Undated

EC 361017

Revision A

EVALUATION OF THE INTERIM REMEDIAL ACTION PUMPING SYSTEM

Evaluation for use of the

Interim Remedial Action Pumping System

At Braidwood Station

HH-6

EVALUATION OF THE INTERIM REMEDIAL ACTION PUMPING SYSTEM

Introduction

In 1998 and 2000, leaks from Vacuum Breakers # 3 and # 2, respectively, on the Lake Blowdown line (0CW09C48) going to the Kankakee River resulted in water contaminated with radioactive tritium being released into the surrounding area. Over time, the tritium entered the groundwater and due to the flow of the groundwater, the contamination has continued to spread. To remediate this problem, Exelon in conjunction with government agencies, has developed a plan to reduce the tritium concentration in the groundwater. The remediation plan involves lowering the level in a local pond (referred to as the Exelon Pond)to draw in turn the surrounding groundwater into the pond. The pond water level will be lowered via a temporary pumping system that discharges into the Blowdown line where it will be diluted with lake water and discharged into the Kankakee River.

To accomplish this plan, the new pumping system must be installed, physical alterations must be performed on the Blowdown line and the operation of the plan must be procedurally controlled. All of these actions must be implemented while conforming to all Station design bases, licensing requirements, State permits and regulations and any new requirements imposed because of the spills and their remediation.

This EC (361017) evaluates the acceptability of discharging tritiated water from the Exelon pond, using the Interim Remedial Action Pumping System (IRAPS), pumping the tritiated water into the Circulating Water System Blowdown Line (CW BD) and discharging it to the Kankakee River. The EC provides a description of new and existing components, revisions to existing systems and components and their operation and control. Additionally, the EC provides the basis and the methods that will be employed to ensure the plan is acceptable with regards to licensing and regulatory requirements.

The descriptions and commitments made in this EC Evaluation are intended for the purposes of the interim remediation action plan (IRAP) described in this document and are not intended as commitments for any other purposes.

To accomplish this evaluation, numerous documents were reviewed and used as inputs for this EC and are referenced, as appropriate.

The document is comprised of six detailed sections. Each section addresses a specific portion of the plan.

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Executive Summary

EC 361017 has evaluated all areas of concern (as listed in the Table of Contents above) relative to implementation of the Interim Remedial Action Pumping System (IRAPS) for transferring water from the Exelon pond to the Kankakee River via the Circulating Water System Blowdown Line (CW BD).

EC 361017 finds all areas reviewed to be acceptable and transfer of water from the Exelon pond to the Kankakee River may commence upon completion of pre-operation actions included in Reference 3 and receipt of approval from the State of Illinois.

Effect on Groundwater

Geological discussion

From Reference 1:

A comprehensive groundwater investigation program was conducted by Conestoga-Rovers & Associates (CRA) at Braidwood Station in 2005 and early 2006.

As a result of that investigation, an area was identified where tritium has been detected above the 35 IAC 620 (Illinois Administrative Code) groundwater standard (20,000 picocuries per liter (pCi/L)). This area, approximately 4.5 acres in size, is located near Smiley Road, at the southeast corner of a pond owned by Exelon and just west of the Circulating Water Blowdown Line (CW BD).

Data indicate that tritium at concentrations above the lower detection capability (approximately 200 pCi/L) has migrated into the Exelon pond, north of Smiley Road and, to a limited extent, past the pond. Maps included in the attached Interim Remedial Action Plan (IRAP) illustrate the location of the tritium plume in the groundwater.

Remediation philosophy

From Reference 1:

The Interim Remediation Action Plan (IRAP) has been developed to retard the movement of the tritium plume in the groundwater and reduce the tritium that has migrated downgradient of the Exelon pond.

Per the evaluation performed in Reference 1, the removal of tritium in the groundwater will be achieved by pumping water from the Exelon pond to lower the level in the pond and create a 'cone-of-depression' in the water table. Lowering of the pond will reverse groundwater flow north of the Exelon pond and mitigate the concentrations of tritium over time. This will allow for the removal of tritium within the main plume area to prevent further tritium migration beyond the vicinity of the Exelon pond.

