- Caller thought he sent something and hadn't
- comments from last PORC mtg not available
- Person said
  - minor editorial comments were coming

EC 360234

EVALUATION

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 and a local pond (referred to as the Exelon pond). 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 the local pond to draw in turn the surrounding groundwater into the pond. The pond water level will be lowered via a 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 (360234) 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 BDL) 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 to 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.

HH-3

Table of Contents

Introduction	**1**
Executive Summary	**3**
Effect on Groundwater	**4**
Geology discussion	4
Remediation philosophy	4
Effects on neighboring residents	5
Communications with neighboring residents	6
Exelon Pond	**7**
General description	7
Tritium Concentration	7
Effect on pond fish	7
Pond level limits	8
Interim Remedial Action Pumping System	**9**
Flow path	9
Basic description of the IRAPS	9
Startup Testing	10
Procedural control of the IRAPS	10
IRAPS Interface with other Procedures	11
Basic description of IRAPS controls	11
Maintenance of IRAPS	12
Operator Training for IRAPS	12
Connection to Circulating Water System Blowdown Line	**12**
Existing vacuum breaker configuration	12
Removal of Vacuum Breaker # 2 (0CW136)	13
Replacement piping/valve segment	13
Surge check valve removal from Vacuum Breaker # 2	14
Effect of Interim Remedial Action Pumping System on the Blowdown Line and Lake Blowdown	**15**
Actions to Prevent Leakage from the BDL Vacuum Breakers	15
Actions to Prevent Leakage from the Vacuum Breaker Enclosures	16
Remote Monitoring of Vacuum Breaker Integrity	16

Local monitoring of Blowdown Line Integrity 17
Concentration in Blowdown Line 17
Blowdown Line Integrity 18
IRAPS Pump to CW BDL Integrity 20
Vacuum Breaker surveillance 20
Transient Effects on the Blowdown Line 20
Failure Modes 22
Braidwood Station Cooling Lake Chemistry 22
Monitoring of Kankakee River 23
Offsite Dose Calculation Manual (ODCM) 23
Chemistry Procedure changes 23
Effect on Wilmington Pumping Station 24
NPDES 24
Approvals for Exelon Pond discharge 25
EC EVAL Preparation and Approval (Washington Group International) 26
Edmund Stukas References 26
References 27

Executive Summary

EC 360234 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). IRAPS will transfer water from the Exelon pond to the Kankakee River via the Circulating Water System Blowdown Line (CW BDL).

All equipment and administrative controls are in place to perform the necessary actions required for pumping water from the Exelon pond.

EC 360234 finds all areas reviewed to be acceptable and transfer of water from the Exelon pond to the Kankakee River may commence upon receipt of approval from the State of Illinois.

Effect on Groundwater

Geology discussion

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 BDL).

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. (Reference 1)

Remediation philosophy

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.

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 operation is expected to last longer than one year, but 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 1)

Effects on neighboring residents

The influence on private wells of neighboring residents has been predicted by CRA and is documented in Reference 15, 16 and 20.

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 20. 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 show may be affected.

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.

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. 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 14)

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 lake willbe monitored twice per week by conducting shoreline walk-downs to look for signs of stressed fish. A log of the shoreline inspections willbe conducted including 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) and Tony D'Antonio, Project Management (or designee). John Petro, Cantera Environmental will provide periodic inspections to support site staff.

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.

Before pump starts or any Fish results

then why doing? - if results are bad, what actions to be taken

The Exelon environmental department has reviewed reportability requirements in the unlikely event of a significant 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.

but could be MR or PN because of large # of fish killed

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.

Interim Remedial Action Pumping System

Flow path

The IRAPS is designed to transfer water from the Exelon Pond into the Circulating Water System Blowdown Line (CW BDL) through a connection in the Vacuum Breaker # 2 vault. Once injected into the Blowdown Line (0CW09C48), the pond water will be diluted with the blowdown water from the Braidwood Cooling Lake and ultimately discharged to the Kankakee River.

Basic description of the IRAPS

The IRAPS pump is attached to an 8-inch flexible hose that flanges under the water level to an 8-inch carbon steel line resting on the walls of the pond.

The 8-inch carbon steel line rises above the surface of the pond to a 20-foot horizontal run of above ground piping. This 20-foot section of piping includes the locally mounted instrumentation and valves required to operate the system.

