PMBeICOL PEmails

From: Ray, Phillip M [pmray@tva.gov]
Sent: Monday, November 24, 2008 4:27 PM
To: Joseph Sebrosky
Cc: Sterdis, Andrea Lynn
Subject: RAI Response
Attachments: RAI-LTR-132 Final.pdf

Joe,

Attached is a courtesy copy of our response to RAI Letter 132. The official submittal to the Document Control Desk has been shipped via Federal Express.

If you have any questions, please call me.

Phillip M. Ray

Nuclear Generation Development & Construction
Tennessee Valley Authority
423-751-7030

Hearing Identifier: Bellefonte_COL_Public_EX
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Subject: RAI Response
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From: Ray, Phillip M

Created By: pmray@tva.gov

Recipients:
"Sterdis, Andrea Lynn" <alsterdis@tva.gov>
Tracking Status: None
"Joseph Sebrosky" <Joseph.Sebrosky@nrc.gov>
Tracking Status: None

Post Office: TVACOCXVS1.main.tva.gov

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Tennessee Valley Authority, 1101 Market Street, LP 5A, Chattanooga, Tennessee 37402-2801

November 24, 2008

10 CFR 52.79

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

In the Matter of) Docket No. 52-014 and 52-015
Tennessee Valley Authority)

BELLEFONTE COMBINED LICENSE APPLICATION – RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION – EVALUATION OF POTENTIAL HAZARDS

Reference: Letter from Joseph Sebrosky (NRC) to Andrea L. Sterdis (TVA), Request for Additional Information Letter No. 132 Related to SRP Section 02.02.03 for the Bellefonte Units 3 and 4 Combined License Application, dated October 23, 2008

This letter provides the Tennessee Valley Authority's (TVA) response to the Nuclear Regulatory Commission's (NRC) request for additional information (RAI) number 02.02.03-09 included in the reference letter.

A response to RAI number 02.02.03-09 in the subject letter is addressed in the enclosure which does not identify any associated changes to be made in a future revision of the BLN application.

If you should have any questions, please contact Phillip Ray at 1101 Market Street, LP5A, Chattanooga, Tennessee 37402-2801, by telephone at (423) 751-7030, or via email at pmray@tva.gov.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on this 24th day of Nov, 2008.

Jack A. Bailey
Vice President, Nuclear Generation Development

Enclosure
cc: See Page 2

cc: (w/ Enclosures)
J. P. Berger, EDF
J. M. Sebrosky, NRC/HQ
E. Cummins, Westinghouse
S. P. Frantz, Morgan Lewis
M. W. Gettler, FP&L
R. Grumbir, NuStart
P. S. Hastings, NuStart
P. Hinnenkamp, Entergy
M. C. Kray, NuStart
D. Lindgren, Westinghouse
G. D. Miller, PG&N
M. C. Nolan, Duke Energy
N. T. Simms, Duke Energy
K. N. Slays, NuStart
G. A. Zinke, NuStart

cc: (w/o Enclosure)
B. C. Anderson, NRC/HQ
M. M. Comar, NRC/HQ
B. Hughes/NRC/HQ
R. G. Joshi, NRC/HQ
R. H. Kitchen, PGN
M. C. Kray, NuStart
A. M. Monroe, SCE&G
C. R. Pierce, SNC
R. Reister, DOE/PM
L. Reyes, NRC/RII
T. Simms, NRC/HQ

Enclosure
TVA letter dated November 24, 2008
RAI Response

Response to NRC Request for Additional Information letter No. 132 dated October 23, 2008
(5 pages, including this list)

Subject: Evaluation of Potential Hazards in the Final Safety Analysis Report

RAI Number	Date of TVA Response
02.02.03-08	To be submitted by January 15, 2009
02.02.03-09	This letter – see following pages

Associated Additional Attachments / Enclosures	Pages Included
None	

NRC Letter Dated: October 23, 2008

NRC Review of Final Safety Analysis Report

NRC RAI NUMBER: 02.02.03-09

RG 1.206 provides guidance regarding the information that is needed to ensure potential hazards in the site vicinity are identified and evaluated to meet the siting criteria in 10 CFR 100.20 and 10 CFR 100.21. The NRC staff's confirmatory analysis of chemicals for potential flammable vapor cloud (delayed ignition) resulted in only styrene concentration exceeding Lower Explosive Limit (LEL) concentration at BLN site, which differs from the applicant's analysis. Please clarify the analysis performed for styrene by including ALOHA inputs used for scenarios considering rupture sizes addressed and entire contents released instantaneously.

