Consumers Power Company

General Offices: 212 West Michigan Avenue, Jackson, Michigan 49201 • (517) 788-0550

November 24, 1980

Mr James G Keppler
Office of Inspection and Enforcement
Region III
U S Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, IL 60137

DOCKET 50-255 - LICENSE DPR-20 -
PALISADES PLANT - LICENSEE EVENT
REPORT 80-021 - CORRECTIONS TO
AUGUST 20, 1980, LETTER

By letter dated August 20, 1980, Consumers Power Company transmitted Licensee Event Report 80-021, Revision 1 along with several Appendices. Appendix C, page 7 did not copy. Appendix E, page 1 had an error as did Appendix F, pages 1 and 2.

Corrections are indicated by a vertical line in the right hand margin. All three (3) Appendices are attached to this letter in their entirety.

David P Hoffman
Nuclear Licensing Administrator

CC Director, Office of Nuclear Reactor Regulation
Director, Office of Inspection and Enforcement
NRC Resident Inspector - Palisades Plant

A002
S
1/1

8012020580

NOV 26 1980

5

APPENDIX C

CALCULATIONS OF RADIOLOGICAL EFFECTS AS RESULT OF HYPOTHETICAL ACCIDENT WITH CV-3030 OPEN

Introduction

Calculations have been performed in accordance with data derived from the analysis given in Appendix D; 490 gallons of containment sump water is delivered over the period between 20 seconds and 150 seconds following a LOCA. During this period, the recirculation line contains 100% sump water as opposed to 52% as in the Appendix C analysis where both ECCS trains were functional. A second variation from the Appendix C calculations arises during the first 150 seconds when the SIRW tank receives a net inflow of fluid because ECCS train A is not functioning to remove water. The net inflow allows airborne radioiodine release during this period as well as during the two hours after the tank empties to its shut-off level of two feet.

Results

Site boundary thyroid dose for the DBA is calculated to be 0.57 mrem due to release of 2.03 mCi dose equivalent I-131. Site boundary thyroid dose for an MHA is 38.8rem, and results from release of 137.4 Ci of dose equivalent I-131. Both the DBA and MHA doses are a factor of 1.09 times the result of the earlier two train analysis. The increase of 9% is due to the release of activity over the 130 second fill period at a release rate of 1% per two hours (0.000139% per second), given an average concentration of 0.25 curies/gallon over that period.

Dose at the control room console is calculated to be 0.44rem. This increase over the two-train dose of 0.23rem arises from the increase in recirculation pipe consentrations from 52% to 100% of sump concentration in the single train event.

Conclusion

Doses continue to represent small fractions of 10CFR50 and 10CFR100 limits. A large degree of conservatism remains in the methods by which these doses are calculated. For further disscusion see the conclusion section of Appendix C.

Results - MHA

Offsite thyroid dose of 35.6 rem at the site boundary is calculated with 25% of core iodine inventory diluted by 1.2×10^5 gallons of fluid available to the sump within the first few seconds of the DBA. The quantity of iodine released is 126 Curies. All assumptions are similar to those described for the DBA case.

Dose at the control room console is calculated to be 0.23 rem due to liquids from the sump present in the recirculation line outside the control room. Exposure from the SIRW itself is negligible since dilution in SIRW water is large, only 10% of the activity remains after 20 minutes. and the control room is shielded by a minimum of 4 feet of concrete in that direction.

Conclusion

Neither control room habitability nor offsite doses are seriously affected by opening of CV-3030, since in all cases represent small fractions of 10CFR50 and 10CFR100 limits.

It must be emphasized that doses have been calculated in a conservative manner. In particular, the MHA fission product inventory based on TID 14844 greatly exceeds the inventory actually expected in the first few minutes of an accident. For example, WASH-1400 worst-case accident descriptions indicate that final gap activity begins to escape the core only after one minute, and core melt occurs only after 16 minutes.*

*WASH 1400, Appendix V, Oct 1975 pg V-86.

