Draft Supplemental Environmental Impact Statement

For Perma-Fix Northwest Mixed Waste Facility Dangerous Waste Permit Renewal

Nuclear Waste Program

Washington State Department of Ecology

February 2025, Publication 25-05-003

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Richland Field Office
3100 Port of Benton Blvd., Richland, WA 99354 • 509-372-7950

February 6, 2025

RE: Draft Supplemental Environmental Impact Statement (SEIS) For Perma-Fix Northwest (PFNW) Mixed Waste Facility (MWF) Dangerous Waste Regulations (DWR) Permit Renewal

Dear Interested Parties:

The Washington Department of Ecology (Ecology) Nuclear Waste Program is requesting input on a draft SEIS for the DWR permit renewal of the PFNW MWF. The permit renewal public comment period is separate from this State Environmental Policy Act (SEPA) review process but has an overlapping public comment period.

PFNW is seeking to renew its DWR Permit for operation of the MWF located in Richland, Washington. As part of the permit renewal process, PFNW submitted a renewal application for the DWR Permit to Ecology in 2009, with the latest revised DWR Permit Renewal Application submitted to Ecology in 2024.

Based on the information from PFNW and public comments received during the expanded scoping period and public meeting, three action alternatives have been developed to evaluate the probable significant adverse environmental impacts of PFNW's proposal. A "no action" alternative is also evaluated as required under the SEPA.

- Alternative 1: Continue with dangerous waste operations currently permitted at the MWF.
- Alternative 2: Continue with currently permitted operations plus the additional activities and treatment units described in the DWR permit renewal application received in August of 2024.
- Alternative 3: Continue with all operations described in the DWR permit renewal application received in August of 2024. Additionally, Perma-Fix would operate the GeoMelt® Process Unit, a stationary thermal treatment unit that treats reactive metal. This unit is not included in the DWR permit renewal application and would require additional permitting activities to authorize its use.
- No Action Alternative: DWR Permit is not renewed and PFNW ceases storing and treating
- mixed waste in accordance with the Closure Plan in the current DWR Permit.

In conjunction with the original DWR permit application, in 1997, the City of Richland issued a Determination of Significance for the proposed construction and operation of the MWF. Richland issued the *Final Environmental Impact Statement for Treatment of Low-Level Mixed Waste* (Final EIS) in 1998. Ecology subsequently issued the initial DWR permit to the Allied Technology Group, Inc. (one of PFNW's predecessors) for operation of the MWF in 1999.

Renewing the DWR permit will allow PFNW to continue treatment, storage, and handling of mixed low-level radioactive waste at its Richland site. The focus of the draft SEIS is to address additional or new impacts associated with PFNW's proposal to renew the DWR Permit for its MWF operation that were not considered in the 1998 Final EIS. The draft SEIS considers new information on increased transportation of waste and changes in MWF operations, waste streams, design, and treatment processes.

Ecology will consider comments received during the comment period when finalizing the SEIS later this year. More information about commenting and the project documents are on the Ecology Nuclear Waste Program website (https://ecology.wa.gov/Waste-Toxics/Nuclear-waste/Public-comment-periods) and posted on the SEPA Register (https://apps.ecology.wa.gov/separ/Main/SEPA/Search.aspx).

Sincerely,

Digitally signed by Holbrook, Edward (ECY)

Edward Holbrook, Deputy Program Manager
Nuclear Waste Program
Washington Department of Ecology

FACTSHEET

Project Name

Renewal of the Perma-Fix Northwest (PFNW) Mixed Waste Facility (MWF) Dangerous Waste Regulations (DWR) Permit

Proposed Action and Alternatives

Washington State Department of Ecology (Ecology) regulates the management of dangerous waste, including the dangerous waste component of mixed waste. Ecology issues DWR Permits to dangerous waste treatment, storage, and disposal facilities.

In addition to making permitting decisions, Ecology has additional responsibilities pursuant to the State Environmental Policy Act (SEPA). Under SEPA, Ecology must consider the probable significant environmental impacts of its permitting decisions, including whether a permitted facility may have probable adverse impacts to the environment, and, if so, evaluate mitigation measures.

The purpose of the Draft Supplemental Environmental Impact Statement (SEIS) is to evaluate the probable significant adverse environmental impacts of the PFNW proposal to renew its DWR Permit for operation of its MWF located in Richland, WA.

The City of Richland issued a Final Environmental Impact Statement (EIS) for treatment of low-level mixed waste in 1998. Ecology issued the initial DWR Permit for the MWF to PFNW's predecessor in 1999.

The current MWF has one approximately 68,000 ft2 building with three areas: the Mixed Waste Non-Thermal Area, the Mixed Waste Thermal Area, and the Waste Storage Area. The focus of the Draft SEIS is to address additional or new impacts associated with PFNW's proposal to renew the DWR Permit that were not considered in the 1998 Final EIS. This SEIS will consider new information on increased transportation of waste, and changes in MWF operations, waste streams, design, and treatment processes.

Three action alternatives are being evaluated in the SEIS in addition to a "no action" alternative (required under SEPA):

- Alternative 1: Continue with dangerous waste operations currently permitted at the MWF.
- Alternative 2: Continue with currently permitted operations plus the additional activities and treatment units described in the DWR permit renewal application received in August of 2024.
- Alternative 3: Continue with all operations described in the DWR permit renewal application received in August of 2024. Additionally, Perma-Fix would operate the GeoMelt® Process Unit, a stationary thermal treatment unit that treats reactive metal. This unit is not included in the DWR permit renewal application and would require additional permitting activities to authorize its use.
- No Action Alternative: DWR Permit is not renewed and PFNW ceases storing and treating mixed waste in accordance with the Closure Plan in the current DWR Permit.

Location

The PFNW MWF is located at 2025 Battelle Blvd in Richland, Washington. The site is located in an industrial area in the northwest part of Richland near the U.S. Department of Energy's Hanford site boundary.

Project Proponent

Bryan Blair, General Manager, Perma-Fix Northwest Richland, Inc.

SEPA Lead Agency

Washington State Department of Ecology

SEPA Responsible Official

Edward Holbrook, Deputy Program Manager
Nuclear Waste Program
Washington State Department of Ecology

Contact Information

Daina McFadden
Nuclear Waste Program
Washington State Department of Ecology
3100 Port of Benton Blvd
Richland, WA 99354
(509) 372-7950

Current PFNW Permits and Licenses	Agency
City of Richland substantial development permit	City of Richland
Joint DWR and Toxic Substances and Control Act (TSCA) permit[a]	Ecology and United States Environmental Protection Agency (EPA)
TSCA PCBs Approval to Commercially Store PCB Waste	EPA
Radioactive Material Licenses	Washington State Department of Health (WSDOH)
Radioactive Air Emission Licenses	WSDOH
Benton Clean Air Agency (BCAA) Orders of Approvals	BCAA
License to export and import radioactive waste[b]	US Nuclear Regulatory Commission (USNRC)

Class V UIC Well, Ecology-Water Quality Program Underground Injection Control Permit	Ecology

[a] On September 27, 2023, EPA granted the Approval to Commercially Store Polychlorinated Biphenyl Waste to PFNW, therefore only DWR permit requires renewal in accordance with the PFNW permit application.

[b] Applies to PFNW Low Level Facility only.

Authors and Principal Contributors

This document has been prepared by and approved by Ecology Nuclear Waste Program staff. Key authors and principal contributors are Alicia Boyd, Emma Greene, and Naoko Schiffern.

Date of Draft SEIS Issuance

February 6, 2025

Public Comment on the Draft SEIS

Agencies, affected tribes, and members of the public are invited to comment on the Draft SEIS. An expanded comment period is being provided pursuant to the Washington Administrative Code (WAC) 197-11-455. The Draft SEIS will be available for a 45-day public comment period. The comment period opens February 6, 2025. Comments must be received or postmarked by March 24, 2025. Comments should focus on the substance of the Draft SEIS and be as specific as possible. Comments received during the comment period will be addressed in the Final SEIS

A public meeting is not scheduled, but if there is enough interest, we will consider holding one.

Written comments may be submitted:

Online (preferred) at Draft Supplemental Environmental Impact Statement[1]

Via Email at: Hanford@ecy.wa.gov

By mail to: Daina McFadden
Nuclear Waste Program
Washington State Department of Ecology
3100 Port of Benton Blvd
Richland, WA 99354

Date Comments Are Due

March 24, 2025

Document Availability

Copies of the Draft SEIS, the 1998 City of Richland Final EIS, and permit application materials will be available during the public comment period online at: Ecology.wa.gov/NWP-comment-periods.

[1] https://nw.ecology.commentinput.com/?id=4jW75ZF9Y

Additionally, SEPA documents can be found on Ecology's SEPA register[2].

A printed copy of the Draft SEIS is available for review at no charge at:

Nuclear Waste Program
Washington State Department of Ecology
3100 Port of Benton Blvd.
Richland, WA 99354

For questions or to obtain a CD or printed copy (you could be charged for the cost of production) of the Draft SEIS, please contact:

Department of Ecology
Daina McFadden
Hanford@ecy.wa.gov
(509) 372-7950.

[2] https://apps.ecology.wa.gov/separ/Main/SEPA/Search.aspx

Publication Information

This document is available on the Department of Ecology's website at:
https://apps.ecology.wa.gov/publications/summarypages/2505003.html

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Website[3]: Washington State Department of Ecology

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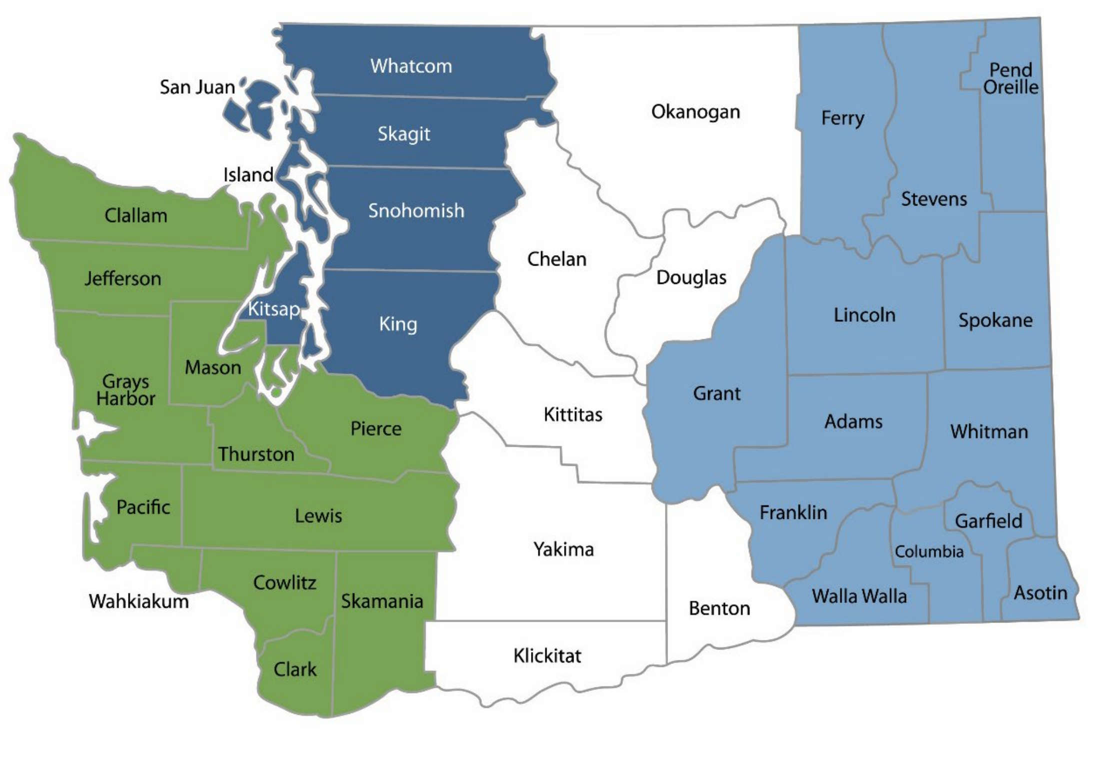
To request an ADA accommodation, contact Ecology by phone at 509-372-7950 or email at Daina.McFadden@ecy.wa.gov. For Washington Relay Service or TTY call 711 or 877-833-6341. Visit Ecology's website for more information.

[3] www.ecology.wa.gov/contact

Department of Ecology's Regional Offices

Map of Counties Served



Southwest Region 360-407-6300	Northwest Region 206-594-0000	Central Region 509-575-2490	Eastern Region 509-329-3400

Region	Counties served	Mailing Address	Phone
Southwest	Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Mason, Lewis, Pacific, Pierce, Skamania, Thurston, Wahkiakum	P.O. Box 47775 Olympia, WA 98504	360-407-6300
Northwest	Island, King, Kitsap, San Juan, Skagit, Snohomish, Whatcom	P.O. Box 330316 Shoreline, WA 98133	206-594-0000
Central	Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, Yakima	1250 West Alder Street Union Gap, WA 98903	509-575-2490
Eastern	Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman	4601 North Monroe Spokane, WA 99205	509-329-3400
Headquarters	Statewide	P.O. Box 46700 Olympia, WA 98504	360-407-6000

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DWR Permit Renewal

Nuclear Waste Program
Washington State Department of Ecology

February 2025 | Publication 25-05-003

DEPARTMENT OF
ECOLOGY
State of Washington

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Terms and Acronyms

%	percent
ALARA	as low as reasonably achievable
ARARACT	as low as reasonably achievable control technology
BARCT	best available radionuclide control technology
BCAA	Benton Clean Air Agency
CFC	chlorofluorocarbon
CFR	Code of Federal Regulations
CH_4	methane
CO_2	carbon dioxide
CWC	Central Waste Complex
DWR	Dangerous Waste Regulations
EA	Environmental Assessment
EBR	experimental breeder reactor
Ecology	Washington State Department of Ecology
EIS	Environmental Impact Statement
FFTF	Fast Flux Test Facility
GHG	greenhouse gas
H_2O	water vapor
HAP	hazardous air pollutant
HFC	hydrofluorocarbon
HEPA	High-Efficiency Particulate Air

HVAC	Heating, Ventilation, and Air Conditioning
INL	Idaho National Laboratory
IP	Industrial Package
km	kilometer
kWh	kilowatt-hour
LAW	Low activity waste
lb	pound
LCF	latent cancer fatality
LDR	land disposal restriction
LLF	Low Level Facility
LLW	low-level waste
m^3	cubic meters
MEI	maximum exposed individual
MFC	Materials and Fuels Complex
µg	microgram
mi	mile: 1 mi = 1.609 km
MLLW	mixed low-level radioactive waste
mrem	millirem
MWF	Mixed Waste Facility
MWNT	Mixed Waste Non-Thermal Area
MWT	Mixed Waste Thermal Area
NA	not applicable
NAAQS	National Ambient Air Quality Standards
NO_x	nitrogen oxide
NO_2	nitrogen dioxide
N_2O	nitrous oxide
NEPA	National Environmental Policy Act
NNSS	Nevada National Security Site
O_3	ozone

ORNL	Oak Ridge National Laboratory
Pb	lead
PFC	perfluorocarbon
PFP	Plutonium Finishing Plant
PNNL	Pacific Northwest National Laboratory
ppb	parts per billion; 1 ppm = 1,000 ppb
ppm	parts per million
RCA	Radiological Controlled Area
RCW	Revised Code of Washington
RCRA	Resource Conservation and Recovery Act
RES	Richland Energy Services
RLA	Rail Loading Area
RSWF	Radioactive Scrap and Waste Facility
Pb	lead
PCB	polychlorinated biphenyl
PM	particulate matter
PFNW	Perma-Fix Northwest, Inc.
SEIS	environmental impact statement supplement
SEPA	State Environmental Policy Act of 1971
SF_6	sulfur hexafluoride
SO_2	sulfur dioxide
SRS	Savannah River Site
SQER	Small Quantity Emission Rate
T	short ton; 1 T = 2,000 lbs; 1 T = 0.907 metric ton
TAP	toxic air pollutant
Tg	teragram; 1 Tg = 1 million metric tons
TLA	Truck Loading Area
TRU	transuranic waste
TRUM	transuranic mixed waste

TSCA	Toxic Substance Control Act of 1976
UCOR	URS CH2M Oak Ridge LLC
USDOE	United States Department of Energy
USDOD	United States Department of Defense
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
USNRC	United States Nuclear Regulatory Commission
VOCs	volatile organic compounds
WAC	Washington Administrative Code
WAP	Waste Analysis Plan
WCS	Waste Control Specialists LLC
WSB	Waste Storage Area
WSDOH	Washington State Department of Health
WSDOT	Washington State Department of Transportation
WSU	Washington State University
ZPPR	Zero Power Physics Reactor

Chapter 1- Introduction

1.1 Purpose of SEIS

The purpose of this Supplemental Environmental Impact Statement (SEIS) is to evaluate the probable significant adverse environmental impacts of the Perma-Fix Northwest, Inc. (PFNW) proposal to renew its Dangerous Waste Regulations (DWR) Permit for operation of its Mixed Waste Facility (MWF). This SEIS supplements the 1998 Final Environmental Impact Statement (EIS) for Treatment of Low-Level Mixed Waste (1998 Final EIS) (City of Richland 1998).

In 1997, the City of Richland issued a Determination of Significance for a proposal by the Allied Technology Group, Inc. (the original owner of the current PFNW facility) for the construction and operation of a mixed low-level radioactive waste (MLLW) treatment facility (Appendix A). The 1998 Final EIS was prepared to evaluate the probable significant adverse environmental impacts of the proposal, including the use of thermal and non-thermal treatment processes to treat MLLW. Ecology issued the initial DWR Permit for the MWF to PFNW's predecessor in 1999.

The focus of this SEIS is to address additional or new impacts associated with PFNW's proposal to renew the DWR Permit for its MWF operation that were not considered in the 1998 Final EIS. This SEIS will consider new information on increased transportation of waste and changes in MWF operations, waste streams, design, and treatment processes.

This evaluation is prepared pursuant to the Washington State Environmental Policy Act (SEPA) (Chapter 43.21C of the Revised Code of Washington [RCW]) and the SEPA Rules (Chapter 197-11 of the Washington Administrative Code [WAC]).

1.2 Ecology Role and Responsibilities

Washington State Department of Ecology (Ecology) regulates the management of dangerous waste, including the dangerous waste component of mixed waste, under Washington's DWR (WAC 173-303). Ecology issues DWR Permits to dangerous waste treatment, storage, and disposal facilities with conditions that ensure the operators treat, store, and handle dangerous waste in a safe and sound manner to protect people and the environment.

In addition to making permitting decisions about the types, volumes, and treatments of waste to be processed at applicant facilities under the DWR, Ecology has additional responsibilities pursuant to SEPA. As the state agency that evaluates PFNW's proposal to renew its DWR Permit, Ecology is the lead agency for purposes of SEPA. Under SEPA, Ecology must

"Dangerous Waste" means any solid waste designated in WAC 173-303-070 through 173-303-100 as dangerous, extremely hazardous, or mixed waste. Dangerous waste is considered hazardous substances under RCW 70.105D.020.

"Mixed Waste" means a dangerous waste that contains both a nonradioactive hazardous component and a radioactive source, special nuclear, or by-product material subject to the Atomic Energy Act of 1954 (WAC 173-303-040).

consider the probable significant environmental impacts of its permitting decisions, including whether a permitted facility may have probable adverse impacts to the environment, and, if so, evaluate possible mitigation measures.

1.3 The Proponent

"Perma-Fix Environmental Services, Inc. is a nuclear services company and leading provider of nuclear waste management services. The Company's nuclear waste services include management and treatment of radioactive and mixed waste for hospitals, research labs and institutions, federal agencies, including the Department of Energy (USDOE), the Department of Defense (USDOD), and the commercial nuclear industry. The Company's nuclear services group provides project management, waste management, environmental restoration, decontamination and decommissioning, new build construction, and radiological protection, safety and industrial hygiene capability to the clients. The Company operates four nuclear waste treatment facilities and provides nuclear services at USDOE, USDOD, and commercial facilities, nationwide" (PFES 2020). PFNW is one of those four facilities.

PFNW is located at 2025 Battelle Boulevard in Benton County, Washington. This forty-five (45) acre site is located in the City of Richland in an industrial area near the USDOE's Hanford site boundary. The location of the PFNW site and a vicinity map are shown in Figure 1 and Figure 2.