The IRAP involves the placement of a pump in the Exelon pond to transfer water from the pond into the Braidwood Station Blowdown Line. The pond water will be pumped via a forcemain (i.e., a discharge pipe to be installed from the pond to a connection point on the blowdown line).

During the start-up of the system, the tritium concentration in the pumped water will be closely monitored and correlated with the flow rate. This will be done to ensure the tritium entering the blowdown line will form a composite concentration in the blowdown line of less than 200 pCi/L.

Local temporary wells will also be closely monitored during the start-up phase to ensure that lowering of the pond will not overdraw nearby shallow private

wells. The IRAP pumping system is a temporary installation. The expected duration of the operation is approximately two years. Pumping may not be continuous, once a steady state pond level is achieved.

The duration of the proposed interim remediation operation will be based on a review of the operating conditions at the impacted area and the effectiveness of the remedial action over time. This review will consider how the proposed pond pumping system could be modified to shorten the cleanup time and to increase tritium recovery. (Reference 3, # 1)

Effects on neighboring residents

The influence on private wells of neighboring residents has been predicted by CRA and is documented in Reference 15 and 16.

The predicted drawdown, or drop in the level of the water table, at locations where private wells exist and are being used is shown on CRA drawing Reference 16. These drawdown values are based upon preliminary modeling performed to assist in the design of the pumping system. The estimated drawdown ranges are from 5.5 feet near the pond to 3.2 feet at locations farther north of the pond. This drawdown amount is valid only for the shallow sand aquifer and would not be experienced in the deeper bedrock private wells, which are installed at depths of 60 ft to over 600 ft, and are in different geological formations.

The predicted drawdown for the pond (7 ft) and the predicted drawdown in areas of the shallow private wells (3 to 5 ft) are based upon conservative modeling assumptions and simplified input parameters. As such, the drawdown required in the pond (and therefore the drawdown measured in the capture zone in the groundwater) will likely be less than predicted.

Planned monitoring of pond and groundwater levels at the start up of pumping will better establish the actual degree of drawdown or drop in the water table aquifer. Areas located out of the predicted capture zone, or approximately 1200 feet from the pond, would not be affected by the pumping according to the preliminary modeling evaluations.

It is not possible to predict, at this time, the specific affects on the shallow private wells because of unknown conditions such as:

- pumping level in the private wells
- average yield of the private wells
- average pumping rate of the private wells
- history of seasonal water table fluctuations around the pond.

Consequently, it is possible that the performance of some of the private wells may be affected by pond pumping. During the pumping operations, Exelon and CRA will monitor water levels in groundwater sampling wells and private

wells and take actions to adjust pumping rates and/or provide water for any residential wells that may be affected. (Reference 3, # 2)

Audible noise impact to neighbors from the pumping site was considered and determined to be negligible, since the IRAPS pump/motor is submersible and will be below the surface of the pond, reducing noise from the pump/motor.

Communications with neighboring residents

The communications plan for the interim remediation project consists of direct communication with the most affected stakeholders, outreach to local and county officials, media outreach and an information night to inform the general public.

Door-to-door communications were made with the most affected stakeholders on March 29, 2006. This included residents whose groundwater is affected along with those who live in the vicinity of the plume or within 1000 feet of the blowdown line. These residents received an information packet that included a letter from the Braidwood Station Site Vice President and a copy of the news release that explained the interim remediation plan. They also received an invitation to the April 6, 2006 information night, and a page with frequently asked questions.

The information night event held on April 6, 2006 was intended to educate the public on the planned remediation efforts and to allow those interested to engage in one-on-one conversations with Exelon, State and NRC representatives.

Also on March 29, 2006, a news release was issued to inform the general public, and local and county officials were contacted by telephone and faxed pertinent information.

The news release and frequently asked questions documents were loaded onto the Braidwood Station tritium communications website (www.braidwoodtritium.info) and the information was included in a previously established hardcopy repository of tritium project documents at the Fossil Ridge Library in Braidwood, IL.

