

# Buried Piping

GE BWR/4 Technology Course

R-504B – 4.1

# Objectives

1. Recognize the nuclear safety, radiological and environmental consequences of leakage from buried piping and tritium leakage into the environment.
2. Identify the major causes for degradation in buried piping integrity.
3. Recognize the regulations that apply to buried piping integrity, including Part 20, Part 50 and state and local environmental regulations.

# Objectives

4. Identify the major components in the industry's Buried Piping Integrity Initiative.
5. Identify the major components in the industry's Groundwater Protection Initiative for coping with the issue.

# 10 Failure Mechanisms

1. Moisture in the soil causing rust through of a carbon steel pipe
2. Inadequate pipe coatings or poor coating application allowing damaged piping
3. Internal corrosion of the piping (raw water systems)
4. Acid or caustic corrosion of piping or tank internals
5. Flow accelerated corrosion

# 10 Failure Mechanisms

6. Galvanic corrosion
7. Microbiologicals
8. Manufacturing defects in piping or tanks
9. Worker installation practices that damage the pipe or tank
10. Heavy equipment that passes over buried piping

# 4 Inspection Issues

- 1. Buried piping failures cannot be observed**
- 2. Detection only after complete failure.**
  - Failure can INOP safety systems.
- 3. Slow leakage of contaminants undetectable.**
  - Until it reaches the water table or local rivers or streams.
- 4. Leakage from tanks in buildings, seeps into vaults or cable runs.**
  - underground areas with no fluids now have contaminants.

# Nuclear safety impact

Underground service water piping impacts:

- emergency diesels
- RHR heat exchangers
- emergency water supplies to the reactor and fuel pools
- reactor building closed loop cooling water
  - RHR seal coolers
  - FPC heat exchangers
  - Recirc pump seal, bearing and motor coolers

# Key Isotopes

## Two primary radioactive components:

- **Tritium**

- Low energy beta
- not external dose issue
- needs an ingestion pathway

- **Strontium 90**

- needs an ingestion pathway
- beta emitter
- bone seeker
- leukemia risk

# Six Other Contaminants

- Fuel oil
- lube oil
- acids
- caustics
- fyrquel
- bleach

# Radiological effluent release technical specifications (RETS)

- Provides ALARA limits for dose
  - Liquid effluents shall not produce doses to any member of the public  $\geq$  than 3 mrem to the whole body or 10 mrems to any organ in a year.
  - Liquid effluents dose during any calendar quarter shall be limited to  $\leq$  1.5 mrems to the total body and  $\leq$  to 5 mrems to any organ.

# Radiation Environmental Monitoring Program (REMP)

- Requires off-site samples:
- Location and type of samples include:
  - airborne mechanisms
  - waterborne mechanisms
  - ingestion pathways (dairy, vegetation and fish samples)
- Annual report to the NRC.
- REMP supplements TS by verifying environmental radiation levels consistent with planned exposures and releases.

# NEI 07-07 Ground Water Protection Initiative

## 5 basic objectives to this initiative:

1. Site characterization should provide an understanding of current predominant ground water gradients.
2. Identify site risks based on plant design and work practices:
  - Evaluate all SSCs that contain or could contain licensed material if there is a credible mechanism to reach ground water.
  - Evaluate work practices involving licensed material if there is a credible mechanism to reach ground water.
3. Establish an on-site ground water monitoring program to ensure detection of radiological releases to ground water.
4. Establish a protocol to prevent migration of licensed material off-site.
5. Ensure that records of leaks, spills, remediation efforts are retained and retrievable to meet the requirements of 10 CFR 50.75(g).

# NEI 09-14 Buried Piping Initiative

- **Program scope includes:**
  - All piping that is below grade, contains any fluid, and is in direct contact with the soil.
  - Underground piping and tanks outside of a building and below grade, if they are safety related, contaminated, or contain licensed material.
- **Program looked for prioritization based on:**
  - Piping function
  - Pipe locations and layout
  - Pipe materials and design
  - Health of cathodic protection systems, if applicable

# Temporary Instruction 2515/182-01

Two phases for inspection:

- Phase 1
  - Are key attributes of NEI 09-14 being met in the Licensee's program?
  - Are completion dates in licensee program similar to those recommended in NEI 09-14?
  - Has licensee completed appropriate items in their plan?
- Phase 2
  - Verify completion of phase 1 prioritization of items
  - Verify the utility is implementing NEI requirements
  - any other programmatic aspects the inspector wants

# Summary

- No findings greater than green for buried pipe or groundwater.
- No instances of public health impacts
  - Poor public perception of issue
- Currently buried piping and ground water is driven by industry initiatives.
- Industry is committed to these (inspection)
  - Regulation will be forthcoming if industry doesn't control the issue.

# Objectives

1. Recognize the nuclear safety, radiological and environmental consequences of leakage from buried piping and tritium leakage into the environment.
2. Identify the major causes for degradation in buried piping integrity.
3. Recognize the regulations that apply to buried piping integrity, including Part 20, Part 50 and state and local environmental regulations.

# Objectives

4. Identify the major components in the industry's Buried Piping Integrity Initiative.
5. Identify the major components in the industry's Groundwater Protection Initiative for coping with the issue.