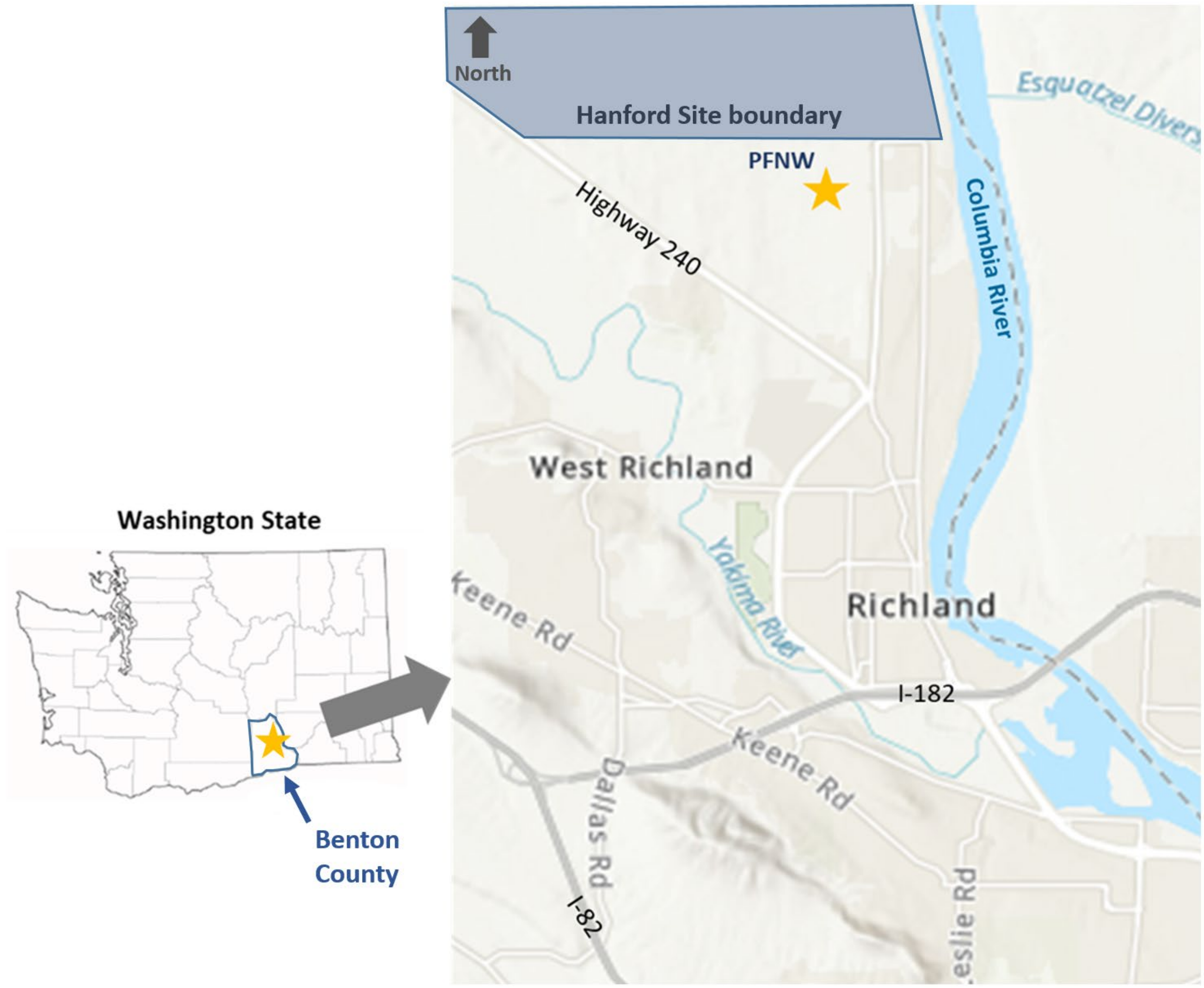

Figure 1: Location of the PFNW Site (Source: WSDOT 2020)

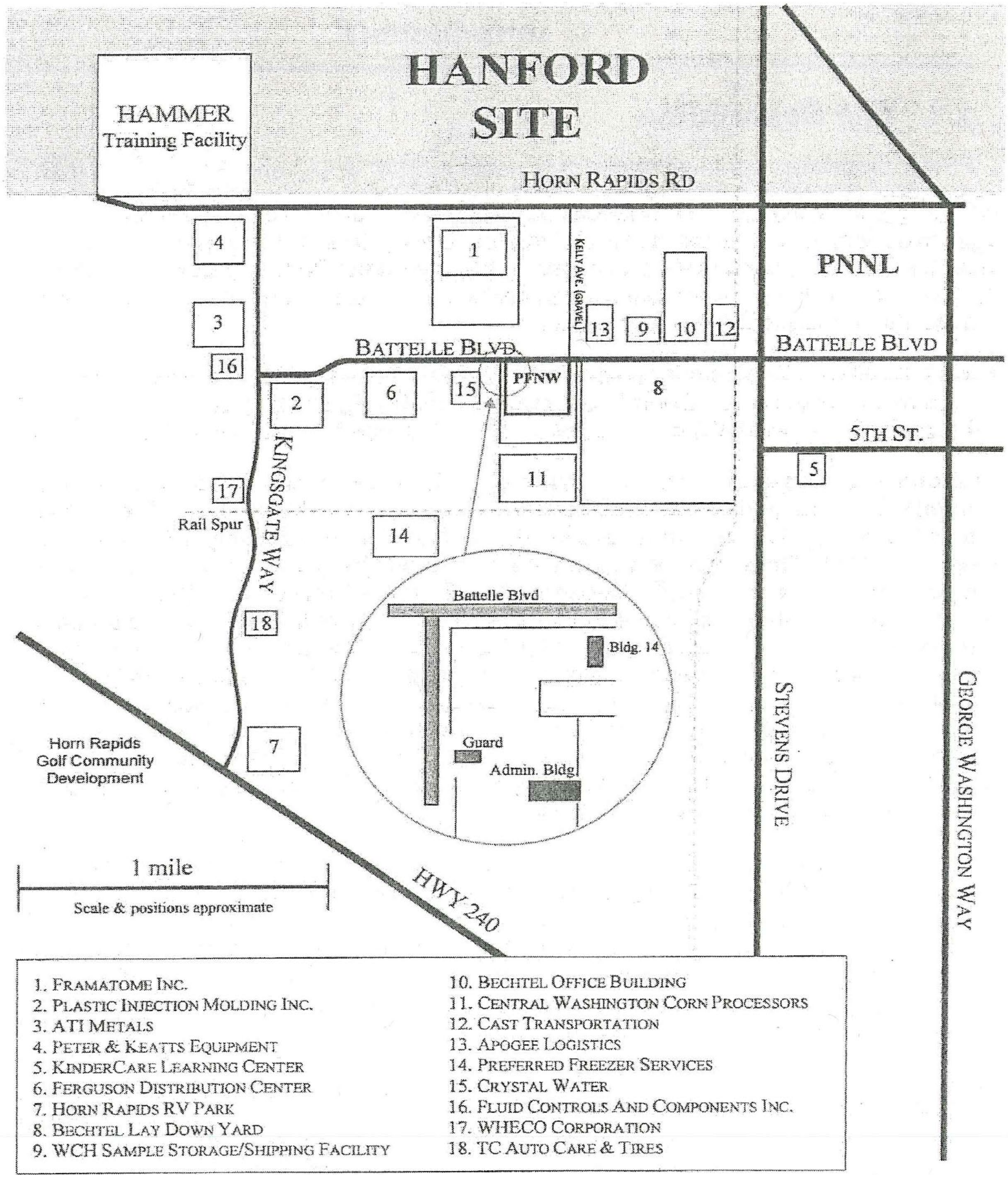

Figure 2: The PFNW Site and the Vicinity (Source: PFNW 2019a)

1.4 Environmental Review Process

PFNW manages and treats both low-level radioactive waste (LLW) and MLLW at its Richland site. The treatment, storage, and handling of MLLW requires a DWR Permit from Ecology. In conjunction with the original DWR Permit application, in 1997, the City of Richland issued a Determination of Significance for the proposed construction and operation of the MWF (Appendix A). The 1998 Final EIS was issued in 1998. Ecology subsequently issued the initial DWR Permit to PFNW's predecessor for operation of the MWF in 1999.

PFNW is seeking to renew its DWR Permit for operation of the MWF. As part of the permit renewal process, PFNW submitted a renewal application for the DWR Permit to Ecology in 2009, with the latest revised DWR Permit Renewal Application submitted to Ecology in 2024 (PFNW 2024). In making a threshold determination under SEPA for PFNW's proposal, Ecology relied on the City of Richland's 1997 Determination of Significance for PFNW's predecessor's proposal to construct and operate the MWF (Appendix A and Appendix B). Due to significant changes and updates to the PFNW facility and operations since the 1998 Final EIS was prepared; Ecology has determined that a SEIS is necessary to evaluate the probable significant adverse environmental impacts specific to PFNW's proposal that were not addressed in the 1998 Final EIS. The SEIS will consider new information on increased transportation of waste and changes in MWF operations, waste streams, design, and treatment processes.

Ecology proceeded with expanded scoping for the SEIS to identify potential reasonable alternatives, potential resource areas and environmental impacts for evaluation, and potential mitigation measures associated with renewing the DWR Permit. Ecology issued a Scoping Notice on March 4, 2019, and provided a 21-day public comment period from March 4 through March 25, 2019. Ecology held a public meeting in Richland, WA on March 13, 2019. The purpose of the expanded scoping was to discuss the PFNW proposal to renew its DWR Permit and ask the public and other agencies for input on potential issues, impacts, and alternatives that should be evaluated in the SEIS.

PFNW has provided Ecology information about its current and future MWF operations, including PFNW's DWR Permit Renewal Application (PFNW 2024) and other information about its foreseeable future operations at the MWF. Based on the information from PFNW and the public comments received during the expanded scoping period and public meeting, alternatives have been developed to evaluate the probable significant adverse environmental impacts of PFNW's proposal (addressed in Chapter 3).

1.5 Following the Issuance of this Draft SEIS

Ecology is issuing this Draft SEIS along with a draft renewal DWR Permit for public review and comment before approving, modifying, or denying the PFNW's DWR Permit Renewal Request (PFNW 2024). Written comments on the Draft SEIS will be accepted during a 45-day public comment period.

Ecology expects to issue the Final SEIS after reviewing all the public comments received during the comment period. In accordance with SEPA regulations, a decision regarding the DWR

Permit Renewal for the PFNW facility will not be made until a minimum of 7 days after issuance of Final SEIS.

Chapter 2- Current Operation at the MWF

This chapter provides background information about PFNW's current operations at the MWF, such as a description of the MWF, the types of mixed waste the MWF handles, waste transportation to and from the MWF, and changes in the MWF operation since the 1998 Final EIS.

PFNW also maintains a separate LLW facility (LLF) at its Richland site to treat LLW that does not meet the definition of mixed waste or waste regulated under WAC 173-303. Since a DWR Permit is not required for PFNW's operation of the LLF, this SEIS focuses on probable significant adverse environmental impacts from the MWF operations only. Nonetheless, information is provided in this chapter about the LLF and waste that does not meet the definition of mixed waste to the extent that it helps provide appropriate context for the evaluation of probable environmental impacts from the MWF.

Except for the volume capacity of waste to be stored and processed at the MWF, which differs for each alternative, this chapter describes elements common to all action alternatives evaluated in the following chapters in this SEIS.

2.1 Facility Description

The PFNW Site, located at the southeast corner of Logston Boulevard and Battelle Boulevard in Richland, Washington, is a 45-acre site divided into two distinct facilities that are adjacent to each other, the MWF and the LLF (Figure 3). Because PFNW does not treat mixed waste at the LLF, PFNW does not require a DWR Permit to operate the LLF. LLW processed and handled at the LLF within the PFNW Site are regulated under a Radioactive Materials License issued by Washington State Department of Health (WSDOH). As such, this SEIS focuses primarily on the MWF as the facility that requires a DWR Permit; however, features of the LLF are discussed when appropriate and necessary to evaluate probable environmental impacts of the MWF.

The MWF is a storage and treatment facility for mixed waste (i.e., MLLW). The original design of the MWF described in the 1998 Final EIS consisted of four separate buildings including the Stabilization (non-thermal treatment) Building, the GASVIT (gasification and vitrification) Building, the Waste Storage Building, and the Administrative Building (City of Richland 1998). Some of the buildings described in the 1998 Final EIS were not constructed separately, and the current MWF has only one building with three areas: the Mixed Waste Non-Thermal Area (MWNT area), the Mixed Waste Thermal Area (MWT area), and the Waste Storage Area (WSB area).

Currently, the MWF consists of a 68,000 ft^2 steel framed, metal sided, predominantly one-story building on a reinforced concrete substructure and designated loading/unloading areas. The MWF is divided into separate areas for 3 activities: treatment, storage, and loading/unloading. All waste that enters the MWF is stored, either repackaged or treated and packaged, then shipped off-site for further treatment or disposal.

The entire MWF building, and the loading/unloading areas are within the Radiological Controlled Area (RCA), which is surrounded by concrete curbing that provides secondary containment in the event of a spill or leak from a container (labeled as RCA Boundaries in Figure 4). The RCA includes the Yard Area and the Truck Loading Area (TLA) on the west side of the MWF (PFNW 2018a).

Outside of the RCA to the south of the MWF building is the Rail Loading Area (RLA) for waste being transported by railcar.

Waste is loaded and unloaded in one of three areas, either inside the MWF building or within the TLA or RLA. The Yard Area is used to transfer waste between the TLA and the MWF building. The TLA is for loading and unloading waste to and from trucks. The RLA is for loading and unloading waste being transported by railcar; the incoming waste by railcars would be transferred to a truck at RLA and moved inside the RCA through the MWF access gate and unloaded either in the MWF or at the TLA and placed in the MWF (PFNW 2010). The RLA has never been used for loading or unloading waste as further explained in Section 2.9.2.

Treatment and/or storage of mixed waste in the MWF takes place in three areas within the MWF building: the MWNT area, the MWT area, and the WSB area.

The aerial view and general layout of the PFNW site is shown in Figure 3 and Figure 4. The general layout of the MWF within the PFNW site is shown in Figure 5.

Figure 3: Aerial View of the PFNW Site
Source: Addendum A Part A Attachment A, Map, Drawings, and Photos (PFNW 2024)

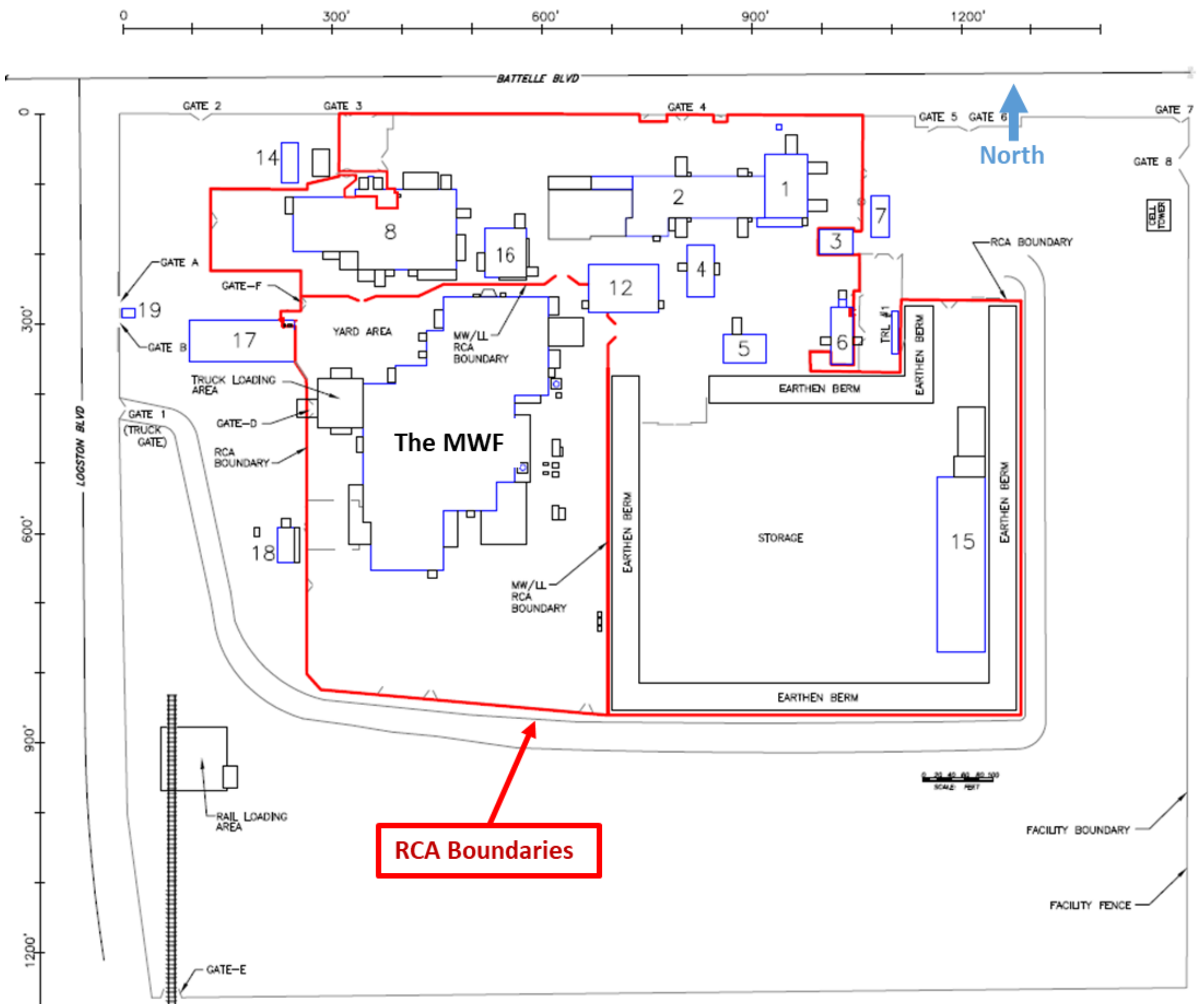

Figure 4: General Layout of the PFNW Site
Source: Addendum A Part A Attachment A, Map, Drawings, and Photos (PFNW 2024)

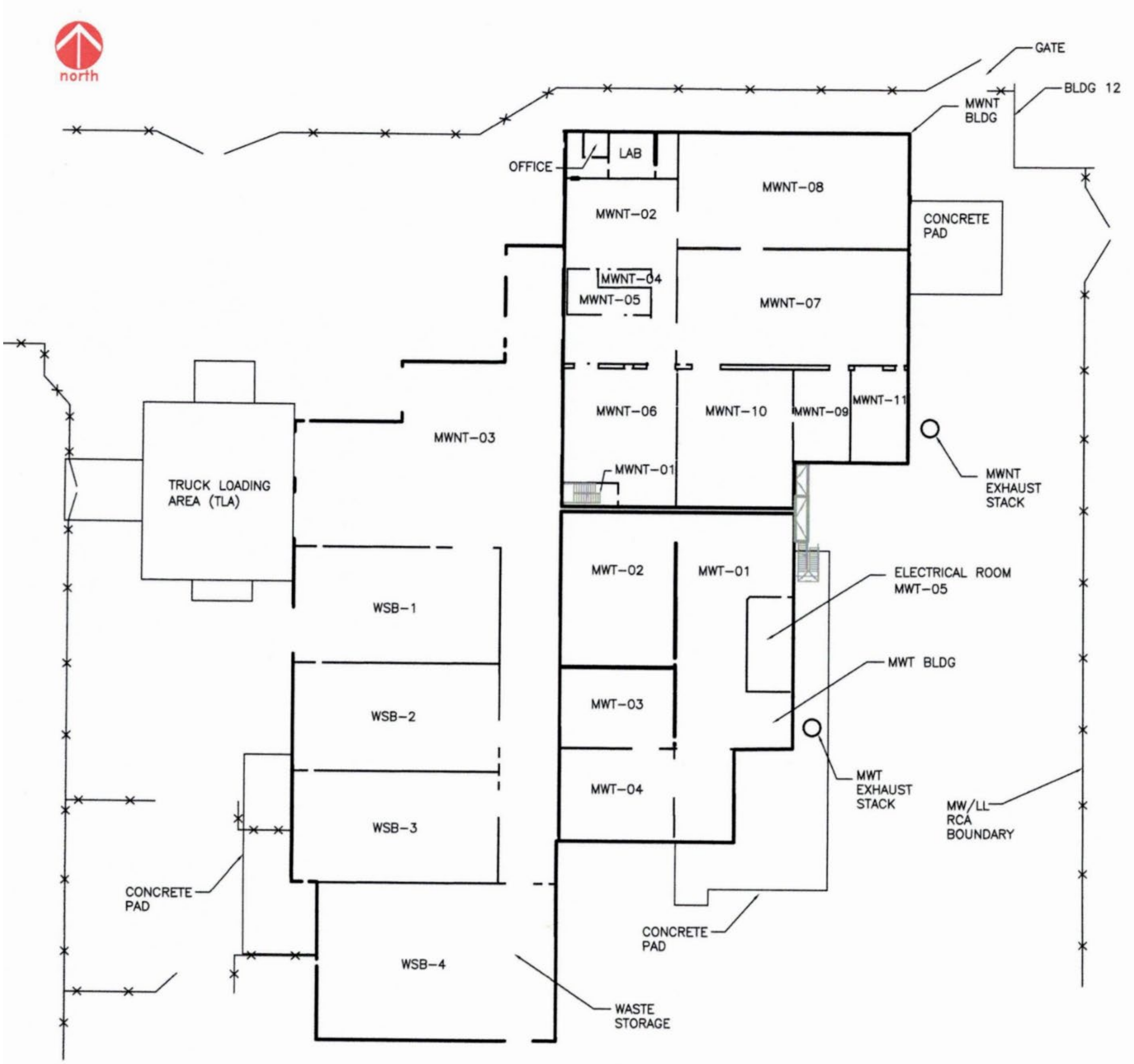

Figure 5: General Layout of the MWF
Source: Addendum A Part A Attachment A, Map, Drawings, and Photos (PFNW 2024)

2.1.1 Mixed Waste Non-Thermal Area (MWNT Area)

The MWNT area is located in the northeast area of the MWF building. It consists of an approximately 22,000 ft^2 area divided into several rooms that are used for treatment and container storage, Truck Bay mainly for truck loading/unloading, waste storage, and waste inspection activities, a laboratory, an office area, and an access stairwell. The MWNT area is surrounded by a continuous curb on the MWF slab to provide a secondary containment. This area was described as the Stabilization Building in the 1998 Final EIS. An annex was constructed in 2000, increasing the original size of the MWNT area (formerly called Stabilization Building) by

6,820 ft^2.