Instrumentation and valves include a 1-inch vent line, pressure indicator, flow meter, including totalizer, 2-inch line for compositor feed, an 8-inch wafer check valve, and an 8" globe valve. All instrumentation and controls will physically be located near the point where the IRAPS pump discharge exits the pond surface. (Reference 2)

The carbon steel line then is flanged to a 10 inch High Density Polyethylene (HDPE) line. This HDPE line, SDR 11 rated for 160 psig, is routed underground, approximately 4 feet below the surface for freeze protection, and enters the Vacuum Breaker # 2 vault through a penetration in the side of the vault.

Within the vault, the 10-inch HDPE is connected, via an 8 " reducing flange, to the temporary piping/valve segment that replaces Vacuum Breaker # 2.

HDPE pipe sections are 'heat fusion welded' together. When fusion pressure is applied at the designated temperature and prescribed force, with special fusion welding equipment, the molecules from each pipe surface end mix. As the joint cools, the molecules return to their crystalline form, the original interfaces have been removed, and the two pipes have become one continuous length. The result is a fusion joint that is as strong, or stronger, than the pipe itself, creating a leak-free joint.

There are no underground flanged connections within the HDPE piping.

The IRAPS pump has a shut off head of 75 psig, which is below the design pressures of the HDPE and the CW BDL of 160 psig and 110 psig, respectively. This pump is capable of 1000 gpm, however, flow will be throttled, based upon the dilution calculation included in Operating Procedure BwOP CW-28, Rev 0, described further in this document.

Exelon engineers will conduct an integrated control and interlock test to verify that the controls, interlocks, and alarms function as designed. The test will be documented in Work Order 00907166.

Startup Testing

Upon completion of IRAPS piping construction, before connecting to the IRAPS pump and CW BDL and prior to any pumping operation, hydrostatic testing of the new piping will verify its integrity at a pressure of 150 psig, twice the shut-off head pressure of the pump.

In addition to hydrostatic pressure testing, standard construction testing, electrical 'dead circuit' testing and instrument calibrations will also be performed.

Testing conducted by the piping contractor will be directed by Exelon. ~~Specific test descriptions and results will be documented in the final version of this EC.~~

Procedural control of the IRAPS

Initial startup operation of the IRAPS will be performed by a new procedure, Braidwood Station Operating Procedure, BwOP CW-28, Rev 0, 'Operation of the Exelon Pond Pump' (Reference 5).

BwOP CW-28 will incorporate the following topics:

1. Verification of the valve lineup.
2. Calculation of IRAPS pump flow rate, based upon current tritium sample results (Reference 10).
3. Starting of the IRAPS pump and throttling flow to the calculated dilution flow rate.
4. Direction to shutdown IRAPS pump <u>immediately</u>, after being notified of leak detection in <u>any</u> of the CW Blowdown Line vacuum breaker vaults by means of the remote monitoring system.

BwOP CW-28 will provide direction for continued operation of the IRAPS, including limitations of pump flow, based upon evaluations of tritium concentrations in the pond. An Excel spreadsheet, attached as part of this EC, will be used in procedure BwOP CW-28 in order to determine maximum IRAP pump flow to keep tritium concentration in the Blowdown line below 200pCi/L.

IRAPS Interface with other Procedures

SPP 06-003, 'CW BD Flow Throttled at Discharge Structure Test' determined the CW BDL pressure at which all installed CW BDL Vacuum Breakers are fully seated. The CW BD flow at this pressure will be incorporated into a procedure revision to BwOP CW-12, 'Circulating Water Blowdown System Fill, Startup, Operation and Shutdown'. (Reference 6)

Furthermore, BwOP CW-12, 'Circulating Water Blowdown System Fill, Startup, Operation and Shutdown' will contain a cross reference to BwOP CW-28 and will require shutdown of the IRAP pump prior to any planned CW BD flow changes or after any transient that causes changes in CW BD flow.

Operator Rounds will be revised to include daily checks of the IRAP pumping system.

Basic description of IRAPS controls

IRAPS has a Hand/Off/Auto switch mounted in the panel board, which is the main control of the pump. When in the Hand mode, the pump will remain in operation until it is placed in the Off mode or it is turned off by the internet-based remote shutoff.

When the position switch is in the Off mode, the pump cannot be turned on remotely.

A level sensor, mounted in the pond, is functional when the switch is placed in the Auto mode. This level sensor sends a signal to the pump controller, turning the pump on or off based upon the 4 to 20ma control signal.

The remote monitoring device receives a 4 to 20 ma signal, which allows an operator to determine the level in the pond at any time. The pond level is monitored by a website providing notification to the operators, through a telephone call, if the pond level is high or low.

If the pump is in any mode other than Off, the remote monitoring device has the ability to Trip and Restart the pump, at any time.

