RADIOACTIVE CONTAMINATION FOUND IN CONSTRUCTION EXCAVATION

RETS-REMP WORKSHOP

EPRI GROUNDWATER PROTECTION WORKSHOP

June 28 – July 1, 2010

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Introduction

- A construction project was planned for November 2009 to implement a modification to some storm drains and catch basins, outside of any radiologically controlled area, (RCA).
- Following the cutting and removal of one section of storm drain, a worker from the job alarmed an exit portal monitor.
- Qualitative gamma spectroscopy analysis of the worker's contaminated clothing showed low levels of Cs-137 and Co-60.
- Upon review of this gamma isotopic data, Chemistry Supervision ordered the work to stop and the site commenced an investigation.

Event Timeline

- Excavation was scheduled to begin 11/9/09. Chemistry stopped the work when notified on 11/6/09 that heavy equipment was going to be excavating an area near one of our groundwater monitoring wells.
- A condition report was written to document the absence of Chemistry and Environmental from the planning process for the excavation.
- Required quarterly well samples were collected and analyzed prior to start of work.

Event Timeline

- Chemistry verified that groundwater from the well was less than detectable in tritium and gamma emitters.
- Work crew had been instructed by Radiation Protection to collect soil samples for gamma spectroscopy at various depths in the dig.
- Chemistry expanded the instruction to require stop work when water was encountered, to sample and analyze, as a conservatism.

Event Timeline

- Although the excavation was within 30 feet of the groundwater monitoring well, it is technically downgradient of the well and near the liquid radwaste discharge line, so it could conceivably contain plant radioactivity not found in the well.
- The area being discussed is all within a few dozen feet of Lake Ontario where the groundwater discharges. The hydraulic gradient this close to the lake is quite small and varies with lake level. The site hydrology study indicates that groundwater this close to the lake tends to be stagnant and seeps rather than flows.

Event Timeline

- Excavation work began 11/11/09. All soil samples collected prior to and during excavation exhibited results consistent with background levels.

- Water, at a depth consistent with the top of the water table, (estimated from the measured depth to water in the nearby well), was encountered in 11/13/09. Work stopped for sampling and analysis.

- The filtered water sample was less than detectable for tritium and gamma emitting radionuclides. Work was allowed to resume.

Event Timeline

- On 11/17/09, two sections of storm drain were cut and removed. Workers noted a slurry of black silt pour from the storm drain sections into the excavation as they were removed.
- The job plan called for covering the excavation with a layer of gravel about a foot deep at the end of the day.
- Groundwater seeped in to cover the gravel to a depth of about a foot overnight. The water was identified as groundwater because of depth to groundwater, and because it had not rained since the excavation started.

Event Timeline

- 11/17/09 at end of day, one of the workers from the excavation alarmed the gamma sensitive exit portal monitor on his way home.
- RP used the PCM to identify his pants as the location of the counts.
- The pants were sent to Chemistry for qualitative gamma spectroscopy and the worker was released.
- All steps taken were consistent with RP procedures.

Event Timeline

- Weak communications between Chemistry and RP on back shift did not raise an alarm about Cs-137 and Co-60 on pants from work outside a RCA.
- Review of gamma spectroscopy results on 11/18/09 by Chemistry supervision led to a Stop Work order on the excavation and initiation of an investigation by the site.
- RP controlled the area as a RCA and began collecting samples from the area.

Event Timeline

- Initial samples of the dirt, gravel and water mix from the pit were analyzed and showed only Cs-137 approximately10 times higher than nominal background.

- Following interviews with the workers, samples were taken near where the black sediment slurry spilled from the storm drain sections. Result was:
  Cs-137 1.32E-5 uCi/cc
  Co-60 1.36E-8 uCi/cc

Event Timeline

- A sample of the silt slurry from the storm drain sections was analyzed. Result was:
  Cs-137 3.68E-4 uCi/cc
  Co-60 1.75E-7 uCi/cc
- As a frame of reference, current Reactor Coolant System(RCS) concentrations of these nuclides are:
  Cs-137 8.79E-6 uCi/cc
  Co-60 9.80E-6 uCi/cc
- NRC and Public Officials were notified under Ginna procedure CHA-RETS-GRNDWTR-REP and NEI 07-07, for plant activity in contact with groundwater on site.

