Progress Energy

Serial: NPD-NRC-2010-051
June 23, 2010

10CFR52.79

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555-0001

LEVY NUCLEAR PLANT, UNITS 1 AND 2
DOCKET NOS. 52-029 AND 52-030
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION LETTER NO. 092 RELATED TO ACCIDENTAL RELEASES OF RADIOACTIVE LIQUID EFLUENTS IN GROUND AND SURFACE WATERS

Reference: Letter from Brian C. Anderson (NRC) to John Elnitsky (PEF), dated May 7, 2010, "Request for Additional Information Letter No. 092 Related to SRP Section 2.4.13 for the Levy County Nuclear Plant, Units 1 and 2 Combined License Application"

Ladies and Gentlemen:

Progress Energy Florida, Inc. (PEF) hereby submits our response to the Nuclear Regulatory Commission's (NRC) request for additional information provided in the referenced letter.

A response to the NRC request is addressed in the enclosure. The enclosure also identifies changes that will be made in a future revision of the Levy Nuclear Plant Units 1 and 2 application.

If you have any further questions, or need additional information, please contact Bob Kitchen at (919) 546-6992, or me at (727) 820-4481.

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

Executed on June 23, 2010.

Sincerely,

John Elnitsky
Vice President
New Generation Programs & Projects

Enclosure

cc : U.S. NRC Region II, Regional Administrator
Mr. Brian C. Anderson, U.S. NRC Project Manager

Progress Energy Florida, Inc.
P.O. Box 14042
St. Petersburg, FL 33733

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NRO

Levy Nuclear Plant Units 1 and 2
Response to NRC Request for Additional Information Letter No. 092 Related to SRP Section 2.4.13 for the Combined License Application, dated May 7, 2010

NRC RAI #	Progress Energy RAI #	Progress Energy Response
02.04.13-12	L-0812	Response enclosed – see following pages
02.04.13-13	L-0813	Response enclosed – see following pages

NRC Letter No.: LNP-RAI-LTR-092

NRC Letter Date: May 7, 2010

NRC Review of Final Safety Analysis Report

NRC RAI #: 02.04.13-12

Text of NRC RAI:

FSAR section 2.4.12.1.2 states that "Based on limited downhole geophysical testing and monitoring of drilling fluid losses at the LNP site, the most productive interval of the Upper Floridan aquifer appears to be at depths of approximately 30 to 60 m (100 to 300 ft.) bgs." 60 m would be equivalent to about 200ft. Clarify this apparent discrepancy regarding the depth of the most productive interval of the Upper Floridan aquifer.

PGN RAI ID #: L-0812

PGN Response to NRC RAI:

The following statement in LNP FSAR Subsection 2.4.12.1.2 includes a typographical error:

"Based on limited downhole geophysical testing and monitoring of drilling fluid losses at the LNP site, the most productive interval of the Upper Floridan aquifer appears to be at depths of approximately 30 to 60 m (100 to 300 ft.) bgs."

The depth of "60" m is incorrect; the correct depth is "91" m. The remainder of the LNP FSAR was reviewed for repetitions of this typographical error and none were identified.

In addition, LNP ER Subsection 2.3.1.5.3 includes this typographical error.

A similar discrepancy exists in the revised text for FSAR subsection 2.4.13.2.4 provided in NPD-NRC-2009-158, p. 13.

Associated LNP COL Application Revisions:

The following statement in LNP FSAR Subsection 2.4.12.1.2 (second sentence of the 11th paragraph) will be changed from:

"Based on limited downhole geophysical testing and monitoring of drilling fluid losses at the LNP site, the most productive interval of the Upper Floridan aquifer appears to be at depths of approximately 30 to 60 m (100 to 300 ft.) bgs."

To read:

"Based on limited downhole geophysical testing and monitoring of drilling fluid losses at the LNP site, the most productive interval of the Upper Floridan aquifer appears to be at depths of approximately 30 to 91 m (100 to 300 ft.) bgs."

LNP ER Subsection 2.3.1.5.3 contains the same statement (second sentence of the 11th paragraph) and will be revised in the same manner.

