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Pilgrim

Water Treatment

Pilgrim Water Treatment History

Operational Water Treatment Objectives:

- Maintain an ultra-high degree of primary system water quality to prevent nuclear fuel damage and accelerated corrosion and damage to components operating at high temperature and pressure
- Maintain a high degree of water quality to maintain worker radiological exposure ALARA, with visual clarity, during refueling and maintenance activities

Decommissioning Water Treatment Objectives:

- Maintain a high degree of water quality to maintain worker radiological exposure ALARA, with visual clarity, during defueling and maintenance activities

Pilgrim Water Treatment History

Operational Water Treatment Systems and Equipment:

- Demineralized Makeup Water – purify Plymouth water for Pilgrim use
- Condensate Demineralizers
- Reactor Water Cleanup System
- Radwaste Treatment

} Corrosion products and seawater

- Torus Filtration (10-year interval) and Feed & Bleed (more frequent)
- Trinuclear Filters during refueling and maintenance activities
- Spent Fuel Pool Filtering and Demineralization System

Decommissioning Water Treatment Systems and Equipment:

- Radwaste Treatment (as-needed)
- Torus Water Treatment
- Refuel Floor Treatment during defueling and maintenance activities
- Spent Fuel Pool Filtering and Demineralization System (as-needed)

Spent Fuel Pool Filtering and Demineralization

- Micron rated filter removes particulates

- Demineralizer contains charcoal for removal of organics and mixed bed resins for removal of ionic impurities. Flexibility of radiological and non- radiological impurities in resin / charcoal amounts

- Improved removal capability by system suction modifications in decommissioning

Refuel Floor Water Treatment Design

- Suction located where segmentation and waste loading work is occurring to maximize treatment effectiveness
- Fine micron particle filtration
- Filter element exchanged before loading degrades effectiveness
- Filter element exchanged 13 times during reactor vessel segmentation

Torus Water Treatment Design

- Mobile suction positioning
- Fine micron filter size
- Filter element exchanged before loading degrades effectiveness
- Future modification capability to add demineralization

Radwaste Demineralizer

Can accommodate varying resin and charcoal mixes based on radiological and non-radiological impurities present

Currently contains 10 cu ft of charcoal and 20 cu ft of Ion Exchange resin

Comparison of Non-Radiological Pollutant Levels in Treated Effluent to Standards (Liquid)

Parameter	Treated Water Concentration	EPA Aquatic Life Criteria Salt Water CMC (Acute)	Discharge Limits in Existing NPDES Permit for other Outfalls	Intake Water Concentration (Ambient Seawater)
Chemical Oxygen Demand	18.1 mg/L			531 mg/L
Total Suspended Solids	1.00 mg/L		30 mg/L	
Chlorine, Total Residual	0.0449 mg/L	0.013 mg/L	0.1 mg/L	0.0170 mg/L
pH	6.87 S.U.	6.5 – 9.5 S.U.	6.5 – 8.5 S.U.	8.07 S.U.
Boron	36.7 µg/L		5,600 µg/L	4,290 µg/L
Copper	1.39 µg/L	4.8 µg/L		1.69 µg/L
Lead	0.660 µg/L	210 µg/L		< 2.50 µg/L
Nickel	2.02 µg/L	74 µg/L		< 3.0 µg/L
Zinc	36.1 µg/L	90 µg/L		< 66.0 µg/L
Oil & Grease	1.47 mg/ L		15 mg/L	< 1.11 mg/L
Total Phenol	< 1.67 µg/L			4.04 µg/L

Comparison of Non-Radiological Pollutant Levels in Treated Effluent to Standards (Gaseous)

Massachusetts Department of Environmental Protection concluded in a letter dated July 19, 2024 that HDI had accurately evaluated that evaporation of 935,850 gallons of water (total volume at the time of the analysis) resulted in the release of a small fraction (1.4%) of Air Quality permitting threshold for regulated pollutants.

Radioactive Effluent Regulations

Total Radiological Effluents limited to 500 mrem per year from all sources (10 CFR 20.1301) and specific isotope limits (10 CFR 20.1302)

Additional NRC regulations require dose to the general public from releases be maintained As Low As Reasonably Achievable (ALARA*).

* ALARA standard entails making what NRC has determined are “reasonable efforts” to maintain radiation exposures below the dose limits in consideration of a balancing of interests and factors that the NRC has considered, including “taking into account the state of technology, the economics of improvements in relation to state of technology, the economics of improvements in relation to benefits to the public health and safety, and other societal and socioeconomic considerations, and in relation to utilization of nuclear energy and licensed materials in the public interest.” *See* 10 C.F.R. § 20.1003 (definition of ALARA).

HDI further restricts releases to;

less that 25 mrem / yr from all sources and
less than 0.6 mrem / mo., 1.5 mrem / qtr, and 3 mrem / yr from liquid discharges

Radioactive Effluent Releases Impact

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<u>Liquid Effluent Releases (based on 2015)</u>

In 2015, there were 7 liquid effluent releases totaling 112,009 gallons. This resulted in a radiological exposure of 0.000067 mrem to the maximum exposed hypothetical member of the public. This number would increase to 0.000496 mrem if 831,375 gallons were discharged.

<u>Gaseous Effluent Releases (based on 2024*)</u>

In 2024, evaporation and work activities resulted in the release of 0.00030 Curies of radioactive particulates and 5.22 Curies of tritium. This resulted in a whole body radiological exposure of 0.00047 mrem to the maximum exposed hypothetical member of the public.

* 2024 selected since building heating was performed during fall-winter and winter-spring periods

For perspective, a radiological exposure of 10 mrem is received for a chest x-ray and the average individual receives 620 mrem from natural and man-made sources per year