TABLE I (RADIOLOGICAL)

FLUID VOLUMES DILUTING FISSION PRODUCT INVENTORY

PRIMARY COOLANT VOLUME	7,800 FT^3	5.835×10^4 GAL
1/2 CLEAN WASTE RECEIVER TANK	4,065 FT^3	3.041×10^4 GAL
SAFETY INJECTION BOTTLES (4)	4,000 FT^3	2.992×10^4 GAL
PRE-EXISTING SUMP VOLUME	304 FT^3	2.275×10^3 GAL
TOTAL DILUTION	16,169 FT^3	1.210×10^5 GAL

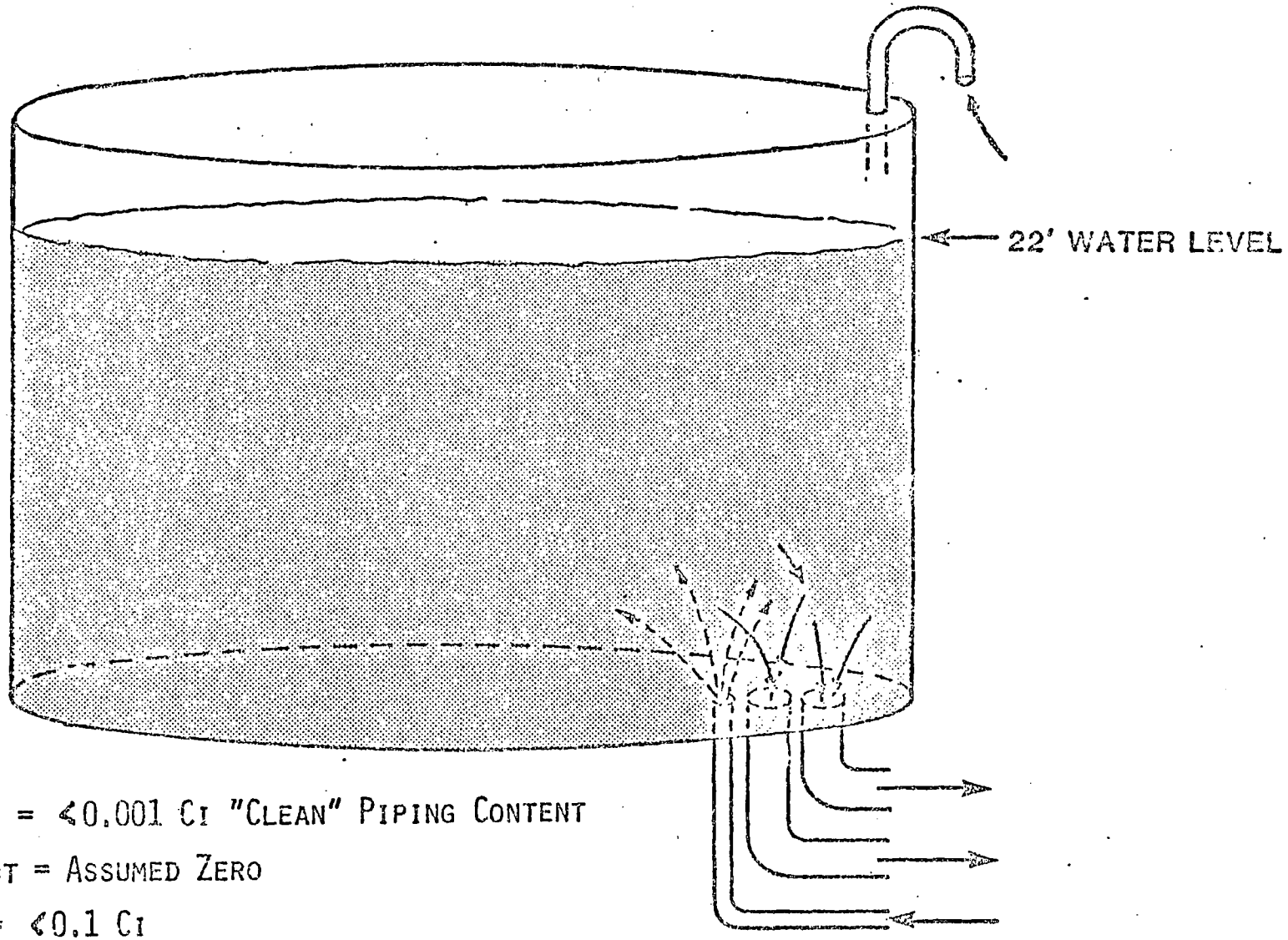
MHA IODINE - 131 CONCENTRATION

CORE INVENTORY AT 2650 MWT = 6.65×10^7 CI

25% CORE INTO COOLANT AT T = 0 $\rightarrow$ 1.66×10^7 CI I-131 $\rightarrow$ 137 CI/GAL