Prior to beginning the pumping, the remediation team will communicate with neighbors whose wells may potentially be affected to describe the monitoring process and contingency plans for any effect on private well performance. (Reference 3, # 3)

Exelon Pond

General description

The Exelon owned pond at issue, is located north and east of the Smiley Road and Center Street intersection. This pond is generally square in shape, with the approximate dimensions of 1100 feet by 1150 feet and an average depth of 16 feet. Pond level is measured using a manual level reading gauge in the southeast corner of the pond. (Reference 2)

Tritium Concentration

Tritium concentration in the pond is currently 2341 pCi/L, however, the concentration level will be assumed to be 3577 pCi/L (Reference 14). This value was chosen for use in the procedural flow rate calculations, with the expectation that the concentration in the pond would remain below this value. Weekly chemistry sampling will verify that this number is not challenged. (Reference 3 # 11)

Effect on pond fish

Tritium transport occurs rapidly through water and is distributed in biological tissue as tritiated water in aquatic vegetation, fish and other animals.

The pond contains several varieties of fish including large mouth bass, crappie, blue gill, catfish and grass carp (white amur). Estimated sizes for the bass are in the 6 to 10 pound range and the grass carp could weigh as much as 40 pounds.

The Illinois Department of Natural Resources (IDNR) and Exelon's Environmental Department have determined the following:

1. While the pond is expected to be pumped down an estimated 7 feet, leaving an approximate pond depth of 9 feet, moving the fish is expected to be more harmful than leaving them in the pond,
2. With IRAPS in operation, the pond will be monitored twice per week by conducting shoreline walk-downs to look for signs of stressed fish. A log of the shoreline inspections will be maintained including the person who conducted the inspection, time of day and general observations. The twice per week inspections will be conducted by Joe Tidmore, Site Environmental (or designee) . John Petro, Cantera Environmental will provide periodic inspections to support site staff.
(Reference 3, # 15)

3. A contingency plan to move the fish from the pond will be established. A fish sampling effort is tentatively planned for the end of April to collect representative species of fish. Collected fish will follow standard IDNR and/or IDPH contaminant sampling protocol and will be sent to a lab for tritium analysis. Completion of any such sampling, or the results, is not required prior to pumping of the pond. (Reference 3, # 4)

The Exelon environmental department has reviewed reportability requirements in the unlikely event of a fish kill in the Exelon pond. The review determined such an event would not be reportable because the pond is not covered by any NPDES Permit nor is it impacted by power plant operations governed by the NPDES Permit.

Pond level limits

The pump will be operated at a sufficient flow rate to drop the pond level by approximately 7 feet. The actual level that will be maintained by the pump will be dependent upon the groundwater level responses in monitoring wells surrounding the pond to ensure that private shallow wells in the area are not lowered to a level that may limit residences water intake. (Reference 1 and 20)

Although preliminary modeling was performed to develop the initial design criteria, the system will be closely monitored and modified during the start-up phase. That is, the steady state pond level and the pump flow rate can and will be varied depending on groundwater response, if design conditions change. (Reference 1)

CRA will provide the aforementioned monitoring and advise Exelon of any recommended changes to monitoring or pumping operation. (Reference 3, # 2)

Additionally, Exelon will review this EC evaluation in approximately two years to determine if any additional testing or re-testing is required to ensure the continued validity of this evaluation. (Reference 3, # 16)

Remote Monitoring of Vacuum Breaker Integrity

Since all eleven vacuum breaker vaults were sealed, as described in the previous discussion, the source of any water within the vault will be from the CW BD and not from groundwater. A continuously monitored leakage detection system has been installed in all eleven of the vacuum breaker enclosures to promptly detect any such leakage.

This leakage detection system will consist of sensors placed at the bottom of the vacuum breaker enclosure that will be wired to a transmitting device installed next to the vacuum breaker. If a sensor detect water, its transmitter will send a signal via a cellular telephone network to Operators in the Braidwood Main Control Room. Upon receipt of notification from the system, operators will promptly take action, remotely or manually, to turn off the pump at the pond to secure the interim remediation operation. A simulated test determined that it would take four minutes from water detection to remote pump shutdown.