Revise 2nd sentence in FSAR subsection 2.4.13.2.4, 4th paragraph from:

> Most wells are screened across only the more productive, initial 30 to 60 m (100 to 300 ft) of the aquifer with well depths typically being no more than 76 m (250 ft.).

To read:

> Most wells are screened across only the more productive, initial 30 to 91 m (100 to 300 ft) of the aquifer with well depths typically being no more than 76 m (250 ft.).

Attachments/Enclosures:

None.

NRC Letter No.: LNP-RAI-LTR-092

NRC Letter Date: May 7, 2010

NRC Review of Final Safety Analysis Report

NRC RAI #: 02.04.13-13

Text of NRC RAI:

Provide a discussion of the degree of conservatism in the transport analysis included in FSAR Section 2.4.13, including discussion of the following.

1. The hydraulic conductivity value applied in the transport analysis as addressed in RAI 02.04.12-22.
2. The effective porosity values applied in the transport analysis as addressed in RAI 02.04.12-23.
3. The assumption that the released contamination is evenly distributed over an aquifer thickness of 250 ft. Clarify the value of aquifer thickness used in the calculations by including it in FSAR Table 2.4.13-203.
4. The groundwater head gradient applied in the transport analysis, considering that a more conservative value for the groundwater gradient than that used in the transport analysis is indicated by the baseline 2007 potentiometric surface map for the Upper Floridan aquifer presented in the recalibrated version of the DWRM2 groundwater flow model (|TMEM-123|). This potentiometric map is based on a more extensive well network that includes LNP site wells.

PGN RAI ID #: L-0813

PGN Response to NRC RAI:

Conservatisms in the transport model have been qualitatively described in the response to LNP FSAR RAI 02.04.13-2 on the conceptual model process and development. The more significant conservatisms incorporated into the transport analysis are identified below:

- The well receptor is assumed to be located on the site boundary 1.2 mi (2 km) away from the spill in the direction of groundwater flow. It would not be possible to have a private or public well closer than this distance to the spill.
- The nearest private and public wells in the direction of groundwater flow are 1.7 miles (2.7 km) and 3.1 miles (5 km) away, respectively. The effluent concentration limit (ECL) would decrease by a factor of five at the nearest actual private well compared to the ECL calculated at the assumed receptor well location in FSAR subsection 2.4.13's analysis.
- An immediate release to Upper Floridan aquifer is assumed. The likely scenario is an accidental release to the backfilled dewatering structure and surficial aquifer followed by eventual migration to the Upper Floridan aquifer. No credit is given for hold-up or migration in the surficial aquifer.

- Higher concentrations and ECLs are predicted when a direct release to the Upper Floridan aquifer is assumed. Release and migration through the surficial aquifer would result in lower concentrations at the well and Withlacoochee River receptors.
- Seepage velocities are maximized based on measured LNP hydraulic and site parameters.
- Dilution of the radionuclides is credited only in the upper half of the Upper Floridan aquifer's depth. This assumption increases the predicted concentrations at the receptor well by up to a factor of two.
- The total rate that radionuclides enter the river is calculated at the nearest river location; no credit is given for spatial dependence along the river or for the depth of nuclides in the aquifer.
- Spatial and temporal variability considerations in the modeling and parameter selection are identified in response to LNP FSAR RAI 02.04.13-2.

The impact and conservatism associated with hydraulic conductivity, effective porosity, aquifer thickness, and groundwater head gradients are discussed below.

Hydraulic Conductivity

The transport model uses the maximum hydraulic conductivity of 54 ft/d determined from slug tests in seven deep wells in the Upper Floridan aquifer (LNP FSAR Table 2.4.12-210). The conductivity is applicable to the 250 ft aquifer thickness over which the test data were analyzed. As discussed in the response to LNP FSAR RAI 02.04.12-22, the observed range of Upper Floridan aquifer transmissivities resulting from analysis of the slug test results is also consistent with the range of Upper Floridan aquifer transmissivities simulated by the revised TMR model (338884-TMEM-123).

