPER, INC.'S RESPONSE TO
ATOMIC SAFETY AND LICENSING BOARD
QUESTIONS REGARDING CONTENTION EC-2**

As requested by the Atomic Safety and Licensing Board ("ASLB") during the oral argument on March 12, 2008 (transcript ("tr. at 632-38)), Riverkeeper, Inc. ("Riverkeeper") hereby provides additional information in response to the questions posed during the oral argument by the ASLB panel regarding Subpart 2 of Riverkeeper's Contention EC-2 (Inadequate Analysis of Severe Accident Mitigation Alternatives).

As stated in Subpart 2 of Contention EC-2, one of the deficiencies in Entergy Nuclear Operations, Inc.'s ("Entergy's") severe accident mitigation alternatives ("SAMA") analysis is that in order to evaluate the consequences of a severe accident, Entergy assumes a "source term" that is significantly lower than the source term put forward by the U.S. Nuclear Regulatory Commission ("NRC") for the same accidents in NUREG-1465, *Accident Source Terms for Light-Water Nuclear Power Plants* (1995)

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("NUREG-1465"). See Riverkeeper, Inc.'s Request for Hearing and Petition to Intervene Etc. at 55, 68-70 (November 30, 2007) ("Hearing Request"). As a result, Entergy calculates health and environmental effects of a severe accident that are less severe and therefore less costly than the health and environmental impacts that would be calculated by using the NRC's source term.

The source term is a description of the fraction of the radioactive contents of the reactor core that is assumed to be released to the environment during a severe accident. It includes the magnitude, timing and duration of the releases of radioactive isotopes during a nuclear plant accident. See *Chernobyl on the Hudson? The Health and Economic Impacts of a Terrorist Attack at the Indian Point Nuclear Power Plant* at 16, 28 (September 2004) ("Chernobyl on the Hudson Report") (Attachment 3 to Declaration of Dr. Edwin S. Lyman in Support of Riverkeeper's Contention EC-2 (November 30, 2007)).

While NUREG-1465 describes the release of radionuclides from the core to the containment building, NRC has concluded in past studies that in a severe accident involving a large early containment failure at a pressurized-water reactor, such as the accident evaluate by Entergy and Riverkeeper, 80-98% of the radionuclide inventory released from the core to the containment would be released to the environment following an energetic containment breach. *Id.* at 32, citing NUREG-1150, *Severe Accident Risks: An Assessment for Five Nuclear Power Plants* at C-108 (1990).

Therefore, for a large early containment failure scenario, the NUREG-1465 source term can be regarded as essentially equivalent to the radiological release to the environment

with the conservative assumption that nearly all radioactive material released to the containment is expelled through the containment breach.

As discussed at page 63 of Riverkeeper's Hearing Request, one reason for the disparity between Entergy's and NUREG-1465's source terms appears to originate in a difference between the computer codes used to generate the source terms, MAAP (used by Entergy in this case and by the nuclear industry as a general matter) and the Source Term Code Package (STCP) and MELCOR codes (used in NRC studies that formed the basis for the regulatory source term presented in NUREG-1465).¹ While the NRC has been aware for at least two decades of the discrepancy between the source term generated by the MAAP code and the source terms generated by the NRC Staff, the NRC has not investigated or determined the reason for the difference. *See* Dr. Lyman's expert report, "A Critique of the Radiological Consequence Assessment Conducted in Support of the Indian Point Severe Accident Mitigation Alternative Analysis" at 3 (November 2007) ("Lyman Report") (Attachment 2 to Declaration of Dr. Edwin S. Lyman in Support of Contention EC-2).² In addition, the disparity between Entergy's source term and the

¹ To clarify what we believe is the crux of Judge McDade's question at page 618 of the transcript, Riverkeeper used a source term corresponding to an early containment failure scenario derived from NUREG-1465 and the assumption (based on technical references) of 100% transmission of the radionuclide inventory from the containment to the environment. Riverkeeper then compared its result to Entergy's result for the same event.

