

The Light company

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October 31, 1985

ST-HL-AE-1497

File No.: G9.17

Mr. George W. Knighton, Chief
Licensing Branch No. 3
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, DC 20555

South Texas Project
Units 1 and 2
Docket Nos. STN 50-498, STN 50-499
Response to DSER/FSAR Item
Concerning Tank Rupture/Groundwater Releases

Dear Mr. Knighton:

The attachment enclosed provides STP's response to Draft Safety Evaluation Report (DSER) or Final Safety Analysis Report (FSAR) items. This information is being provided in response to a verbal request from a NRC reviewer.

The item number listed below correspond to those assigned on STP's internal list of items for completion which includes open and confirmatory DSER items, STP FSAR open items and open NRC questions. This list was given to your Mr. N. Prasad Kadambi on October 8, 1985 by our Mr. M. E. Powell.

The attachment includes mark-ups of FSAR pages which will be incorporated in a future FSAR amendment.

The items which are attached to this letter are:

<u>Attachment</u>	<u>Item No.*</u>	<u>Subject</u>
1	D 0.5-6	Tank Rupture/Groundwater Release

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* Legend

D - DSER Open Item
F - FSAR Open Item

C - DSER Confirmatory Item
Q - FSAR Question Response Item

L1/DSER/a8

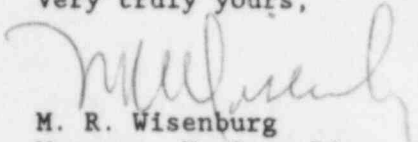
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Houston Lighting & Power Company

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If you should have any questions concerning this matter, please contact Mr. Powell at (713) 993-1328.

Very truly yours,



M. R. Wisenburg
Manager, Nuclear Licensing

MEP/bl

Attachments: See above

L1/DSER/a8

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Revised 9/25/85

2.4.13.3.2 Shallow Aquifer Zone: Groundwater in the shallow aquifer flows southeasterly from the plant site toward the Colorado River and Matagorda Bay, as indicated on Figures 2.4.13-17 and 2.4.13-19 for the lower shallow aquifer and the upper shallow aquifer, respectively. Water quality is marginal to poor in both zones of the shallow aquifer. Shallow wells are rarely employed in the site region except for occasional stock watering. Only one shallow, low-production well (well no. 42 - Table 2.4.13-2) is reported downgradient near the site. This well is screened between depths of 104 and 107 ft. Considering the quality and quantity limitations, there is a low probability that any new use of water from the shallow aquifer would occur in the general area downgradient of the site.

Available evidence indicates that the shallow aquifer is confined beneath the site and downgradient, to the southeast and east, to the discharge points noted above. For purposes of this evaluation, it is assumed that both portions of the shallow aquifer discharge to the Colorado River during periods of low flow in the Colorado River.

Two types of potential radioactive releases from the plant and the associated MCR to the groundwater have been identified:

1. Accidental releases occurring within the MEAB
2. Operating releases to the Circulating Water System

The potential for accidental releases to reach both the upper and lower shallow aquifer zones is analyzed as described in Section 2.4.13.3.2.1. In Section 2.4.13.3.2.2, an evaluation of releases to the upper shallow aquifer during normal operating conditions is presented.

2.4.13.3.2.1 Accident Conditions - The most critical accidental spills would occur within the MEAB. They would be collected on the foundation mat, which is approximately 6 ft in thickness and founded at El. 4.0 ft MSL. Normally, this mat will provide a barrier between the MEAB and groundwater. However for this analysis it is assumed that ~~64,000 gallons or 80 percent of the volume of the Recycle Holdup Tank (RHT) is released into the shallow aquifer~~ (see Section 15.7.3.2). Figure 2.5.4-54 illustrates in cross-section excavations in the plant area. In that figure, the upper shallow aquifer is denoted as layers B and C and the lower shallow aquifer as layer E.

