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**Originator Phone:** 2464

**Originator Group:** Chemistry Technical Staff

**Operability Required:** Y

**Supervisor Name:** McElrath, Joel W.

**Reportability Required:** Y

**Discovered Date:** 12/10/2007 17:35

**Initiated Date:** 12/10/2007 20:04

**Condition Description:**

Elevated Tritium confirmed in Monitoring Well, MW-03-07 development water. Tritium concentration was confirmed at 22,000 pico curies/liter, which is above the Offsite Dose Calculation Manual (ODCM) Limit of 20,000 pico curies/liter. A total of five shallow monitoring wells were installed during the period of Nov. 28 to Nov. 30, 2007. MW-01-07 is located the OCA, in the South Storage yard, between the South Storage Bldg. and the PA fence, MW-02-07 is located in the PA, in the roadway between the turbine building and the cooling tower pump house, MW-03-07 is located in the PA between Turbine Building Drain Tank, T-41 and Fuel Oil Storage Tank, T-926, MW-04-07 is located in the PA roadway between the Feedwater Purity Bldg. and the compressed gas bottle storage area, and MW-05-07 is located in the PA roadway north west of the Feedwater Purity Bldg. MW-01-07, MW-02-07, MW-04-07 and MW-05-07 development water samples were analyzed for Tritium and indicated less than the minimum detectable activity level (MDA) of 641 pico curies/liter. Radio-Isotopic analysis of each Monitoring Well development water did not contain detectable radionuclides. Each monitoring well is approximately 200 feet east of the Lake Michigan shoreline and were installed per the NEI initiative.

Per HP 2.8 "Response to Unusual Radiological Occurrences" Rev 18, pages 14, 15, section 5.11 "Radiological Spill or Leak to the Environment", b. Positive Environmental Sampling Results, in part, 3. "IF a water sample from an onsite groundwater monitoring well or surface water that is hydrologically connected to groundwater exceeds the ODCM reporting criterion, THEN, the REMP/RETS Analyst shall notify the State and Local Agencies as described; c. Notifications shall be made before the end of the next business day. 2. Prior to notifications, notify Regulatory Affairs that the notifications will be made. The agencies that need to be notified, include: State of Michigan, Chief of Radiological Protection and Medical Waste Section of the Michigan Department of Environmental Quality (MDEQ); The local agencies to be notified include: the Van Buren County Office of Domestic Preparedness, City of South Haven, Covert Township, and the South Haven Charter Township.

Recent REMP samples from the South Haven Municipal water supply were found to be less than the MDA for Tritium.

**Immediate Action Description:**

Notified, Radiation Protection Supervision, Site Vice President, Plant Manager, Regulatory Affairs Manager and Shift Manager.

**Suggested Action Description:**

Initiate an Action Plan to determine the source of the positive results identify actions to remediate the condition.

**TRENDING (For Reference Purposes Only):**

<u>Trend Type</u>	<u>Trend Code</u>
KEYWORDS	KW-TRITIUM CONTAMINATION
HEP FACTOR	P
INPO-BINNING	RP1
REPORT WEIGHT	1
AD	RPMG
KEYWORDS	KW-ENVIRONMENTAL DISCHARGE
GRADE ACE	21.6

**Attachments:**

- Suggested Action Description
- HP 2.8 Notifications
- MW-03-07 TRITIUM RESULTS
- mw-03-07 results and map

*N-18*

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**ATTACHMENT 9.2 TYPICAL LOWER TIER APPARENT CAUSE EVALUATION & RESPONSE TEMPLATE**

<b>Condition Report Number:</b> CR-PLP-2007-06228	<b>Assigned Department:</b> Licensing
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**PROBLEM STATEMENT:** *(The WHAT) (see Procedure step 5.4[2](a))*

An elevated level of tritium was identified and confirmed in groundwater monitoring Well #3 that is in excess of the Offsite Dose Calculation Manual (ODCM) limit. The source of the tritium intrusion at the Well #3 location needs to be identified, isolated and corrected.

**Does this ACE report require an Equipment Failure Evaluation (EFE)?**  Yes  No  
(See procedure steps 5.4 [2] (b) and 5.5)

**IF Yes, THEN** complete Attachment 9.7 Equipment Failure Evaluation **AND** attach in PCRS

**IF No, THEN** an EFE analysis is not required.

**Was an HPER performed for this CR?**  Yes  No  
(See procedure step 5.4 [2] (b))

**IF Yes, THEN** ensure results of the EN-HU-103 HPER are discussed in the Explanation of Problem section.

**EXPLANATION OF PROBLEM:** *(The HOW) (see Procedure step 5.4[2](c))*

During the period between November 28-30, 2007, 5 shallow groundwater monitoring wells were installed along the west border of the plant site, approximately parallel to the Lake Michigan beach (see Condition Description for specific locations). The well locations are numbered 1-5 from south to north, approximately 200 feet east of the Lake Michigan shoreline and are spaced equally apart with intent to reasonably monitor the entire western plant protected area border with the lake. Well #3 is the middle well of the 5 wells. The wells were installed per NEI 07-07, "Industry Ground Water Protection Initiative."