DOSE EQUIVALENT I-131 $\rightarrow$ 258 CI/GAL

First 20 Seconds - Dose Equivalent I-131 Evaluation



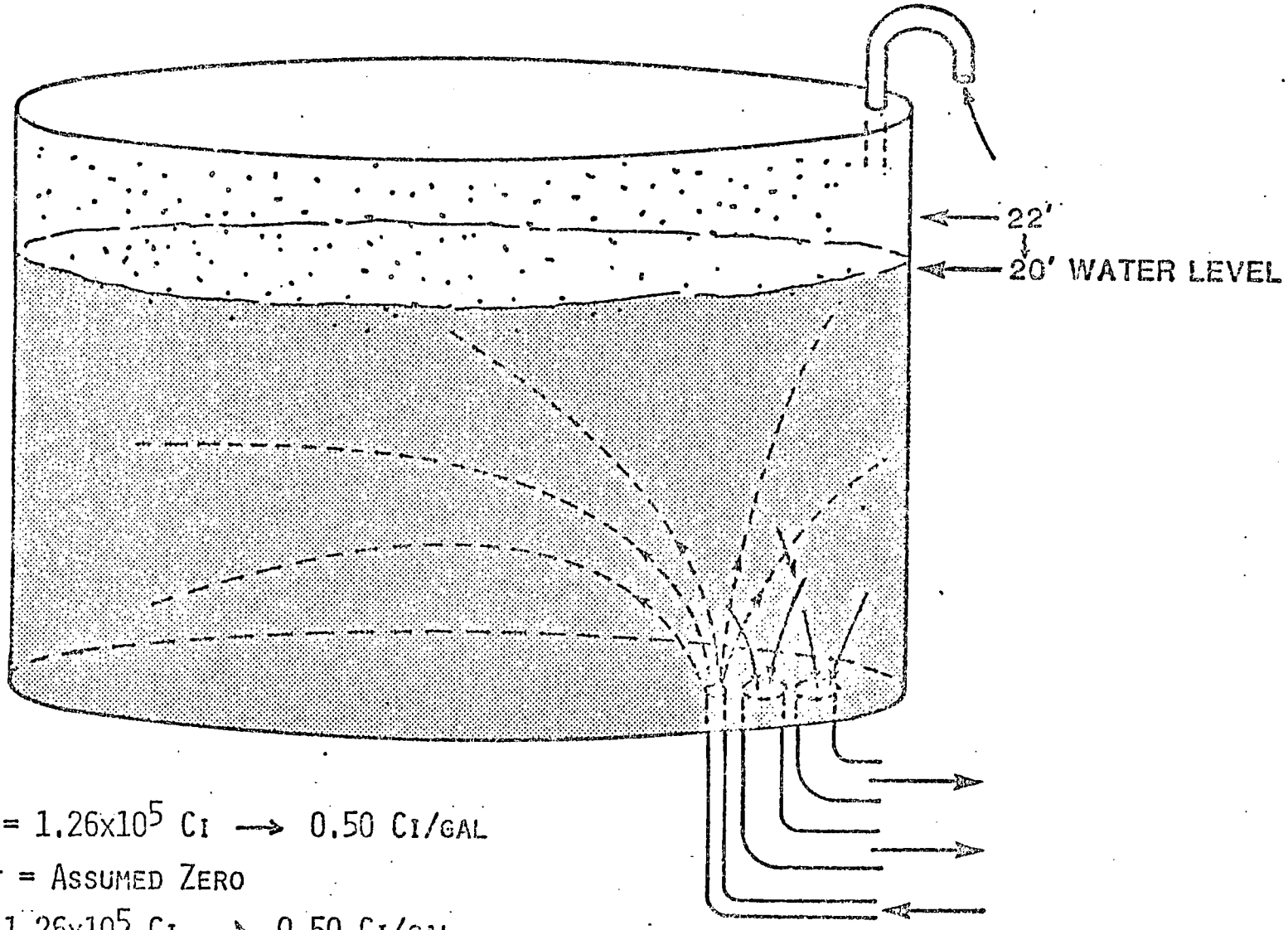
Fluid Activity In = ≤0.001 Ci "Clean" Piping Content