Although the upper and lower shallow aquifers appear to be separated hydraulically (see the piezometric levels shown on Figures 2.5.4-67, 2.5.4-68, and 2.5.4-69), a potential hydraulic connection requires that accidental releases into both upper and lower shallow aquifer zones be considered. The Containment and Fuel-Handling Buildings are constructed in an excavation which cuts the impermeable layer between the lower and upper shallow aquifers in the plant area.

a waste processing system tank in the MEAB fails and the contents are released into the shallow aquifer

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Figures 2.5.4-67 through 2.5.4-69 are hydrographs of piezometric levels in the upper and lower portions of the shallow aquifer in the vicinity of the excavation. During the period from September 1973 until construction dewatering began in November 1975, the levels ranged as follows:

- Upper shallow aquifer - maximum, +26.5 ft MSL
- minimum, +21.5 ft MSL
- Lower shallow aquifer - maximum, +18.5 ft MSL
- minimum, + 9.5 ft MSL

The Colorado River minimum water elevation near the site is +2.0 ft MSL (see Figure 2.4.13-18).

Accidental releases from the MEAB into the upper and lower shallow aquifers have been considered. The following cases are evaluated:

1. Releases into the lower shallow aquifer under post-construction piezometric conditions - Calculations of radionuclide concentrations are performed for the nearest down gradient point at the Colorado River. Flow to well number 42 has also been considered; however the flowpath to this well is much longer than that to the nearest point on the Colorado River. Consequently, discharge concentrations at the well would be even lower than at the river. Thus, migration to the nearest point of the Colorado River is the controlling case for the lower shallow aquifer.
2. Release into the upper shallow aquifer under post-construction piezometric gradients. The potential for migration of radionuclides from the MEAB to the Colorado River to the Main Cooling Reservoir relief wells has been considered and is discussed in Section 2.4.13.3.2.1.2.

2.4.13.3.2.1.1 Migration Through the Lower Shallow Aquifer - The flow to the nearest point on the Colorado River is the controlling case for the lower shallow aquifer. The following presents the method of analysis, input data, and a discussion of the results and calculated radionuclide concentrations at points of discharge.

Analysis Considering Dispersion. The tank spills were first
2.4.13.3.2.1.1.1. ~~Analytical Method~~ The analytical model ~~used to~~ for one-dimensional flow of a finite initial slug volume, with three dimensional dispersion (Reference 2.4.13-15). It is instantaneously released as a finite volume to the lower shallow aquifer and travels along the shortest flow path to the Colorado River. It is assumed that the mass of each radionuclide in the spill is dispersed throughout the spill volume.

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analyzed using an

INSERT A (on page 2.4-58) no paragraph:

No retardation of the dissolved radionuclides by adsorption (ion exchange with the solid matrix) is considered; all isotopes are assumed to travel at ground water velocity. Therefore, the first approach is to examine the impact of decay and dispersion at the velocity of ground water. As will be seen, concentrations of all radionuclides, except Cs-137, that might be contained in a waste tank would be reduced to below MPC (maximum permissible concentration) values listed in Appendix B, Table II of 10 CFR 20. The Cs-137 concentration is reduced substantially below MPC when the effect of adsorption is considered. A second analytical approach demonstrating the effect of adsorption is described in Section 2.4.13.3.2.1.1.4.

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adapted from

In the case of a slug of solution containing radionuclides which is introduced instantaneously into the groundwater system in an infinitesimally small volume, the following equation is applicable (Ref. 2.4.13-8):

$$\frac{c}{m} = \frac{1/n}{(4\pi D t)^{3/2}} \exp - \left[\frac{(x - \bar{u}_x t)^2}{4D t} + \frac{(y - \bar{u}_y t)^2}{4D t} + \frac{(z - \bar{u}_z t)^2}{4D t} \right] + \lambda t \quad (\text{Equation 2.4.13-1})$$

where:

- c = quantity of radionuclide cation per volume of interstitial solution, at any time, t, and at any point x, y, z,
- m = total quantity of radionuclide introduced with the slug (microcuries);
- n = total porosity of the aquifer (dimensionless);
- t = time since introduction of the slug (time);
- x = distance from point of injection in direction of groundwater flow (length);
- y = distance laterally, perpendicular to groundwater flow (length);
- z = distance vertically, from center of slug (length);
- λ = decay coefficient = $0.693/T_{1/2}$ where $T_{1/2}$ is the radionuclide half-life (time);
- \bar{D} = ~~average~~ ^{average} dispersion coefficient (length²/time)

~~where:~~

~~D = the average dispersion coefficient~~
 $\bar{D} = (D_x D_y D_z)^{1/3}$, and where:
 D_x, D_y, D_z = the dispersion coefficients valid for the x, y, and z directions, respectively, and,
 $\bar{u}_x, \bar{u}_y, \bar{u}_z$ = the average velocities of the radionuclide in the x, y, and z directions, respectively (length/time).