The MWNT area is the main area in the MWF for treatment of mixed waste. Processing of non-mixed waste occasionally takes place in the MWNT area due to operational constraints as further discussed in section 2.3 of this chapter. Current non-thermal treatment processes occurring in the MWNT area include stabilization, solidification, neutralization, size reduction, compaction, shredding, deactivation, chemical oxidation, chemical reduction, physical extraction (decontamination), and macroencapsulation (R. Huckfeldt, personal communication, August 5, 2020). Additionally, the rooms within the MWNT area are used for container storage.

2.1.2 Mixed Waste Thermal Area (MWT Area)

The MWT area is located in the southeast area of the MWF building. It consists of an approximately 13,500 ft^2 area divided into four rooms. The northern wall of the MWT area adjoins the southern wall of the MWNT area, and the entire MWT area is surrounded with a continuous concrete curb on the MWF slab. This area was described as the GASVIT building in the 1998 Final EIS; however, the MWF was instead constructed to include this area to house the GASVIT™ thermal treatment system. The GASVIT™ Processing Unit was only in operation between May 2000 and June 2001 (B. Nicholas, personal communication, Jan 7, 2013). On September 11, 2012, PFNW submitted to Ecology the closure summary report and the certification of closure for GASVIT™ Processing Unit. Ecology completed a physical walkdown in the MWT Area and verified the unit has been removed on November 9, 2012. Ecology sent PFNW a letter notifying them of the acceptance of the closure certification in January 2013 (Ecology 2013b).

Currently, the rooms within the MWT area are used for container storage and the GeoMelt® In Container Vitrification System. This system is not currently permitted to treat any dangerous waste, as further discussed in section 2.7.2.

2.1.3 Waste Storage Area (WSB Area)

The WSB area is an approximately 32,500 ft^2 area that is divided into four rooms and includes a hallway. The eastern wall of the WSB area adjoins the western wall of the MWNT area. The southernmost room, as labeled as WSB-4 in Figure 5 (formerly called as Waste Storage Bay #4), was originally designed as a covered storage pad with large flammable storage cabinets (i.e. only providing a roof structure). However, this room was constructed instead as an enclosed structure to isolate the waste from the outside environment, which increased the original size of the WSB area by 7,070 ft2. The WSB area is principally used for the storage of containerized mixed waste, including unloaded waste that does not go directly into a processing area and treated waste forms awaiting off-site shipment. The WSB area contains 17 HAZMAT cabinets for the storage of incompatible or hazardous waste. The WSB area is entirely surrounded by a continuous concrete curb so that container storage has a secondary containment feature.

2.2 Required Permits and Licenses

PFNW manages, stores, and treats waste at its Richland site (both the MWF and LLF) under several permits and licenses from various federal, state, and local agencies, as shown in Table 1. These permits and licenses stipulate conditions within which PFNW must operate.

Table 1: Current PFNW Permits and Licenses

Permit and Licenses	Agency
City of Richland substantial development permit	City of Richland
Joint DWR and Toxic Substances and Control Act (TSCA) permit[a]	Ecology and United States Environmental Protection Agency (EPA)
TSCA PCBs Approval to Commercially Store PCB Waste	EPA
Radioactive Material Licenses	Washington State Department of Health (WSDOH)
Radioactive Air Emission Licenses	WSDOH
Benton Clean Air Agency (BCAA) Orders of Approvals	BCAA
License to export and import radioactive waste[b]	US Nuclear Regulatory Commission (USNRC)
Class V UIC Well, WDOE-Water Quality Program Underground Injection Control Permit	Ecology

[a] On September 27, 2023, USEPA granted the Approval to Commercially Store Polychlorinated Biphenyl Waste to PFNW, therefore only DWR permit requires renewal in accordance with the PFNW permit application (USEPA 2023).

[b]Applies to PFNW LLF only.

2.3 Background on Waste to be Treated

The origin of waste treated at PFNW can be organized into 5 generator categories:

1. USDOE, Hanford site
2. USDOE, other sites
3. Other Federal agencies (non-USDOE)
4. Non-Federal domestic generators
5. International generators

Likewise, the types of waste treated can be organized into 4 waste type categories:

1. LLW (not mixed)
2. MLLW
3. Transuranic waste (not mixed) (TRU)
4. Mixed transuranic waste (TRUM)

2.3.1 Low Level Radioactive Waste (not mixed) (LLW)

> LLW is defined as waste that contains radioactive material that is not high-level radioactive waste, spent nuclear fuel, or byproduct material as defined in section 11e.2 of the Atomic Energy Act of 1954 (WSDOH 2020a).

This type of waste could come from any of the 5 generator categories. Over the 10 years (2010-2019), PFNW processed an average of 499 metric tons (550 short tons) of solid LLW per year and 877 metric tons (967 short tons) of liquid LLW per year, although the variation from year-to-year has been large (as shown in Table 2) (R. Huckfeldt, personal communication, August 5, 2020). The average annual quantity of both solid and liquid LLW is 1,376 metric tons (1,517 short tons) per year during the same period of time. The largest percentage of this waste has come from USDOE's Hanford site and other USDOE sites. Other generators include commercial nuclear plants, hospitals, medical research facilities, universities, and private industries (PFNW 2019a).

In the past, the treatment process for LLW includes size reduction, decontamination, and stabilization and encapsulation in the Low Level Facility (LLF) (PFNW 2019a). Following the treatment, the treated waste form is packaged and shipped offsite for disposal. Table 2 presents the annual quantities of LLW processed in the PFNW site from 2010 to 2019.

Table 2: Annual Quantities of LLW Processed in the LLF (2010-2019)

Year	Solid LLW (metric tons)	Liquid LLW (metric tons)	Total LLW[a] (metric tons)	Total LLW Shipment Numbers[b]
2019	438	732	1,169	130
2018	504	999	1,503	149
2017	309	311	619	85
2016	214	728	942	95
2015	200	1,075	1,275	115
2014	357	1,211	1,568	138
2013	388	328	717	109
2012	148	503	652	109
2011	2,129	2,610	4,739	371
2010	299	273	573	125
Average (2010-2019)	499	877	1,376	143

LLF = low level facility

LLW = low-level radioactive waste

[a] The total quantities of LLW are the total waste quantities of both solid and liquid LLW processed in the LLF.

[b] Shipment number is the number of trucks delivering waste to the LLF.

Source: (R. Huckfeldt, personal communication, August 5, 2020)

PFNW receives LLW from international generators. Currently, PFNW has a USNRC license to export waste[4] to Italy (license number: XW025).

From 2010 to 2019, PFNW received a total of 187.6 metric tons (206.8 short tons) of LLW originated in Great Britain (license numbers: IW033 and XW022) and Canada (license numbers: IW022/05 and XW012/05) (R. Huckfeldt, personal communication, August 5, 2020). PFNW anticipates processing LLW imported from other international generators in the future, including LLW generated in Mexico, Europe, and Japan (PFNW 2018a). PFNW applied for USNRC license to export waste to Mexico (license number: XW019) , Germany, and Canada in 2018, 2020, and 2021, respectively.

The USNRC has limits on the quantity of certain radionuclides that licensees can have at their facilities per 10 CFR 61. These limits apply whether the licensee is regulated directly by the USNRC, or by a USNRC Agreement State. Washington is an Agreement State, a State that has signed an agreement with the USNRC authorizing the State to regulate certain uses of radioactive materials within the State (USNRC 2020). Therefore, possessing and processing of LLW is done pursuant to WSDOH licenses and it does not require a USNRC license.

LLW is normally processed in the LLF; however, there are times when processing of LLW takes place in the MWF due to operational constraints. Examples of LLW processed in the MWF include large debris waste. PFNW cleans and decontaminates the equipment (i.e. Super Compactor) prior to processing LLW to prevent the waste from becoming mixed waste. PFNW provides notification to Ecology of its intent to process LLW in the MWF and upon completion of cleaning and decontamination of the treatment unit (i.e. Super Compactor), in accordance with the facility's internal procedure (Mixed Waste Operating Procedure). The treated LLW may be either sent to the LLF or shipped directly off-site from the MWF.

Another example of LLW processed in the MWF is depleted uranium. Despite the pyrophoric characteristic, depleted uranium itself is exempt from RCRA being a radiological source material per 40 CFR 261.4(a)(4). Depleted uranium becomes mixed waste if it is in oil contaminated with PCB or heavy metals instead of clean mineral oil. PFNW has processed about 700 drums of depleted uranium in the past (Ecology 2020e). Processing of depleted uranium in the MWF started in 2008 when Ecology and USEPA jointly granted temporary authorization to manage depleted uranium possibly contaminated with PCB in the Extraction Mixing System (Ecology and USEPA 2008). Following the expiration of temporary authorization in November 2008, Ecology and USEPA's jointly approved PFNW to permanently add the Extraction Mixing System for management of depleted uranium as a Class 2 Permit Modification in 2009 (Ecology and USEPA 2009). PFNW didn't install the Extraction Mixing System (PFNW 2018a), and management of depleted uranium has been through macroencapsulation following draining and decanting the

[4] The USNRC issues export licenses when companies wish to export waste back to the country it came from after being processed in the U.S.

mineral oil without using a specific treatment unit in the area permitted for macroencapsulation in the MWF (Ecology 2020e).

2.3.2 Mixed Low Level Radioactive Waste (MLLW)

This type of waste could come from any of the 4 categories of domestic generators.

MLLW is defined as waste containing LLW and hazardous constituents defined under 10 Code of Federal Regulations (CFR) Part 61, the *Resource Conservation and Recovery Act of 1976* (RCRA), the Toxic Substances and Control Act (TSCA), or dangerous waste defined by WAC 173-303 (City of Richland 1998).

Current DWR Permit through Permit Conditions II.B.1 and II.B.2, Permit Conditions, rev. 11 (Ecology and USEPA 2020) requires PFNW to submit a four-week advance notification to receive mixed waste from out of state generators and foreign generators in accordance with WAC 173-303-290(1).

In addition to the notification requirement, PFNW has to meet a federal requirement for import of hazardous waste in accordance with 40 CFR Part 262.84. This federal import regulation requires PFNW (or the foreign exporter) to provide a notification to USEPA for its intent to import mixed waste at least 60 days before the first shipment is expected (40 CFR Part 262.84). It provides a mechanism to ensure waste designation of foreign waste during the pre-acceptance process (as described in section 2.6.1). PFNW told Ecology that it does not plan to accept MLLW from international generators (PFNW 2019b). In August 2020, PFNW notified Ecology of its intent to receive foreign mixed waste from the U.S. Navy in Okinawa, Japan (Ecology 2020f).

From 2010 to 2019, PFNW processed an average of 207 metric tons (228 short tons) of solid MLLW per year and 2 metric tons (2.2 short tons) of liquid MLLW per year, although the variation from year-to-year has been large, as shown in Table 3 (R. Huckfeldt, personal communication, August 5, 2020). The average annual quantity of both solid and liquid MLLW is 209 metric tons (230.2 short tons) per year during the same period of time. The largest percentage of this MLLW has come from USDOE's Hanford site, as shown in parenthesis in Table 3. Most of this MLLW has been solid waste in the past 10 years, as shown in Table 3.

Table 3: Annual Quantities of MLLW Processed in the MWF (2010-2019)

Year	Solid MLLW (from Hanford[a]) (metric tons)	Liquid MLLW (from Hanford[a]) (metric tons)	Total MLLW[b] (from Hanford[a]) (metric tons)	Total MLLW Shipment Number[c]
2019	85.3 (76.4)	0 (0)	85.3 (76.4)	81
2018	186.2 (130.6)	0 (0)	186.2 (130.6)	115
2017	93.2 (71.0)	0 (0)	93.2 (71.0)	67
2016	156.9 (135.4)	0 (0)	156.9 (135.4)	64

Year	Solid MLLW (from Hanford[a]) (metric tons)	Liquid MLLW (from Hanford[a]) (metric tons)	Total MLLW[b] (from Hanford[a]) (metric tons)	Total MLLW Shipment Number[c]
2015	213.5 (105.4)	3.1 (3.1)	216.6 (108.5)	71
2014	96.0 (43.0)	1.2 (1.0)	97.2 (44.0)	61
2013	210.2 (68.5)	2.2 (2.0)	212.4 (70.5)	99
2012	240.7 (112.5)	3.9 (3.8)	244.6 (116.3)	127
2011	449.5 (352.6)	0.1 (0.1)	449.6 (352.7)	234
2010	340.7 (217.7)	10.4 (1.3)	351.1 (219.0)	190
Average (2010-2019)	207.2 (131.3)	2.1 (1.1)	209.3 (132.4)	111

MLLW = mixed low-level radioactive waste
MWF = mixed waste facility
[a] Quantities in the parenthesis are for waste originated from the Hanford site.
[b] The total quantities of MLLW are the total waste quantities of both solid and liquid MLLW processed in the MWF.
[c] Shipment number is the number of trucks delivering waste to the MWF.
Source: (R. Huckfeldt, personal communication, August 5, 2020)

2.3.3 Transuranic Waste (not mixed) (TRU)

TRU processed at PFNW has historically come from waste generated during demolition of the Plutonium Finishing Plant (PFP) at the Hanford site. After being processed, TRU is packaged for shipment back to the Hanford site for interim storage at the Central Waste Complex (CWC). During federal fiscal year 2019, approximately 500 cubic meters (17,657 cubic feet) of TRU (such as PFP glove boxes) was received at PFNW to be size reduced to a volume of 122 cubic meters (4,308 cubic feet). PFNW repackaged the size-reduced TRU in 68 boxes, which are currently stored at the CWC (USDOE 2019b). Shipments of TRU waste from the Hanford site to PFNW are expected to continue for at least the next decade (USDOE 2024). However, since USDOE's PFP demolition project is complete (USDOE 2022) and there are no other on-going or foreseeable projects in the Hanford site from which PFNW anticipates receiving a large volume of TRU. Therefore, PFNW would only receive a small volume of TRU from the Hanford site in the foreseeable future.

The USNRC has limits on the quantity of certain radionuclides that licensees can have at their facilities. These limits apply whether the licensee is regulated directly by the USNRC, or by a USNRC Agreement State. Washington is an Agreement State, a State that has signed an agreement with the USNRC authorizing the State to regulate certain uses of radioactive materials within the State (USNRC 2020). Possessing and processing of TRU is done pursuant to WSDOH licenses, and it does not require a DWR Permit.

TRU waste debris, which is not designated as mixed waste, is normally processed in the LLF; however, due to operational constraints, there have been times when processing of TRU takes place in the MWF (B. Wiegman, personal communication, November 22, 2019), as shown in

Table 4. Occasional TRU processing in the MWF started in 2010 to support Hanford site's PFP Project with Ecology and USEPA's joint approval as a Class 1 Permit Modification in 2011 (Ecology and USEPA 2011).

Treatment of large sized TRU waste debris requires the Super Compactor in the MWF since the LLF doesn't have a treatment capability for the size of the waste. Cleaning and decontamination of the equipment is necessary prior to processing TRU to prevent the waste from becoming mixed waste. PFNW provides notification to Ecology its intent of processing TRU in the MWF and upon completion of cleaning and decontamination of the equipment, in accordance with the facility's internal procedure (i.e., Mixed Waste Operational Procedure). The treated TRU may be either sent to the LLF or shipped directly back to the Hanford site from the MWF.

From 2010 to 2019, PFNW has received a total of 138.8 metric tons (153.0 short tons) of TRU from the Hanford site. PFNW processed an average of 11.1 metric tons (12.2 short tons) of TRU per year in the LLF and 2.8 metric tons (3.1 short tons) of TRU per year in the MWF, although the variation from year-to-year has been large, as shown in Table 4 (R. Huckfeldt, personal communication, August 5, 2020). The average annual quantity of total TRU processed in the PFNW site is 13.9 metric tons (15.3 short tons) per year during the same period of time.

Table 4: Annual Quantities of TRU Processed in the PFNW Site (2010-2019)

Year	TRU Processed in the LLF (metric tons)	TRU Processed in the MWF (metric tons)	Total TRU[a] (metric tons)	Total TRU Shipment Number[b]
2019	38.9	0	38.9	16
2018	23.0	0	23.0	12
2017	40.6	1.4	42.0	18
2016	8.2	0.9	9.1	7
2015	0	0	0	1
2014	0	0	0	1
2013	0	0	0	0
2012	0	0	0	0
2011	0	23.9	23.9	11
2010	0	1.8	1.8	2
Average (2010-2019)	11.1	2.8	13.9	7

LLF = low level facility
MWF = mixed waste facility
PFNW = Perma-Fix Northwest, Inc.
TRU = transuranic waste
[a] The total quantities of TRU are the total waste quantities of TRU processed in the PFNW site (both LLF and MWF).

[b] Shipment number is the number of trucks delivering waste to the PFNW site.
Source: (R. Huckfeldt, personal communication, August 5, 2020)

2.3.4 Mixed Transuranic Waste (TRUM)

This type of waste could come from USDOE's Hanford site, PNNL, or other USDOE sites. USDOE is unlikely to ship other than very small volumes of TRUM from sites other than the Hanford site to PFNW because of the stringent shipping requirements (e.g. segmented rolling road closure as discussed in section 2.9.1.1).

> TRUM is defined as waste containing transuranic waste and hazardous constituents under 10 CFR Part 61, the *Resource Conservation and Recovery Act of 1976* (RCRA), the Toxic Substances and Control Act (TSCA), or dangerous waste defined by WAC 173-303.

Treatment of TRUM involves size reduction and repackaging of the waste into certifiable containers acceptable for eventual offsite disposal at the Waste Isolation Pilot Plant (WIPP) in New Mexico. PFNW, "the only available capability today for repackaging TRUM", receives containers of TRUM for size reduction and repackaging, then ships back to the Hanford site CWC before shipment for eventual disposal at WIPP (USDOE 2019e).

Approximately 3,370 containers of potential TRUM requiring repackaging are currently in storage at the Hanford site CWC (USDOE 2019e). Individual containers range in size from 55 gallons (0.208 cubic meters) up to 15,982 gallons (60.5 cubic meters) stored in CWC and up to 29,217 gallons (110.6 cubic meters) stored outside CWC (M. Baker, personal communication, November 5, 2019). Another 12,000 containers of potential TRUM are "retrievably stored" in trenches adjacent to the CWC. Retrieval operation of retrievably stored waste is in a standby condition, and it is not anticipated to occur until approximately FY 2033 (USDOE 2020).

USDOE has enforceable schedules for treatment of the 3,370 TRUM containers. USDOE has enforceable schedules to retrieve the 12,000 containers of potential TRUM, then complete treatment. USDOE anticipates completing the treatment over a 30-year period ending in 2050 (USDOE 2020). Thus, on average, PFNW could expect to process up to 600 containers per year, although the numbers of containers processed in a single year could vary. Also, the volume processed year-to-year could vary depending on whether USDOE chooses to treat large boxes or smaller containers. It's also possible that USDOE could, in the future, treat some containers on the Hanford site rather than shipping them to Perma-Fix for treatment.

From 2010 to 2019, PFNW has processed an average of 78.4 metric tons (86.4 short tons) of TRUM per year, although the variation from year-to-year has been large (as shown in Table 5) (R. Huckfeldt, personal communication, August 5, 2020). PFNW told Ecology that TRUM waste received is debris and solid, however liquid and sludge are incidental (B. Wiegman, personal communication, November 22, 2019).

Table 5: Annual Quantities of TRUM Processed in the MWF (2010-2019)

Year	TRUM Processed in the MWF (metric tons)	Total TRUM Shipment Number[a]
2019	156.3	19
2018	91.5	11
2017	78.7	15
2016	111.2	16
2015	116.4	16
2014	47.8	11
2013	24.1	6
2012	17.0	12
2011	112.3	33
2010	29.1	8
Average (2010-2019)	78.4	15

MWF = mixed waste facility
TRUM = mixed transuranic waste
[a] Shipment number is the number of trucks delivering waste to the MWF.
Source: (R. Huckfeldt, personal communication, August 5, 2020)

2.4 Physical State of Waste

The MWF receives MLLW, TRUM, and occasionally non-mixed waste such as TRU and LLW in the following physical forms:

- Solid (e.g. soil, ash, powder)
- Liquid (e.g. water, acid, caustic, and solvent)
- Sludge
- Debris (e.g. wood, metal, concrete, and plastic)

2.5 Waste Profile

The MWF is permitted to receive and process MLLW with Dangerous Waste Codes D, F, K, P, U, and Washington State specific codes WP, WSC, WT, and WPCB under the DWR (WAC 173-303). A description of the waste designated by these codes is provided in Table 6 below. Table 7 lists the currently permitted Dangerous Waste Codes in the MWF.