Fluid Activity Out = Assumed Zero

Fluid Inventory = ≤0.1 Ci

Release to Atmosphere - Negligible
(Air Flowing Into Tank)

20 Seconds to 150 Seconds - Dose Equivalent I-131 Evaluation



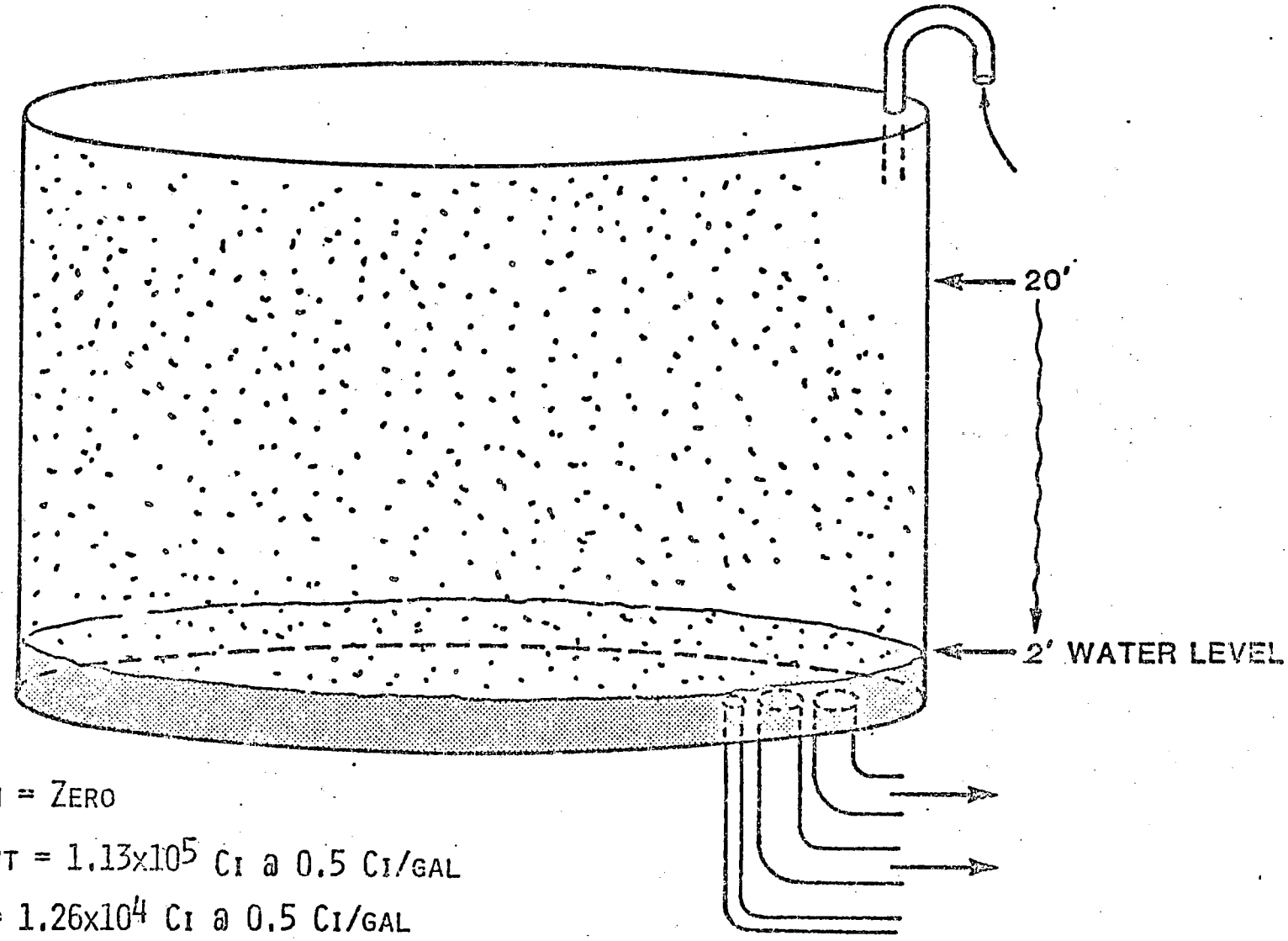
Fluid Activity In = 1.26×10^5 Ci ⟶ 0.50 Ci/gal

