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Nuclear Regulatory Commission
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DOCKET 50-255 - LICENSE DPR-20 - PALISADES PLANT -
LICENSEE EVENT REPORT 89-022 - RADIOLOGICAL CONSEQUENCES OF A SIRW TANK RUPTURE

Licensee Event Report (LER) 89-022 (Radiological Consequences of a SIRW Tank Rupture) is attached. The information does not meet the criterion specified in 10CFR50.73, however, due to the nature of this issue a voluntary Licensee Event Report is being submitted.

Brian D Johnson
Staff Licensing Engineer

CC Administrator, Region III, USNRC
NRC Resident Inspector - Palisades

Attachment

OC1089-0011-NL02

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NRC Form 366 (9-83)

U.S. NUCLEAR REGULATORY COMMISSION
APPROVED OMB NO. 3150-0104
EXPIRES: 8/31/85

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
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TITLE (4)
RADIOLOGICAL CONSEQUENCES OF A SIRW TANK RUPTURE

EVENT DATE (5)			LER NUMBER (6)					REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR		SEQUENTIAL NUMBER		REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAMES	DOCKET NUMBER(S)
											N/A	0 5 0 0 0
0 7	2 3	8 9	8 9	—	0 2 2	—	0 0	1 0	1 9	8 9	N/A	0 5 0 0 0

OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
	N	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
POWER LEVEL (10)	1 8 0	20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	X OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	
		20.405(a)(1)(iv)	50.73(a)(2)(ii)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
C S Kozup, Technical Engineer, Palisades	AREA CODE 6 1 6 7 6 4 - 8 9 1 3

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS		CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	
X	B P	T K		No							

SUPPLEMENTAL REPORT EXPECTED (14)		EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
YES (If yes, complete EXPECTED SUBMISSION DATE)	X NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single-space typewritten lines) (16)

On July 23, 1989 it was determined that no licensing basis existed which defined the radiological consequences of a safety injection refueling water (SIRW) tank [BP;TK] rupture. Consequently, no radionuclide concentration limits have ever been established. The potential for having an unidentified licensing basis was identified by Corporate Health Physics and Plant Licensing personnel while reviewing documentation associated with radioactive releases from the SIRW tank. The reactor was critical with the Plant at 80 percent of rated power when it was determined that no licensing basis existed.

The SIRW tank is located above the main Control Room at approximately the 643 foot elevation and is not physically enclosed by any other Plant structure. While it was recognized during both original Plant licensing and the Systematic Evaluation Program that the tank was not designed to withstand tornado wind forces or resultant missiles, the only consequence determination performed involved potential effects on other equipment due to deluge and non-availability of a boron injection source. A licensing analysis performed has determined the criterion of 10CFR100.11 to be applicable. Preliminary dose consequence analyses for tank rupture, based on past tank concentrations going back to 1975 have resulted in doses only a fraction of 10CFR100.11.

Description

On July 23, 1989 it was determined that no licensing basis existed which defined the radiological consequences of a safety injection refueling water (SIRW) tank [BP;TK] rupture. Consequently, no radionuclide concentration limits have ever been established. The potential for having an unidentified licensing basis was identified by Corporate Health Physics and Plant Licensing personnel while reviewing documentation associated with radioactive releases from the SIRW tank. The reactor was critical with the Plant at 80 percent of rated power when it was determined that no licensing basis existed.

The SIRW tank T-58 is located above the main Control Room at approximately the 643 foot elevation and is not physically enclosed by any other Plant structure. The tank stores the borated water used to fill the refueling cavity during refueling operations. The tank is sized to provide a useable volume capable of filling the refueling cavity to a depth of 24 feet. Upon initiation of emergency safety injection, the high and low pressure safety injection pumps P-66 A&B and P-67 A&B respectively, and the containment spray pumps P-54 A,B&C, take suction from the SIRW tank. During Plant operation at least 250,000 gallons of borated water are maintained available for safety injection. The useful tank capacity exceeds the 250,000 gallons and provides at least 20 minutes of safety injection time with all pumps operating at their design flow rates. Pump suction is automatically transferred to the containment sump upon a low SIRW tank level signal via the recirculation initiation actuation signal logic.

The tank contents are maintained at a boron concentration in the range of 1720 ppm to 2000 ppm. This concentration is sufficient to provide a five percent shutdown margin with all control rods withdrawn for beginning of core life at 60 degrees F.

The SIRW tank is designed for a wind loading of 30 pounds per square foot and a roof loading of 40 pounds per square foot to account for loads due to snow. It is additionally designed for seismic loads of 0.23g horizontal and 0.07g vertical without exceeding material yield stress. The tank was fabricated to ASA Standard B96.1 and is constructed of aluminum with cathodic protection provided at all interfaces with dissimilar metals. Heating steam is provided to the SIRW tank heat exchanger E-57 in order to maintain the tank above 40 degrees F to prevent freezing.