The main operating panel is equipped with a main disconnect switch and transformer disconnect. The transformer powers the breaker panel that powers the internal outlets, the pump controller and the remote monitoring device.

Power for the IRAPS is supplied from the Commonwealth Edison off-site power, not an on-site Braidwood Station power supply.

Maintenance of IRAPS

Maintenance of the IRAPS system will be performed by Exelon maintenance personnel. Preventive maintenance tasks will be developed and scheduled. This action will be completed following startup of the system.

Operator Training for IRAPS

All Operations crews are required to attend classroom training, during their next training cycle, on operation of the IRAPS system.

Crews that currently have scheduled training after the IRAPS system is to be operational are required to read and sign the required reading package.

This reading package covers the purpose of the IRAPS system, how to control it and proper response if an alarm is received from the system.

All Operations crews are currently scheduled to have classroom training on the IRAPS system by the end of OPs training cycle 06-3.

There will be no additional training with regards to the leak detection system (remote monitoring of vacuum breaker integrity) since the required training package describes adequately the tasks associated with responding to an alarm.

Connection to Circulating Water System Blowdown Line

Existing vacuum breaker configuration

CW Blowdown Line, 0CW09C48, has eleven air/vacuum valves strategically placed along the length of the Blowdown line. (References 19 and 22).

These valves, referred to as vacuum breakers in this discussion, act to introduce air into the line under conditions where a section, or sections, of the pipe are no longer water solid, thus helping prevent a vacuum condition, or to release air from the line when filling the system or during operation.

Referred to as a 'vacuum breaker', the device is actually a combination of an air/vacuum valve and an air release valve, both mounted on top of a surge check valve.

The air/vacuum valve operates to allow air to escape freely at any velocity (maximum discharge velocity is approximately 300 feet per second at 6.7 PSI)

The surge check valve operates on the interphase between the kinetic energy in the relative velocity flows of air and water. This surge check is a normally open valve, spring loaded, so that air passes through unrestricted. When water rushes into the surge check unit, the disc begins to close against the spring tension and reduces the rate of water flow into the air valve by means of throttling holes in the disc.

This action ensures normal gentle closing of the Air/Vacuum Valve regardless of the initial velocity flows involved and minimizes pressure surges when the valve closes.

As soon as the air/vacuum valve is closed, the pressure on both sides of the surge valve disc equalizes and the disc automatically returns to its open position. This means the air/vacuum valve does not need an incipient vacuum to open, but can open at any time the water level drops and line pressure approaches atmospheric and immediately have full re-entry flow of air into the pipeline before a vacuum can form.

The slow closing feature protects the air/vacuum valve itself and at the same time prevents the air/vacuum valve from creating a surge in the pipeline by slamming shut.

Removal of Vacuum Breaker # 2 (0CW136)

Vacuum Breaker # 2, 0CW136, will be removed from the CW System Blowdown Line. Replacing the vacuum breaker within the concrete vault will be a combination of new 8" carbon steel line flange connected to the existing butterfly isolation valve 0CW135 and two 8" check valves. The piping/valve segment will be connected to the previously installed 10" to 8" reducer, part of the Interim Remedial Action Pumping System.

EC 360112 will provide an opening for the High Density Polyethylene (HDPE) pipe of the IRAPS to enter Vacuum Breaker # 2 vault. The vault will be appropriately sealed after the HDPE pipe entry into the vault is completed.

Replacement piping/valve segment

The new piping/valve segment will consist of new 8 inch piping, fittings, two check valves and support. This configuration was designed to be installed in place of Vacuum Breaker # 2 and attached to the Vacuum Breaker surge valve.

Piping and components shall conform to the requirements of Piping Design Table 100BB.

Any welding shall be performed in accordance with applicable Exelon procedures.

A support capable of supporting 500 lbs is required between the pipe and the new floor of the vault. Wood cribbing, a jack stand or other suitable configurations that can support the weight of the piping is acceptable. The additional support is required to prevent placing an eccentric load on the CW blowdown pipe. Since the new concrete floor is on grade, it is capable of supporting the additional load.

Configuration details are provided on sketch. (Reference 9)

A hydrostatic test will be performed for the piping/valve segment. Test pressure shall be equal to the test pressure for the pond piping. If shop tested, pressure shall be 150 psig.

Verification of check valve flow orientation will be verified.