Fluid Activity Out = Assumed Zero

Fluid Inventory = 1.26×10^5 Ci ⟶ 0.50 Ci/gal

Release to Atmosphere - Negligible
(Air Flowing Into Tank)

150 Seconds to 20 Minutes - Dose Equivalent I-131 Evaluation



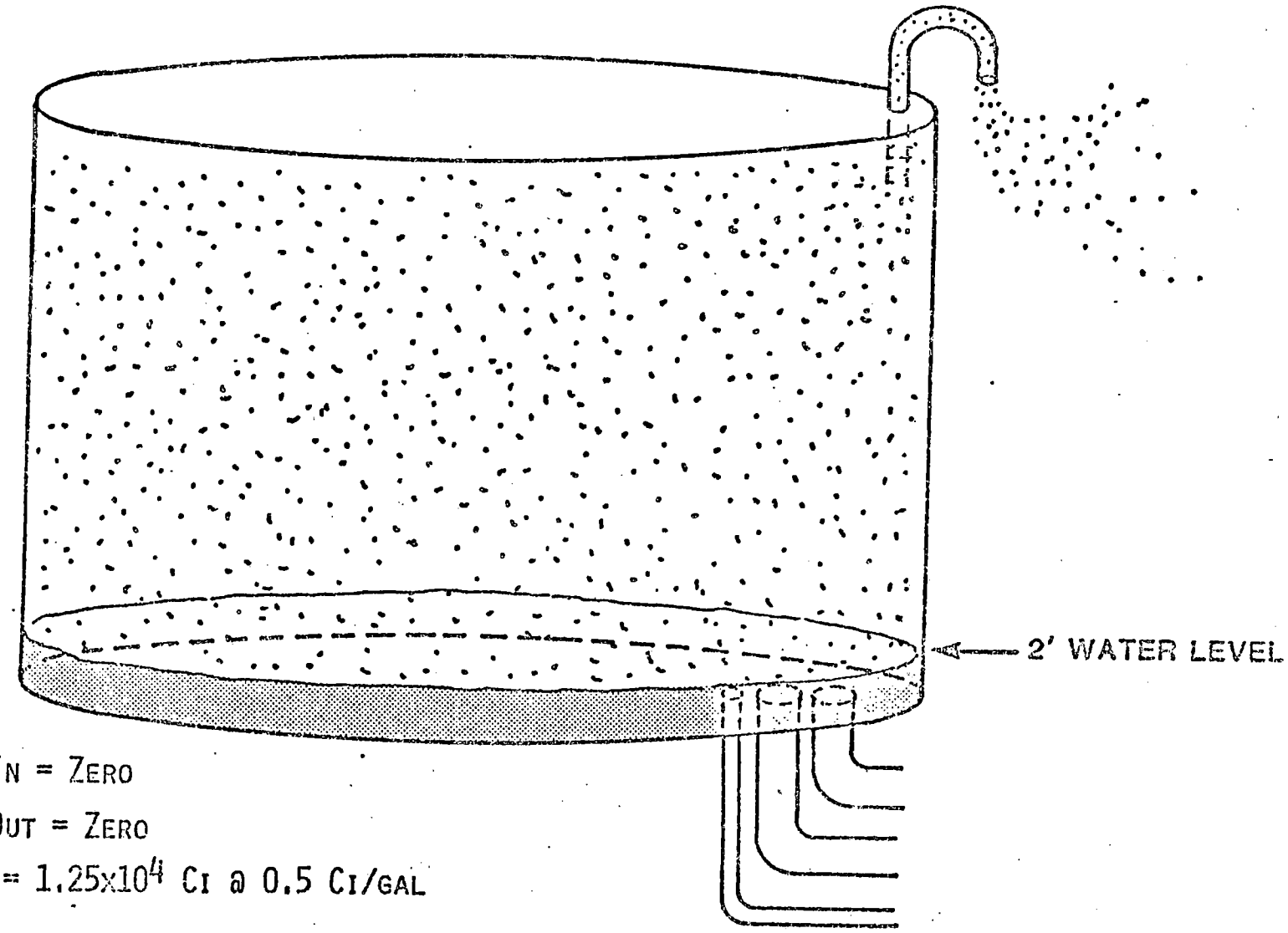
Fluid Activity In = Zero

Fluid Activity Out = 1.13×10^5 Ci @ 0.5 Ci/gal

Fluid Inventory = 1.26×10^4 Ci @ 0.5 Ci/gal

Release to Atmosphere = Zero
(Air Flowing Into Tank)

20 Minutes to 2 Hours Plus 20 Minutes - Dose Equivalent I-131 Evaluation



Fluid Activity In = Zero

Fluid Activity Out = Zero

Fluid Inventory = 1.25×10^4 Ci @ 0.5 Ci/gal

Release to Atmosphere = 126 Ci D.E. I-131

DOSE TO THYROID AT SITE BOUNDARY - MHA

DOSE = (Q) (X/Q) (B) (T) (DCF)

WHERE:

DOSE = REM
Q = CI/SEC RELEASE RATE (126 CI/7200 SEC) = 0.0175 CI/SEC DOSE EQUIVALENT I-131
X/Q = SEC/M^3 DIFFUSION (5.5×10^{-4} SEC/M^3 PER R.G.1.4 AND AMENDMENT 31)
B = M^3/HR BREATHING RATE (1.25 M^3/HR PER R.G.1.4)
T = HRS OF BREATHING TIME (2 HRS)
DCF = DOSE CONVERSION FACTOR (1.48×10^6 RAD/CI INHALED, PER R.G.1.4)

RESULT: 35.6 REM

DBA RESULT - PRIMARY COOLANT AT 1.0 UCI/ML DOSE EQUIVALENT I-131: 0.52 MILLIREM

Control Room Habitability

- 6" Recirculation line exposure determined to be only significant concern
- 2' Concrete wall between line and control room
- Intervening equipment and display panels not included as shielding
- 15' to 20' Distance between source and operator at main console
- Line filled with
  1) Mixture 52% sump fluid; 48% SIRW tank water