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For example, $\frac{u'}{x} = \frac{u}{x} \frac{R_f}{f}$

where:

u = average velocity of water on the pores (length/time)

R_f = the reduction factor due to cation exchange (Ref. 2.4.13-9)

delete:

and considering flow in the x direction only ($U_y = U_z = 0$)

By integrating Equation 2.4.13-1 over the dimensions x_0 , y_0 , and z_0 of a slug of finite prismatic volume, we obtain Equation 2.4.13-2, the analytical model used in this analysis:

$$c = \frac{m}{8n x_0 y_0 z_0} \left[\operatorname{erf} \left(\frac{x + \frac{x_0}{2} - U_x t}{\sqrt{4D_x t}} \right) - \operatorname{erf} \left(\frac{x - \frac{x_0}{2} - U_x t}{\sqrt{4D_x t}} \right) \right]$$

$$\cdot \left[\operatorname{erf} \left(\frac{y + \frac{y_0}{2}}{\sqrt{4D_y t}} \right) - \operatorname{erf} \left(\frac{y - \frac{y_0}{2}}{\sqrt{4D_y t}} \right) \right]$$

$$\cdot \left[\operatorname{erf} \left(\frac{z + \frac{z_0}{2}}{\sqrt{4D_z t}} \right) - \operatorname{erf} \left(\frac{z - \frac{z_0}{2}}{\sqrt{4D_z t}} \right) \right]$$

$$\cdot \left[\exp \left(\frac{q}{1 - \lambda t} \right) \right]$$

(Eq. 2.4.13-2.)

NOTE:

GENERAL
Corrections:

1. $U_x \leftarrow$ cap U & subscript x
2. no primes

where:

$x_0, y_0, z_0 =$

the dimensions of the slug in the soil at time 0, along the respective axes, and D_x, D_y, D_z are as defined for Equation 2.4.13-1. ~~Equation 2.4.13-2 was derived under the assumption that $u = u_0$, $y = z$.~~

the remaining

Equation 2.4.13-2 was solved iteratively to determine the peak concentration at the Colorado River, and the arrival time of this peak.

INSERT B

~~2.4.13.2.1.1.2 Selection of Model Parameters~~ Activity of radionuclides

(a) ~~Total activities of the radionuclides in the Recycle Holdup Tank (assumed to be 80 percent full) are shown in Table 2.4.13-4B.~~

INSERT B (on page 2.4-60):

2.4.13.2.1.1.2 Selection of Model Parameters -

Values for the parameters in the model are provided by data collected during the site investigations. The source terms (isotope concentrations and volumes of tanks in the MEAB) are based on design of the waste processing system (Chapter 11).

Source of hypothetical spill and critical isotopes. The several tanks of the waste processing system can contain varying amounts and concentrations of radioisotopes. Inspection of the realistic activities reveals that the ECT (evaporator concentrates tank) and the RHT (recycle holdup tank) contain the highest concentrations of the critical radionuclides, considering volumes and half-lives of the isotopes. Although many isotopes present are at high concentrations, they have short half-lives in relation to the time of migration in ground water to the Colorado River. They would reduce to negligible concentrations by radioactive decay in a short time following the spill. Critical isotopes present in high concentrations and with long half-lives include H-3 (tritium), Cs-137, Sr-90, and I-129. They are high concentrations relative to the MPC (maximum permissible concentration) values listed in Appendix B, Table II of 10 CFR 20. The highest concentrations of these isotopes, except H-3, are present in the ECT. The RHT contains the highest concentration of H-3.

Porosity (n) - An average total porosity of 0.37 for the lower shallow aquifer was calculated from 92 dry density measurements, using a specific gravity for the solids of 2.57 gm/cm^3 . Specific gravity measurements (four) ranged from 2.57 to 2.67 gm/cm^3 . For conservatism, the lowest of these was used to determine total porosity. Although for sandy materials, effective porosity has been found to be identical to total porosity (Ref. 2.4.13-16) an effective porosity equal to 80 percent of total porosity has been assumed for purposes of the accidental spill analysis.