BLN RAI ID: 2225

BLN RESPONSE:

The following assumptions are used to develop an ALOHA model for a postulated leak from a barge located on the Tennessee River:

Weather conditions:

- Wind speed 1.55 knots from the direction of the accident measured at 3 meters (Note: Wind direction is unimportant since the calculations will only consider directions directly downwind from the release for sake of conservatism.)
- Ground roughness is assumed to be open country
- Cloud cover 10%
- Air temperature 90 °F (32 °C)
- Stability Class D
- Relative Humidity 50% (Humidity has a minimal effect on the calculation, because increasing or decreasing this value to its maximum or minimum will have negligible effects.)
- No inversion height (Inversion height is an atmospheric condition in which an unstable layer of air near the ground lies beneath a very stable layer of air above. This inversion can trap light gases closer to the ground and cause higher concentrations; however, all the hazards modeled use a heavy gas model, where all of the gases stay close to the ground and cause the inversion height to be irrelevant.)

The cloud cover air temperature and relative humidity were set at their particular levels in order to create a high stability class, which minimized atmospheric dispersion. The lowest wind speed allowed by ALOHA is 1.55 knots. At very low wind speeds (below 1.55 knots), the direction of the vapor cloud is unpredictable, causing the ALOHA program to become unreliable. At very high wind speeds, the vapor cloud disperses very quickly into the atmosphere and becomes inconsequential to the surroundings. Therefore, a wind speed of 1.55 knots was selected to analyze a worst-case scenario. Having a ground roughness comparable to that of open country is a level of conservatism that will allow the vapor cloud to travel a greater distance without being slowed down or dispersed by any ground interferences, such as hills, mountains, or buildings. The assumed temperature for this model bounds the mean temperature for the site and for Huntsville, Alabama (81 °F or 27 °C), the "location" used by ALOHA (see discussion of location, below). The selection of a high ambient temperature is conservative relative to vaporizing the released chemicals. The combination of a high stability class, which would be expected during nighttime hours, with a high ambient temperature, which would be expected during daytime hours, is an additional

level of conservatism. Sensitivity models were performed in ALOHA to justify that these conditions are conservative.

The release location was assumed to be the nearest point from the accident site to BLN, which is approximately 0.65 miles north-northwest of the release point.

For all cases, the leakage source was assumed to be a leak in a horizontal cylinder with a diameter of 38 feet and a length of 100 feet. Iowa Department of Transportation (Reference 1) states that a large barge volume is about 453,600 gallons. The dimensions of the barge assumed for the ALOHA model is 850,000 gallons, greater than the volume stated in Iowa Department of Transportation, which is considered as a level of conservatism. This volume is much greater than that which corresponds to the maximum barge capacity of 1,811 tons reported by the United States Army Corp of Engineers (USACE) for barge traffic past the BLN site. The barge geometry is an arbitrary assumption that has no impact on the analysis since the release rate is based on the size of the rupture opening and the mass of chemical being transported. The rupture opening was assumed to be a rectangular hole with a length of 5 meters and a width of 1 meter. A second case was assumed to have an opening area of 1 m^2 (1 m x 1 m). The opening was assumed to be on the tank bottom, although there is no reasonable mechanism for a failure of this type at this location on the river. Having the rupture at the bottom is a conservative assumption because it allowed for the greatest amount of spillage to occur and without limiting the amount of chemicals released by the position of the rupture.

The chemicals were assumed to be at ambient temperature (90 °F/32 °C). The release was assumed to have occurred over water, and the assumed water temperature, based on Tennessee River survey data taken near the site, was 80 °F (27 °C). This is conservative since the large pool spread and the infinite water heat source resulted in a higher evaporation rate.

The hazards considered are flammability and damaging overpressure at the accident location directly downwind of the release, which represents the Bellefonte Nuclear Plant location.