The transmitting device is powered by a solar panel mounted outside of each vacuum breaker vault. A 6-day battery provides backup power and is charged by the solar panel.

Upon receipt of an alarm from the leak detection system, operators have two options.

1. connect via a web site (alarmagent.com) and remotely shut down the IRAPS pump at the pond, or
2. dispatch an equipment operator to turn off the pump at the pond to secure the interim remediation operation.

Operation of the remote leak detection system will be controlled by BwOP CW-28.

Local monitoring of Blowdown Line Integrity

On a weekly basis, the BD right-of-way will be inspected for signs of leaks. Personnel performing the inspection will notify the Braidwood Station Main Control Room (MCR) to secure the IRAPS pumping if signs of leakage are found. Specific details of the weekly inspection will be included in the operating surveillance procedure (Reference 3, # 17).

Tritium concentration in Blowdown Line

Chemistry and Operations procedures include sampling and flow rate limitations to ensure that the composite concentration of tritiated water remains less than 200 pCi/l at all times. This limitation is governed by a table in BwOP CW-28, which lists maximum and minimum flow rates from the pond pump based on CW BD flow. See Attachment A. The maximum flow rates were determined by a dilution calculation using a Cooling Lake tritium concentration of 35 pCi/l, which was obtained via enhanced LLD analysis of the Cooling Lake) and an assumed maximum pond concentration of 3577 pCi/l. Weekly chemistry sampling of the pond will verify that the pond concentration remains below 80% of the assumed maximum concentration (2862 pCi/l). See Section 'Chemistry Procedure changes'.

Pond concentration was conservatively estimated based on tritium content in the groundwater plume being completely transferred into the pond volume. (Reference 14)

Note: This concentration limit is intended to apply to the IRAP as approved by various state agencies as documented in the "Agreed Preliminary Injunction Order," (Reference 26). This limit is not intended as regulatory commitment outside of the referenced Order.

Discharge from Station radioactive release tanks is administratively prohibited and controlled by maintaining Release Tank Discharge Header and Isolation Valves 0WX896 and 0WX353 out-of-service in the closed position.

water intake. Tritium releases to the Kankakee River are allowed in concentrations up to the limits specified in the Offsite Dose Calculation Manual (ODCM) i.e., 1E6 pCi/l. The concentration of tritium discharged to the Kankakee River under this interim remediation plan will be less than 200 pCi/l, well within limitations of the ODCM. Even without considering any further dilution from river flow, this concentration would not have any adverse effect on the Wilmington public water supply or any private wells close to the river. (Reference 15 and 16)

NPDES

The IRAP will utilize the existing NDPES permit allowing discharge of the water to the Kankakee River through the Blowdown Line, therefore eliminating the need for additional agency permitting. Verbal concurrence has been obtained from the IEPA supporting this position.

Braidwood Chemistry considers this discharge a sub-waste stream of the Blowdown Line and therefore no specific reportable NPDES monitoring of the discharge would be required.

Approvals for Exelon Pond discharge

Illinois Attorney General permission to implement the pumping plan is anticipated after P.O.R.C review of this DCP evaluation and approval will subsequently be documented in this DCP.

Prior to beginning the interim remediation pumping, approval will be required by the parties involved in the Complaint filed March 6, 2006, against Exelon. These parties include Illinois Attorney General (representing Illinois Environmental Protection Agency) and the Will County State's Attorney. This approval will be in the form of an "Agreed Preliminary Injunction Order," signed by Exelon and the parties involved in the complaint. (Reference 26)

Relevant portions of the Order follow:

12. To halt the further migration of the tritium plume emanating from vacuum breakers No. 2 and No. 3 into groundwater on and offsite, Exelon Generation has developed a plan titled, "Interim Remedial Action Plan," which is attached hereto as Exhibit A and incorporated by reference herein. Within twenty one (21) days of entry of this Preliminary Injunction Order, and receipt by Exelon of all necessary permits (if any), Exelon Generation shall initiate pumping of the Exelon pond in accordance with that plan.