Distance (x, y, z). The distance from the MEAB to the nearest point on the Colorado River (x) is 3 miles, or 15,840 feet. Lateral (y) and vertical (z) distances were assumed to be zero.

Decay Coefficient (λ) - This term was calculated for each radionuclide, using the half-lives as shown in Table 2.4.13-4B.

Reduced Dispersion Coefficients (D_x, D_y, D_z) - A reduction factor (R_F) of 1.0 was used to calculate D_x, D_y and D_z . This means that the attenuation of radionuclides due to adsorption onto subsurface soil particles has been ignored in the accident analysis. A value of $1.344 \text{ ft}^2/\text{day}$ was used for D_x , the coefficient of dispersion in the direction of flow. This value was derived by assuming a longitudinal dispersivity of 3 feet, multiplying by the velocity of $.448 \text{ ft/day}$ and neglecting molecular diffusion. Because of inhomogeneities in alluvial deposits, dispersivity is a scale-dependent parameter (Ref. 2.4.13-14). For the accidental spill analysis, a field-scale value is appropriate, in view of the long travel path (3 miles). Three feet was selected as a reasonable dispersivity, based on measured and modeled values reported in Ref. 2.4.13-13, for alluvial materials. Dx

A value of $0.067 \text{ ft}^2/\text{day}$ was used D_x , the transverse coefficient of dispersion. This value was derived by assuming a transverse dispersivity equal to $1/20$ of the longitudinal dispersivity. Model simulation and field test data (Ref. 2.4.13-14) suggest that this is a conservative assumption. The vertical coefficient of dispersion (D_z) was set equal to $1 \times 10^{-4} \text{ ft}^2/\text{day}$ to assure confinement of the plume within the aquifer boundaries. 51
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Velocity (u_x, u_y, u_z) - The velocity along the flow path, u_x was set equal to the seepage velocity, 0.448 ft/day , and assumes $R_F = 1.0$ (no retardation). Velocities in the transverse and vertical direction u_y and u_z were set equal to zero. The gradient used to determine seepage velocity along the flow path was based on a hydraulic head difference of El. +27 feet (ground surface) at the plant site, and El. +2 feet at the Colorado River. Using a flow path length of 15,840 feet, a gradient of $1.58 \times 10^{-3} \text{ ft/ft}$ was calculated. Ux

Pumping test data for the lower shallow aquifer indicate a permeability ranging from 0.020 to 0.031 cm/sec (Table 2.4.13-3). Estimates of horizontal permeability were also obtained from the correlation between effective grain size and horizontal permeability. These estimates ranged from 0.0125 to 0.040 cm/sec with an average of 0.022 cm/sec. The permeability value selected for use in the accidental spill analysis was 0.030 cm/sec or 85 ft/day. This represents an average of the long and short term values obtained during Pump Test 2, at the plant site, and is felt to be conservative.

The porosity used to calculate the seepage velocity of 0.448 ft/day was 0.30 (30 percent). As noted above, this value was determined by assuming an effective porosity equal to 80 percent of the total porosity (.37).

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Dispersion

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2.4.13.3.2.1.1.3 Results of Analysis in the Lower Shallow Aquifer - The calculated peak concentrations ~~for the discharge of radionuclides through the lower shallow aquifer are presented on Table 2.4.13.4B. The time to these peak concentration^s is about 35,000 days (95.9 years). The concentrations presented do not include dilution in the receiving water bodies,~~

except Cs-137

NOTH The discharge concentrations for all isotopes are equal to or less than the limits defined in Column 2, Table II, Appendix B, to 10CFR20. ~~If dilution in the Colorado River is included, the resulting concentrations would be further reduced.~~

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INSERT D → 2.4.13.3.2.1.2 Migration Through the Upper Shallow Aquifer - The route of accidental release of radionuclides into the upper shallow aquifer is similar to that used for the lower shallow aquifer, but in addition to flow from the MEAB to the Colorado River, flow from the MEAB to the MCR relief wells was considered. The mechanism of the accident at the MEAB is the same as stated in Section 2.4.13.3.2.1.