  2) Iodine concentration as used with offsite dose calculations
  3) Particulate concentration based on 1% of core inventory to sump
- Exposure duration 130 seconds

Result: 0.225 rem

DBA Result - $<$0.01 mrem

Conclusions of Radiological Evaluation

- Maximum Hypothetical Accident:
  1) Site boundary total body dose negligible due to depressurization of primary system prior to removal from sump
  2) Site boundary thyroid dose 36 rem
  3) Control room dose 0.23 rem

- Effects are considered to represent small fractions of 10CFR50 and 10CFR100 criteria

- Design Basis Accident:
  1) Site boundary total body dose negligible
  2) Site boundary thyroid dose 0.5 millirem
  3) Control room dose < 0.01 millirem

APPENDIX E

OFFSITE DOSE AND CONTROL ROOM HABITABILITY ASSUMING LOSS OF TRAIN A SAFEGUARDS PUMPS

Introduction

Since the opening of CV-3030 would not in itself prohibit ECCS operation, it is assumed that only primary coolant activity at the Technical Specification limit of 1 microcurie per gram dose-equivalent I-131 is involved in recirculation to the SIRW following a postulated DBA. Two aspects of this event are considered: 1) Release of iodines to the environment via the SIRW tank vent following addition of 490 gallons of sump water to the tank via the recirculation line; and 2) Dose to control room personnel from the 6" recirculation line during the 130-second period it is filled with a mixture of 48% SIRW and 52% containment sump water.