Another estimate of hydraulic conductivity is discussed in the response to LNP FSAR RAI 02.04.12-10. This estimate is based on an analysis of the Upper Floridan aquifer using commercial software for multi-layer aquifer systems (MLU). The MLU model used drawdown data from two pumping tests in site wells. The aquifer's hydraulic conductivity is 130 f/d when estimated from the transmissivities determined in the MLU models (see LNP FSAR RAI 02.04.12-11, Table 1). This hydraulic conductivity is conservative but is not considered as representative of site conditions determined by the slug tests.

An alternative radionuclide transport analysis is included in this RAI response. The alternate analysis uses a hydraulic conductivity of 130 ft/d and demonstrates acceptable results are obtained at FSAR subsection 2.4.13's well receptor location.

Secondary Porosity

The effect of secondary porosity may be observable as a concentration peak which arrives earlier than the contaminant flow through the porous limestone. The porosity of fractured media is smaller than that for limestone, but under conditions of the same hydraulic head, the contaminants can move with greater velocity than the matrix component. The process is complex because contaminants can diffuse in and out of the matrix while the flow is held-up in the irregular flow path or confined in unconnected, dead-ended spaces within the fractures. Similarly, convective exchange can occur between flowing and immobile fluids.

The Advection-Diffusion (ADE) model overpredicts the contaminant concentration if the secondary porosity is assumed applicable for all flow. In addition, flow through fractures is expected to have field or scale effects. Flow very near to a fracture would be largely defined by

the presence of the fracture whereas the far field effect with many intervening fractures might be characterized by an equivalent porous medium. Similarly, greater dispersion occurs when fractures are present in the porous rock compared to the unfractured medium (Gelhar). This effect has been observed to be particularly significant in carbonates (Schulze-Makuch).

The transport analysis in FSAR subsection 2.4.13 used an effective porosity of 0.15, a value considered appropriate for wellhead protection and contaminant spread studies in West Central Florida (Hernando County). This effective porosity is one-half the average value of 0.29 for Avon Park formation limestone in WRIR 93-4171.

Several qualitative factors reduce the early arrival concentration associated with secondary porosity effects. Compensating mechanisms not explicitly credited in the model include advective dispersion, hold-up of contaminant flow in the fractures or diffusion of radionuclides and water into the matrix (through fracture walls). In addition the relatively high porosity of limestone would tend to promote storage of contaminated water within the matrix.

The alternate analysis in this RAI response makes use of an effective porosity of 0.05. This porosity is considered conservative; see response to LNP FSAR RAI 02.04.12-23. The alternate analysis demonstrates that concentrations would remain within regulatory limits without explicit credit for the above mechanisms.

Aquifer Thickness Depth

FSAR subsection 2.4.13's transport analysis uses an Upper Floridan aquifer thickness of 250 ft although the aquifer is expected to be at least 500 ft thick near the site. 250 ft (76 m) is used because it corresponds to the depth of public supply wells near the site; see response to LNP FSAR RAI 02.04.13-3. The thickness is conservative because the radionuclide concentrations will be about twice the concentration of a 500 ft aquifer if fully diluted across the aquifer thicknesses.

With a point release occurring at the top of an aquifer, the concentrations will be greater at the top near the release site because not enough time has occurred for the nuclides to be vertically dispersed across the aquifer. Eventually the radionuclide concentration will approach the fully diluted concentration when sufficient time elapses or the front of the plume has moved far from the location of the release.

Figure 1 shows the normalized vertical distribution for a conserving contaminant (neither decaying nor retarded radionuclide) as a function of distance from the release location. Values are shown at the upper surface (Z = 0 m) and lower boundary (Z = 76 m) of the aquifer. The curves are normalized to the fully mixed case which provides a perspective on the fraction of mixing achieved: full mixing occurs at unity. The vertical distributions at the upper and lower elevations are within 7% percent of fully mixed when the center of the plume is 2,000 m from the release. The plume is assumed to have a horizontal linear velocity of 0.08 m/day, the value used in the Upper Floridan well receptor analysis in FSAR subsection 2.4.13.