As discussed above, there is a hydraulic connection between the upper and lower shallow aquifers where the power block excavation penetrates these zones; as discussed in Sections 2.5.4 and 2.5.6, the present differential head between the upper shallow aquifer (at El. +21.5 ft to El. +26.5 ft) and the lower shallow aquifer (at El. +15.0 ft to El. +18.5 ft) of 6 to 10 ft is expected to dissipate, resulting in an average piezometric surface between El. +17 and El. +26 ft for both portions of the shallow aquifer in the plant area. Because the stabilized head within the upper and lower shallow aquifers at the plant site will be lower than that of the upper shallow aquifer in the surrounding area, the existence of a gradient toward the MCR is not a realistic assumption.

Existence at the MCR of an imposed head of up to 20 ft. above ground surface is an additional reason why a gradient toward the MCR is unrealistic.

2.4.13.3.2.2 Operating Conditions - During normal operation, discharges of radioactive effluent to the groundwater and surface water environment occur only via direct discharge to the MCR. The average annual concentration of radionuclides in the MCR were calculated in accordance with procedures described in Appendix 5.3.A of the STP Environmental Report - Operating License Stage, (Reference 2.4.13-7). The results are shown on Table 11.2-7.2 for those isotopes with significant half-lives.

Discharge to the environment from the MCR occurs from seepage through the reservoir floor to the ground water. Groundwater flow from the reservoir is intercepted in part by a relief well system around the perimeter of the MCR which then discharges to surface waters. The underseepage condition is discussed in Section 2.4.13.3.2.3.

INSERT C (on page 2.4-62) no paragraph:

of critical isotopes that would occur at the Colorado River from a hypothetical spill of a waste processing tank in the MEAB are presented in Table 2.4.13-4B. The listed concentrations are the results of applying equation 2.4.13-2 which addresses only dispersion and radioactive decay under one-dimensional flow at the rate of ground-water seepage velocity. Reduction in concentration caused by retardation of a nuclide by adsorption (longer travel time) is not considered.

INSERT D (on page 2.4-62):

2.4.13.3.2.1.1.4 Impact of Adsorption on Cs-137. To demonstrate that Cs-137 would also be at concentrations below the MPC value, a simplified analysis was performed to demonstrate the significant effect of retardation due to isotope adsorption. The equation used is (Ref. 2.4.13-17):

$$\frac{C}{C_0} = e^{-\lambda t} \quad \text{Equation 2.4.13-3}$$

where: C = concentration at time t ,

C_0 = initial concentration,

λ = decay constant (defined above), and

t = time since the accidental release.

In order to calculate travel time from the MEAB to the Colorado River, the velocity of cesium ion was determined from the relation:

$$U_{ion} = U_{water} R_f \quad \text{Equation 2.2.13-4}$$

where:

R_f = retardation coefficient

U_{ion} = velocity of the ion (cesium),

U_{water} = ground-water seepage velocity, and

$$R_f = \frac{1}{1 + K_d \frac{\rho}{n}}$$

where:

ρ = bulk density, and

K_d = distribution coefficient

The distribution coefficient (K_d) is a measure of the extent to which adsorption takes place for a particular ion, and is a site-specific parameter depending on the mineralogy and structure of the soil, as well as the chemical characteristics of the ground water. Isherwood (Ref. 2.4.13-14) reports representative distribution coefficients for cesium and strontium in different types of geologic materials. Typical K_d values for cesium range from 22 to 3165 ml/g for unconsolidated materials in fresh water. A K_d of 5 ml/g was used in computing U_{ion} to demonstrate that only a small amount of adsorption would be needed to greatly reduce radionuclide concentrations at the Colorado River. The quantity ρ/n can be determined from site data, but generally ranges between 4 and 10 g/cm³ (Ref. 2.4.13-16). For conservatism, a value of 4 g/cm³ was used for ρ/n . These values of K_d and ρ/n give a retardation factor (R_f) of 0.0476. From Equation 2.4.13-4, U_{ion} is 0.02 ft/day.