All components of this new piping/valve segment are designed for a working pressure greater than either the IRAPS or CW Blowdown Line

Surge check valve removal from Vacuum Breaker # 2

The surge check valve portion of 0CW136, Vacuum Breaker # 2, is not designed to pass 1000 gpm flow, according to the vendor. Removal can be accomplished by removing the surge check valve internals, which can be accomplished without disconnecting isolation butterfly valve, 0CW135. Following removal of the air/vacuum valve portion of 0CW136, the internals of the surge check valve can be removed through the top of its body.

Is this method #1

0BwOS CW-A1, 'Circulating Water System Blowdown and Makeup Vacuum Breaker Valve Inspection', an annual inspection, was last performed on 11/11/2005 to verify proper operation of 0CW135. However, should method number 1 above be used, the possibility still exists that the CW Blowdown may need to be secured if 0CW135 does not properly seal.

Effect of Interim Remedial Action Pumping System on the Blowdown Line and Lake Blowdown

Actions to Prevent Leakage from the BDL Vacuum Breakers

The following actions are being taken to provide confidence that the vacuum breaker valves will not leak while executing the IRAP.

1. Each vacuum breaker valve that will be in service was inspected prior to initially commencing the interim remediation operation, and in particular:
   - float integrity and seating surface components within each vacuum breaker valve were inspected to ensure the proper sealing of those components to prevent leakage.
   - replacement of any vacuum breaker release valves found faulty.
2. A review was performed to evaluate if vacuum breaker PMs require revision or addition due to the higher operating pressure of the CW BDL. SPP 06-003 (Reference 4) will adjust CW BDL pressure as discussed below.
   It was concluded that the PM frequency for the vacuum breakers was adequate, and that the PM frequency for the air release valves would need to be updated for replacement every 2 years for all 11 of the vacuum breakers.
3. During the interim remediation pumping operation, the blowdown line will be operated 'pressurized' (pipe water solid) along the full length of the pipeline to ensure the vacuum breaker valves that are in service will remain seated (i.e., closed). 'Pressurization' will be accomplished by throttling a new 18 inch valve installed per EC 360114, "Add an Additional Valve to CW Blowdown Line 0CWC2CA18", at the end of the Blowdown line near the discharge point into the Kankakee River. (Reference 13)
4. SPP 06-003, 'CW BD Flow Throttled at Discharge Structure Test', will determine the CW BDL flow and the desired pipe pressure to fully seat the vacuum breakers. The CW BD flow at this pressure will be incorporated into a procedure revision to BwOP CW-12, 'Circulating Water Blowdown System Fill, Startup, Operation and Shutdown'. (Reference 4)

Actions to Prevent Leakage from the Vacuum Breaker Enclosures

The vacuum breaker vaults were modified to be watertight. Watertight manhole covers are anchored to the concrete vault roof slab. A watertight gasket has been installed between the frame and the concrete roof slab to prevent water intrusion.

New concrete floors for the vaults are reinforced with welded wire fabric mesh and doweled into the manhole walls to prevent cracking and differential movement of the slab. A bentonite water-stop is installed at all joints and slab penetrations (floor slab to manhole wall, floor slab to drain pipe, floor slab to flange outlet) and a twelve inch wide strip of joint wrap will be applied around the vault wall at the wall to floor slab interface to preclude water movement into or out of the vault. The inside of the vaults were covered with suitable waterproof coatings at the base of each vacuum breaker pit were installed per EC 360112 to contain any leakage within the vault. (Reference 12)

Confusing

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 BDL 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 the sensors detect water, the 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.

need to determine and of contamination when may occur

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 is controlled by BwOP CW-28.

Local monitoring of Blowdown Line Integrity

On a weekly basis the BDL 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.

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 flow rates from the pond pump based on CW BDL flow. The maximum flow rates were determined by a dilution calculation assuming a Cooling Lake tritium concentration of 35 pCi/l, which was obtained via enhanced LLD sampling 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.

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.

The existing chemistry and radiation monitoring at the River will be used to monitor the flow.

Blowdown Line Integrity

The CW BDL is constructed of pre-stressed concrete 'Embedded Cylinder Pipe' (ECP) manufactured by Interpace Corporation, Design Class D with an internal design pressure of 110 psig. The pipe has been evaluated for full internal vacuum and has been found acceptable. (Reference 21)

The CW BDL is a 48-inch diameter, 4.5-mile long pipeline constructed of a reinforced concrete outer exterior, a carbon steel shell, and an inner concrete liner. The pipe is constructed in 20-foot segments. Pipe segments are joined with bell and spigot joints. There are approximately 1500 joints along the length of the pipe. The pipe is designed for operation at 75 psig, with a specified maximum pressure of 110 psig, but will be operated around 50 psig.