A development water sample from the well installations was analyzed for tritium on December 10, 2007, with the results of that analysis as follows: Well #s 1, 2, 4 and 5 indicated less than the minimum detectable tritium activity of 641 pico curies/liter. Well #3 indicated 22,000 pico curies/liter of tritium activity. Radio-isotope analysis of each well sample contained no detectable particulate radionuclides.

Subsequently, on December 13, 2007, each of the 5 monitoring wells was sampled and analyzed for tritium with the following results: Well #s 1, 4, 5 indicated less than minimum detectable tritium activity. Well #2 indicated a small amount of tritium at approximately 1,000 pico curies/liter. Well #3

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indicated approximately 35,000 pico curies/liter tritium. Again, no particulate radionuclides were noted in the well samples.

The results of studies of groundwater movement on site indicate that groundwater flow direction is in the westward direction, toward Lake Michigan, at an assumed rate of approximately 6 feet per day. Neither the direction nor flow rate has been positively confirmed, but represent the conclusions from a hydrogeologic study conducted of site groundwater.

The general conclusion from the above information is that an intrusion of tritium is currently occurring near or hydrologically upstream (east) of Well #3, and may also be affecting Well #2, but to a much lesser extent. Spills/leaks of water containing tritium that have been documented to have occurred in the general area of Well #2 and #3 over previous years have been ruled out as a cause of the current problem, since there have been no recent incidents of spills/leaks, and the assumed movement of groundwater should have dissipated any localized tritium concentration in the groundwater from historical leaks.

A team was assembled to identify the apparent source of the tritium. The team is comprised of individuals representing the following areas: Chemistry, Radiation Protection, Engineering, Operations, Maintenance, and Licensing.

**APPARENT/CONTRIBUTING CAUSE(S):** (*The WHY*) (see Procedure step 5.4[2](d))

At this time, the team determined only possible causes for the problem. Actions have been initiated based on the possible causes that will lead to discovery of the actual apparent cause of the issue.

The team used a logical approach to determine possible causes. The results were subsequently reviewed and approved by a K-T (Kepner-Trego) trained individual, independent of the team.

The process for determining possible causes was initiated by identifying all sources of water on site containing tritium (that are not completely enclosed within a building where leakage would be evident), and eliminating all of these sources with tritium concentrations less than 30,000 pico curies/liter:

	<u>pico curies/liter</u>
T-81, Primary System Makeup Tank	< MDA
Well #2	1150
Turbine Sump	1850
T-90, Primary System Makeup Tank	4940
T-2, Condensate Storage Tank	5190
T-41, Turbine Sump Drain Tank	8560
Well #3	34,500
Aux, Safeguards, and Cont. Sumps	≈100,000,000 +

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T-91, Utility Water Storage Tank	120,000,000
Safety Injection and Refueling Water Tank	156,000,000
Spent Fuel Pool	177,000,000
Primary Coolant System	638,000,000

From the list of sources with sufficient tritium concentration, the primary coolant system, spent fuel pool, and safety injection and refueling water tank were eliminated based on no physical communication pathway between the source and/or its service piping with the ground. The safeguards room sumps, and/or containment sump could be considered to be in contact with the ground, but each of these sources is below the water table, which would more likely result in groundwater intrusion to the sump rather than sump contents entering the groundwater. The auxiliary building sump is also in contact with the ground; however, its distance from Well #3 would suggest a wider plume by the time its contents migrated westward to the well locations.

The most likely source of the tritium in Well #3 is from the T-91, Utility Water Storage Tank, and/or its service piping. As noted above, T-91 contains a high tritium concentration. The tank is located approximately equidistant between Well #2 and Well #3. T-91 is completely above ground, and rests on a concrete pad. T-91 was inspected and its lining repaired during the ALPS conversion project. Any tank leakage that could exist would be observed as water around the outside of tank, or water leaking directly down into the valve pit. No leakage around the tank is evident.

On January 4, 2008, the T-91/T-90 combined valve pit was noted to contain approximately 1 foot of water. The valve pit was pumped out and the water was sampled for both tritium and particulate radionuclides. The tritium concentration was determined to be approximately 115,000,000 pico curies/liter tritium, which is completely consistent with the tritium concentration of T-91. However, as with the monitoring wells, the particulate radionuclides that are also present in T-91 were not noted in the valve pit sample. Industry experience with leaks of water to the ground that contain both tritium and other particulate radionuclides is that the tritium transports through the ground, while the particulate radionuclides are filtered by the ground soil and do not migrate with the groundwater. Since no particulate radionuclides were present in this sample from the T-91 valve pit, the water in the valve pit was assumed to not be direct leakage from T-91 to the pit, but rather, in-leakage via the ground.