Travel time (t) of cesium to the Colorado River is $\frac{\text{distance}}{\text{velocity}} = \frac{x}{U_{ion}}$

Thus, time to reach the Colorado River, taking into consideration retardation effects, is 792,000 days, or over 2000 years. The decay during that period, using equation 2.4.13-3 will reduce the concentration of Cs-137 from 0.55 to 2.7×10^{-21} uci/ml, well below the MPC value.

Replace with new table

TABLE 2.4.13-4B

CALCULATED PEAK CONCENTRATIONS FOR DISCHARGE
THROUGH THE LOWER SHALLOW AQUIFER TO NEAREST
POINT ON COLORADO RIVER (ACCIDENTAL RELEASES)

<u>Isotope</u>	<u>Half-life</u>	<u>Accidental Release ($\mu\text{Ci/ml}$)</u>	<u>MPC ($\mu\text{Ci/ml}$)</u>	<u>Peak Conc. at Colo. R. ($\mu\text{Ci/ml}$)</u>
Cs(137)	30 yrs.	1.5×10^{-3}	2×10^{-5}	3.3×10^{-6}
Sr(90)	28 yrs.	8.1×10^{-7}	3×10^{-7}	1.5×10^{-9}
H(3)	12 yrs.	1.0	3×10^{-3}	8.9×10^{-5}
Cs(134)	2 yrs.	2.1×10^{-3}	9×10^{-6}	*
I(131)	8 days	2.0×10^{-2}	3×10^{-7}	*
Te(132)	78 hrs.	2.3×10^{-3}	2×10^{-5}	*

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Note: Peak concentrations are negligible (i.e., at least five orders of magnitude below MPC).

TABLE 2.4.13-4B

SUMMARY OF HYPOTHETICAL SPILL ANALYSIS IN
LOWER SHALLOW AQUIFER

Isotope	Half-Life (yrs)	Maximum Tank Concentration (uCi/ml)	Tank	MPC (uCi/ml)	Peak Conc. at Colo. River (uCi/ml) (See Note)
Cs-137	30	5.5×10^{-1}	ECT	2×10^{-5}	7.6×10^{-5} *
Sr-90	28	2.9×10^{-4}	ECT	3×10^{-7}	3.5×10^{-8}
I-129	1.7×10^7	1.48×10^{-6}	ECT	1.48×10^{-6}	1.9×10^{-9}
H-3	12	1.0	RHT	3×10^{-3}	8.9×10^{-5}

*NOTE: These concentrations consider radioactive decay and dispersion with no retardation by adsorption (equation 2.4.13-2). Analysis of the adsorption effect on the concentration of Cs-137 reduces it to 2.7×10^{-21} uCi/ml. See discussion in section 2.4.13.3.2.1.1.4.

Add to References Section:

24.13-17

Grove, D. B. , 1970. A method
to describe the flow of radioactive
^{ions}
Laboratories in ground water: Sandia
Contract Report SC-CR-70-6139.

released to the atmosphere and the meteorological parameters used are presented in Table 15.7-2 for the analysis.

15.7.2.3 Radiological Consequences. The offsite doses calculated to result from the rupture of the RHT are presented in Table 15.7-2. The doses are seen to be a small fraction of the 10CFR100 values. | 43

15.7.3 Postulated Radioactive Releases Due to Liquid-Containing Tank Failure (Ground Release) | 43

15.7.3.1 Identification of Causes and Accident Description. Radioactive liquid releases may occur or be postulated to occur as a result of leaks in piping, leaks in tanks and other equipment, and failure of tanks and other equipment. | 43

Insert A

The most limiting of these is found to be the rupture of the RHT, resulting in the release of the liquid contents to the floor of the cubicle. The RHT has a non-nuclear safety design classification and is designed nonseismic; however, it is located in a seismic Category I structure.

15.7.3.2 Analysis Assumptions. For the purpose of evaluation the off-site consequences of the rupture of a storage tank, all tanks, in the LWPS and the RHT were considered. The tank containing the highest activity was found to be the RHT. | 43

Insert B → One-hundred percent of the liquid volume of the RHT is released into the RHT cubicle. The liquid is assumed to enter the ground water environment. RHT data is provided in Tables 15.7-3 and 15.7-4. Section 2.4.13 provides the dispersion and travel times of accidental releases of liquid effluents.