Table 6: Waste Code Descriptions under Dangerous Waste Regulations

Waste Code	Description
D	The D-waste codes apply to waste with the following 4 characteristics: • Ignitability • Corrosivity • Reactivity • Toxicity.
F	The F-waste codes apply to waste from non-specific, common manufacturing and industrial processes. The 7 manufacturing and industrial processes to generate F-coded waste are: • Spent solvent waste • Electroplating and other metal finishing waste • Dioxin-bearing waste[a] • Chlorinated aliphatic hydrocarbons production • Wood preserving waste • Petroleum refinery wastewater treatment sludges • Multisource leachate.
K	The K-waste codes apply to waste from specific industries or sources. The 13 industries that generate K-coded waste are: • Wood preservation • Organic chemicals manufacturing • Pesticides manufacturing • Petroleum refining • Veterinary pharmaceuticals manufacturing • Inorganic pigment manufacturing • Inorganic chemicals manufacturing • Explosives manufacturing • Iron and steel production • Primary aluminum production • Secondary lead processing • Ink formulation • Coking (processing of coal to produce coke).
P and U	The P and U-codes apply to waste from discarded commercial chemical products. The 3 criteria that generate P and U-coded waste are: • The waste must contain one of the chemicals listed on the P or U-list; • The chemical in the waste must be unused; and • The chemical in the waste must be in the form of a commercial chemical product.
WP	Washington State-only waste codes. WP codes are persistent dangerous waste.
WPCB	Washington State-only waste codes. WPCB codes are state-specific PCB sources.
WSC	Washington State-only code. WSC codes are solid or semi-solid corrosive waste.
WT	Washington State-only codes. WT codes are toxic dangerous waste.

Source: WAC 173-303

[a] Waste classified as dioxin waste (F020-F023 and F026-F028) is restricted from the MWF due to a regulatory restriction (PFNW

2019b). Source: Current DWR Permit, Attachment CC, Waste Analysis, rev. 5 (Ecology and USEPA 2020).

Table 7: Currently Permitted Dangerous Waste Codes in the MWF

Characteristic Waste "D" Coded Waste	Nonspecific Sources "F" Coded Waste	Source-specific "K" Coded Waste	Discarded Chemical Product "P" Coded Waste	Discarded Chemical Product "U" Coded Waste	Washington State-Specific "W" Coded Waste
D001-043	F001-012 F019 F024-025 F032 F034-035 F037-039	K001-011 K013-052 K060-062 K069 K071 K073 K083-088 K093-118 K123-126 K131-132 K136 K141-145 K147-151 K156-159 K161 K169-172	P001-018 P020-024 P026-031 P033-034 P036-051 P054 P056-060 P062-064 P066-078 P081-082 P084-085 P087-089 P092-099 P101-106 P108-116 P118-123 P127-128 P185 P188-192 P194 P196-199 P201-205	U001-012 U014-039 U041-053 U055-064 U066-099 U101 U102-103 U105-138 U140-174 U176-194 U196-197 U200-211 U213-223 U225-228 U234-240 U243-249 U271 U278-U280 U328 U353 U359 U364 U367 U372-373 U387 U389 U394-395 U404 U409-411	WL01-02 WP01-03 WPCB WSC2 WT01-02

Source: Current DWR Permit, Attachment CC, Waste Analysis, rev. 5 (Ecology and USEPA 2020)
Note: Acceptable Dangerous Waste Code may be added or deleted at any time due to changes in regulations and permit renewal.

2.6 Waste Acceptance

PFNW may accept at the MWF waste that meets the criteria of the waste acceptance process as required by the current DWR Permit, Attachment CC, Waste Analysis, rev. 5 (Ecology and USEPA 2020). As described below, unsuitable waste is either rejected during the pre-acceptance process before transfer to the MWF or is returned to the generator if a discrepancy is found upon arrival at the MWF.

2.6.1 Pre-Acceptance Process

Pre-acceptance is a process for deciding whether to accept a waste prior to receiving the waste at the MWF, as required by the current DWR Permit, Attachment CC, Waste Analysis, rev. 5 (Ecology and USEPA 2020). Waste generators submit to PFNW a complete waste profile, including a description of how the waste was generated and an analytical results or process knowledge justification (PFNW 2018a). PFNW's pre-acceptance decision is based on:

- Conditions and limitations of existing facility permits and applicable regulations
- Treatment capabilities
- Nature of the waste
- Compatibility of the waste with the proposed treatment process (e.g. treatment equipment, reagents, protective coating, containers, etc.)
- Compatibility of the waste with other waste being managed

During the waste profile review process, PFNW ensures that the waste code associated with the waste are allowed by the current DWR Permit, Attachment BB Part A Form, rev. 4 (Ecology and USEPA 2020) (as shown in Table 7). Any restricted waste, as detailed in the current DWR Permit, Attachment CC, Waste Analysis, rev. 5 (Ecology and USEPA 2020) would be denied during this process. The restricted waste is as follows:

- Forbidden explosives as defined by 49 CFR Part 173.54, or Class 1 explosives (Divisions 1.1, 1.2, 1.3, & 1.5) as defined by 49 CFR Part 173.50 (WAC 173-303-090(7)(a)(viii))
- Waste carrying a waste code not listed in the Part A of the current DWR Permit, Attachment BB Part A Form, rev. 4 (Ecology and USEPA 2020)
- Waste classified as explosive or shock sensitive as defined by WAC 173-303-090
- Waste classified as dioxin waste (F020-F023 and F026-F028)
- Containers (not including aerosol cans) holding a containerized gas at a pressure greater than 25 psi or larger than 18" in any dimension
- Liquid waste received in greater than 55-gallon containers with a flash point less than 100F

If PFNW determines that the waste may be accepted for treatment at the MWF, the generator will be informed of the pre-acceptance and a shipment date is scheduled. PFNW then prepares the MWF to receive the incoming waste (PFNW 2015).

2.6.2 Waste Acceptance Process at the MWF

Upon arrival of pre-accepted waste at the MWF, the manifest or shipping paperwork is checked against the waste shipment to determine if there are any discrepancies.

If no discrepancies are found, the waste is authorized to be off-loaded into the MWF. Once off-loaded, the waste is subject to verification screening to ensure that the waste shipment matches the waste stream represented by its profile on the manifest (PFNW 2018a).

Verification screening includes receipt, container count, visual inspection, and chemical screening of waste, such as pH screening, mercury screening, and PCB screening (PFNW 2015).

PFNW identifies a waste shipment as "non-conformance" if it is different in chemical or physical properties from the information on the waste profile, pre-acceptance information, or manifest. In addition, it is classified as a significant discrepancy if it were "significantly" different in quantity, or type shown on the manifest. Non-conforming waste may be rejected or re-evaluated for possible acceptance. If a significant discrepancy is found and cannot be resolved within 15 days, arrangements would be made to return the waste to the generator, or another facility authorized by the generator (PFNW 2018a).

2.7 Current Waste Treatment at the MWF

The MWF processed 267 metric tons of waste per year on average from 2014 to 2018 as shown in Table 8. For perspective, the LLF processed 1,352 metric tons of waste on average during the same period of time. The types of the waste processed in the MWF includes MLLW, TRUM, occasional non-mixed LLW or TRU, and secondary waste generated in both the MWF and LLF. The types of waste processed in the LLF includes LLW, TRU, and secondary non-mixed waste generated in the LLF.

Table 8: Annual Quantities of Waste Processed in the PFNW Site (2014-2018)

Year	The MWF[a] (metric tons)	The LLF[b] (metric tons)	PFNW Site[c] (metric tons)
2018	289	1,644	1,932
2017	175	797	972
2016	392	1,138	1,530
2015	334	1,443	1,778
2014	147	1,737	1,884
Average (2014 – 2018)	267	1,352	1,619

[a] Waste processed in the MWF may include MLLW, TRUM, occasional non-mixed waste (LLW/TRU), and secondary mixed waste generated in the PFNW site.
[b] Waste processed in the LLF may include LLW, TRU, and secondary non-mixed waste generated in the PFNW site.
[c] The waste quantities in the PFNW site are the waste quantities in both the MWF and LLF combined.
Source: (R. Huckfeldt, personal communication, March 2, 2020)

There are currently two permitted areas for treatment in the MWF: MWNT area operation and MWT area operation. Only the MWNT area has been fully operational since the issuance of the original DWR Permit, as further discussed in sections 2.7.1 and 2.7.2.

2.7.1 MWNT Area Operation

Current non-thermal treatment processes occurring in the MWNT area include stabilization, solidification, neutralization, size reduction, compaction, shredding, deactivation, chemical oxidation, chemical reduction, physical extraction (decontamination), and macroencapsulation (R. Huckfeldt, personal communication, August 5, 2020). In support of these processes, additional activities occur within the MWF including waste inspections, sampling, treatability studies, generator activities, transfer and packaging of waste, sorting, and container handling, transport and storage (PFNW 2018a).

The MWNT area currently operates the four non-thermal treatment lines: solids stabilization, liquids stabilization, lead and other metals stabilization, heterogeneous debris stabilization. Each treatment line is designed to pre-treat and treat the waste to meet RCRA LDR requirements in accordance with the Current DWR Permit, Attachment PP, Process Engineering Description for Stabilization Building, rev. 7 (Ecology and USEPA 2020). These treatment lines are employing the following six treatment systems currently in operation:

- Solids stabilization line
    - Size reduction and screening
    - Low-capacity mixing system
- Liquids stabilization line
    - In-container mixing system
- Physical extraction line (also called as "lead and other metals stabilization line" in the 1998 Final EIS)
    - Cutting/shearing
- Macro-encapsulation line (also called as "heterogeneous debris stabilization line" in the 1998 Final EIS)
    - Aerosol can puncturing device
    - Compaction and Macroencapsulation

2.7.1.1 Treatment Systems

The following eight types of treatment systems/units are currently installed and permitted for operation to support the four treatment lines under the current DWR Permit, Attachment BB, Part A Form, rev. 4 (Ecology and USEPA 2020):

- Size Reduction and Screening System

  The Size Reduction and Screening system consists of an integrated screen and shredder assembly that includes a bin dumper, enclosed metering conveyor and hopper. This unit is approximately 40 ft x 17 ft x 25 ft tall and constructed of carbon steel. It is used to reduce the size of solid waste for easier handling, packaging, and treatment. For example, the stabilization process by the Low-Capacity Mixer requires that the particle size of the waste matrix be less than 3/8 inch (9 mm), which can be accomplished by this system. Any process can use size reduction if the waste to be treated is too large to fit into the treatment unit. The shredder is used to ensure that waste can properly be treated within the required treatment unit.

Following size reduction by the shredder, waste particles meeting the required size (3/8 inch (9 mm)) pass the screen and are conveyed through the discharge chute into an attached container placed in the filling station under the shredder. Material that is too large to pass through the screen is picked up again by the shredder teeth and re-sized until it is small enough to pass through the screen. The Size Reduction and Screening system does not process any ignitable, reactive, or incompatible waste to prevent a fire.

It has a treatment capacity of 5 short ton per hour or 120 short tons per day (4.54 metric ton per hour or 109 metric tons per day). This system is operational but hasn't been used since PFNW took over the business in 2007 (Ecology 2019).

- Cutting and Shearing

  The Cutting and Shearing treatment system consists of work benches, tables, an electric saw, a shear cutter, a high-pressure water cutter, and hand tools, such as hydraulic, pneumatic, or electrically-operated grinders, drills, hammers, chisels, and cutting torches. This system reduces large-sized waste (debris) to a size suitable for further processing in other pretreatment and treatment systems. Additionally, Cutting and Shearing is used to perform physical extraction (decontamination) by scarification, grinding, planning or spalling, per 40 CFR Part 268.45 Table 1, by the use of grinders or other tools to provide decontamination of waste debris. This treatment system involves workers using tools such as electric saws, shear cutters, and hand tools such as pneumatic, air, and electrically-operated grinders, drills, hammers, chisels, and cutting torches to cut and shear waste (debris). Examples of the types of waste that may require cutting and shearing include metal, wood, plastic, and construction debris such as discarded tanks, piping, glove boxes, and paneling. Stabilized waste that does not pass the required LDR treatment standard would also be brought to this system before re-processing. Any ignitable, reactive, or incompatible waste would be rejected to prevent a fire.

  This system is made of portable units, except for a power saw which is a stationary unit.

  It has a treatment capacity of 5 short ton per hour or 120 short tons per day (4.54 metric ton per hour or 109 metric tons per day). This system is operational, but not currently used (Ecology 2019).

- Compaction and Macroencapsulation

  The Compaction and Macroencapsulation treatment system is comprised of In-drum Compactor and Super Compactor to provide volume reduction and macroencapsulation treatment for waste (debris). Macroencapsulation of hazardous or mixed waste debris in a sealed jacket of inert material meets the USEPA Alternative Debris Treatment Standard and thereby qualifies the waste debris for disposal in a mixed waste, Subtitle C, landfill. The

Compaction and Macroencapsulation treatment system does not process any ignitable, reactive, or incompatible waste to prevent a fire.

- In-drum Compactor has a 50,000 lbs compaction force and is used for in-container compaction of debris. This unit has a treatment capacity of 1 short ton per hour or 24 short tons per day (0.907 metric ton per hour or 21.8 metric tons per day).
- Super Compactor provides a compaction force of approximately 350,000 lbs and is used for squeezing each drum until the drum contents approach their absolute density (i.e. the density of the material being compacted with no free space between particles). Average volume reduction capability of the combined in-drum compaction and super-compaction unit is expected to be approximately 6-7 times less than the original volume. This unit has a treatment capacity of 4 short ton per hour or 96 short tons per day (3.6 metric ton per hour or 87.1 metric tons per day).
- Next, the compacted drums (referred to as pucks) are taken out of the Super Compactor and placed in the staging area next to the Super Compactor. When a sufficient number of pucks are accumulated in the staging area, they are placed in a macroencapsulation jacket. There are three types of jackets used for macroencapsulation: a welded polyethylene pipe, a welded stainless-steel drum or tube, and a welded stainless steel box. After pucks are placed in a jacket, the jacket is filled with sand or grout to minimize void space in the container, then a lid is placed on top and welded on. The sealed jacket is inspected, cleaned if required, labeled, weighed, and staged for a shipment either back to the generators or offsite for disposal.

- Low-Capacity Mixing System

  Low-Capacity Mixing System consists of a mixer, a reagent feeder, a reagent container lift, a solid waste feeder, a waste container lift, and disposal containers. This treatment system is performed by mixing waste (solid) with reagents, such as Portland Cement, lime/pozzolans, iron salts, silicates, and clay, for stabilization. Stabilization process is used to transform the waste (solid) to a cement-like solid form with less solubility/mobility, or toxicity, which then qualifies the waste for disposal as a mixed waste (i.e. meeting RCRA LDR standard). This approximately 20 ft x 10 ft x 20 ft tall stationary unit is constructed of a carbon steel. It has a treatment capacity of 2.0 short ton per hour or 48 short tons per day (1.8 metric ton per hour or 43.5 metric tons per day).

- In-Container Mixing System

  In-Container Mixer is a mixing unit with a paddle that submerses in a 55-gallon drum, consisting of a mixer, a reagent additive feeder, container pump, and a drum-ventilation lid wherein empty disposal containers are positioned to receive waste (solid, liquid, and slurry) and reagents.

  This system is operated by adding reagent to waste in a 55-gallon drum to neutralize and stabilize waste into a cement-like solid form to meet RCRA LDR standard. The 55-gallon drums serve as both the mixing vessel and the final disposal containers for the waste being treated in this process. The original In-Container Mixer unit was removed due to irreparable damage that occurred in 2013. A new unit was installed in May 2019 during the process of permit modification to replace the previous unit (PFNW 2019c). In April 2020, Ecology and USEPA jointly approved PFNW to operate the new unit as a Class 2 Permit Modification (Ecology and USEPA 2020). The new unit has the following features:

- Increased motor power (from ½ horsepower to 25 horsepower)
- A treatment capacity of 0.54 short ton per hour or 12.85 short tons per day (0.49 metric ton per hour or 11.7 metric tons per day)
- Directional control of the mixing shaft (instead of simple up and down movement)
- Drum-ventilation lid that replaced the prior ventilation confinement enclosure.
- Newly developed operator criteria to determine when mixing is complete to allow for more consistently effective treatment.
- Newly designed reagent containers and storage and transfer apparatus.

In addition, if the waste in the receiving container meets the process limits for the In-Container Mixer the receiving container can also be used for mixing operations.

- Aerosol Can Puncturing Device

  Aerosol Can Puncturing Device consists of a cylinder where the non-punctured can is placed into, a spark-resistant tip that enters the aerosol can, and a lever that controls the tip. This commercially available device is a portable device used for size reduction by depressurizing/deactivating non-punctured aerosol cans to render them empty and stable. The propellants, compressed gases, and volatile organic compounds (VOCs) would be captured and treated with activated carbon filter cartridge mounted on the drum prior to being discharged as a fugitive emission. It has a treatment capacity of 0.015 short ton per hour or 0.36 short tons per day (0.014 metric ton per hour or 0.33 metric tons per day).

  This device was added through a Class 2 Permit Modification in 2013 with the initial need for an upcoming mixed waste stream primarily made up of aerosol can co-mingled with other mixed waste debris. Ecology approved PFNW to purchase and use the device in July 2013 (Ecology 2013a).

- Bench Scale Treatment System (Labhood)

  Bench Scale Treatment System is installed under a ventilated laboratory fume hood in the Laboratory room in the MWNT area. This system is a new unit added to the current DWR Permit Attachment BB Part A Form, rev. 4 in 2020 (Ecology and USEPA 2020). PFNW added this system to treat small volumes of waste (solid, liquid, or sludge) that are not operationally feasible for treatment in other processes within the MWF including neutralization, stabilization, deactivation, chemical reduction, chemical oxidation, or solidification. This system is also used to test new reagent recipes and to test how to treat new waste streams on a small scale before transitioning to full scale. This unit is approximately 8 ft x 2.6 ft x 8 ft lab hood which would be a stationary unit. It has a treatment capacity of 0.1 short ton per hour.

Table 9 presents each treatment unit in the MWNT area and the associated maximum design capacity for each unit under the current DWR Permit Attachment BB Part A Form, rev. 4 (Ecology and USEPA 2020). The total annual treatment capacity of the MWF based on the design capacity for the currently permitted and operated treatment units is 154,618 short tons (140,267 metric tons) with 6,033 cubic yards as storage capacity.

Table 9: Treatment Systems (Units) and Capacity under the Current DWR Permit

Treatment System (Unit)	Permitted Volume (T/hr)	Permitted Volume (T/day)[b]
Size Reduction and Screening	5 T/hr	120 T/day
Cutting/Shearing	5 T/hr	120 T/day
In-drum Compactor[c]	1 T/hr	24 T/day
Super Compactor	4 T/hr	96 T/hr
Low-Capacity Mixer	2 T/hr	48 T/day
In-Container Mixer	0.54 T/hr	12.85 T/day
Aerosol Can Puncturing Device	0.015 T/hr	0.36 T/day
Bench Scale Treatment	0.1 T/hr	2.4 T/day

T = short ton; 1T = 0.907 metric ton

T/hr = short ton per hour; T/day = short ton per day

[a] Source: Current DWR Permit, Attachment BB Part A Form, rev. 4 (Ecology and USEPA 2020)

[b] Permitted volume at full capacity (T/day) was calculated by multiplying the hourly permitted volume (T/hr) by 24 (hr) based on the scenario with 24 hours of operation in a day.

[c] In-drum Compactor identified in the Attachment BB Part A Form, rev. 4 is identified as in-drum compactor in Attachment PP, Process Engineering Description for Stabilization Building, rev. 7 (Ecology and USEPA 2020).

2.7.2 MWT Area Operation

The GASVIT™ Processing Unit for a combined gasification and vitrification process was the fifth treatment line described in the 1998 Final EIS and in the current DWR Permit Attachment PP, Process Engineering Description for Stabilization Building, rev. 7 (Ecology and USEPA 2020) was the only unit permitted for operation in the MWT area (previously described as GASVIT Building); however, as described in Section 2.1.2, this unit was only in operation between May 2000 and June 2001, and it was removed and certified closed in 2012 (Ecology 2013b). There are no thermal treatment processes in the MWT area permitted under the current DWR Permit, according to Attachment BB Part A Form, rev. 4 (Ecology and USEPA 2020).

PFNW has installed the GeoMelt® Process Unit for a new thermal process that is not currently permitted under the DWR, therefore PFNW cannot currently use this unit to treat waste. PFNW has been operating the GeoMelt® Process Unit under a treatability study, which does not require a DWR Permit per WAC 173-303-071(3)(s). The GeoMelt® Process Unit has run 18 treatability studies (i.e. 18 melts) from 2018-19. One treatability study was conducted to treat radioactive reactive metal with the GeoMelt® Process Unit from October 7, 2019 to October 10, 2019 (PFNW 2020). The radioactive reactive metal treated in this study was an experimental breeder reactor (EBR) subassembly from Idaho National Laboratory (INL), and the treated waste form (monolith) was shipped to Nevada National Security Site (NNSS) in Nevada for disposal on March 13, 2020. Another treatability study was conducted in 2021 to process a liner from the Radioactive Scrap and Waste Facility (RSWF) from INL.

In addition to the radioactive reactive metal, PFNW conducted 16 treatability studies (i.e. 16 melts) to treat a total of 934 RCRA empty drums between December 20, 2018 and October 14, 2019. RCRA empty drums are LLW, not mixed waste; therefore, Ecology was not involved in reviewing or approving the treatability studies of those drums.

The GeoMelt® Process Unit has not been included in the proposed PFNW DWR permit. If PFNW wishes to add the GeoMelt system into the MWF permit, then after the permit renewal goes into effect, PFNW will need to submit to Ecology a permit modification request prior to the initial processing of waste in the GeoMelt® system.

2.7.3 Permitted Activities in Waste Storage Area

Activities in the WSB area include waste unloading and loading, waste storage, and inspection activities. No waste treatment activities are permitted in the WSB area.

The current storage capacity of the combined container storage areas in the MWF including all three areas is 6,033 cubic yards according to the Current DWR permit, Attachment BB Part A Form, rev. 4 (Ecology and USEPA 2020).