Industry failures experienced for Prestressed Concrete Cylinder Pipe, such as the CW BDL, have occurred due to:

- Mortar coating defects and damage
- Corrosive soils
- Inappropriate design
- Hydrogen embrittlement of reinforcement from cathodic protection practices
- Poor joint protection
- Overpressurization from transients
- Steel liner welding defects
- Improper bedding and backfilling

Today, after 25 years of service, the blowdown line is potentially susceptible to only some of these failure mechanisms.

For example, if the design of the pipe were inappropriate or the pipe had been bedded or backfilled improperly, a failure would have likely manifested itself by now.

The Station procedurally controls changes in blowdown flow that could cause overpressurization transients and a recently performed hydraulic analysis (Reference 18) determined that the existing vacuum breakers adequately protect the concrete line for all transients within the Plant's design basis. Reinforcement failures due cathodic protection practices are not possible near the river since the steel pipe there is not cathodically protected.

Since November of 2005, Exelon has taken several measures to determine the current condition of the blowdown pipe. A series of over 20 wells were drilled along the pipe from Vacuum Breaker 1 to beyond Vacuum Breaker 3. Groundwater level and chemistry data from these wells indicate that the detected concentrations of tritium in groundwater are not the result of an ongoing release from the Blowdown Line.

EVALUATION

In December 2005 and January 2006, Braidwood Station Engineering performed acoustic testing of the CW Blowdown Line to attempt to verify the integrity of the line. The acoustic method was chosen after reviewing a number of options, including a constant pressure test, installation of sample wells adjacent to the line, an acoustical leak detection test, an internal visual inspection, an internal robotic crawler test, and an external thermography test. The acoustic test was chosen based on the perceived sensitivity, ability to identify leak location, and lack of impact on Station blowdown operations.

The testing technology (Sahara system) is a non-destructive acoustical testing process that is capable of identifying a leak as small as 0.25 gallons/hour in a high-pressure pipeline. Given that the Blowdown Line is operated at low pressures, the line was pressurized above its normal operating pressure for the test to maximize the capability of the equipment to detect leakage. The test pressure ranged from 20 psig to approximately 60 psig, depending on elevation of the piping. The test introduced an induced leak at two locations to determine the sensitivity of the testing system. Due to physical limitations of the pipeline arrangement, the induced leak could only be located at a greater distance from the sensor than the location of any actual leaks (60 inches vs. 24 inches). Thus, the tested sensitivity underestimates the actual sensitivity. The calculated sensitivity of the test performed is conservatively one gpm at the normal operating pressure of the pipe.

The testing results indicated only one potential area of concern near the Blowdown Line discharge structure at the Kankakee River past the concrete-to-steel pipe transition. This area is not located near any of the known areas of elevated tritium concentrations and excavation of the area, including the transition joint revealed that there were no leaks in the pipe. The excavation afforded an opportunity to perform a visual examination of the exposed concrete pipe at the transition joint. The concrete pipe was in excellent condition with no signs of cracking or spalling. The acoustic test also operated the piping at elevated pressure which effectively proved the pipe's ability to withstand up to 60 psig at the low points.

– But need to go to 75#

In conclusion, while the continued integrity of the blowdown pipe cannot be guaranteed indefinitely, recent testing and inspections provide reasonable assurance that the pipe is not leaking significantly and is capable of withstanding pressure above the expected pressure during interim remediation.

Further, during SPP 05-012, that supported the inspection, the CW BDL was pressurized to 19 psig at ~ 10 feet above the pipe's high point. This pressurization provides additional confidence in the pipe integrity.

Since the CW BDL flow will be throttled, for pressurization of the line, the flowrate, and thus the velocity in the line, will be reduced. No flow velocity-induced erosion will occur, since the flowrate, even with the additional 1000 gpm form the IRAPS, is less than the flowrate during normal CW BDL operation.

IRAPS Pump to CW BDL Integrity

The HDPE piping connecting the IRAPS to the piping/valve segment replacing Vacuum Breaker # 2 was hydrostatically tested at 150 psig prior to burial, per the construction testing. (The piping was buried for freeze protection, thus eliminating the need for heat tracing). The HDPE pipe is rated for 160 psig (design pressure).

The span of approximately seven hundred feet of HDPE piping, from the pumping system to the connection at Vacuum Breaker # 2, will not be observed by a daily walkdown, since the piping is new with a recent hydrostatic test.