15.7.3.3 Radiological Consequences. The radiological consequences of this accident are presented in Section 2.4.13.

15.7.4 Design Basis Fuel-Handling Accidents

15.7.4.1 Identification of Causes and Accident Description. The design basis fuel handling accident is defined as the dropping of a spent fuel assembly during fuel handling, resulting in the rupture of the cladding of the fuel rods in the assembly despite many administrative controls and physical limitations imposed on fuel-handling operations. All refueling operations are conducted in accordance with prescribed procedures under direct surveillance of a supervisor.

During refueling operations, the Normal Containment Purge Subsystem is operating; this system is described in Section 9.4.5. Should a fuel handling accident occur in the Containment, the RCB Purge Isolation monitors are capable of identifying that the activity release has occurred and initiating Containment isolation. The function, instrument type, setpoints, safety class, and other pertinent information on the RCB Purge Isolation monitors are given in Section 11.5. Isolation of the Containment is described in Section 6.2.4, which discusses the valves, mode of operation, closure time, and other information. | 2
| 32
Q450.
01N
| 32
Q450.
01N

for tritium

Insert A

An analysis was performed to determine the worst possible tank failure based on contained activity and volume. As a result of this review the worst activity for the radionuclides considered was the evaporator concentrates tank ^(EUR) and the RHT.

~~It should be noted that both of these tanks~~
It should be noted that both of these tanks are located in a seismic Category I structure.

for radionuclides other than tritium

Insert B

For the purpose of this analysis all tanks containing radioactivity were reviewed taking into consideration their specific activity as well as the tank volume. The worst total activity available for release was found to be the evaporator concentrates tank for all nuclides except Tritium. Due to its size the RHT contains the most activity of Tritium.

Thus the ^{Co-137, Sr-90, and S-124} contents of the concentrates tank were assumed to be released to the ground water. ^{A Coincidental} with release of ^{just} the RHT Tritium contents was also assumed to provide the maximum off-site nuclide concentrations. The assumptions used in determining the activities can be found in Table 15.7-3 with the activities provided in Table 15.7-4.

The radionuclides considered were obtained by comparing the half-life verses the transit time to the Colorado River (~90 years). The resulting concentrations and methods of dispersion can be found in Section 2.4.13.

TABLE 15.7-³~~A~~PARAMETERS USED IN ANALYSIS OF LIQUID-CONTAINING TANK FAILUREParameters

Core thermal power, Mwt

4,100
~~3,000~~Fuel defects
(Based on a 3 region core ^{burnup} model)~~1.0%~~ .12%

43

Activity inventory

Activity shown
in Table 15.7-~~34~~Volume of spill, gal
Recycle Holdup Tank
Evaporator - Concentrates Tank64,000
4,000Model for spill transport to
wells and surface watersSee Section
2.4.13

TABLE 15.7-8

ACTIVITY TOTAL IN THE RECYCLE HOLDUP TANK

<u>Isotope</u>	<u>Curies*</u>	<u>Isotope</u>	<u>Curies*</u>
H-3	2.4×10^2	Nb-95	9.9×10^{-4}
Cr-51	1.2×10^{-1}	Mo-99	1.7
Mn-54	9.5×10^{-3}	I-131	4.8
Co-58	2.9×10^{-1}	Te-132	5.6×10^{-1}
Fe-59	1.2×10^{-2}	Cs-134	5.1×10^{-1}
Co-60	3.4×10^{-2}	Cs-136	2.7×10^{-1}
Sr-89	6.8×10^{-3}	Cs-137	3.6×10^{-1}
Sr-90	2.0×10^{-4}	Ba-140	4.4×10^3
Y-91	1.3×10^{-3}	La-140	3.2×10^{-3}
Zr-95	1.2×10^{-3}	Ce-144	6.5×10^{-4}

43

Replace

*Assuming the tank is filled to 80 percent of capacity.

Table 15.7-4

Activity Available for Release

<u>Isotope</u>	<u>Curies*</u>
H-3	242**
Cs-137	8.3
Sr-90	4.5×10^{-3}
I-129	2.2×10^{-5}

* Assuming the tank is 80% full.

** Recycle Holdup Tank