2.7.4 Secondary Waste Treatment

The MWF generates secondary waste through its routine operations. Examples of secondary waste include personal protective equipment, spent sampling materials, obsolete/non-repairable work tools, incidental liquids generated during compaction or other waste treatments, high-efficiency particulate air (HEPA)/charcoal filters, and floor sweepings. For the purpose of waste minimization, secondary waste generated on site, wherever possible, is recycled, treated, and size reduced before being shipped offsite. This secondary waste would be disposed of off-site carrying the same dangerous waste codes as the waste that had been treated.

The LLF also generates secondary waste through its routine operation, such as thermal treatment residue and baghouse ash. PFNW takes a sample from the secondary waste generated in the LLF, temporally stores the waste in the 90-Day accumulation area until sample results are available for waste designation. If the waste is designated as mixed waste, it is then transferred to the MWF for permitted storage and treatment before shipped offsite for disposal or further treatment in other facilities. If the waste is not designated as mixed waste, it is then managed as LLW in the LLF. (Ecology 2019)

According to its annual dangerous waste reports (Ecology 2020d), PFNW generated 10.2 metric tons (11.2 short tons) of secondary waste in 2019 with 328.4 metric tons (362.0 short tons) on average from 2010 to 2019, as shown in Table 10.

Table 10: Secondary Waste Generated from the PFNW Site (2010-2019)

Year	Secondary Waste Generated (metric ton)
2019	10.2
2018	22.8
2017	13.5
2016	10.9
2015	101.7
2014	273.4
2013	102.9
2012	686.2
2011	1203.7
2010	859.2
Average (2010 - 2019)	328.4

PFNW = Perma-Fix Northwest, Inc.
Source: Annual Dangerous Waste Reports (Ecology 2020d)

2.8 Treated Waste Form

No waste (treated or untreated) is permitted to be disposed of on the PFNW site.

Treated waste forms are packaged, certified in accordance with LDR regulations, and shipped back to the generators, other facilities for further treatment, or disposed of at one of the following locations predetermined by generators:

- Energy Solutions, Clive, Utah
- Waste Control Specialists, Andrews, Texas
- US Ecology, Richland, Washington
- Diversified Scientific Services, Inc., Kingston, Tennessee
- Clean Harbors Aragonite LLC Facility, Grantsville, Utah
- NNSS, Las Vegas, Nevada
- USDOE's Hanford site, Richland, Washington

Size-reduced TRU and TRUM are repackaged and shipped back to the Hanford site for interim storage at the CWC, Hanford site before shipment for eventual disposal at WIPP. International waste is returned to the country of origin for disposal.

2.9 Transport of Waste to and from the MWF

PFNW transports waste to and from the MWF in accordance with USDOT and USNRC requirements. The type of containers used for transporting waste to and from the MWF depends on the type and volume of the waste, such as drums, boxes, ISO containers, bags, tankers, totes that meet the criteria of 49 CFR Part 178 (B. Wiegman, personal communication, Jan 3, 2020). In some cases, the generator arranges for transportation and in other cases PFNW arranges for transportation. In both cases it's a transportation company that owns & operates the vehicles, not PFNW.

Currently only trucks have been used to transport all waste types to and from the PFNW site, including LLW, MLLW, TRUM, and TRU. PFNW is considering railcar and barge as additional future means to possibly transport waste to and from the PFNW site.

2.9.1 Truck

According to its annual dangerous waste reports (Ecology 2020d), PFNW received 99 trucks delivering the total of 139.2 metric tons (153.4 short tons) of waste to the MWF in 2019. On average, the MWF annually received 101 trucks delivering 182.9 metric tons (201.6 short tons) of waste from 2010 to 2019, as shown in Table 11.

Table 11 shows that the majority of waste processed in the current MWF operation comes from the Hanford site. In 2019, the MWF received 92 trucks delivering the total of 135.4 metric tons (149.3 short tons) of waste originated from the Hanford site. On average, the MWF annually received 90 trucks delivering 157.2 metric tons (173.3 short tons) of waste originated from the Hanford site from 2010 to 2019.

Table 11 presents the annual quantities of waste delivered to the MWF by trucks from 2010 to 2019.

Table 11: Waste Deliveries to the MWF by Trucks (2010-2019)

Calendar Year	Total Waste Waste Quantity (metric tons)	Total Waste Shipment Number[a]	Waste from Hanford[b] Waste Quantity (metric tons)	Waste Shipment Number[a] from Hanford[b]
2019	139.2	99	135.4	92
2018	136.5	106	129.8	96
2017	93.6	62	90.2	58
2016	131.2	59	124.6	55
2015	151.8	72	150.7	69
2014	97.3	75	88.0	67
2013	86.8	73	64.3	56
2012	162.2	110	131.9	98
2011	511.1	220	423.7	185
2010	319.5	135	233.4	121
Average (2010 – 2019)	182.9	101	157.2	90

MWF = mixed waste facility
[a] Shipment number is the number of trucks delivering waste to the MWF.
[b] Shipment number from Hanford is the number of trucks delivering waste from the Hanford site to the MWF.
Source: Annual Dangerous Waste Reports (Ecology 2020d)

Incoming waste by truck utilizes the public road system. There are five ports of entry into Washington State, including Bow Hill, Cle Elum, Plymouth, Ridgefield, and Spokane. The majority of shipments to the PFNW site use the Plymouth or Spokane Ports of Entry. From Plymouth Port of Entry, incoming waste trucks travel north on Interstate 82/U.S Route 395 toward Richland. From Spokane Port of Entry, incoming waste trucks travel southwest on Interstate 90/U.S. Route 395 toward Richland.

The most frequently used main route to the PFNW site is State Route 240 and Battelle Boulevard (B. Wiegman, personal communication, December 21, 2018). Waste coming from the Hanford site normally goes through the Wye Barricade, along Stevens Drive to Battelle Boulevard. If determined that a detour is necessary, waste from Hanford site could go through the Wye Barricade, along State Route 240 to Battelle Boulevard. Incoming waste trucks enter the PFNW site by traveling south on Logston Boulevard approximately 140 yards from Battelle Boulevard, then by turning left (east) onto the facility's gravel access road to the gate along the security fence to enter the PFNW site.

Outgoing waste trucks follow the same route in the vicinity as incoming waste trucks, but in reverse.

The waste transportation routes by trucks between the MWF and the Plymouth and Spokane Ports of Entry are shown on Figure 6.

Figure 6: The Truck Routes between the MWF and the Plymouth and Spokane Ports of Entry

(Source: WSDOT 2020)

2.9.1.1 Rolling Road Closure

TRUM and TRU is transported separately to and from the Hanford site and PNNL using a segmented “rolling road closure” along Battelle Blvd. A rolling road closure is a convoy with lead and following escort vehicles that restrict traffic going in the same direction as the truck carrying waste. Traffic in the opposite direction is not shut down (B. Wiegman, personal communication, November 22, 2019).

A segmented rolling road closure for the TRUM and TRU transportation was agreed to by USDOE and Washington State Patrol, in accordance with a Memorandum between Western Governors and USDOE, “Regional Protocol for the Safe and Uneventful Transportation of TRU waste” (Western Governors and USDOE 2019).

In addition to a segmented rolling road closure, USDOE provides a driver that is a federal employee as per 49 CFR 171.1(d)(5) for TRU and TRUM shipments to and from both Hanford site and PFNW. By providing a federal driver, the TRUM and TRU waste transportation is considered as solely for noncommercial use and therefore is exempt from USDOT’s Hazardous Material Regulations per 49 CFR Part 171.1(d)(5) (PFNW 2018b). TRU and TRUM waste that is exempt under 49 CFR Part 171.1(d)(5) is transported in Industrial Package (IP)-2 at minimum for untreated TRU and TRUM instead of the USDOT compliant Type B-package).

For more details on MLLW and LLW, see Section 2.3.2, “Low Level Radioactive Waste (not mixed”, and section 2.3.2, “Mixed Low Level Radioactive Waste”. The MWF occasionally receives non-USDOT compliant containers of MLLW and LLW from the Hanford site. Transportation of these non-USDOT compliant shipments is completed using rolling road closure (B. Wiegman, personal communication, November 22, 2019). Rolling road closures for shipments between Hanford site and the MWF are shown on Figure 7.

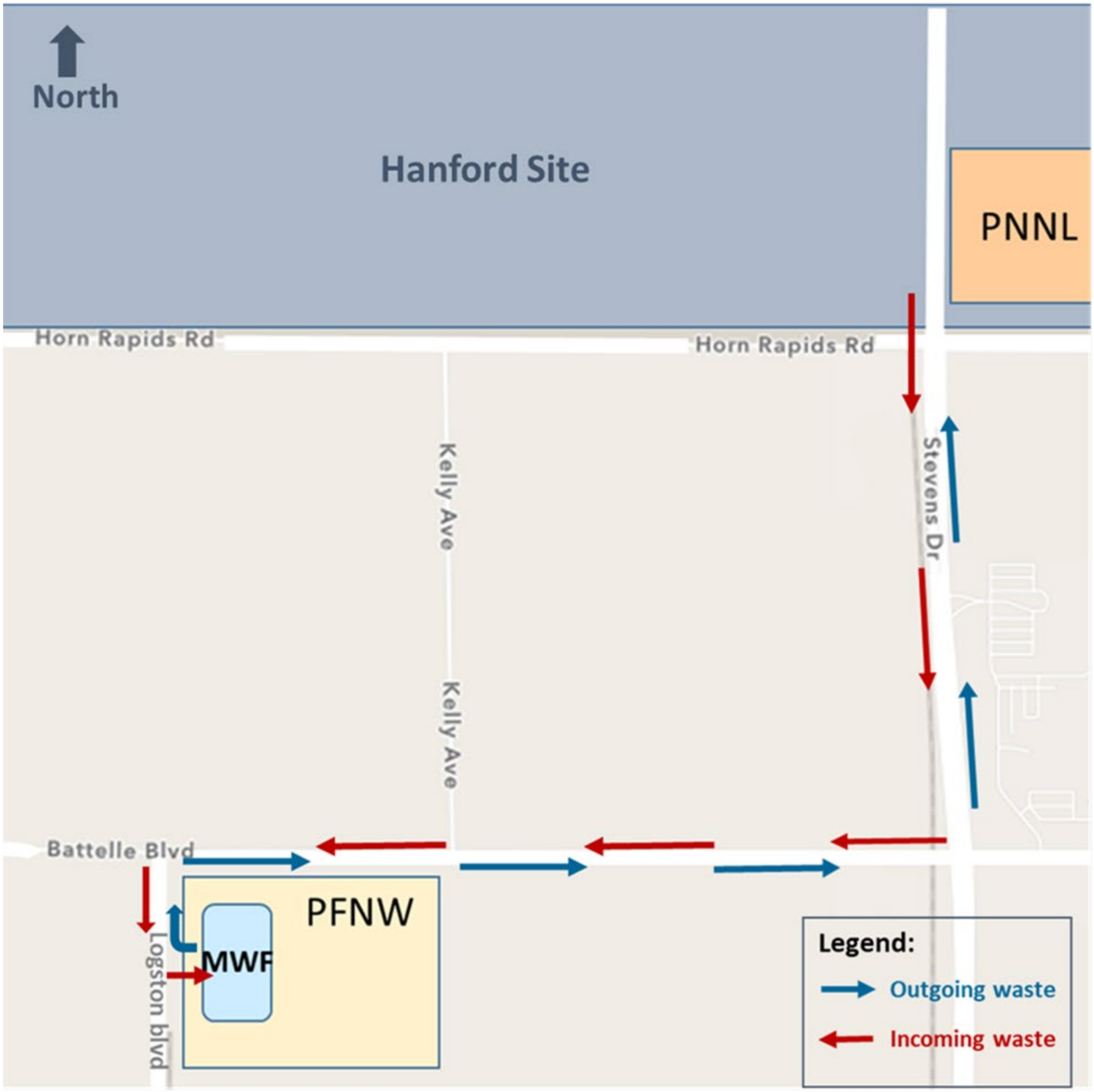

Figure7 Road Closure for Hanford Transport (Source: WSDOT 2020)

2.9.2 Railcar

PFNW seeks to utilize existing facilities to accommodate rail transportation through the City spur. In February 2011, Ecology and USEPA jointly approved Class 2 Permit Modification for the addition of a rail spur and two concrete containment pads (i.e. RLA and TLA) to allow for the loading and unloading of containerized mixed waste in the MWF yard area. Railcars have not been used to transport any waste to or from the PFNW site, nor for onsite only movement between units. However, PFNW expects to use railcars to transport waste in the future (B. Wiegman, personal communication, November 22, 2019).

Waste types for potential future railcar transportation are likely LLW and MLLW only as PFNW proposed that truck with road closure would be the only mode of transportation for TRU and TRUM (B. Wiegman, personal communication, November 22, 2019). Currently, there are neither USNRC certified packaging that are available for TRU and TRUM to transport by railcars nor an existing rail system established for TRU and TRUM. Furthermore, currently there is no active rail transportation for waste to and from the Hanford site where a majority of TRU and TRUM processed in the PFNW site originates from. Therefore, Ecology expects only LLW and MLLW as potential waste types for a rail transportation.

Based on the current volume of PFNW's both MWF and LLF operations, if railcars were to be used for waste transportation in conjunction with trucks, PFNW anticipates that approximately ten trucks per day and one railcar per day could deliver all types of waste to the PFNW site (PFNW 2018a).

Containerized and bulk waste transported on railcars would travel to and from the MWF via the established interstate rail system. Considering that the majority of current truck shipments from out of state to PFNW use Plymouth or Spokane port of entry, incoming waste by railcar would likely enter Washington State through either Hinkle, Oregon (through Wallula junction) or Spokane (B. Wiegman, personal communication, December 21, 2018). The routes for the railcar transportation to the PFNW site are owned by Port of Benton and either Union Pacific Railroad or Burlington Northern Santa Fe, LLC. Outgoing waste via rail follows the same path as incoming waste in reverse.

Railroad transportation routes in Washington State and Tri-Cities are shown on Figure 8 and Figure 9, respectively. The possible waste transportation routes by rail between the MWF and the state boundaries with Oregon and Idaho are shown on Figure 10.

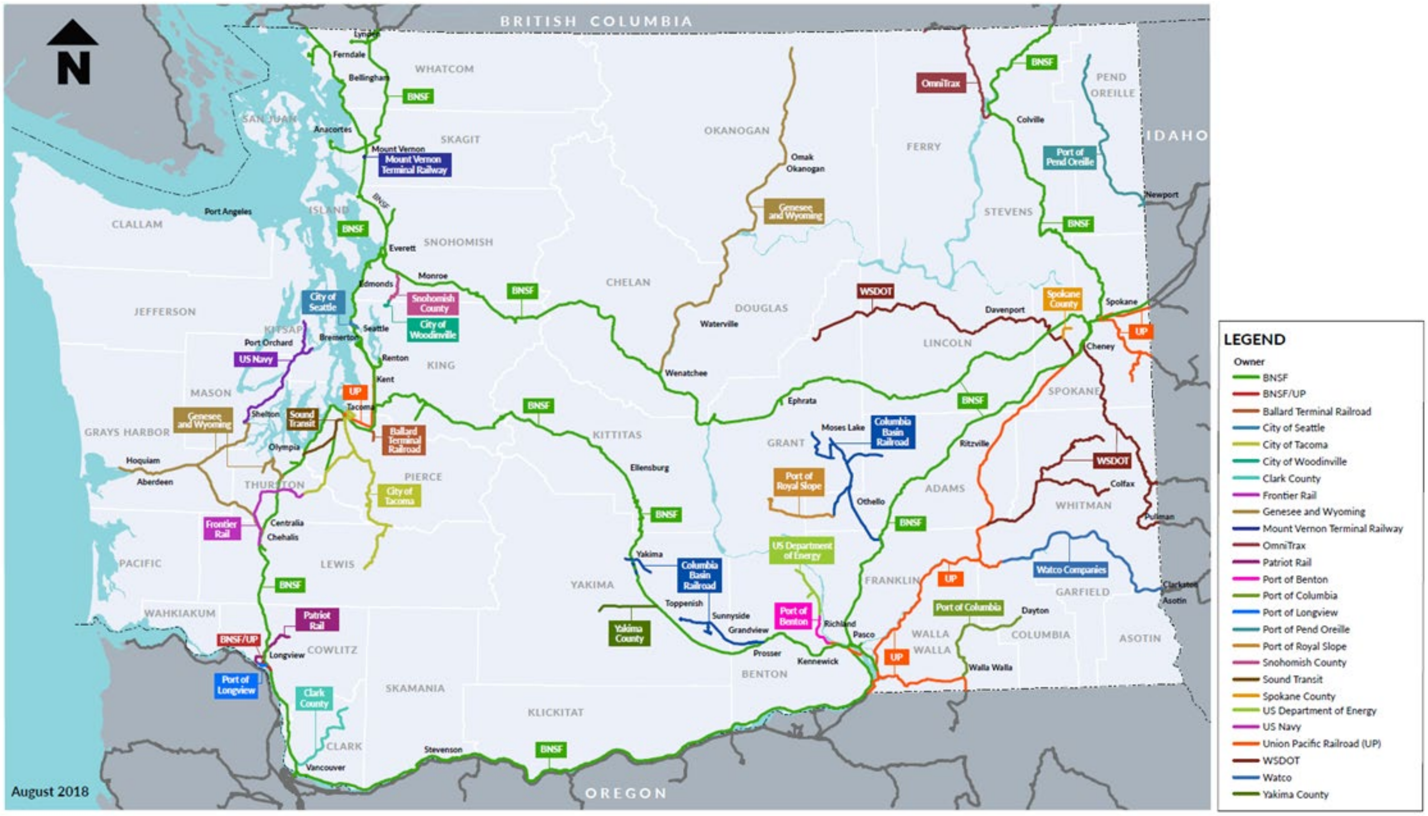

Figure 8: Railroad Transportation Routes in Washington State
(Source: WSDOT 2018)

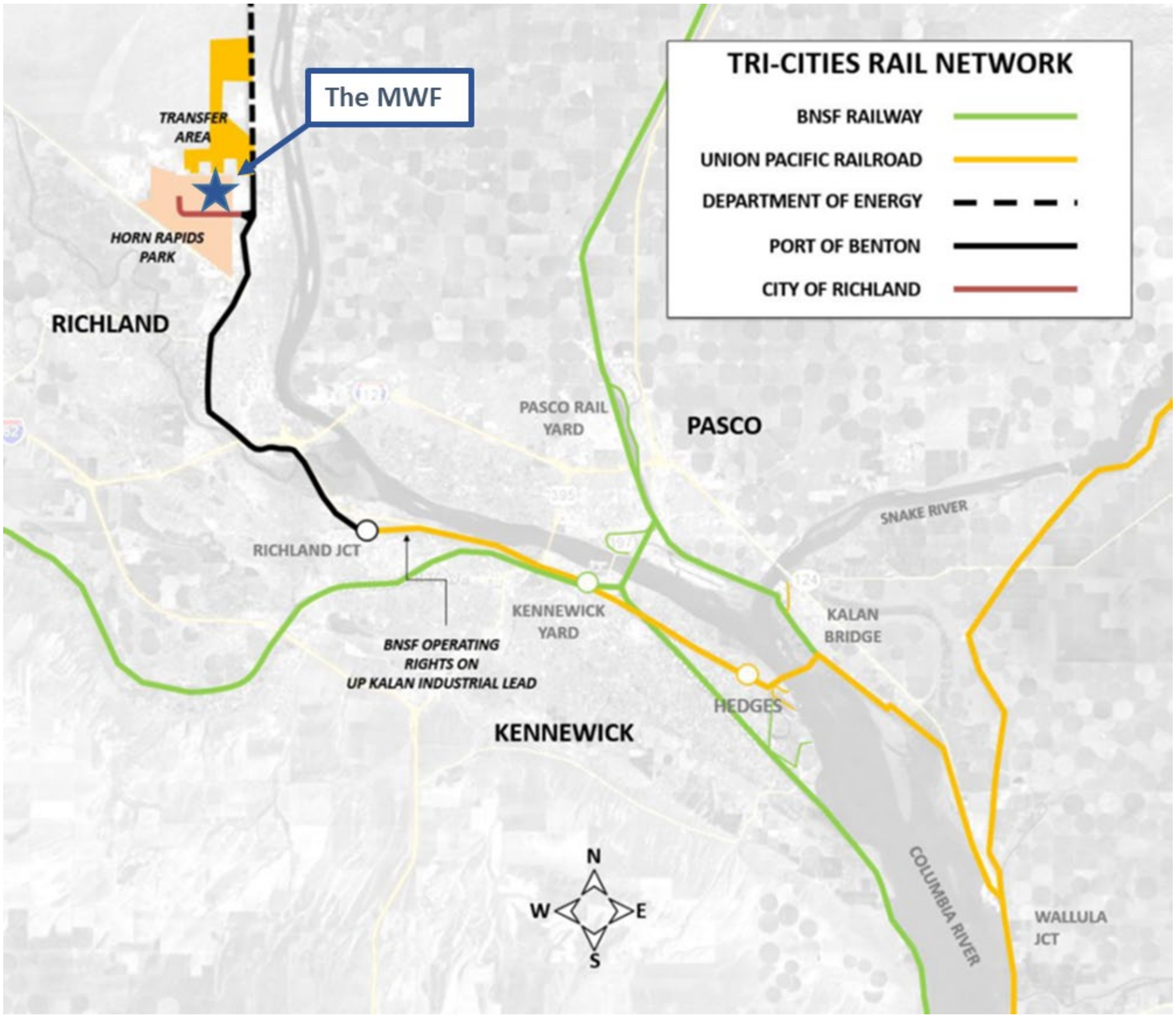

Figure 9: Railroad Transportation Routes in Tri-Cities
(Source: Port of Benton and City of Richland 2017)

Figure 10: The Rail Routes between the MWF and the State Boundaries (Source: WSDOT 2020)

2.9.3 Barge

Currently barge transportation is not used to transport waste to or from the PFNW site. However, PFNW has expressed interest in this capability for LLW in the future. PFNW told Ecology that "only LLW would be brought to the facility via ship (including barge) and that no MLLW would utilize ship or barge for transportation" (PFNW 2019b). Ecology does not expect PFNW to transport TRU and TRUM by barge due to the stringent shipping requirements for TRU and TRUM (e.g. segmented rolling road closure as discussed in section 2.9.1.1).