For the sake of completeness, doses from MHA fluids circulation also has been determined. MHA dose parameters are readily available for control room dose calculations, so the MHA calculations were utilized in determination of DBA doses by appropriate scaling of the nuclide inventory. Offsite doses were calculated independently by use of iodine inventories for each case. Total body doses from noble gas were not calculated because coolant from the sump would be lacking in noble gasses due to degassing upon release from the primary system.

Results - DBA

Maximum offsite dose of .52 millirem to thyroid is calculated from release of 1.86 mCi dose equivalent I-131. This release resulted from a transfer of 490 gallons of undiluted primary coolant to the SIRW, 100% of which mixes with SIRW water. The tank empties to a 2-foot level in a maximum of 20 minutes. No iodine escapes during pump down, since airflow through the SIRW vent is inward at that time. One percent of the available iodine inventory escapes to the atmosphere within the next two hours (similar to a fuel pool accident described in Regulatory Guide 1.25). Dose was calculated in accordance with Regulatory Guide 1.25.

Dose at the control room console is calculated to be less than 0.01 millirem integrated over the two-minute period during which primary coolant is flowing through the 6" recirculation pipe outside the control room. The dose is low primarily because two feet of concrete is present between the piping and control room interior. Dose from the SIRW tank is negligible because concentration is very low once diluted in the SIRW volume. Also, a minimum of 4 feet of concrete separates the tank from the control room.

APPENDIX F

EFFECT ON MAIN STEAM LINE BREAK

AT 1400 MWD/MTU

I. REFERENCES

1. XN-NF-79-94(p) "Palisades Cycle 4 Startup Predictions and Nuclear Data for Operation".

2. "Palisades Cycle 4 Startup Data, Supplementary Information", R.G. Grummer to B.D. Webb, November 30, 1979.

II. DATA

1. Net worth (N-1) at 60°F - Reference 2, Table 2

   BOC4 = 3.63% Δρ , EOC4 = 4.09% Δρ

2. Power defect at 700 ppmb - Reference 1, Figure 6.5

   = 1.2% Δρ

3. Net rod worth (N-1) at 532°F - Reference 1, Table 6.1

   BOC4 = 4.90% Δρ , EOC4 = 5.49% Δρ

4. Shutdown boron concentration, k_{eff} = .98, No xenon - Reference 1, Table 6.2 N-1 Configuration

	532°F	60°F
BOC4	1000	1050
EOC4	150	500

5. Core conditions - 1400 Mwd/MT Cycle burnup
   700 ppm boron

6. Reciprocal boron worth - Reference 1, Figure 6.6

   1000 ppm, 60°F, BOC = 77.0 ppm/% Δρ
   150 ppm, 60°F, EOC = 70.5 ppm/% Δρ

III. ANALYSIS

1. Worth of control rods 60°F including uncertainty.

   BOC = 3.63 x .90 = 3.27% Δρ
   EOC = 4.09 x .90 = 3.68% Δρ

   Interpolating to cycle burnup of 1400 Mwd/MT worth (N-1) =

$$3.27 + \frac{1400}{10,400} (3.68 - 3.27) = 3.32\% \Delta\rho$$

2. Reactivity added by cooldown. This is derived by extracting the change in net rod worth due to cooldown from the change in shutdown boron concentration from hot to cold conditions.

a. At 1000 ppm

$$\left[1050 - 1000 - (4.90 - 3.63) \times 77\right]/77 = -0.62\%\ \Delta\rho$$

b. At 150 ppm

$$\left[500 - 150 - (5.49 - 4.09) \times 70.5\right]/70.5 = 3.56\%\ \Delta\rho$$

c. Interpolating to 700 ppm

$$\Delta\rho_{700} = -.62 + \frac{1000 - 700}{1000 - 150}\,(3.56 + .62) = 0.86\%\ \Delta\rho$$

3. Shutdown Margin - Equals rod worth minus power defect minus reactivity from cooldown.

$$3.32 - 1.20 - 0.86 = 1.26\%\ \Delta\rho$$

CONCLUSION

The Palisades reactor could have cooled all the way to 60°F without boron inejction and remained subcritical until xenon decay. There is adequate margin in the analysis to account for large uncertainty factors.