# Tritium Ground Water Issues

Presentation for
DOE Tritium Focus Group
May 5-6, 2015

Steven M. Garry, CHP
US Nuclear Regulatory Commission
NRR/DRA/ARCB

# Tritium Leaks

U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*

- Approximately 70% of plants have had some leakage, a list of plants with leaks is on NRC public web site
  - http://www.nrc.gov/reactors/operating/ops-experience/tritium/list-leaks-spills.pdf
- Most leaks are from non-safety related, underground piping
  - onsite groundwater contamination up to 19 million pCi/L
  - No tritium from leaks detected offsite except at Braidwood
- NRC has determined leaks have very low safety significance
- However, significant public, media, State and Congressional interest

# NRC Actions

U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*

- NRC is cooperating with other federal (EPA) and state agencies, tribal and local governments on groundwater protection
- Industry initiated a voluntary ground water monitoring program
- NRC is monitoring the effectiveness of the industry groundwater protection initiatives, but no regulatory basis for enforcement.

# Background

U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*

- NRC is responsible to regulate and ensure adequate protection of public health and safety

- Nuclear plants are not zero-release plants
  - Normal effluent discharges are:
    - 100 – 500 Ci tritium via liquid effluents to waterways
    - 100 Ci tritium to gaseous effluents

- Nuclear plants release radioactive effluents under ALARA controls [“as low as is reasonably achievable”]
  - Less than 3 mrem/yr from liquid effluents

# Radioactive Effluents

U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*

- Nuclear plants produce 20% of electricity in USA
- Nuclear plant radioactive effluents are low, ~30 times below regulatory limits
- US radiation dose
  - 620 mrem/yr from background and medical
  - Typically less than 1 mrem/yr from nuclear plants
  - Radiation dose from leaks ~ 0 mrem/yr

# Regulatory Framework

U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*

- NRC has authority under the Atomic Energy Act and Energy Reorganization Act of 1974
- EPA authorities under Clean Water Act, Safe Drinking Water Act, CERCLA, RCRA, and 40 CFR 190
- States have authorities under both EPA & State's rights to set state health and safety standards

# Regulatory Impact

U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*

- NRC regulatory focus is on human safety vs. environment protection
- Tritium contaminated areas are generally very small areas, and are localized “on-site” with slow leakage to off-site areas
- Radioactive leaks have little safety significance (zero or very close to zero dose)
- However, some members of public expect NRC to prevent all leaks and to protect environmental resources

# Hydrogeology

U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*

- Nuclear (and coal) plants are built on lakes and rivers (need cooling water for steam turbines)
- Subsurface, underground water flow is generally toward the lakes and rivers (away from drinking water wells)
- Tends to flush leaks out of ground water and into the lakes and rivers, drinking water supplies have been mostly unaffected
- Some potential for minor impacts to drinking water aquifers

# Public Concern

U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*

- Very high public concern
- Public mindset that plants are not supposed to leak
- Fear of contaminating drinking water supplies
- Expect inspection and maintenance to prevent leaks

# Issues from Public Meetings

U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*

- How can NRC allow plants to leak tritium?
- Why aren't NRC regulations preventing leaks/spills to groundwater?
- Why doesn't the NRC protect the environment?
- What enforcement actions are NRC taking?

# Maintain Barriers

U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*

- Underground piping – not designed for routine inspection, difficult to inspect
- Some piping is being brought above ground
- Leaks viewed by public as inadequate maintenance of entire plant

# NRC Enforcement Actions

U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*

- Public perceive need for more reliable NRC enforcement actions
- NRC response to events – seen as variation in NRC response
- Better real-time communication needed – both internal and external

# Strengthen Trust

U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*

- Need to communicate promptly, effectively, and clearly
- Loss of trust when environmental leaks occur
- Loss of trust when NRC fails to require maintenance to prevent leaks
- Loss of trust when remediation is not required

# Nuclear Industry Response

U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*

## Nuclear Energy Institute – Ground Water Protection Initiative

- Voluntary initiative – above and beyond regulations
- Develop a ground water protection program

# Industry Initiative

- Improve management of leaks
- Improve communications with external stakeholders

# Industry Initiative

U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*

- Perform subsurface hydrogeology study to identify ground water flow directions
- Evaluate piping and systems containing radioactive fluids and determine the risk of leakage
- Install ground water monitoring wells
- Establish decision making plan for remediation
- Notify State and local authorities early

# Industry Initiatives

U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*

- Buried Piping Integrity Initiative
  - Develop buried piping program
  - Prioritize piping inspections through risk ranking
  - Perform piping inspections

# Offsite Discharges

U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*

- NRC is developing model to calculate offsite discharges
- Determine groundwater concentrations
- Multiply by cross sectional area
- Multiply by groundwater flow rate
- Estimate < 1 curie per year

# NRC Website Links

U.S.NRC
United States Nuclear Regulatory Commission
*Protecting People and the Environment*

- http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/buried-pipes-tritium.html
- http://www.nrc.gov/reactors/operating/ops-experience/grndwtr-contam-tritium.html
- http://www.nrc.gov/reactors/operating/ops-experience/tritium/plant-info.html
- http://www.nrc.gov/reactors/operating/ops-experience/tritium/sites-grndwtr-contam.html
- http://pbadupws.nrc.gov/docs/ML1415/ML14157A132.pdf
- http://pbadupws.nrc.gov/docs/ML0931/ML093160004.pdf
- http://pbadupws.nrc.gov/docs/ML1100/ML110050525.pdf
- http://pbadupws.nrc.gov/docs/ML0703/ML070300534.pdf (see pages 16 - 19)
- http://www.nrc.gov/reading-rm/doc-collections/commission/secys/2012/2012-0046scy.pdf and
- http://www.nrc.gov/reading-rm/doc-collections/commission/srm/2012/2012-0046srm.pdf