Normalized concentrations would be less than those shown at 2,000 m if the same 250 ft deep well were assumed to be in a 500 ft thick aquifer. Figure 1 shows the vertical distributions are initially the same as the 250 ft aquifer but decrease below these values with distance from the release site. Decreases are due to the spread of the contaminants into the region below 250 ft. At 3,000 m the concentrations at Z = 76 m elevation approaches full dilution which is one-half the concentration of the 250 ft thick aquifer. The same figure shows that the upper elevation at Z = 0 m is still not well mixed. Therefore, the use of a 250 ft thick aquifer is conservative with the well 2,000 m from the source. The concentrations are confirmed in the supporting calculations to ensure they are well mixed across the 250 ft depth.

Site Hydraulic Gradients

The transport analysis uses hydraulic gradients based on measurements from onsite monitoring wells. The onsite data are considered the most reliable for assessing transport between the reactor units and a receptor well located 2 km away on the site boundary.

The LNP site is relatively level, with very little variation in surface topology with no rivers or streams or other major drainage features. LNP FSAR Figures 2.4.1-203 and 2.4.1-204 show little change in elevation from north to south while the east to west variation is from elev. 55 ft to 40 ft with much of the site at elev. 42 ft. Because potentiometric levels tend to mimic surface elevations, the gradient is expected to be small across the site.

The TMR groundwater flow model in 338884-TMEM-123 is adapted from SWFWMD's district-wide MODFLOW model. The TMR model simulated regional aquifer hydrologic levels due to LNP withdraw of groundwater from the Upper Floridan aquifer. Particular effort was made to calibrate the model to reproduce annual average water levels in the onsite observation wells and in four USGS and two SWFWMD wells outside LNP's property. In addition, 20 synthetic wells were incorporated to simulate offsite water levels based on USGS 2007 potentiometric surface levels.

Four of the six wells were located more than 7 km northeast of the reactors in areas of higher water level than at the site; one well was 3.1 km to the north; one was 7.6 km to the southwest in a low lying area near Inglis. The synthetic wells (based on USGS contours which in themselves are models) were located outside of the site boundaries.

Figure 11 in 338884-TMEM-123 provides a potentiometric representation of the existing conditions in the Upper Floridan aquifer. The potentiometric data in FSAR Table 2.4.12-208 for deep observation wells averages 38.8 ft which is comparable to the average elevation predicted near the site observation wells in 338884-TMEM-123, Table 2 and Figure 11. However, Figure 11 also shows that the USGS information will result in a predicted water level contour of only 30 ft near the same location. There is general agreement between USGS and the 338884-TMEM-123 model contours except on site. The discrepancy indicates that the USGS contours do not replicate the actual site measured data.

The LNP site wells are considered the better sources of information for determining site gradients and flow to the receptor well. Monitoring well MW-12D is in the direction of groundwater flow in the Upper Floridan aquifer relative to the reactor plants (see FSAR Figure 2.4.12-216). Table 1 examines the gradients toward MW-12D. Table 1 was constructed from the data in LNP FSAR Tables 2.4.12-207 and 2.4.12-208. The highlighted gradients in the table are in the direction of flow toward MW-12D from the reactor locations; the remaining gradients are from other observation wells near the reactors toward MW-12D. The tabulation shows that the annual gradient in the Upper Floridan aquifer from site data is less than 7E-4 ft/ft, the value used in the transport model.

Surficial aquifer gradients toward MW-1S are also small. MW-1S is approximately 1.5 km southwest of both reactors and 0.6 km up-gradient of the transport analysis's receptor well. Surficial aquifer gradients between the reactors and MW-1S are also shown in Table 1. The small surficial gradients and general site topography provide some additional support that the Upper Floridan gradients are small.

The use of site ground water levels is an appropriate basis for establishing the gradient used in the groundwater transport analysis. The gradient is reliable because the data were obtained during the controlled LNP subsurface exploration program which included measurements nearer to the postulated spill and receptor locations than the offsite USGS wells.