Any future barge transportation would utilize the Columbia-Snake River System between the Pacific Ocean and Port of Benton through Vancouver, Washington (PNWA 2019). Port of Benton is located along the Columbia River at river mile 343, approximately 1.6 miles east of the PFNW site (Port of Benton 2019). PFNW told Ecology that if a barge is used, it would then need to be transferred to a truck or train for direct delivery to the PFNW facility (PFNW 2018a). It is more likely that waste would be transported between the PFNW site and Port of Benton by truck through Battelle Boulevard. The Columbia-Snake River System as a potential barge transportation route is described in Figure 11.

Figure 11: Columbia-Snake River System as a Potential Barge Transportation (Source: WSDOT 2020)

2.10 Changes in the MWF Operation since the 1998 Final EIS

There have been changes and updates in the MWF operation since the 1998 Final EIS was prepared. This section discusses the changes in the MWF since the 1998 Final EIS.

2.10.1 Changes in Facility Design

The following are the main changes to the facility design of the MWF:

- The 1998 Final EIS anticipated that the MWF would be constructed as four separate buildings; however, the MWF was actually constructed as a single building that is divided into four areas.
  - The Stabilization Building described in the 1998 Final EIS is now the MWNT area.
  - The GASVIT Building described in the 1998 Final EIS is now the MWT area.
  - The Waste Storage Building described in the 1998 Final EIS is now the WSB area.
  - The Administrative Building described in the 1998 Final EIS is now part of the MWNT area.
- The total area of the MWF has expanded from 54,000 ft^2 as described in 1998 Final EIS to 68,000 ft^2 currently.

- An annex constructed in 2000 increased the original size of the MWNT area by 6,820 square feet.
- The WSB-4, originally designed as a covered storage pad, was constructed instead as an enclosed structure, which increased the original size of the WSB area by 7,070 ft^2.

- A rail connection to the City spur was completed through Class 2 Permit Modification in 2011 to accommodate rail transportation.

2.10.2 Changes in Waste being processed

TRUM is a new waste type that was not described in the 1998 Final EIS or the current DWR Permit. TRU is a new waste type being processed normally at the LLF, but occasionally in the MWF under WSDOH license. Both TRUM and TRU are discussed in the section 2.3.

The number of trucks delivering waste to the MWF has been less than the estimated number evaluated under the 1998 Final EIS. While annually 475 truck deliveries of waste were estimated as the peak operating capacity in the 1998 Final EIS, fewer truck deliveries have been made to the MWF under the current operation. According to its annual dangerous waste reports
(Ecology 2020d), PFNW received 99 truck deliveries of waste to the MWF in 2019 with 101 deliveries on average from 2010 to 2019, as shown in Table 11 in section 2.9.1.

Waste quantity delivered to the MWF has also been smaller than estimated quantity under the 1998 Final EIS. While annually 9,500 metric tons (10,500 short tons) of waste were estimated as the peak operating capacity in the 1998 Final EIS, a much smaller quantity of waste has been delivered to the MWF under the current operation. According to its annual dangerous waste reports (Ecology 2020d), PFNW received 139.2 metric tons (153.4 short tons) of waste to the MWF in 2019 with 182.9 metric tons (201.6 short tons) of waste on average from 2010 to 2019, as shown in Table 11 in section 2.9.1.

Proportion of waste originated from the Hanford site compared with waste from other generators has been larger under the current MWF operation than estimated in the 1998 Final EIS. The Final EIS estimated that of the 475 annual trips based on the peak operating capacity, 24 trips would come from Seattle area, 226 trips would come from the Spokane area, and 225 trips would come from the Vancouver area. According to its annual dangerous waste reports (Ecology 2020d), the MWF received 92.9 percent (i.e. 92 out of 99 shipments) of waste shipments originated from the Hanford site in 2019 with 88.7 percent (i.e. 90 out of 101 shipments) of waste shipments on average from 2010 to 2019.

2.10.3 Changes in Waste Treatment

There has been an increase in the MWF treatment capacity since the 1998 Final EIS. The 1998 Final EIS estimated the annual maximum treatment capacity of the MWF to be 9,500 metric tons (10,500 short tons) for the GASVIT™ and stabilization process combined (City of Richland 1998). While PFNW estimates to accept up to 10,225 metric tons (11,271 short tons) of waste at the MWF annually under the current DWR Permit, Attachment BB Part A Form, rev. 4 (Ecology and USEPA 2020), the MWF has a total treatment capacity of 140,267 metric tons

(140,267 short tons) based on the design capacity for the currently permitted and operated treatment units. The maximum treatment capacity of the MWF has increased by approximately 15 times since the 1998 Final EIS estimated.

2.10.3.1 Change in Treatment Processes

The 1998 Final EIS described that the MWF would utilize three principal treatment processes: stabilization, macroencapsulation, and GASVIT™ process. Other treatment processes were employed as pre-treatments prior to stabilization and GASVIT™ process. Pre-treatment processes for solid waste included drying, size reduction and screening, cutting and shearing, and sorting. Pre-treatment processes for liquid waste included liquid consolidation, liquid treatment (e.g. neutralization), filtration, and ultra-violet oxidation. The waste pre-treatment and treatment processes were split into five primary lines that included solids stabilization, liquids stabilization, lead and other metals stabilization, heterogeneous debris stabilization, and organics GASVIT™ treatment (City of Richland 1998).

The GASVIT™ Processing Unit was removed and certified closed in 2012 (Ecology 2013b). The MWF currently operates the four non-thermal treatment lines (solids stabilization, liquids stabilization, lead and other metals stabilization, heterogeneous debris stabilization) employing the six treatment systems which are listed below and described further in Section 2.7.1.

- Solids stabilization line
    - Size reduction and screening
    - Low-capacity mixing system
- Liquids stabilization line
    - In-container mixing system
- Lead and other metals stabilization line
    - Cutting/shearing
- Heterogeneous debris stabilization line
    - Aerosol can puncturing device
    - Compaction and Macroencapsulation

In addition to GASVIT™ Processing Unit, the current DWR Permit has many treatment units that PFNW does not operate currently (PFNW 2013)(PFNW 2018a), including:

- Bulk Reagent Storage System
    - never installed.
- Container Rinse System
    - never installed.
- Debris Washing
    - never installed.
- Dryer System
    - never installed.

- Extraction Mixing System
    - constructed, but never installed.
- High-Capacity Mixer
    - never installed.
- Liquid Consolidation System
    - never installed.
- Liquid Holding System
    - never installed.
- Liquid Treatment System
    - never installed.
- Mercury Amalgamation (a part of Cutting and Shearing as described in section 2.7.1.1)
    - never installed.
- Physical Extraction System
    - never installed.
- Polymer Mixing System
    - never installed.
- Sorting System
    - Installed, but never used and removed (PFNW 2008).

2.10.3.2 Change in Ventilation System

The 1998 Final EIS evaluated air emissions assuming that the stabilization and GASVIT buildings would use a common stack for discharging air from the MWF's Heating, Ventilation, and Air Conditioning (HVAC) system to the atmosphere. Instead of using a common exhaust point, PFNW's predecessor installed two exhaust stacks in the MWF. The MWT area and the MWNT area each have their own HVAC system and discharge to separate stacks: the MWT area stack and the MWNT area stack (PFNW 2018a).

2.10.3.3 Change in Mitigation Measures

The 1998 Final EIS described mitigation measures to mitigate potential human health and environmental impacts from both construction and operation of the MWF, as follows;

- The MWF would be designed, constructed, and operated in compliance with the comprehensive set of commercial requirements that have been established to protect public and worker health and the environment. These requirements encompass a wide variety of topics, including radiation protection, design criteria for nuclear facilities, fire protection, emergency preparedness and response, seismic events, and operations safety requirements.
- Measures would be taken to protect construction and operations personnel from occupational hazards. These measures include the following:

    - Emphasis on safety awareness
    - Radiation and hazardous waste training
    - Use of appropriate personal protective equipment (e.g., gloves, eye protection, and respirators)
    - Personal and environmental radiation monitoring and the application of administrative limits to restrict exposures to within regulatory limits and as low as reasonably achievable levels
    - Administrative controls for potentially hazardous areas
    - Monitoring exposure to occupational noise and the use of Occupational Safety and Health Act (OSHA) -approved hearing protection during construction and operation
    - Good housekeeping of work areas
    - Preparing and implementing safety plans for all field work activities.
- Pollution control or treatment equipment would be used to minimize releases of contaminants to the environment and to meet regulatory standards. Air emissions would be treated through the use of an acid-gas scrubber, a syngas converter, HEPA filters, and activated carbon filters to reduce levels of air emissions below regulatory standards.
- Environmental monitoring systems would be implemented to continually monitor potential releases to the environment.
- All waste handling activities would take place within areas having secondary containment, which would prevent releases to the environment.
- All shipments of radioactive or hazardous materials on public roads would be performed in compliance with all regulatory requirements including requirements (Code of Federal Regulations, Title 49) for the following:
    - Maintaining manifests
    - Using appropriate shipping containers
    - Using trained and licensed transporters
    - Using appropriate signs on vehicles
    - Providing appropriate notices to potentially involved organizations.
- Energy recovery (thermal) from heat in the offgas system would be used to the extent practicable to reduce facility electrical usage (City of Richland 1998).

Most of the mitigation measures described in the above list from the 1998 Final EIS are local, state, and federal requirements applicable to the construction and operation of the MWF. The only exception is the last item in the list to use energy recovery from heat in the offgas system, which is related to GASVIT™ Processing Unit. Since GASVIT™ Processing Unit was only in operation between May 2000 and June 2001 as described in Section 2.1.2, this measure has not been implemented. No other changes in mitigation measures from those evaluated in the EIS.

2.10.3.4 Change in Facility Safety Features

Apart from the proposed mitigation measures, the 1998 Final EIS described facility safety features to ensure safe shutdown of the process systems in the event of a process upset or key component failure, specifically in the GASVIT™ Processing Unit. GASVIT™ Processing Unit was only in operation between May 2000 and June 2001, and it was removed and certified closed in 2012, as described in Section 2.1.2.

Additionally, fire sprinkler system was described along with the coated concrete floor with curbing as a secondary containment system in the 1998 Final EIS. However, a fire sprinkler system was not installed in the MWF due to the characteristic of the waste processed at the MWF and the concerns with spreading radiological contamination.

Current safety features employed at the MWF include (PFNW 2018a):

- Secondary containment system in the MWF and the loading and unloading areas (TLA and RLA) to allow for any spills or leaks to be contained and cleaned up as soon as possible.
- Security system including the controlled access area with the 24-hour security at the gate and the warning signs posted on the facility boundaries.
- Emergency equipment including first aid equipment, eye wash and safety showers, water for fire control, fire extinguishers, emergency back-up diesel generators.
- Proper aisle space maintained to allow for unobstructed movement of emergency equipment and personnel, as required in WAC 173-303-340(3) and WAC 173-303-630(5).
- Radiological work permits for all work taking place within the MWF to meet requirements for the appropriate personnel protective equipment.
- Trainings to ensure that MWF is operated and maintained in a safe manner and in compliance with regulations.
- Inspections performed to verify integrity of secondary containment systems, check for evidence of spills and leaks, ensure no deterioration of containers, ensure appropriate aisle spacing, and check first aid and other emergency and security devices, as required in WAC 173-303-630(6).

2.11 Changes in the Vicinity of the MWF and City of Richland

In order to mitigate transportation impacts, PFNW's predecessor was working with the City of Richland to extend Battelle Boulevard from the PFNW site west to Kingsgate Way, which is connected to State Route 240 (City of Richland 1998). The City of Richland has completed the extension of Battelle Boulevard to Kingsgate Way.

The City of Richland has grown significantly since the 1998 Final EIS was completed and the original DWR Permit was issued to PFNW's predecessor in 1999. The City of Richland Comprehensive Plan considered the increased growth in the area (City of Richland 2017a). The population in the city limit has grown by 48% from 38,708 in 2000 to 57,303 as estimated in 2019. With the average an annual growth rate of 2.4% over the last 20 years, it is anticipated that the population would grow to 78,431 residents in 2037 (City of Richland 2017b)(USCB 2019).

Currently, the nearest neighbors to the MWF are Central Washington Corn Processors, approximately 400 m (0.25 mile) to the south; Framatome, approximately 400 m (0.25 mile) to the northwest; Bechtel's laydown yard, approximately 350 m (0.22 mile) to the east; and Ferguson Distribution Center, approximately 500 m (0.31 mile) to the west. The nearest residential dwellings are currently 1.7 km (1.1 miles) to the southeast, compared with 2.7 km (1.7 miles) to the southeast as described in the 1998 Final EIS. The nearest childcare facility, located 1.3 km (0.8 mile) to the east, is the same facility described in the 1998 Final EIS. Residential development since 1998 within 2-mile radius from the MWF includes

- Apartments adjacent to the south end of the Battelle campus
- Apartments adjacent to Washington State University (WSU) Tri-Cities
- Townhouses adjacent to the intersection of Battelle Blvd. and the Columbia River
- Horn Rapids neighborhood in the southwest
- Other houses and townhouses in the southeast

Chapter 3 - Alternatives

This chapter identifies three action alternatives and one no-action alternative for PFNW's DWR Permit Renewal along with the unique characteristics of each alternative. All action alternatives (Alternatives 1, 2, and 3) share a number of common elements, which are discussed in Chapter 2. This chapter focuses on elements of each alternative that would change or add to PFNW's current MWF operations.

3.1 Alternative 1

Under Alternative 1, with a DWR Permit Renewal, PFNW continues its current operations at the MWF as described in Chapter 2, Section 2.7.

3.1.1 New Waste Treatment Activities under Alternative 1

Under Alternative 1, PFNW continues to operate the existing and currently permitted units. No new waste treatment activities would take place under this alternative.

3.1.2 Alternative 1 Permitted Waste Types

Under Alternative 1, there is no change in the waste types to be treated from the current operations at the MWF. The following waste types are expected to be accepted at the MWF for storage and/or treatment as described in Chapter 2:

- MLLW
- TRUM

3.1.3 Waste Treatment Capacity under Alternative 1

Under Alternative 1, the MWF will continue to have a current storage capacity of 6,033-cubic yard in the container storage areas. The total annual treatment capacity of the MWF based on the design capacity for the currently permitted and operated treatment units is 154,618 short tons (140,267 metric tons). PFNW estimates to accept up to 11,271 short tons (10,225 metric tons) of waste at the MWF annually. This estimate is the same as for the current DWR Permit Attachment BB Part A Form, rev. 4 (Ecology and USEPA 2020), and it is well below the annual treatment capacity of 154,618 short tons (140,267 metric tons) . The treatment capacity that would be permitted under Alternative 1 are provided in Table 12 below. Table 12 presents each treatment unit and the associated maximum design capacity for each unit under Alternative 1.

Table 12: Treatment Units and Maximum Design Capacities under Alternative 1

Treatment Unit	Treatment Capacity (T/hr)	Treatment Capacity (T/day)[a]
Shredder System, formerly called as Size Reduction and Screening under the current DWR Permit[b]	5 T/hr	120 T/day
Cutting/Shearing	5 T/hr	120 T/day
In-drum Compactor, formerly called as In-Barrel Compactor under the current DWR Permit[b]	1 T/hr	24 T/day
Super Compactor	4 T/hr	96 T/day
Low-Capacity Mixer	2 T/hr	48 T/day
In-Container Mixer	0.535 T/hr	12.85 T/day
Aerosol Can Puncturing Device	0.015 T/hr	0.36 T/day
Bench Scale Treatment	0.1 T/hr	2.4 T/day

T = short ton; 1T = 0.907 metric ton
T/hr = short ton per hour; T/day = short ton per day
[a] Treatment capacity (T/day) was calculated by multiplying the hourly permitted volume (T/hr) by 24 (hr) based on the scenario with 24 hours of operation in a day.
[b] Source: Attachment BB Part A Form, rev. 4 (Ecology and USEPA 2020)

3.1.4 Types and Routes for Transport under Alternative 1

Under Alternative 1, there is no change in the types and routes for transport to and from PFNW as described in Chapter 2, Section 2.9. The ultimate destination for disposal of treated waste forms from the operations at the MWF under Alternative 1 similarly will not change.

3.2 Alternative 2

Under Alternative 2, with a DWR Permit Renewal, PFNW continues its current operations at the MWF with revisions as described in the draft renewal DWR Permit based on the DWR Permit Renewal Application (PFNW 2024).

3.2.1 New Waste Treatment Activities under Alternative 2

Under Alternative 2, waste treatment and pre-treatment processes would not be grouped into four non-thermal treatment lines (solids stabilization, liquids stabilization, lead and other metals stabilization, and heterogeneous debris stabilization). Instead, each permitted treatment unit would be capable of performing a particular form of treatment, and if necessary, waste can move to another unit for further treatment (PFNW 2018a).

3.2.1.1 Treatment Units

Under Alternative 2, PFNW will be permitted to operate the following treatment units in the MWNT area and update the currently permitted operations (as described in Chapter 2, Section 2.7) as follows:

- In-Container Mixer

  The existing and currently permitted In-Container Mixer would be operated. Treatment capacity of this system would be decreased from the current capacity of 12.85 short tons per day
  (11.7 metric tons per day) to 5 short tons per day (4.54 metric tons per day). The decreased capacity is based on the engineering calculation in Appendix DA-2, Treatment Capacity Calculation provided in the DWR Permit Renewal Application (PFNW 2024).

  The existing unit was approved to operate through a Class 2 Permit Modification in April 2020, to replace the previous unit which was damaged beyond repair in 2013 as described in Chapter 2, Section 2.7. This unit would be operated to perform neutralization, stabilization, deactivation, chemical reduction, chemical oxidation, or solidification of solid, sludge and liquid waste streams.

  Under this alternative, the In-Container Mixer would include the following new features:

  - Deactivation, chemical reduction, and chemical oxidation as new processes in addition to the current neutralization, solidification, and stabilization.
  - Sludge as a new waste stream replacing the current waste stream “slurry” which is under a definition of liquid with its physical property being less dense than sludge.
  - A decrease in treatment capacity from the current operation.

- Shredder System

  The existing and currently permitted Size Reduction and Screening unit (as described in Chapter 2, Section 2.7) would be renamed and operated as the Shredder System. Treatment capacity of this system would be decreased from the current capacity of 120 short tons per day (109 metric tons per day) to 24 short tons per day (21.8 metric tons per day). The decreased capacity is based on the engineering calculation in Appendix DA-2, Treatment Capacity Calculation provided in the DWR Permit Renewal Application (PFNW 2024).

- Low-Capacity Mixer

  The existing and currently permitted Low-Capacity Mixing System unit would be operated to perform solidification, stabilization, chemical reduction, or chemical oxidization of solid, sludge, and liquid waste streams. Waste (solid, liquid, or sludge) and reagents are batch fed from a container into the mixer from the feed port. Treatment capacity of this system would be decreased from the current capacity of 25.2 short tons per day (22.9 metric tons per day) to 7.4 short tons per day (6.7 metric tons per day). The decreased capacity is based on the engineering calculation in Appendix DA-2, Treatment Capacity Calculation provided in the DWR Permit Renewal Application (PFNW 2024).

Under this alternative, the Low-Capacity Mixer would include the following new features:

- Solidification, chemical reduction and chemical oxidation as new processes in additions to the current stabilization process.
- Liquid and sludge as new waste streams in addition to the solid waste stream that is currently treated.
- Decrease in treatment capacity from the current operation.

- Aerosol Can Puncturing Device

  The existing and currently permitted Aerosol Can Puncturing Device would be operated with an increased treatment capacity. Treatment capacity of this system would increase from the current capacity of 0.36 short tons per day (0.33 metric tons per day) to 3.2 short tons per day (2.9 metric tons per day). The increased capacity is based on the engineering calculation in Appendix DA-2, Treatment Capacity Calculation provided in the DWR Permit Renewal Application (PFNW 2024).

- Bench Scale Treatment

  Bench Scale Treatment, already installed in the Laboratory, would be an existing unit to be permitted for use under a ventilated laboratory fume hood located in the laboratory room in the MWNT area. The maximum volume of waste that would be treated in this system at any one time is two (2) gallons of liquid waste or 10 pounds of solid waste. The treatment capacity of this system would be decreased from the current capacity of 2.4 short tons per day (2.2 metric tons per day) to 0.58 short ton per day (0.53 metric ton per day). The decreased capacity is based on the engineering calculation in Appendix DA-2, Treatment Capacity Calculation provided in the renewal application (PFNW 2024).