During the Atomic Energy Commission's (AEC) evaluation of Consumers Power's application for an operating license, they identified the need for additional information. The additional information, categorized into groups corresponding to the original Palisades FSAR, was requested by letter dated May 28, 1969. Request 5.32 was presented as follows:

5.32 The SIRW tank is located on the roof of the Auxiliary Building, directly over the Control Room, Cable Spreading Room and emergency diesel generators, and it is not designed to resist tornadoes. What are the potential consequences of a major rupture of this tank?

Consumers Power provided a response to this request on August 26, 1969 as Amendment 15 to our "Application For Reactor Construction Permit and Operating License". Within this response it was identified that in the event of a major rupture of the SIRW tank, water would not be maintained on the roof surrounding the tank and that most of the water would flow down the north wall of the Auxiliary Building. After detailing all the hypothesized flow patterns, it was concluded that "rupture of the SIRW tank would require an orderly Plant shutdown with no effect on other safety-related equipment". This response was revised on May 18, 1978, however, neither version provided any discussion regarding the potential radiological consequences of the hypothesized tank rupture.

Within the original FSAR, all associated amendments to the original license application, subsequent revisions to the FSAR and the updated FSAR, the only radiological consequence from a SIRW tank rupture evaluated was that associated with tritium accumulation. Amendment 21 to the Reactor Construction Permit and Operating License dated February 26, 1971 described planned modifications to the condenser cooling and liquid radioactive waste systems. These modifications were agreed to by Consumers Power in our settlement agreement with interveners. As a result, in Section 11.3.3.2 on Amendment 21, Consumers Power committed to submit to the AEC an evaluation of potential operating and accidental releases associated with tritium accumulations based on the final design of the modified liquid radwaste system.

On June 22, 1972 Consumers Power met the above commitment by submitting to the AEC the "SIRW Tank Rupture Accident Analysis". This analysis concluded that the average dose to an individual in South Haven would be 0.056 Rem. The SIRW tank was chosen as the source for this analysis since its volume was larger than that of the primary system makeup water tank and the spent fuel pool. Additionally, during refueling, a portion of the primary coolant is mixed with SIRW tank water and spent fuel pool water causing an increase in tritium concentration. The bases and results of this analysis were input into the FSAR (Section 11.1.3.3) by revision on December 15, 1973. No radionuclides other than tritium were identified as being considered during this evaluation even though primary coolant was identified to be mixed with SIRW tank water.

Applicable accident analyses identified within both the original and updated FSAR include; FSAR 14.20, "Liquid Waste Incident" and FSAR 14.21, "Waste Gas Incident". These analyses do not appear to have been revised since they were originally presented in the license application. Within FSAR 14.20 it is identified that "accidents which might result in release of activity to the environs involve rupture or leakage from the liquid waste system components, or the accidental release to the circulating water discharge canal of the contents

of one of the treated waste monitor tanks. All components of the liquid radwaste system are located within the Containment and Auxiliary Buildings." This analysis concluded that plant design insures that radioactive liquid leakage or spillage will be retained within the facility and that adminis trative controls and automatic interlocks together with the failsafe design of the instrumentation and control devices provide assurance against any release of liquid waste to the environs in excess of 10CFR20 limits. As the SIRW tank is clearly not within the Containment or Auxiliary Buildings, is part of the safety injection/emergency core cooling system and not part of the liquid system described in the FSAR, and has been hypothesized to rupture and release its contents to Lake Michigan, this analysis is not applicable.

FSAR 14.21, while entitled Waste Gas Incident" does address the rupture of a liquid containing tank, the volume control tank. This FSAR section is directly referenced by FSAR 14.20 within the statement, "activity release from the liquid waste system to the environs can occur only by accidental discharge to the circulating water discharge canal or by a rupture of the volume control tank with the ensuing gaseous release as discussed in Section 14.21". FSAR 14.21 recognizes that any failure in the chemical and volume control system is very unlikely, however, it was analyzed to define the radiation dose that might result. This analysis concludes that a rupture of the volume control tank would not present any undue risk as resultant doses for this hypothesized event are well below the limits specified in 10CFR100.11.

The next consideration given to the hypothesized rupture of the SIRW tank arose during the Integrated Plant Safety Assessment, Systematic Evaluation Program (SEP). The final report from this effort, NUREG-0820, was issued in April 1982. Three topics within this program addressed the loss of the SIRW tank and/or operation plant effluents. The first, Topic III-2, "Wind and Tornado Loadings" concluded that the SIRW tank was not shown to be able to withstand tornado wind and pressure loadings prescribed by the requirements of 10CFR50 Appendix A, General Design Criterion 2 as implemented by Regulatory Guide 1.117 and Standard Review Plan (SRP) Section 3.3. This Topic further presented that the effect of safe shutdown of the Plant is minimal because alternate water sources could be made available. The alternate sources of water were to be prescribed during the Emergency Operating Procedure rewrite in accordance with CEN-152. This Topic did not consider radiological consequences of a tank failure. The NRC staff concluded that backfitting of the SIRW tank would not be required and prescribed actions within the Topic were acceptable. The second, Topic III-4.A, "Tornado Missiles", drew exactly the same findings and conclusions as Topic III-2.