Alternate Evaluation

An alternate evaluation is performed using a hydraulic conductivity of 130 ft/d which is derived from the MLU analysis of the Upper Floridan aquifer at LNP. Also, a lower bound effective porosity of 0.05 is used. All other parameters including the source term are the same as the analysis described in FSAR subsection 2.4.13.

The use of the alternate hydraulic conductivity and porosity increases the average linear velocity from 0.08 m/d to 0.56 m/d in the radionuclide transport analysis. The greater velocity reduces the transport time and radiodecay of nuclides compared to the FSAR analysis. The alternate evaluation is conservative since it does not credit removal mechanisms in fractures such as hold-up in void zones or exchange between moving and immobile fluids: transport is through the fractured limestone with an effective porosity of 0.05.

The assumption of increased linear velocity through the fractures increases the radionuclide concentrations at the well receptor. The tabulation below compares the calculated effluent concentration limits (ECLs) for the alternate and FSAR subsection 2.14.13 analyses. The ECLs demonstrate that tritium is the dominant contributor in both cases.

Parameter	FSAR Subsection 2.4.13.	Alternate Analysis
Hydraulic conductivity	54 ft/d	130 ft/d
Effective porosity	0.15	0.05
Linear velocity	0.08 m/d	0.56 m/d
ECL – all nuclides	0.7%	54%
Peak time - tritium	68 yr	9.8 yr
Peak conc. - tritium	6.4E-06 µCi/cc	5.2E-04 µCi/cc
ECL – tritium only	0.7%	52%

Figure 2 shows the time-dependent tritium concentrations in the alternate and FSAR subsection 2.4.13 analyses. The earlier arrival of the tritium compared to the FSAR analysis is characterized by a peaked distribution which is a feature of less radiodecay and dispersion along the transport path. Although more peaked, the maximum concentration is 52% of the limit tabulated in 10CFR20, Appendix B, Table 2.

The peaked distribution in Figure 2 for the alternate analysis is somewhat idealized because hold-up and increased dispersion in the fractures, if credited, will decrease the peak. These same mechanisms will also skew the distribution to the right after the peak, albeit at lower concentration. The important point is that the concentration will be less than maximum shown in Figure 2 for the alternate analysis.

The 10CFR20 limits are the annual average concentrations that could be continuously ingested over a year and meet the 50 mrem per annum dose limit of 10 CFR 20.1302. The annual average limit for tritium in drinking water is 1E-03 µCi/cc as given in 10CFR20, Appendix B, Table 2.

The tritium exposure in the FSAR analysis occurs over a period of years with the concentration near the maximum value as shown in Figure 2. The average annual concentration can be conveniently taken as the peak concentration for a one-year period when the arrival is broadly

distributed as in the case of the FSAR subsection 2.4.13 analysis. The exposure to tritium in the alternate analysis is over a much shorter period albeit at a higher concentration. When the exposure is averaged over a one year period centered on the peak value, the annual average concentration is 37% of the 10 CFR 20, Appendix B, Table 2 limit (i.e., average activity concentration of 0.37E-03 μCi/cc). This can be compared to about 52% for tritium when the comparison is made on the basis of peak concentration alone. Thus, it should be possible that more pronounced tritium peaks than those in the alternate analysis could be accommodated and meet acceptance criteria.

The alternate analysis reinforces the conservatism in the FSAR evaluation:

1. Use of the very conservative hydraulic conductivity and porosity give acceptable results compared to 10CFR20 acceptance criteria, and
2. Margin is available to demonstrate that early arrival times can meet annual average exposure concentrations prescribed in 10CFR20, Appendix B, Table 2.

References:

338884-TMEM-123, "Revised Groundwater Model Evaluation of Simulated Drawdown Water Impacts, LNP", Rev. 0.

Hernando County, "Groundwater Protection and Siting Ordinance", Ordnance No. 94-08, June 1994

Gelhar, L.W., et al, A Critical Review of Field Scale data on Dispersion in Aquifers, Water Resources Research, Vol 28, No. 7, July 1992.