What Happened?

- Where would Cs-137 at concentrations higher than in the RCS come from?
- The team made an initial estimate of the age of the material based on the Cs-137 to Co-60 ratios in the samples, historical Ginna RCS data, and the general decay equation.
- This was important to be able to advise Site management that the material was greater than 20 years old, so immediate plant operation was determined to not be involved in the contamination event.

What Happened >20 years ago?

- The team looked at many events but became focused on two issues - Ginna had a tube rupture in 1982 and Ginna had chronic primary-to-secondary leakage until Steam Generator replacement in 1996.

- Both presented potential pathways for significant quantities of radioactivity from the RCS to reach the storm drains.

- The radioactive material could remain in a low flow pipe with soil, silt, and/or clay.

What Happened >20 years ago?

- Significant quantities of radioactivity released to the environment in the January 1982 tube rupture event were captured in the heavy snowfall that day and dropped on site. Much of that snow was collected and melted in the Turbine Building basement and directed to the Retention Tank – a monitored release pathway the discharges into Lake Ontario. Some snow also melted into storm drains.
- Likewise, regeneration of Condensate Polisher resin, which removed the ionic radioactivity from primary-to-secondary leakage, released radioactive material through the Retention Tank.

Was it from melted snow?

- Melted snow was discounted as a significant contributor to this event. A review of the Cs-137 to Co-60 ratios in snow samples collected following the tube rupture indicated enrichment in Co-60, which would disagree with the current excavation sample ratios after correction for decay.
- This is logical in light of the tendencies of Co-60 to exist as a particulate and Cs-137 to exist as a soluble ion. The release to the environment was primarily steam from an atmospheric relief valve.
- Particulates can carry over in steam and soluble ions tend not to.

Was it from chronic primary-to-secondary leakage?

- A more formal calculation of the age of the radioactivity in the various samples showed an age consistent with reactor coolant from approximately 30 years ago.
- The bulk of activity released from chronic primary-to-secondary leakage would average less than 20 years old.

Where did it come from?

- The bulk of RCS activity that entered the secondary side during the 1982 tube rupture event remained in the secondary coolant system until an orderly release could be planned.
- Then it was released from various secondary systems through the monitored pathway of the Retention Tank as permitted liquid effluent releases.
- The Retention Tank releases to the Discharge Canal via the …..

Finally the answer

…….the Storm Drain System !?!

- The Retention Tank discharges into a storm drain that shared a catch basin with the removed sections of storm drain.
- Workers noted that when the Retention Tank discharged, they got back flow into the affected storm drain.
- This appeared to be an original design flaw, as was radioactive releases into storm drains in general.
- (Unlike the 1980s and 1990s, recent Retention Tank activity is less than detectable.)

What Was Broken?

- The site did not have historical radiological events adequately documented in plant processes and procedures.
- The original design of the Retention Tank release was flawed, with the apparent assumption that only traces of radioactivity would be there.
- The job package did not involve all key stakeholders in the review process.
- Questioning attitude was weak in many people involved – this could have prevented the spill to ground, although not the radiological cleanup.

Corrective Actions

A complete list of corrective actions is quite long. The list of key fixes is:

- Remediate the spill area.
- Remove remaining radioactive material in the affected storm drain and dispose of as Radwaste.
- Evaluate all storm drains for extent of condition.
- Repair the defective catch basin.
- Modify the Retention Tank to discharge directly to the Discharge Canal via a dedicated pipe.
- Fully implement the EPRI Groundwater Protection Guidelines.

Lessons Learned

Key lessons to take home.

- Complete and accurate documentation of radioactive spills, leaks, and events over the entire plant history, and inclusion of radiological consequences of past events in site processes and procedures is key to avoiding environmental radiological events.
- Have a healthy, skeptical questioning attitude whenever the concept of radioactivity interfaces with the concept of the environment. We are supposed to stop work whenever we have a question about safety – radiological, environmental, industrial, or nuclear safety.