- In-Barrel Compactor 1 and In-Barrel Compactor 2

  There will be two identical in-barrel compactors; In-Barrel Compactor 1 and In-Barrel Compactor 2. In-Barrel Compactor 1 was formerly a part of the Compaction and Macroencapsulation, while In-Barrel Compactor 2 will be a new unit. Both in-barrel compactor units have been used as a part of Compaction and Macroencapsulation system. They consist of a hydraulic ram shaft, a drum seal lid, compactor plate, and a base plate. These units would be used to compact waste (solid or debris) inside of a 55- or 85-gallon drum to provide volume reduction prior to further compaction of the drum in the Super Compactor. Solid is a new waste stream in addition to debris waste stream that is currently processed. The approximately 36 in x 40 in x 10 ft portable unit would be constructed of steel. The treatment capacity of these units is 26 short tons per day (23.6 metric tons per day) each.

- Drum Compactor

  This existing portable unit will update a part of currently permitted process of Compaction & Macroencapsulation. It consists of a hydraulic ram shaft, a compactor plate, and a base plate. The unit would be used to compact drums of waste (solid or debris) contaminated with TSCA regulated PCBs that cannot be processed in the In-Barrel Compactors. This portable unit is constructed of steel. The treatment capacity of this unit is 96 short tons per day (87 metric tons per day).

- Super Compactor

  This existing portable unit would update the Compaction and Macroencapsulation process. This process includes a Super Compactor unit with an integrated conveyor that takes several containers of waste and greatly reduces their volume by the application of compressive force. It is used to package and/or prepare waste (solids or debris) for macroencapsulation. The compressed containers are then removed from the Super Compactor, placed in an overpack and encapsulated. This approximately 25 ft x 6 ft x 13 ft tall unit is a stationary unit constructed of steel. The treatment capacity of this system would be decreased from the current capacity of 96 short tons per day (87 metric tons per day) to 36 short ton per day (33 metric ton per day). The decreased capacity is based on the engineering calculation in Appendix DA-2, Treatment Capacity Calculation provided in the DWR Permit Renewal Application (PFNW 2024).

3.2.1.2 Additional Treatment Processes

Under Alternative 2, PFNW will be permitted to operate additional treatment processes in the MWNT area in addition to the treatment units described in the previous section (Section 3.2.1.1). Additional treatment process outside the permitted treatment units include cutting and shearing, draining/decanting, and macroencapsulation.

- Cutting/Shearing

  This process would update the existing and currently permitted Cutting and Shearing treatment system (as described in Chapter 2, Section 2.7). Treatment capacity of this process would be decreased from the current capacity of 120 short tons per day (109 metric tons per day) to 7.6 short tons per day (6.9 metric tons per day). The decreased capacity is based on the engineering calculation in Appendix DA-2, Treatment Capacity Calculation provided in the DWR Permit Renewal Application (PFNW 2024).

- Draining/Decanting

  A new Draining/Decanting process would be added as additional processes. Some waste (solid, debris, liquid, or sludge) the MWF receives may contain liquids that require draining or decanting (for example, depleted uranium chips in oil or equipment that is found to contain free liquids) in order to physically separate the waste forms. These liquids will be drained or decanted into a container from the solid or debris using pumps or screens. If enough liquid is collected to sample, it will be containerized, sampled, and either treated in the MWNT area or sent off-site for further treatment as detailed in Addendum D, Process Information provided in the DWR Permit Renewal Application (PFNW 2024). If there are not enough liquids to support sampling, it will be absorbed and added back into the waste container.

- Macroencapsulation (formerly part of Compaction & Macroencapsulation)

Macroencapsulation process would update the previous Compaction and Macroencapsulation process. Macroencapsulation is an immobilization technology to treat waste (solid or debris) via the application of surface coating materials such as polymeric organics (e.g. resins and plastics) or a jacket of inert inorganic materials to substantially reduce surface exposure to potential leaching media.

Unlike other non-thermal treatment processes, macroencapsulation can take place in the Truck Bay in the MWNT area in addition to the other permitted rooms in the MWNT area. Because the Truck Bay does not have building ventilation, this process in the Truck Bay can only be used on closed containers of debris.

3.2.1.3 Stabilization, Solidification, Neutralization, Deactivation, Chemical Oxidation/Reduction

Treatment operations by the treatment units in Section 3.2.1.1 may include stabilization, solidification, neutralization, deactivation, chemical oxidation/reduction, volume reduction, and macroencapsulation.

Treatment methods on some wastes (solids, liquids, or sludges) could be performed manually by PFNW personnel (without the use of the In-Container Mixer or the Low-Capacity Mixer). These treatment methods include solidification, stabilization, deactivation and neutralization. The appropriate reagent would be added to the container of waste. If mixing is required, a small hand mixer would be used to mix the reagents with the waste. The containers would be allowed to cure, if necessary, then sampled and stored for shipment off-site.

Treatment strategies for these processes include:

- Stabilization: mixing with cement-like or polymer-based reagents.
- Solidification: adding a material that is used to soak up free liquids by either adsorption or absorption, or both. The need for solidification to soak up free liquids is determined by either a visual inspection, or the Paint Filter Test (SW-846 Method 9095) for sludges and/or damp wastes. The Paint Filter Test may be performed at the MWF or the Washington State accredited Laboratory.
- Neutralization: neutralizing with reagents to result in a pH greater than 2 but less than 12.5 as measured in the aqueous residuals.
- Deactivation: the removal of the hazardous characteristics of a waste stream due to its ignitability, corrosivity, and/or reactivity.
- Chemical reduction: reduction of hexavalent Chromium and/or any other oxidizers through the combinations of reagents such that the leachability of the constituent has been reduced to meet LDR standards. The reagents that may be used in this reaction are listed in Table C-5 of Addendum C, Waste Analysis Plan, provided in the DWR Permit Renewal Application (PFNW 2024).
- Chemical oxidation: Oxidation of cyanide, sulfides and/or organics with a combination of reagents to chemically oxidize to carbon dioxide, nitrogen and/or sulfates such that the leachability of the constituent has been reduced to meet LDR standards.

3.2.2 Alternative 2 Permitted Waste Type

Under Alternative 2, the MWF will be permitted to store and/or treat currently permitted waste types as described in Chapter 2.

- MLLW
- TRUM

Additionally, the following new waste stream will be added for storage and/or treatment under this alternative.

- Direct Feed Low Activity Waste (DFLAW) Secondary Waste

  "The DFLAW approach will separate and pretreat some of the tank waste (approximately 23.5 million gallons) from certain underground tanks at the Hanford Site and immobilize (vitrify in a glass matrix) the pretreated low-activity waste (LAW) at the LAW Vitrification Facility.

  The DFLAW approach is a two-phased approach that will separate and pretreat supernate (essentially the upper-most layer of tank waste that contains low concentrations of long-lived radionuclides) from some of the Hanford tanks, to generate a LAW stream. Phase 1 of the DFLAW approach will entail the following: in-tank settling; separation (removal by decanting) of the supernate (including dissolved saltcake and interstitial liquids); filtration; and then cesium removal using ion exchange columns in a tank-side cesium removal (TSCR) unit. For Phase 2, DOE plans to treat additional supernate (including dissolved saltcake and interstitial liquids) using the same processes and will deploy either an additional TSCR unit or construct a filtration and cesium removal facility." (USDOE 2023)

  The DFLAW program will generate liquid and solid secondary waste (MLLW). Although it is the generator to determine which RCRA-permitted treatment, storage, and disposal (TSD) facilities to ship for offsite treatment and disposal, it is expected some of the DFLAW secondary waste will be accepted at the MWF for storage and/or treatment. DFLAW is anticipated to start in 2025 at the time of this writing.

  Examples of DFLAW secondary waste the MWF expects to receive for storage and/or treatment includes debris, liquids, Effluent Treatment Facility brines and acetonitrile distillate from the Effluent Management Facility overheads, and HEPA filters from the LAW Vitrification Facility. If the MWF is chosen as the RCRA-permitted TSD facility to treat the DFLAW secondary waste, USDOE estimates shipping to MWF approximately 2,600 cubic meters of DFLAW secondary waste on annual average. Out of 2,600 cubic meters on annual average, 580 cubic meters of the waste is estimated to be liquid. (USDOW 2023) PFNW identifies In-Container Mixer to treat the DFLAW secondary liquid waste as the currently available and permitted treatment unit.

3.2.3 Alternative 2 Waste Treatment Capacity

Under Alternative 2, the MWF will have a decreased storage capacity of 3,107-cubic yard in the container storage areas. The decreased storage capacity is based on the engineering calculation in Appendix DA-1, Secondary Containment Calculations provided in the DWR Permit Renewal Application (PFNW 2024).

The total annual treatment capacity of the MWF based on the design capacity for each treatment unit would be 265,669 short tons (241,011 metric tons). PFNW estimates to accept up to 11,272 short tons (10,226 metric tons) of waste at the MWF annually. This estimate is the same with the estimate from both the current DWR Permit and Alternative 1, and it is well below the annual treatment capacity of 265,669 short tons (241,011 metric tons).

Table 13 presents each treatment unit and the associated maximum design capacity for each unit under Alternative 2.

Table 13: Treatment Units and Maximum Design Capacities under Alternative 2

Treatment Unit/Additional Treatment Processes	Treatment Capacity (T/day)
Shredder (formerly Size Reduction and Screening)	24 T/day
Low-Capacity Mixer	7.4 T/day
In-Container Mixer	5 T/day
Aerosol Can Puncturing Device	3.2 T/day
Bench Scale Treatment	0.58 T/day
In-Barrel Compactor 1 (formerly part of Compaction and Macroencapsulation)	26 T/day
In-Barrel Compactor 2	26 T/day
Drum Compactor (formerly part of Compaction and Macroencapsulation)	96 T/day
Super Compactor (formerly part of Compaction and Macroencapsulation)	36 T/day
Cutting/Shearing	7.6 T/day
Draining/Decanting	16 T/day
Macroencapsulation (formerly part of Compaction and Macroencapsulation)	480 T/day

T = short ton; 1T = 0.907 metric ton
T/day = short ton per day

3.2.4 Types and Routes for Transport under Alternative 2

Under Alternative 2, there is no change in the types and routes for transport, and the ultimate destination for waste disposal from the current operation at the MWF as described in Section 2.9 in the previous chapter.

3.2.4.1 Liquid Mixed Waste Transport

The MWF is expected to receive increased volume of both liquid and solid mixed waste by truck primarily from the Hanford site through DFLAW as described in Section 3.2.2.

PFNW is required to comply with USDOT and USNRC requirements when transporting DFLAW secondary waste to and from the MWF, as described in Section 2.9. The DFLAW secondary waste will be transported along the same routes as other Hanford-derived waste. The packaging for the DFLAW liquid secondary waste would include drums (typically 55-gallon, but up to 119-gallon), totes (typically 275- or 330-gallon, but any size between 55 and 550-gallon) or tanker trucks, in USDOE and USDOT compliant shipments (B. Wiegman, personal communication, January 3, 2020).

The treated waste form will then be shipped back to the Integrated Disposal Facility (IDF) in the Hanford Site by truck for final disposal. The treated waste, if not accepted at the IDF per IDF Waste Acceptance Plan, may be shipped out of the state by truck for final disposal at other RCRA-permitted disposal facilities such as Waste Control Specialists (WCS) in Texas. The frequency of shipments will vary depending on the customer’s needs.

If the MWF is chosen as the RCRA-permitted TSD facility to treat the DFLAW secondary liquid waste, USDOE estimates approximately 39 truck shipments on annual average from Hanford Site to the MWF. (USDOE 2023)

3.3 Alternative 3

Under Alternative 3, with a DWR Permit Renewal, PFNW continues its current operations at the MWF with revisions as described in Alternative 1 and Alternative 2; operates a GeoMelt® Process Unit.

3.3.1 Requested New Waste Treatment Activities under Alternative 3

Under Alternative 3, PFNW will be permitted to operate the following treatment units and additional treatment processes in the MWNT area, as described in Section 3.2.1:

- Treatment units to be permitted
    - In-Container Mixer
    - Shredder System (formerly Size Reduction and Screening with increased capacity)
    - Low-Capacity Mixer
    - Aerosol Can Puncturing Device
    - Bench Scale Treatment
    - In-Barrel Compactor 1 (formerly part of Compaction & Macroencapsulation)
    - In-Barrel Compactor 2
    - Drum Compactor (formerly part of Compaction & Macroencapsulation)
    - Super Compactor (formerly part of Compaction & Macroencapsulation)
- Additional treatment processes to be permitted

- Cutting/Shearing
- Draining/Decanting
- Macroencapsulation (formerly part of Compaction & Macroencapsulation)

Furthermore, under Alternative 3, the following new treatment unit would be permitted:

- GeoMelt® Process Unit (new unit to be permitted in the MWT area)

  GeoMelt® Process Unit is an 8 ft wide (2.4 m) x 8 ft deep (2.4 m) x 12 ft high (3.7 m) stationary thermal treatment unit that would be operated in the MWT area. The GeoMelt® process is a type of vitrification that treats reactive metal through deactivation to make the final form of the waste acceptable for disposal at an authorized disposal unit (B. Wiegman, personal communication, December 21, 2018).

  The process includes lowering and securing a hood system containing the connections to the air pollution control system and electrodes onto a melt box, then applying an electric current through the electrodes. This process heats a mixture of waste and glass forming material to target temperatures up to 2,800 degrees Fahrenheit (1,538 degrees Celsius), but the waste is not combusted in the melt box. This results in the oxidation of the reactive metals to oxides, as well as incorporation of said oxides and radionuclides being immobilized in the resulting glass matrix. The gases from the melter are drawn through an off-gas treatment system that consists of a baghouse filter and HEPA filter (PFNW 2021).

  PFNW is proposing to process up to 1,200 pounds of reactive metals per melt and approximately 50,000 pounds (22.7 metric tons) of reactive metal per year (PFNW 2021) (B. Wiegman, personal communication, November 22, 2019). Concentration limits and/or quantity of reactive metal that can safely be processed in GeoMelt® system depends on the types of reactive metal (e.g., Steel-Clad vs. non-steel Clad).

  The end product after each melt is a 10 short ton, 7 ft (W) x 7 ft (D) x 3 ft (H) monolith (B. Wiegman, personal communication, January 3, 2020). The capacity of the GeoMelt® treatment is approximately four melts per month (B. Wiegman, personal communication, November 22, 2019).

  The GeoMelt® In Container Vitrification System is already installed and located in the MWF, but this system is not currently permitted to treat any dangerous waste nor is it included in the proposed DWR Permit renewal. If PFNW wishes to add the GeoMelt® system into the MWF permit, then after the permit renewal goes into effect, PFNW will need to submit to Ecology a permit modification request pursuant to Permit Condition 1.2.1.2 prior to the initial processing of waste in the GeoMelt® system. As a new thermal treatment unit, the GeoMelt® treatment unit would need a thermal risk assessment included as a part of permit modification request. There will be a public comment period for the draft permit modification in accordance with WAC 173-303-830. Ecology will make a final permit decision after reviewing all the public comments received.

3.3.2 Alternative 3 Permitted Waste Types

Under Alternative 3, the MWF will be permitted to store and/or treat the currently permitted waste types as described in Chapter 2 and as follows:

- MLLW
- TRUM

Additionally, the following new waste streams will be added for treatment under this alternative.

- DFLAW Secondary Waste, as described in Section 3.2.2 for Alternative 2.
- Reactive metals

Radioactively contaminated reactive metal would be received by PFNW to be treated with the GeoMelt® treatment process unit. Examples of the type of material expected include sodium (Na), sodium-potassium (NaK) and/or lithium hydride (LiH).

It is expected that the majority of the radioactively contaminated reactive metal would come from the INL in Idaho Falls, the Oak Ridge National Laboratory (ORNL) in Oak Ridge, TN, and from the Hanford site (B. Wiegman, personal communication, December 21, 2018).

PFNW conducted one treatability study to treat an experimental breeder reactor subassembly (radioactive reactive metal) with the GeoMelt® Process Unit from October 7, 2019 to October 2019 (as described in Chapter 2, Section 2.7).

3.3.3 Alternative 3 Waste Treatment Capacity

Under Alternative 3, MWF will have a storage capacity of 6,033-cubic yard in the container storage areas. The total annual treatment capacity of the MWF based on the design capacity for each treatment unit and additional treatment process would be 265,669 short tons (241,011 metric tons). PFNW estimates to accept up to 11,272 short tons (10,226 metric tons) of waste at the MWF annually. This estimate is the same for Alternative 2 and is higher than 10,538 short tons (9,560 metric tons) of waste estimated under both the current DWR Permit and Alternative 1, while it is well below the annual treatment capacity of 265,669 short tons (241,011 metric tons).

Table 14 presents each treatment unit and the associated maximum design capacity for each unit under Alternative 3.

Table 14: Treatment Units and Maximum Design Capacities under Alternative 3

Treatment Unit/Additional Treatment Processes	Treatment Capacity (T/day)
Shredder (formerly size reduction and screening)	24 T/day
Cutting/Shearing	7.6 T/day
Low-Capacity Mixer	7.4 T/day
In-Container Mixer	5 T/day
Aerosol Can Puncturing Device	3.2 T/day
Bench Scale Treatment	0.58 T/day
In-Barrel Compactor 1 (formerly part of Compaction and Macroencapsulation)	26 T/day
In-Barrel Compactor 2	26 T/day
PCB Drum Compactor (formerly part of Compaction and Macroencapsulation)	96 T/day
Super Compactor (formerly part of Compaction and Macroencapsulation)	36 T/day
Draining/Decanting	16 T/day
Macroencapsulation (formerly part of Compaction and Macroencapsulation)	480 T/day
GeoMelt® Process Unit	0.08 T/day[a]

T = short ton; 1T = 0.907 metric ton
T/day = short ton per day
[a]Estimated based on assumption of processing up to 1,200 pounds of reactive metals per melt with each melting cycle takes seven days including cooling time (PFNW 2021).

3.3.4 Types and Routes for Transport under Alternative 3

Under Alternative 3, the following types and routes for transport of waste to and from the MWF would be expected in addition to the current types and routes for transport (as described in Section 2.9 in Chapter 2).

3.3.4.1 Reactive Metal Transport

Radioactively contaminated reactive metal will be shipped to the MWF by truck in the future.

PFNW has identified the following shipping quantities by trucks from the three generators:

- INL (Idaho Falls, ID): 30 to 40 shipments in a 2- to 4-year window.
  Reactive metal waste streams from INL may include, but not limited to
  - EBR Subassemblies: One of the reactive metal waste streams at INL consists of approximately 53 metric tons of heavy metals consisting of sodium-bonded,

uranium-based material produced during development of the Liquid Metal Fast Reactor technology. Most of this material is sodium bonded blanket material, referred to as “axial” or “radial” depending on its position in the reactor, from the Experimental Breeder Reactor II (EBR-II) at INL and the Edison Detroit Fermi Reactor.

    - Sodium Components Maintenance Shop Contact Handled MLLW Inventory: Decommissioning of the sodium-cooled EBR-II and other various INL projects generated a variety of waste items that range in size and configuration from small paint cans to large EBR-II sodium traps. The waste includes contaminated piping, reactor tools, pumps, valves, vapor traps, and other debris.
    - RSWF Liner Wastes: The RSWF, Building 771, is located at the Materials and Fuels Complex (MFC) on the INL site. RSWF was constructed in 1965, to store highly radioactive solid waste (e.g., irradiated subassembly hardware, melt refining crucibles, filters, etc.) generated primarily from EBR-II
    fuel-refining operations performed at the facility currently known as the MFC Fuel Conditioning Facility. Much of the radioactive material stored at RSWF contains reactive sodium.

- ORNL (Oak Ridge, TN): 30 to 40 shipments in a 5-year window.

  Reactive metal waste streams from ORNL may include, but not limited to

    - URS CH2M Oak Ridge LLC (UCOR) Shields: The East Tennessee Technology Park in Oak Ridge, Tennessee enriched uranium for major defense and energy programs for more than 40 years. The facility, now managed by UCOR, has a large inventory of radioactive-contaminated metals known as “shields” that were constructed for use in experiments at ORNL. The shield containers are constructed of aluminum or stainless steel of varying sizes and shapes that were then filled with reactive metal material.

- Hanford site (Richland, WA): 10 to 20 shipments in a 5-year window.

  Reactive metal waste streams from the Hanford site may include, but not limited to

    - Fast Flux Test Facility (FFTF) Drums: The FFTF was a 400-megawatt (thermal) liquid-metal cooled (sodium) research and test reactor located at the Hanford Site. FFTF developed and tested advanced fuels and material for the Liquid Metal Fast Breeder Reactor program from 1982 to 1992. Mixed waste stored in drums can include elemental sodium, sodium-potassium (D001, D003, WSC2), toxics metals (D004 – D011), as well as debris (e.g., piping, equipment, and components) contaminated with sodium or sodium-potassium (PFNW 2021)(B. Wiegman, personal communication, December 21, 2018).

Some smaller quantities can also be shipped from other USDOE facilities, but these quantities are likely to be negligible (B. Wiegman, personal communication, December 21, 2018). Treated waste forms would then be shipped for final disposal at the NNSS in Nevada or other disposal sites.

3.4 No Action Alternative

Under the No Action Alternative, the DWR Permit would not be renewed, which would require PFNW to cease storing and treating mixed waste at the MWF. All the mixed waste stored in the MWF, and all mixed waste treatment units would be packaged for shipment offsite in accordance with the Closure Plan in the current DWR Permit, Attachment HH Closure and Financial Assurance, rev. 4 (Ecology 2012). PFNW could continue to treat LLW under its radioactive materials license from WSDOH.