Schulze-Makuch, D., Longitudinal Dispersivity and Implications for Scaling Behavior, Ground Water, Vol. 43, No. 3, May-June 2005.

USGS WRIR 93-4171, Hydrology and Results of Tracer Tests at the Old Tampa Well Field in Hillsborough County with Implications for Wellhead-Protection Strategies in West Central Florida, 1995.

LNG-0000-GLC-003, Rev. 3 (Available in LNP reading room)

LNP FSAR RAI 02.04.12-10

LNP FSAR RAI 02.04.12-11

LNP FSAR RAI 02.04.12-22

LNP FSAR RAI 02.04.12-23

LNP FSAR RAI 02.04.13-2

LNP FSAR RAI 02.04.13-3

RAI 02.04.13-13 Table 1
Gradients (ft/ft) in Direction from Reactors toward Receptor

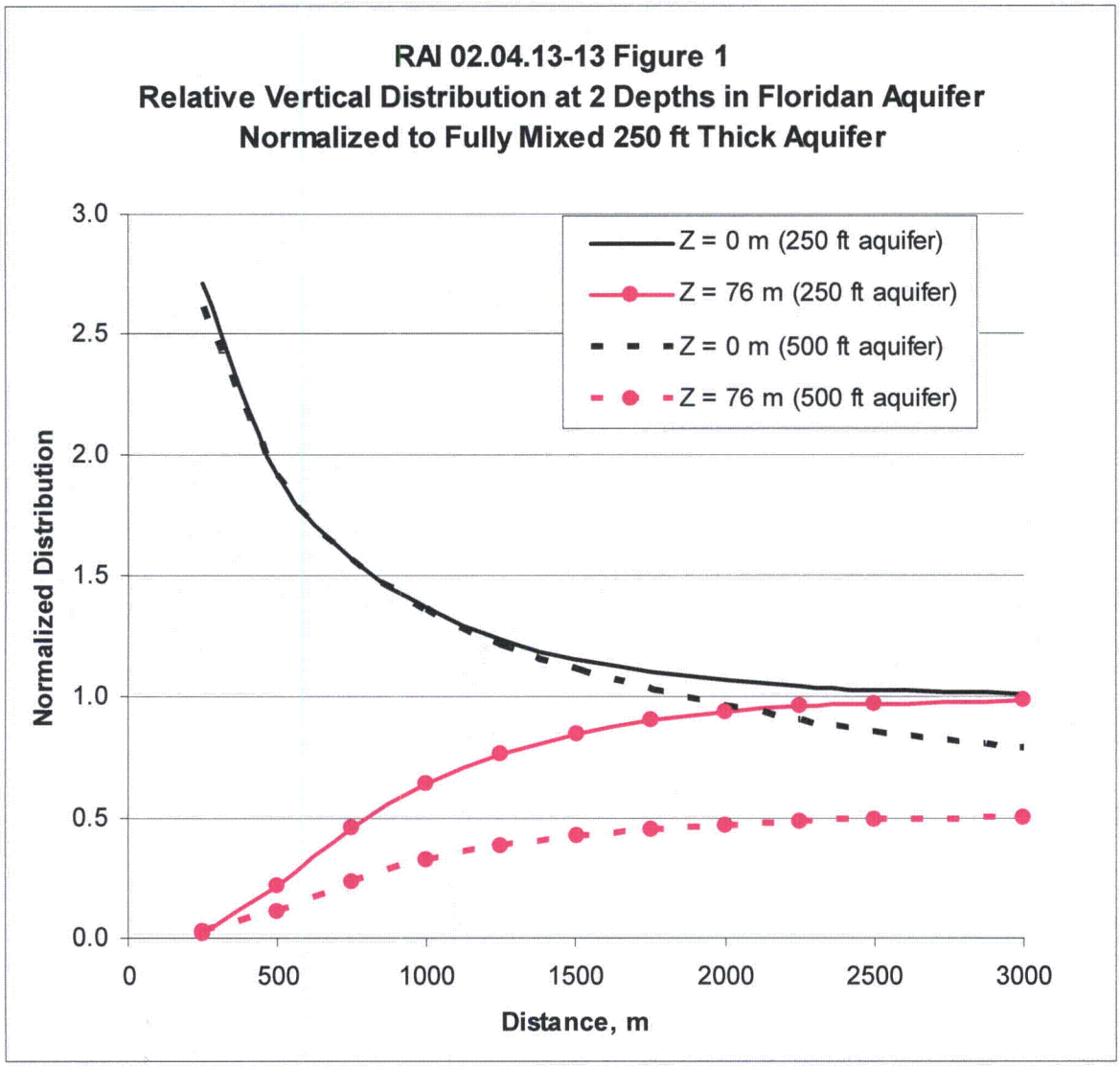
Toward MW-12D in Upper Floridan Aquifer

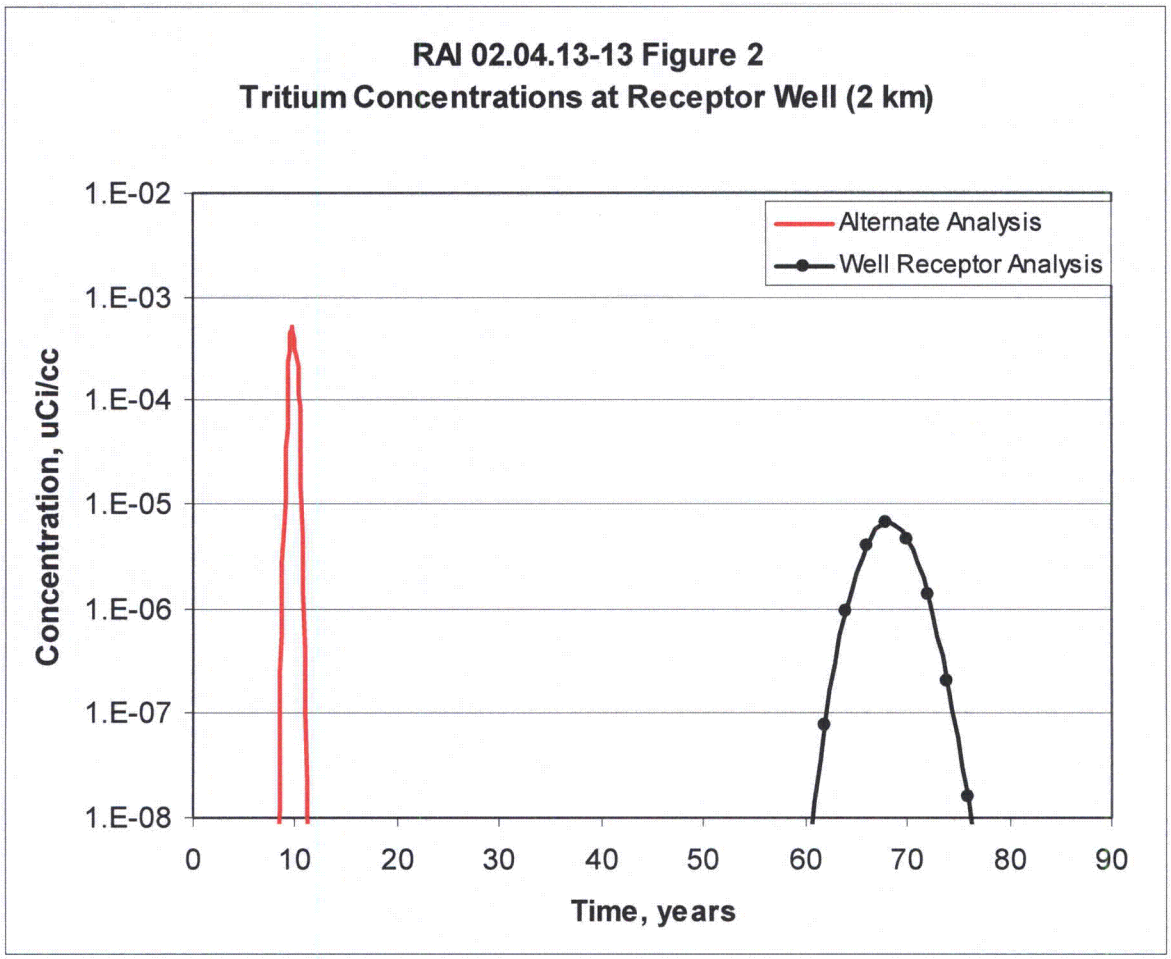
From	Distance, ft	March	June	Sept	Dec	Average
MW-16D	1.50E+03	-6.7E-04	-7.3E-04	-6.5E-04	-7.3E-04	-7.0E-04
MW-14D	1.59E+03	-6.9E-04	-6.8E-04	-5.6E-04	-6.1E-04	-6.4E-04
MW-6D	1.89E+03	-3.5E-04	-4.0E-04	-3.6E-04	-3.6E-04	-3.7E-04
MW-8D	2.73E+03	-5.4E-04	-5.3E-04	-5.4E-04	-5.1E-04	-5.3E-04
MW-10D	1.84E+03	-5.4E-04	-6.1E-04	-5.3E-04	-6.2E-04	-5.7E-04