ALOHA uses two congestion levels: congested and uncongested. ALOHA's blast (overpressure) estimates are based on experiments that used a volume blockage ratio (volume occupied by obstacles within the cloud divided by cloud volume) of less than 1.5% for an uncongested area and greater than 1.5% for a congested area. The degree of confinement has a direct effect on the estimated flame speed and resulting overpressure. In general, low confinement means that the gases produced in an explosion are free to expand, while high confinement means they are constrained, as inside a pipe. For the BLN site, the existence of water bodies and open land between the assumed accident location and the site is representative of an uncongested area.

In order to determine which commodities would be modeled in ALOHA, the properties of each commodity was investigated, paying closest attention to the flash point of each of the chemicals.

The lower the flash point of a chemical, the greater the possibility it is to become a hazardous vapor cloud likely to ignite or combust. For this calculation, any chemical with a flash point greater than 100 °F (38 °C) was eliminated from review. The National Fire Protection Association Hazard Identification System (NFPA 704M) cites this temperature as the transition point between hazard ratings two and three. Therefore, only hazards classified as three or four were considered. Based in this criterion, the only chemical that represents a flammability or explosion concern for a barge release is styrene. Alcohols have also been identified as a commodity transported via the Tennessee River that may pose a threat to the site; however, alcohols are highly soluble in water and thus are unable to evaporate sufficiently to form a local vapor cloud explosion before they are transported away by dissolution into the river.

In order to run a model in ALOHA, a site "Location" must be entered, designated by a town and a state contained in ALOHA's data bank. This information is used to determine longitude and latitude, which in turn is used to find the angle of the sun for certain aspects of the model. BLN is located in Jackson

County, Alabama, seven miles east of Scottsboro, Alabama. The closest recognizable town in ALOHA is Huntsville, Alabama, which is about 35 miles west of the site. Another input for ALOHA is the date and time for the accident. By default, ALOHA assumes that the accident occurs on the date and time associated on the computer's internal clock; however, this can be manually changed to any date and time that the user specifies. For this analysis, mid June was chosen as the date because it represents a summer month ensuring a high solar incident angle and warm weather conditions. Noon or 12:00 PM was selected as the time of day, because it represents a period of time when the sun is the strongest, causing the most evaporation.

The conservative models with a 5 m^2 hole and a 1 m^2 hole were performed and determined not to pose a threat in terms of overpressure, as shown in Table 1. However, since the barge holds such a large volume of styrene, not all of the chemical leaked out during the one hour ALOHA allows for release. The results remain conservative because of the conservative hole size, the location of the hole, and the other conservative assumptions discussed above. In order to examine this result further, a sensitivity study was performed whereby the entire contents of the barge were injected into the atmosphere via a direct source. This direct source introduces styrene into the atmosphere at a rate of 106,000 lb/sec, for one minute, bringing the total amount released to 6,341,344 pounds, representing the maximum capacity of an assumed barge. This source assumes that the chemical will immediately turn into a vapor and will not form a pool. This study showed that, even with these extreme assumptions, an overpressure of 1.0 psi is not obtained at the site, although the concentration levels do reach the lower explosive limits of styrene. The response to NRC Letter 36 RAI number 02.02.03-05 stated that an instantaneous release was used as a most conservative case to bound other releases; however, it is only used as a means to demonstrate that an overpressure greater than 1.0 psi will not be reached at the site. The case as modeled with the tank with the large rupture size is more realistic yet still conservative.

Table 1: Results of ALOHA Model Runs for a Barge Accident

Leakage from Assumed Large Hole (5 m^2) from a Barge						
Chemical	Barge Capacity (tons)	LEL (ppm)	Pool Diameter	Flammable Area of the Vapor Cloud	Maximum Concentration During First Hour at Site (ppm)	Overpressure at Site (psig)
Styrene	3,170	11,000	1,303 yds	1,292 yds	5,670	0.309
Leakage from Assumed Small Hole (1 m^2) from a Barge						
Chemical	Barge Capacity (tons)	LEL (ppm)	Pool Diameter	Flammable Area of the Vapor Cloud	Maximum Concentration During First Hour at Site (ppm)	Overpressure at Site (psig)
Styrene	3,170	11,000	1,111 yds	1,013 yds	763	0.155

This response is PLANT-SPECIFIC.

Reference:

Iowa Department of Transportation, Cargo Comparison, www.ingrambarge.com

ASSOCIATED BLN COL APPLICATION REVISIONS:

None

ASSOCIATED ATTACHMENTS/ENCLOSURES:

None