HDPE pipe is made from high-density polyethylene, which is known for its flexibility, toughness and chemical resistance. Since HDPE pressure pipe is fusion welded together, the weld is as strong as the original pipe, it becomes a monolithic or one piece pressure piping.

Refer also to section 'Basic description of the IRAPS' for a description of 'fusion welding'.

Vacuum Breaker surveillance

0BwOS CW-A1, 'Circulating Water System Blowdown and Makeup Vacuum Breaker Valve Inspection', an annual inspection, was last performed on 11/11/2005 to verify the integrity of the CW BDL vacuum breakers and their manual isolation valves.

Transient Effects on the Blowdown Line

A transient analysis (Reference 18) of the CW BDL was commissioned to determine the acceptability of pumping, using the IRAPS, through the VB# 2 location, at up to 1000 gpm.

A variety of potential events was postulated to bound the challenges to the pipe integrity. Without analysis, one of the events (a passive failure of the 0CW047A, isolation valve at the River, stem to disc joint) was known to challenge the integrity of the pipe. The decision was made to remove the valve internals, rather than analyze the event. why

All analyzed events have the flow throttled at the discharge structure to 10±5 psig at the VB# 5 location.

The events analyzed included:

1. A loss of switchyard (and therefore all CW and CW Blowdown Booster pumps) with a starting condition of 25,000 gpm blowdown flow and coastdown of the pumps.
2. Closure of one of the 0CW049 butterfly valves on the discharge of the Blowdown Booster pumps with both units blowing down at 12,500 gpm each. This transient was run with four sensitivities: 0.1 second closure, 1.0 second closure, 5 second closure and 30 second closure. The latter would simulate the spurious hot short loss of 1/2CW018, an expected potential event. The other three sensitivities were to cover the passive failure mode of loss of stem to disc joint on the 0CW049 valve: these were recognized to be beyond design basis, but known to occur in the industry, and specifically at Braidwood Circulating Water inlet valves and LaSalle blowdown valves.
3. Closure of one of the 0CW049 butterfly valves on the discharge of the Blowdown Booster pumps with a single unit blowing down at 12,500 gpm (as in an outage situation). This transient was run with four sensitivities: 0.1 second closure, 1.0 second closure, 5 second closure and 30 second closure. The latter would simulate the spurious hot short loss of 1/2CW018, an expected potential event. The other three sensitivities were to cover the passive failure mode of loss of stem to disc joint on the 0CW049 valve: these were recognized to be beyond design basis, but known to occur in the industry, and specifically at Braidwood Circulating Water inlet valves and LaSalle blowdown valves.

The results demonstrated that, for blowdown with flow throttled at the river, all design basis events (Case 1, and the 30 second closure of the butterfly valve in Cases 2 and 3) were acceptable with 1000 gpm pumped through VB# 2 (VB# 2 Out of Service). All transient pressures were within the Blowdown Line design pressure.

For the more rapid closure of the butterfly valve (beyond design basis events), the blowdown line pressures up to VB# 1 were beyond the concrete blowdown line design pressure. Additional studies are recommended to address the optimal protection for this portion of the line, removal of some of the existing vacuum breakers, and restoration to unthrottled flow at the river. These studies are being handled through the Station corrective action program. (Reference 18)

Failure Modes

IRAPS piping (HDPE) failure is improbable, as explained in section 'IRAPS Pump to CW BDL Integrity' above.

Failure of a check valve, in the piping/check valve segment which replaced Vacuum Breaker # 2, is improbable since the valves are new and were tested prior to installation. However, should one check valve fail, the second check valve provides redundancy. In addition, there is a third check valve at the pond.

— why not previously mentioned

Since the shutoff head of the IRAPS pump is less than the design pressure of the HDPE pipe, there is no concern of over pressurization.

Braidwood Station Cooling Lake Chemistry

Water chemistry of the cooling lake is controlled by the blowdown and make-up process by means of the Kankakee River.

Operation of the IRAPS may require a reduced lake blowdown flowrate from current values, due to measures taken to ensure the Blowdown Line is maintained 'water solid'.

The effect of a potential reduction in lake blowdown flow due to increased blowdown line pressure using the newly installed throttling valve was evaluated.

The actual reduction in flow will be determined following completion of SPP-06-003; however, a potential reduction from 25,000 gpm to 20,000 gpm was chosen as a conservative estimate. Reduction to a value below 20,000 gpm is unlikely.

Based on this, there will be no quantifiable effect on the softening of the lake or on the risk of a precipitation event, assuming that the current treatment protocol for the lake is maintained.