Toward MW-1S in Surficial Aquifer

From	Distance, ft	March	June	Sept	Dec	Average
MW-15S	4.71E+03	-3.3E-04	-3.9E-04	-3.8E-04	-3.3E-04	-3.6E-04
MW-13S	5.29E+03	-2.7E-04	-3.3E-04	-2.7E-04	-2.6E-04	-2.9E-04
MW-3S	1.22E+04	-4.4E-04	-3.7E-04	-4.0E-04	-3.6E-04	-3.9E-04
MW-2S	1.02E+04	-1.4E-04	-5.7E-05	-6.5E-05	9.8E-06	-6.3E-05
MW-4S	6.56E+03	-7.0E-04	-6.7E-04	-7.0E-04	-7.0E-04	-6.9E-04
MW-5S	5.56E+03	-2.2E-04	-3.1E-04	-2.6E-04	-2.3E-04	-2.6E-04
MW-9S	4.57E+03	-2.7E-04	-4.0E-04	-3.8E-04	-3.8E-04	-3.6E-04
MW-7S	6.40E+03	-3.2E-04	-3.0E-04	-2.8E-04	-2.6E-04	-2.9E-04
MW-11S	3.76E+03	-2.1E-04	-5.0E-04	-3.8E-04	-3.6E-04	-3.6E-04

Notes:
Highlighted rows are for observation wells near reactor locations.
Negative gradient means flow is toward MW-12D or MW-1S
Calculated from well coordinates and observed water levels in FSAR Tables 2.4.12-207 and 2.4.12-208.


RAI 02.04.13-13 Figure 1
Relative Vertical Distribution at 2 Depths in Floridan Aquifer
Normalized to Fully Mixed 250 ft Thick Aquifer
Z = 0 m (250 ft aquifer)
Z = 76 m (250 ft aquifer)
Z = 0 m (500 ft aquifer)
Z = 76 m (500 ft aquifer)
Normalized Distribution
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
500
1000
1500
2000
2500
3000
Distance, m


RAI 02.04.13-13 Figure 2
Tritium Concentrations at Receptor Well (2 km)
Alternate Analysis
Well Receptor Analysis
Concentration, uCi/cc
1.E-02
1.E-03
1.E-04
1.E-05
1.E-06
1.E-07
1.E-08
0
10
20
30
40
50
60
70
80
90
Time, years

Associated LNP COL Application Revisions:

1. Add entry to LNP FSAR Table 2.4.13-203:

Parameter	Surficial Aquifer	Upper Floridan Aquifer
Aquifer depth, h (j)	NA (g)	76 m (g)

2. Add note (j) to bottom of LNP FSAR Table 2.4.13-203:

   j) The analytical aquifer depth is conservatively taken as the well depth from FSAR Subsection 2.4.13.2.4.

Attachments/Enclosures:

None.