The third, Topic XI-2, Subtask 3, "Effects Of Accidental Liquid Releases On Nearby Water Supplies", was to perform a generic analysis of the consequences of liquid tank failures for those plants which received their license prior to the issuance of the SRP. This Topic was deleted as a Palisades specific review as "experience in performing SRP analyses for newer plants has indicated that

it is highly unlikely that radioactive concentrations in the nearest potable water supply could exceed 10CFR20 values".

In addition to the documents reviewed above, a search of NRC Safety Evaluation Reports was conducted. This search did not reveal any report which gave consideration to the radiological consequences of a SIRW tank rupture.

Cause Of The Event

The failure to define the licensing basis for the radiological consequences of a rupture of the SIRW tank has been attributed to an oversight by all participants during initial Plant licensing. This failure resulted in no radionuclide concentration limits being established for SIRW tank contents.

Corrective Actions

The SIRW tank was placed in the fast recirculation mode to provide demineralized cleanup of existing radionuclides. This practice will continue as much as practical until appropriate concentration limits for SIRW tanks concentration are established. Operating Procedures were reviewed to determine the practicality of revising procedures to minimize the ingress of primary coolant system (PCS) activity into the SIRW tank. Operational activities reviewed included; safety injection tank sampling and boron concentration adjustments, clean waste receiver tank content transfer and PCS drain down evaluations. Due to the minimal Technical Specifications Action Statement time allowance for safety injection tank sampling and inadequate alternative storage tank capacity to support PCS draining during outage activities, no further procedural action was deemed necessary to minimize contaminated water influx to the SIRW tank. Currently, established long-term actions for upgrading in-plant filtration are being evaluated utilizing SIRW tank cleanup as a desired output.

An evaluation of the radiological consequences of a SIRW tank rupture utilizing past radionuclide concentrations is in-progress. Preliminary results indicate that even with the highest past concentration (5.34E-2 micro-curies/ml; December 1975) used as the source term, dose consequences represent less than one percent of 10CFR100.11 limits.

Based on the above historical review and the fact that no radioactive concen tration limits have ever been imposed for the contents of the SIRW tank, it is apparent that no licensing basis was ever documented. After review of 10CFR50 Appendix I, 10CFR20 Appendix B and 10CFR100.11 it is apparent that the dose criterion delineated by 10CFR100.11 are the applicable acceptance criterion for the radiological consequences of the hypothetical SIRW rupture. This conclusion is based on the following:

1. 10CFR50 Appendix I was not a section of the Code of Federal Regulations until approximately 1974 and therefore, cannot define the Circa 1969 licensing basis.

2. 10CFR50 Appendix I is intended to provide limitations on the amount of radioactive waste released such that doses to the public are maintained ALARA during operation. The SIRW tank is not part of the radioactive waste system defined with either the original or updated FSAR.

3. 10CFR20 Appendix B as implemented by 10CFR20.106 provides radionuclide concentrations for controlling releases of radioactivity such that when concentrations are averaged over a period not greater than one year, a whole body dose to an individual at the site boundary will not exceed 0.5 Rem. This implies an operational limit and not a limit associated with an event stemming from a natural phenomenon (ie, a tornado/tornado missile) rupturing the tank.

4. The location of the SIRW tank and Plant operating description (eg, SIRW contents are mixed with primary coolant) provided during Plant licensing do not allow compliance with the operational limits provided by 10CFR20 Appendix B as implemented by 10CFR20.106. Therefore, a modification beyond the original Plant design and licensing basis would be required to attain compliance.

5. 10CFR100.11 prescribes acceptable dose criterion for reactor siting against plant design for events other than operational occurrences. This criterion is utilized for demonstrating acceptability for events detailed within Section 14 of the FSAR. While dose consequences of fluid release by a SIRW tank rupture was apparently not considered within the licensing basis of Palisades, the rupture of tanks, other than radioactive waste system components, were considered and the limits specified within 10CFR100.11 are the stated licensing bases acceptance criterion.

Limits will be established for allowed radionuclide concentrations within the SIRW tank to ensure continued compliance with 10CFR100.11. The Palisades FSAR will be updated after the completion of the radiological consequence analyses.

Analysis Of The Event

As presented above, the catastrophic failure of the SIRW tank has only been hypothesized to occur as the result of tornado wind forces or resultant tornado missiles. Based on the low probability of this event and the insignificant dose consequences (ie, a fraction of 10CFR100.11) which would have resulted had the tank ruptured, no threat to the health and safety of the public was presented.

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TEXT *(If more space is required, use additional NRC Form 366A's)* (17)

This event does not meet the criterion specified in 10CFR50.73, however, due to the nature of this issue a voluntary Licensee Event Report is being submitted.