The potential blowdown flow reduction will increase the hydraulic cycle on the lake from 1.76 to 1.95. This increase will require additional chemical treatment costs of $36,000 in the remainder of 2006, and additional costs of $80,000 in 2007.

Monitoring of Kankakee River

Offsite Dose Calculation Manual (ODCM)

The following ODCM (Reference 7) changes will be made:

- Sections 10.2.1.2 "Liquid Release" has been added to the liquid release section in Chapter 10 to define the flow path, monitoring, and controls for the Exelon Pond Remediation process.
- Section 10.2.3.1.2.2 "Release Limits" was added to describe the Administrative Limit (200 pCi/L) for the remediation.
- Figure 10.3 was changed to include the Exelon pond and the flow path into the CW BD.
- Table 12.3-1 to document the continuous monitoring, frequency (weekly, monthly, quarterly) and type of sampling (gamma, tritium, I-131 etc.)

Chemistry Procedure changes

New Chemistry Department procedures were created for the IRAPS process:

- BwCP 1003-14, 'Exelon Pond Weekly Discharge'.
- BwCP 1003-15, 'Exelon Pond Monthly Discharge'.
- BwCP 1003-16, 'Exelon Pond Quarterly Discharge'.

These new procedures describe the weekly, monthly, and quarterly composite and grab sample requirements, frequencies. etc.

BwCP 1003-14 also includes steps for comparing weekly grab sample tritium concentrations from the Exelon Pond to the calculated maximum concentration that the Exelon Pond is expected to reach to ensure that we do not exceed the 200 pCi/L CW BD outfall limit.

The weekly, monthly and quarterly 0BwCSR 12.3.1.b.1-1, 0BwCSR 12.3.1.b.1-2, 0BwCSR 12.3.1.b.1-3, were revised to ensure that the composite samples are pulled, tabulated and quantified.

An inline monitor is not required for the Exelon Pond remediation based on environmental groundwater gamma analysis results from the plume characterization project of less than the lower limit of detection and that gamma analysis will be performed for the Exelon Pond samples required by the procedures above. (References 23, 24 and 25)

Effect on Wilmington Pumping Station

The CRA evaluation considered the effect of introducing tritium into the CW BDL on the Kankakee River, particularly the effect on the Wilmington public 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.

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.

EC EVAL Preparation and Approval (Washington Group International)

Prepared by: ______________________ Date:

John M Damron

Reviewed by: ______________________ Date:

Bruce Acas

Approved by: ______________________ Date:

Edmund Stukas

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
9. "Alternate Connection for Pond Discharge' sketch of piping/check valve segment, WGI supplied.
10. 'Interim Remedial Action Pumping System Dilution Calculation', Excel spreadsheet attachment to EC 360234.
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 13, REV 1 Blowdown piping to outfall structure 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

20. Conestoga-Rovers & Associates, Project 45065-01 Drawing # (PRES001)GN-WA001 MAR 31/2006

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'.

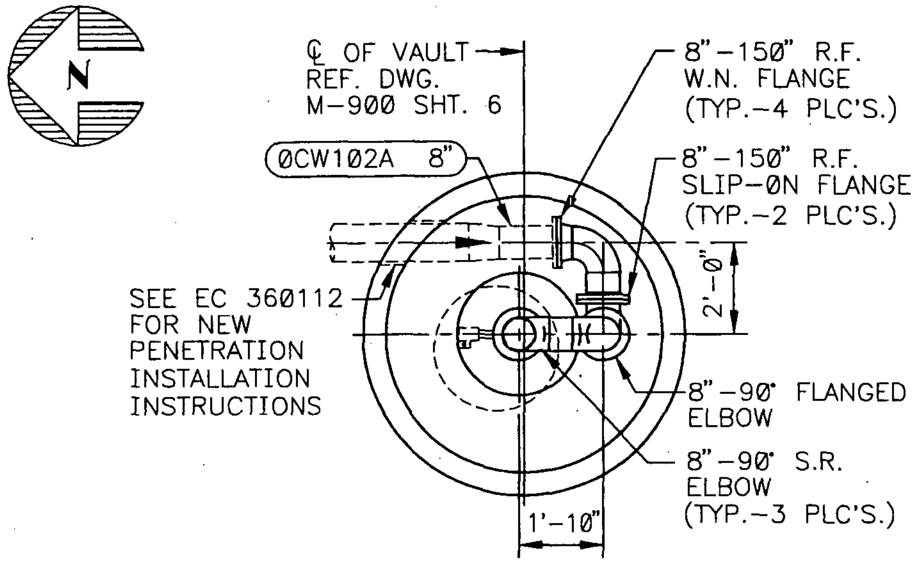
24. BwCP 1003-15, 'Exelon Pond Monthly Discharge'.