14. As described in the Interim Remedial Action Plan, Exelon Generation will discharge the water pumped from the Exelon pond by means of the blowdown line. At all times when discharging such water through the blowdown line, Exelon Generation shall:

a) conduct a weekly visual inspection, or alternative method of monitoring, of the pipeline corridor to check for signs of pipe failure and document its findings. This documentation shall be available for inspection by the Plaintiff;

b) install monitoring wells at the mid-point between vacuum breakers. Exelon Generation shall on a monthly basis sample these wells, and one existing down gradient shallow monitoring well located adjacent to each vacuum breaker, for tritium, chloride and sodium; and shall provide these results to the Illinois EPA on a quarterly basis; *

c) maintain a continuous monitoring system in each vacuum breaker vault to warn Exelon Generation of any water discharges from the vacuum breakers. Exelon Generation shall immediately cease pumping water from the Exelon pond into the blowdown line if such discharge(s) are identified;

d) maintain the impermeable barriers it recently installed at the base of each vacuum breaker pit;

e) operate the blowdown line in a flooded condition; and

f) take all other necessary steps to ensure that water from the Exelon pond, and any other wastewaters, are not discharged at any point other than the permitted outfall to the Kankakee River.

* monitoring wells will be functional 30 days after IRAPS pumping begins.

In addition, the NRC has asked to review our plan for interim remediation, although no formal approval is required. A letter to the NRC, dated April 4, 2006, describes the plan. (Reference 17) Prior to beginning of pumping, the personnel responsible for implementation of the IRAP will verify the NRC has no unresolved concerns with the plan.

References

1. 'Interim Remedial Action Plan', Exelon Generation Company LLC - Conestoga-Rovers & Associates (CRA), dated March 2006
2. 'Interim Remedial Action Pumping System' Project 45065-01, Conestoga-Rovers & Associates, Drawings:
   - CS-01
   - EF-01, 'Engineering Flow Diagram Legend'
   - EF-01, ''Engineering Flow Sheet 1'
   - ST-01, 'Site Plan'
   - ST-02, 'Valve Station Pad'
   - ME-01, 'Piping @ Valve Station'
   - E-01, 'Electrical Panel'
   - E-02, 'Panel Schematic Wiring Diagram'
3. Action Tracking Item 448107, Action Items for Interim Remediation Action Plan, assigned to Exelon personnel.
4. SPP 06-003, 'CW BD Flow Throttled at Discharge Structure Test'
5. BwOP CW-28, Rev 0, 'Operation of the Exelon Pond Pump'
6. BwOP CW-12, 'Circulating Water Blowdown System Fill, Startup, Operation and Shutdown'.
7. Offsite Dose Calculation Manual
8. NPDES Permit IL0048321
9. EC 360234, Rev 0, 'Piping Connection at CW Blowdown Line Vacuum Breaker #2'
10. 'Interim Remedial Action Pumping System Dilution Calculation', Excel spreadsheet, Attachment A to EC 361017.
11. CRA drawings for vacuum breaker vault leak detection:
    - "Vacuum Breaker Valve Leak Detection Vault Installation Wiring Diagram", Figure 1
    - "Vacuum Breaker Valve Vault Installation Details", Figure 2
    - "Vacuum Breaker Valve Leak Detection System", Figure 6.3
12. EC 360112, 'Waterseal of Vacuum Breaker Vaults'
13. EC 360114, 'Add an Additional Valve to CW Blowdown Line 0CWC2CA-18"'

14. 'Tritium Concentration in Pond', e-mail from N. Smith/P. Harvey (CRA) to A. Haeger (Exelon) dated February 28, 2006.

15. 'Estimate of Groundwater Level Drawdown in the Shallow Sand Aquifer in the Vicinity of the Exelon Pond During Interim Remediation', Memorandum from P. Harvey (CRA) to A. Haeger (Exelon) dated April 4, 2006.