² At the oral argument, counsel for Entergy incorrectly asserted that the MAAP code was "recently approved by the NRC." Statement by Martin O'Neill, tr. at 627. The MAAP code has not been approved by the NRC. At most, individual industry applications of the code have been approved by NRC. The NRC has not independently validated the code itself, nor has it resolved the substantial differences between results generated by NUREG-1465 and those generated by MAAP, although it continues to observe significant disparities between the results of NRC-sponsored studies and industry

source term used by Riverkeeper (based on NUREG-1465 and the conservative assumption of 100% release from the containment to the environment) could be based on different assumptions regarding the release of radionuclides from the core to the containment, releases from the containment to the environment, or both. The Entergy Environmental Report does not break down its source term into core-to-containment and containment-to-environment factors, however, and therefore these individual factors cannot be directly compared with those used by Riverkeeper.

Dr. Lyman concludes that in light of the significant disparity between the source terms assumed by Entergy and the NRC Staff in evaluating the consequences of the same severe accident sequences, and in light of the fact that the NRC has not reviewed the adequacy of the MAAP code or satisfied itself that the reasons for the discrepancy in source terms are acceptable, Entergy should not be allowed to rely on MAAP-generated source terms unless it can provide a technically credible justification for the differences between them and the source term developed by the NRC. *Id.*

Riverkeeper also wishes to clarify that in evaluating the impacts and costs of a severe accident in Subpart 2 of Contention EC-2, Riverkeeper assessed the highest-impact severe accident scenario identified in Entergy's Environmental Report, early

studies using MAAP. *See* Lyman Report at 3. In a recent draft report by the Electric Power Research Institute (EPRI), for instance, the author noted "areas of disagreement" between NRC (using the codes SCDAP/RELAP5) and EPRI (using the MAAP code) in the analysis of thermally induced steam generator tube rupture, one of the severe accident scenarios that is evaluated in Entergy's environmental report (and which is the subject of subpart 1 of Contention EC-2). Kenton, Marc, *A Review of Recent NRC-Sponsored Station Blackout Analyses* (Draft: April 16, 2007) (ADAMS Accession No. ML071140093). According to the report, "[s]everal key differences in the two approaches persist, and resolution of these differences should greatly affect the perceived risk." *Id.* at 27.

containment failure. Lyman Report at 3. *See also* tr. at 629 and tr. at 626-27 (statement by Mr. O'Neill that Riverkeeper "looked at the same thing using a different source term"). Riverkeeper did not evaluate a containment bypass scenario in Subpart 2 of Contention EC-2, although the costs of a containment bypass accident are addressed in Subpart 1. *See* question by Judge McDade at page 622 of the oral argument transcript and response by Ms. Curran at p. 623.³

Riverkeeper also wishes to clarify that assumptions regarding plume dispersal do not affect the calculation of the source term. *See* question by Judge Lathrop, tr. at 625-26. The source term relates only to the radioactive inventory of the core, not to how it is subsequently dispersed. The analysis of radiation dispersal is a separate subject that is addressed in paragraph (b) of the basis of Subpart 2 of Contention EC-2. *See* Riverkeeper's Hearing Request at 61-63, Lyman Report at 4. The source term is used as an input into the MACCS2 code, which calculates the dispersal and deposition of radionuclides subsequent to their release from reactor containment, and also calculates the resulting radiation doses to the exposed population. This information is then used to estimate the costs of a severe accident for the purpose of conducting a SAMA analysis.

³ In a containment bypass accident, the containment does not fail, but rather radiation is released through pathways other than a breached containment. *See* Dr. Thompson's expert report, "Risk-Related Impacts from Continued Operation of the Indian Point Nuclear Power Plants" at 14 (November 28, 2007) (Attachment 2 to Declaration of Dr. Gordon R. Thompson in Support of Riverkeeper's Contention EC-2).

Respectfully submitted,

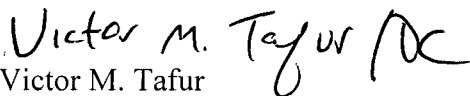


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CERTIFICATE OF SERVICE

I certify that on April 7, 2008, copies of the foregoing Riverkeeper, Inc.'s Response to Atomic Safety and Licensing Board Questions Regarding Contention EC-2 were served on the following by e-mail and first-class mail:

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