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

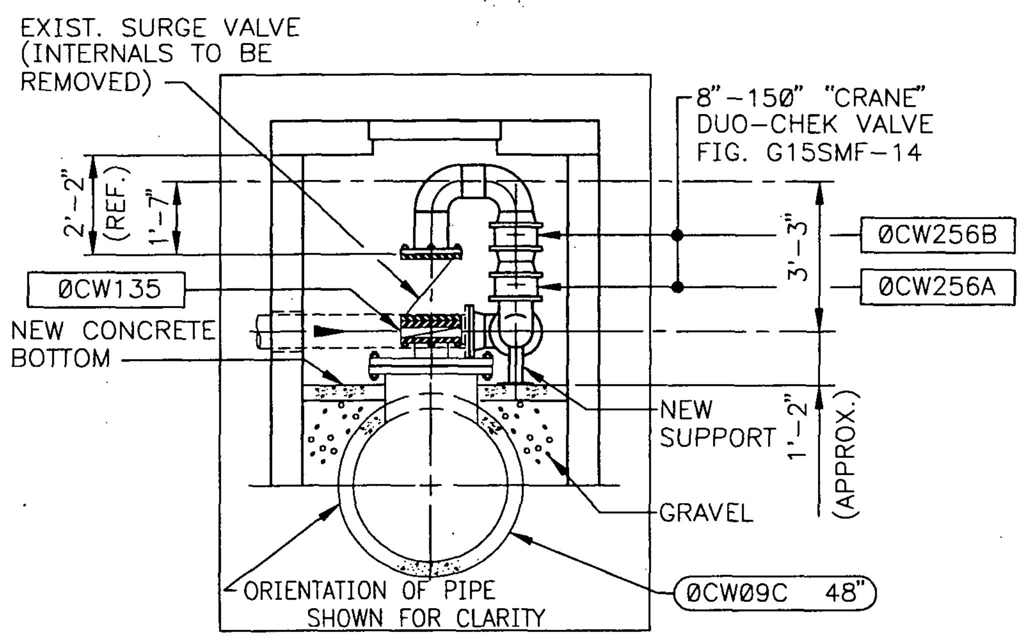
26. "Agreed Preliminary Injunction Order", People of the State of Illinois vs. Exelon Corporation, dated May 4, 2006.

Reference 9 - EC360234-M-SK01 5-9-2006.pdf

ATTACHMENT 9



PLAN



ELEVATION

CIRCULATING WATER BLOWDOWN LINE-ØCWØ9C-48"
VACUUM BREAKER #2 VAULT
EC 360234 REV. 000
ALTERNATE CONNECTION FOR POND DISCHARGE

EC NUMBER: 360234 REV. 000
PAGE NO. ____ OF ____
DRAWING NO./REV: EC360234-M-SK01 /REF.
PREPARED BY: ____ DATE ____
REVIEWED BY: ____ DATE ____

Plant Operating Review Committee Meeting Agenda

5/16/06 1300 Aspen
PORC 06-019

PORC Topic	PORC Review Summary	Presenter	PORC Number
EC Review	EC 360234 Evaluation Tritium Remediation Project for the Exelon Pond	Al Haeger	06-019
Sub Committee Items	None		

This is the tentative PORC agenda. PORC Review Packages for the individual topics may have been submitted separately to allow the PORC Member the maximum possible time for review.

Regular PORC Members Scheduled	Alternate PORC Members Scheduled
Chair - Dudek Mike Smith Cheryl Gayheart John Moser (or) (RP)	Larry Brooks Pat Daly (RP)

PORC chairperson should consider asking these questions prior to or during PORC reviews:

Prior to PORC:

- Would a joint PORC with another site facing the same issue provide more insight?
- Are the PORC members adequately independent from the issue?

At the beginning of an issue presented to PORC

- Should the PORC ask for a presentation prior to discussing the issue to clarify what is being approved and to have the presenter identify potential nuclear safety issues?
- Does the PORC have the expertise to fully evaluate the issue or could it benefit from additional members joining the quorum?

Prior to adjournment of an issue presented to PORC

- Has the PORC specifically questioned the nuclear safety aspects of the issue?
- Are there any dissenting viewpoints related to the issue, either within or outside the PORC, and has the dissent been openly discussed and the resolution documented?
- Has the PORC adequately encouraged a questioning attitude and not allowed, "Group think" to occur?