16. 'Simulated Groundwater Drawdown in the Shallow Sand Aquifer at Private Well Locations When Pumping from the Pond', CRA Drawing 45065-01(PRES001)GN-WA001, dated March 31, 2006.

17. 'Groundwater Tritium Interim Remediation', letter to US Nuclear Regulatory Commission from K. Polson (Exelon) dated April 4, 2006.

18. Calculation BRW-06-0073-M, 'Hydraulic Transient Analysis of the Circulating Water Blowdown Pipeline'.

19. M-900 series of Braidwood Station Piping and Instrument Drawings
    - Sheet 2, REV G, Outdoor Piping Arrangement Braidwood Station Units 1 & 2
    - Sheet 3, Rev C, Outdoor Piping Arrangement Braidwood Station Units 1 & 2
    - Sheet 4, Rev B, Outdoor Piping Arrangement Braidwood Station Units 1 & 2
    - Sheet 5, Rev B, Outdoor Piping Arrangement Braidwood Station Units 1 & 2
    - Sheet 6, Rev A, Outdoor Piping Arrangement Braidwood Station Units 1 & 2
    - Sheet 13, REV I, Blowdown piping to outfall structure Braidwood Station Units 1 & 2

20. 'Proposal for Investigation and Evaluation of Prestressed Concrete Cylinder Pipe (PCCP) Water Pipeline for Braidwood Nuclear Power Station', from Construction Technology Laboratories, Inc. to J. Gastouniotis, dated July 10, 1992.

21. 'Full Vacuum Condition Design For Prestressed Concrete Steel Cylinder Pipe', Interpace Project No. SB-77-27 dated April 4, 2006

22. M-44 Sheet 3A, Braidwood Station Piping and Instrument Drawings

23. BwCP 1003-14, 'Exelon Pond Weekly Discharge'.

24. BwCP 1003-15, 'Exelon Pond Monthly Discharge'.

25. BwCP 1003-16, 'Exelon Pond Quarterly Discharge'.

26. "Agreed Preliminary Injunction Order", People of the State of Illinois vs. Exelon Corporation, dated May 4, 2006.

27. Evaluation Report of 'Nondestructive Pipeline Condition Assessment of 48 " Concrete Blowdown Line', The Pressure Pipe Inspection Company Ltd., DCI-REP-20060131-S2H0, January 2006.

28. Email from S. Tritch to J. Damron dated 5/22/06.

29. Not Used

30. Email from H. Hannoun to A. Haeger dated 4/28/06.

31. Email from M. Anjum to J. Gosnell dated 5/23/06.

32. Email from M. Anjum to J. Gosnell dated 5/23/06.

Attachment A **Interim Remedial Action Pumping System Dilution Calculation** **EC 361017 Revision 000**

Blowdown Flow (GPM)	Cooling Lake Background (pCi/L)	Maximum IRAPS Pump Flow (GPM)
25000	35.1	1153
24000	35.1	1106
23000	35.1	1060
22000	35.1	1014
21000	35.1	968
20000	35.1	922
19000	35.1	876
18000	35.1	830
17000	35.1	784
16000	35.1	738
15000	35.1	692
14000	35.1	645
13000	35.1	599
12000	35.1	553
11000	35.1	507
10000	35.1	461
9000	35.1	415
21691	35.1	1000
20606	35.1	950
19522	35.1	900
18437	35.1	850
17352	35.1	800
16268	35.1	750
15183	35.1	700
14099	35.1	650
13014	35.1	600
11930	35.1	550

Enter a Cooling Lake tritium concentration or Pond tritium concentration.

Cooling Lake (pCi/L)	plus/minus
35.09	0.957

Pond (pCi/L)
3,777

Attachment A **Interim Remedial Action Pumping System Dilution Calculation** **EC 361017 Revision 000**

Blowdown Flow (GPM)	Cooling Lake Background (pCi/L)	Maximum IRAPS Pump Flow (GPM)
10845	35.1	500
9761	35.1	450
8676	35.1	400