Subsequently, on January 10, 2008, entry into the valve pit identified leakage into the valve pit from a ceiling penetration, along the recirculation inlet line to T-91. The water originates above the ceiling and can be seen running down the pipe exterior. The leak drips to the floor of the valve pit at a rate of 4 drops per minute. This water contained tritium and particulate radionuclides consistent with T-91, and is strong evidence of leakage from T-91 to the valve pit. Despite the identification of this leak path, this leak is not currently considered to be the source of the tritium that was identified in Well #3. A separate WR and CR will be initiated for this leak.

There are 4 service pipes associated with T-91. The pipes range from 2" to 4" diameter, and are welded stainless steel. The pipes are buried together with the pipes that service T-90 (7 total pipes) at a depth of approximately 6 feet. The pipes are directly in the ground, exiting the west side of the auxiliary building below grade, and traveling a path initially westward past the radwaste heating boiler room and the south end of the feedwater purity building. This portion of the piping run is directly upstream of Well #3. Near Well #3, the pipe run turns to the south and follows a path along

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and beneath the road until it reaches the area of the T-91/T-90 valve pit, where the pipes enter the valve pit.

Two of the T-91 service pipes are associated with tank recirculation. T-91 is on continuous recirculation back to the auxiliary building. A third pipe is the normal T-91 fill line from the auxiliary building. The fourth line is the T-91 overflow line.

Because of their proximity to Well #3, a leak in one or more of these underground piping runs that service T-91 is viewed as the most likely cause of the tritium in Well #3. This would be a leak that is separate from the leak identified from T-91 into its valve pit. At this time, there is no evidence that the identified leak from T-91 to the valve pit is able to exit the valve pit and/or affect Well #3.

**EXTENT OF CONDITION:** (see Procedure step 5.4[2](e))

As noted earlier, this conclusion is considered a possible cause. Extent of condition must be deferred until actions are initiated to identify the specific leak location(s) and cause. An action will be generated to augment this evaluation with additional information when complete information is known.

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EFE Codes (see Procedure step 5.5 [5]):

INPO PO&C codes:	Failure Mode Codes:

ACE Evaluator (print Name):
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CR-PLP-2007-06228  
 Ground Water Tritium in Monitoring Well Samples  
 Additional Information

The follow information augments the attached ACE and serves as an interim update on the ground water tritium issue at Palisades. It is provided to CARB to enable members to have the latest information on the subject. The attached Lower Tier ACE was completed on January 10, 2008, with information known at that time. Investigation is continuing into the actual cause. A "circle-back" CA has been generated to finalize the ACE; currently due April 17, 2008.

Subsequent to the completion of the attached ACE, the following additional information has been determined:

- T-91 was originally believed to rest on a full concrete pad. This information was not correct. T-91 rests a concrete ring foundation and is otherwise in contact with the ground. Therefore, the observed leak through the floor of T-91 into the valve pit may not represent the entire potential for T-91 to be leaking directly to ground. The tank was entered and visually inspected. Significant coating failure was observed. Scoping for T-91 repair/replacement is in progress. CR-PLP-2008-00134
- The buried pipes servicing T-91 were tested via air pressure drop, visual, and hydrostatic methods resulting in the determination that the 2" recirculation pipe has a leak. CR-PLP-2008-00554
- Tracer gas testing using helium confirmed a leak location on the 2" recirculation pipe near the T-90/91 valve pit. Planning is in progress to excavate the area to determine the specific cause.
- The original ACE contains an error in the tritium concentration of tank T-90. T-90 had been eliminated as a source based on a low tritium level of approximately 5K pc/l, compared to Well 3 tritium originally at 35K pc/l. Further questioning has revealed that T-90 has a tritium level of approximately 50K pc/l, which is above the level of tritium detected in Well 3. While not mathematically ruled out, T-90 is still not suspected as a source since the concentration would appear to be too low to have the indicated affect on Well 3 when diluted with ground water. By comparison, T-91 tritium level is approximately 2000 times that of T-90.

Well Samples:	1	2	3	4	5
Dec 13, 2007	<mda	1000	35000	<mda	<mda
Jan 14, 2008	<mda	<mda	9000	<mda	<mda
Jan 28, 2008	<mda	<mda	19000	<mda	<mda
Feb 11, 2008	<mda	<mda	42000	<mda	<mda
Feb 25, 2008	<mda	<mda	16700	<mda	<mda