3.4.1 Continued LLW Treatment

Under the No Action Alternative, it is expected that PFNW would continue and likely expand its treatment of LLW in order to keep the business running after the MWF operation ceases.

3.4.2 Waste Types in the LLF

Currently, PFNW is treating in the MWF some TRU and depleted uranium, both of which are non-mixed waste and are regulated under a WSDOH license. Under the No Action Alternative, PFNW would be treating this non-mixed waste strictly at its LLF. The current LLF doesn't have full treatment capabilities, such as a process area and treatment unit to process such waste. It is anticipated that PFNW would need to expand its LLF to accept all non-mixed waste from both domestic and international generators. Any mixed waste delivered to the PFNW site would need to be rejected and shipped back to the generators. Any secondary waste generated in the LLF and designated as mixed waste would be shipped offsite for treatment and eventual disposal.

3.4.3 Waste Treatment Capacity in the LLF

Under the No Action Alternative, it is expected that PFNW would expand the operation at its LLF. The LLF would need to add treatment capabilities and units within the facility to treat some non-mixed waste that are currently treated in the MWF, such as TRU and nonhazardous depleted uranium. At a minimum, Super Compactor or a similar treatment unit to process a large debris waste, would need to be installed and permitted under a WSDOH license. The waste treatment capacity in the LLF would increase beyond the current operation.

3.4.4 Types and Routes for Transport for the Continuous Operation at the LLF

Under No Action Alternative, it is expected that PFNW will expand the waste transportation to and from its LLF. If more LLW from international generators were to be treated at the LLF, the waste transportation under this alternative could include more than the current method of truck: barge and rail truck.

3.5 Other Alternatives Considered but Eliminated

3.5.1 Treatment of up to 3 million gallons of liquid mixed waste

PFNW would like to treat more liquid mixed waste in the future. PFNW requested Ecology to include in an alternative, a treatment of up to 3 million gallons per year of liquid mixed waste per year to be evaluated in this SEIS. PFNW told Ecology that the liquid mixed waste includes waste similar to what USDOE proposed for the Test Bed Initiative (R. Huckfeldt, personal communication, May 26, 2020). However, PFNW has not identified specific sources of this large quantity of liquid mixed waste. Considering that largest percentage of MLLW currently and historically processed at the MWF has come from the Hanford site as shown in Table 3 in Section 2.3, it is likely that the largest percentage of any liquid mixed waste treated by PFNW would come from the Hanford site. Historical data shows that other domestic generators do not typically ship large quantities of liquid MLLW across the country.

Shipment of 3 million gallons of liquid mixed waste from the Hanford site to PFNW would be considered a major federal action that would require evaluation in a NEPA EIS. SEPA rules allow Ecology to adopt relevant NEPA evaluations in whole or in part. Therefore, potential impacts from these sources of liquid mixed waste aren't analyzed in this SEPA SEIS. Therefore, potential impacts from these sources of liquid mixed waste aren't analyzed in this SEIS.

3.5.2 Bulk Scale Liquid Waste Treatment System

PFNW proposed to install Bulk Scale Liquid Waste Treatment System in the MWT area to treat liquid mixed waste, as described earlier in section 3.5.1 or for treatment of DFLAW liquid secondary waste as described in Section 3.2.2. This system will consist of 5 tanks, a large mixing unit, reagent storage vessels, and a loading/unloading area. The volume capacity of the system would be approximately 5,000 gallons (19 metric tons) a day (B. Wiegman, personal communication, November 22, 2019).

The Bulk Scale Liquid Waste Treatment System has not been installed in the MWT area. Furthermore, little information about this system was available at the time of this writing, including a treatment process, treatment design capacity, or schedule of the installment. Therefore, prior to initial processing of dangerous waste in this system, PFNW would need to submit a permit modification request after the DWR Permit Renewal goes into effect, for the system to be permitted as a new non-thermal treatment unit. Potential impacts from this system aren't analyzed in this SEIS.

3.5.3 Barge Transportation

PFNW proposed barge transportation as a possible future means of waste transportation for LLW; however, adequate information has not been provided to Ecology to consider barge transportation as a part of PFNW's foreseeable future operation. Therefore, barge transportation is not considered as a part of foreseeable MWF operation in this SEIS and is not discussed further for impact analyses.

3.5.4 Treatment of Higher Level TRU and Higher Level TRUM

For the purposes of this SEIS, "higher level TRU" is defined as TRU that would cause PFNW to exceed a limit of 200 grams of plutonium at any one time. Under the current WSDOH license for LLW, PFNW is permitted to possess and process plutonium not exceeding a limit of 200 grams at any one time per WAC 246-220-010 (WSDOH 2020b).

PFNW anticipates to start processing higher level TRU in the near future but would have to obtain an exemption to their license limit from USNRC. WSDOH does not have the authority to approve an increase above the current limit of 200 grams of plutonium. With USNRC approval followed by WSDOH licensing action, the limit could be increased above 200 grams of plutonium with the controls in place to maintain the inventory below the quantity and concentration in which a critical mass could be stored or processed.

If granted an exemption from USNRC, higher level TRU, not designated as mixed waste, would be processed in the LLF. Processing of higher-level TRU would be done the same way as TRU pursuant to WSDOH licenses and it does not require a DWR Permit.

Additionally, PFNW wants the capability to treat higher level TRUM that would require a USNRC exemption to allow more than 200 grams of plutonium in the MWF at any one time. If granted an exemption from USNRC, higher level TRUM, designated as mixed waste, would be processed in the MWF. Processing of higher-level TRUM would be done the same way as TRUM pursuant to WSDOH licenses and a DWR Permit. Both higher level TRU and higher level TRUM would come most likely from USDOE's Hanford site and PNNL because of the stringent shipping requirements (e.g. segmented rolling road closure as discussed in section 2.9.1.1).

USNRC licensing actions would support an exemption for both higher level TRU and higher-level TRUM. This USNRC decision will require Environmental Assessment (EA) under National Environmental Policy Act (NEPA). Therefore, this SEIS doesn't evaluate the potential adverse environmental impacts of treating higher level TRU and higher-level TRUM.

Chapter 4 - Affected Environment

This chapter describes the existing environmental setting of the PFNW site and the surrounding area that could be affected by the action and no action alternatives to the PFNW DWR Permit Renewal.

This chapter is organized by the elements of the environment to describe the existing environment that could be affected by the PFNW proposal to renew its DWR Permit. Elements of the environment have natural and built/human environments.

Elements from Natural environment include:

- Earth resources
- Air quality
- Water Resources
- Ecological Resources
- Energy

Elements from Built/Human Environment include:

- Human Health
- Noise
- Land Use
- Transportation
- Environmental Justice
- Cultural and Historical Resources

The 1998 Final EIS, Environmental Assessment for future development on the South Federal Campus, PNNL (USDOE 2013), Hanford Annual Site Environmental Report for Calendar Year 2018 (USDOE/RL, 2018), City of Richland Comprehensive Plan: Integrated Non-Project Final Environmental Impact Statement (City of Richland, 2017a), and City of Richland Comprehensive Plan 2017 (City of Richland, 2017b) are hereby incorporated by reference. These documents describe the affected environment for the PFNW site and nearby Hanford site and are the principal sources of the information presented in the following sections.

The impact analyses in this SEIS are conducted to provide sufficient information to specifically support a permitting decision for the PFNW's DWR Permit Renewal. This SEIS focuses on only the subjects that are relevant to the PFNW's DWR Permit Renewal and its impacts as required by SEPA.

4.1 Earth Resources

Elements from Earth resources include geology and soil, topography, and seismicity.

A description of earth surface characteristics of the PFNW site is included in the 1998 Final EIS (Chapter 2.1.2.1, page 21). Soil at the MWF location had been previously disturbed as described in the 1998 Final EIS. The information regarding the characteristics of geology and soil has not changed with the existing MWF operation.

The MWF is located on a topographical high area as shown in Figure 12. Topography at the MWF location has not changed with the existing MWF operation.

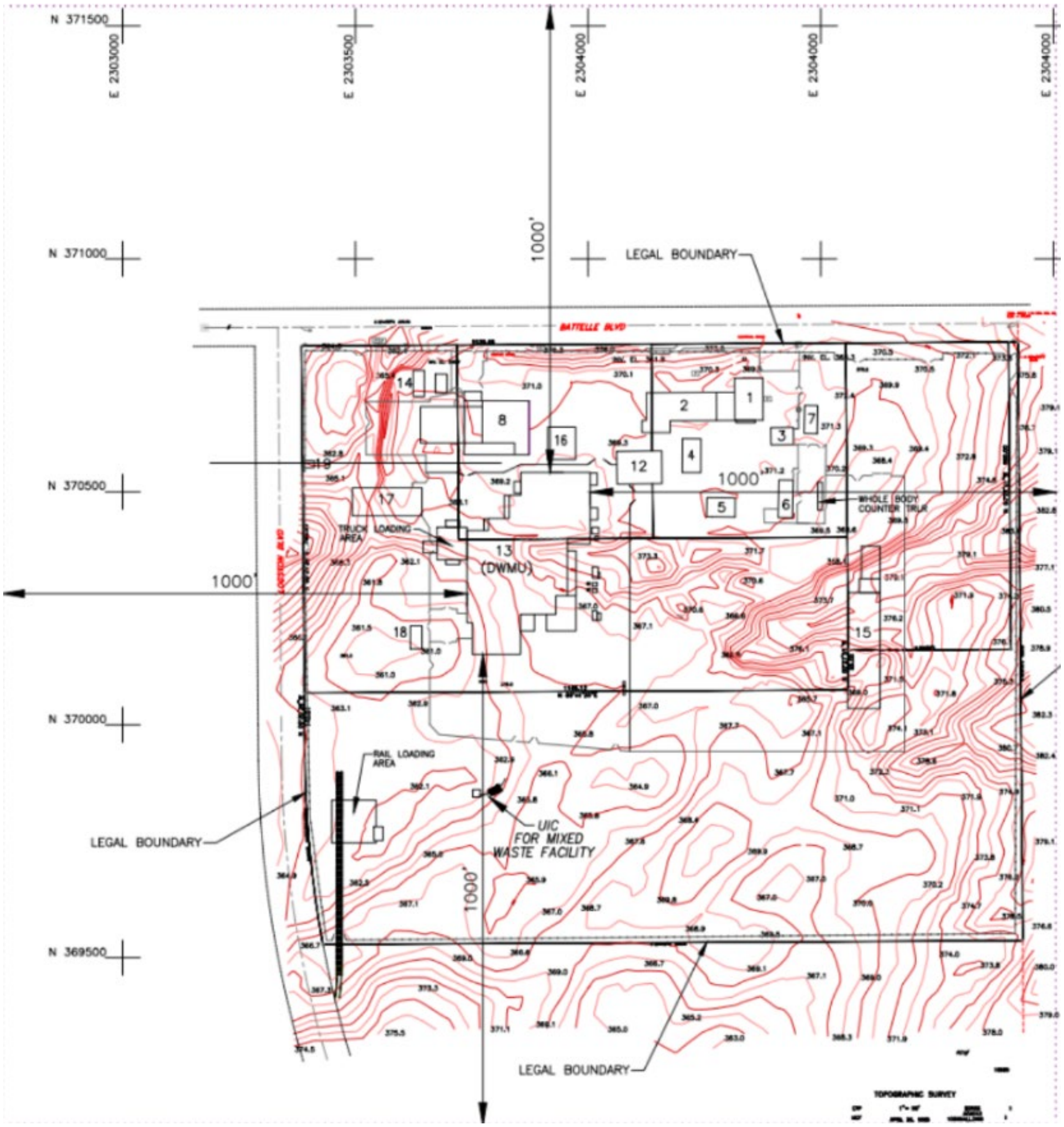

Figure 12: Topographic Map at the MWF
Source: Part A Attachment included in the DWR Permit Renewal Application (PFNW 2024)

The two largest earthquakes near the MWF occurred in 1918 and 1973: both, approximate magnitude-4.4 earthquakes, occurred in the central portion of the Columbia Plateau north of the MWF near Othello, Washington.

As a part of operating license review for Columbia Generation Station, a nuclear energy facility located five miles north of the MWF, USNRC concluded that four Hanford earthquake sources should be considered for seismic design: The Rattlesnake-Wallula alignment, Gable Mountain, a "floating" earthquake in the tectonic province, and a swarm area. USNRC estimated a maximum earthquake magnitude of 6.5 for Rattlesnake-Wallula alignment and 5.0 for Gable Mountain. The floating-earthquake design criterion was developed from the largest event located in the Columbia plateau, the magnitude-5.75 Milton-Freewater earthquake. The maximum-swarm earthquake for the purpose of seismic design was a magnitude-4.0 event based on the December 1973 earthquake (USDOE 2012).

Earthquake-produced ground motion is expressed in units of percent g (force of acceleration relative to that of the Earth's gravity) (USDOE 2012). Per the 2014 U.S. Geological Survey National Seismic Hazard Maps, the earthquake peak ground acceleration at the MWF for 2% probability of exceedance in 50 years has a value of 0.17g (a value equivalent to a magnitude of 5 to 5.9) (USGS 2014). Similarly, the earthquake peak ground acceleration at the MWF for 10% probability of exceedance in 50 years has a value of 0.07g (a value equivalent to a magnitude of 4 to 4.9).

In other words, it is estimated that an earthquake producing a horizontal (ground) acceleration of 0.17 g at the MWF would be experienced on average every 2500 years. Similarly, it is estimated that an earthquake producing a horizontal (ground) acceleration of 0.07 g at the MWF would be experienced on average every 500 years.

Earthquake hazard maps are shown in Figure 13 and Figure 14.

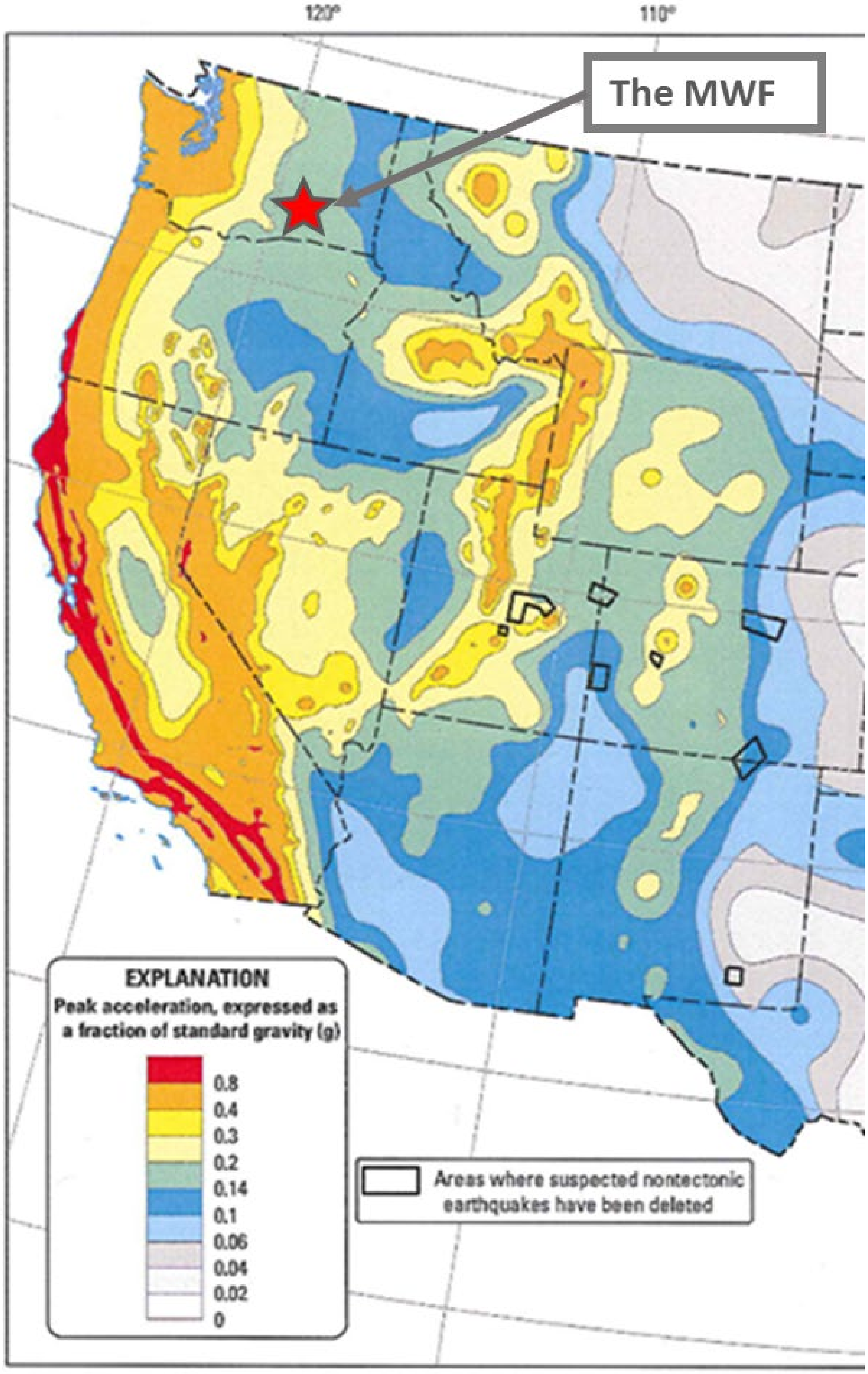

Figure 13: 2014 USGS Seismic Hazard Map – Peak Ground Acceleration of 2 % in 50 years
Source: Addendum B included in the DWR Permit Renewal Application (PFNW 2024).

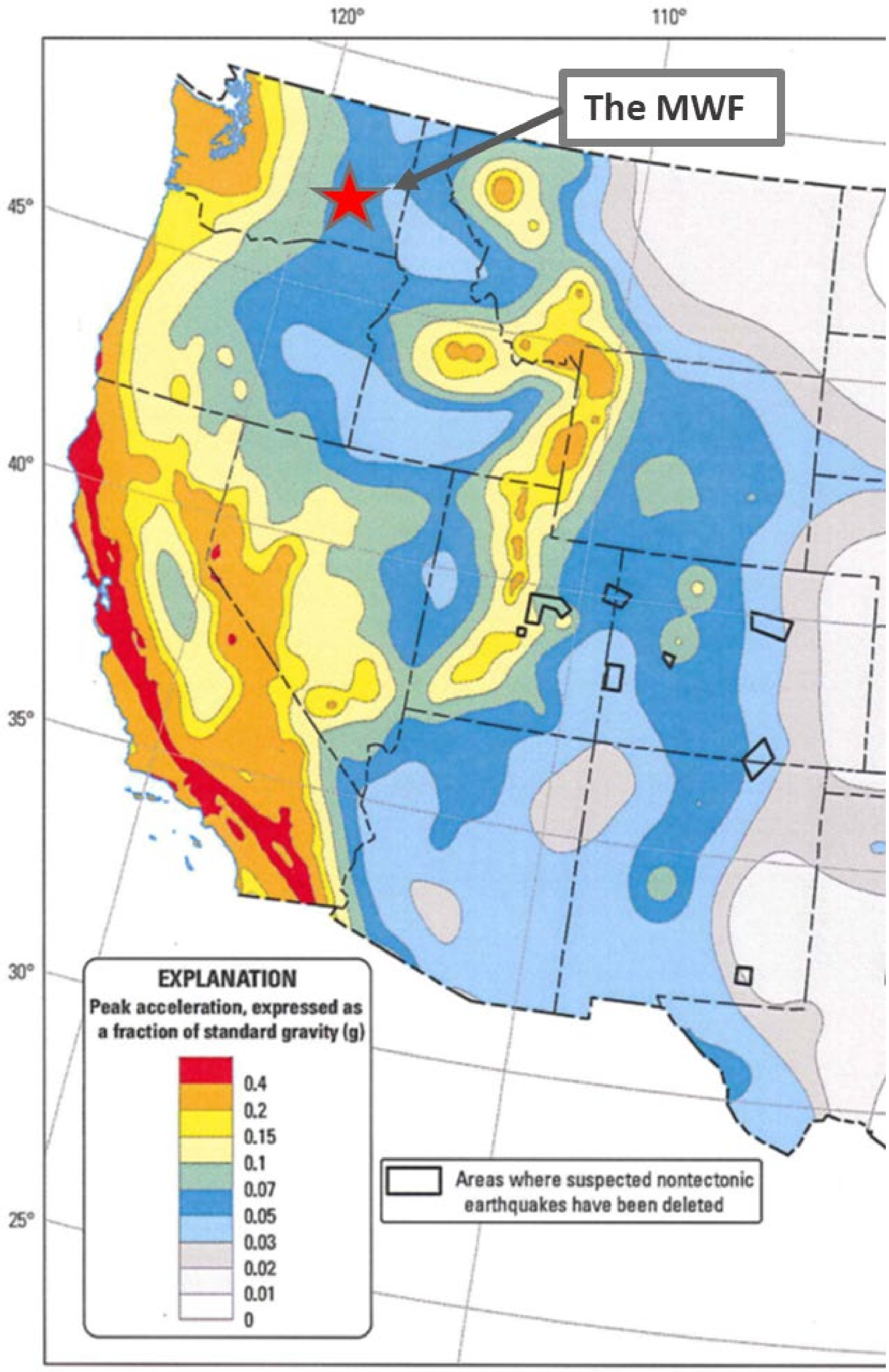

Figure 14: 2014 USGS Seismic Hazard Map – Peak Ground Acceleration of 10 % in 50 years
Source: Addendum B included in the DWR Permit Renewal Application (PFNW 2024).

4.2 Air Quality

Air quality in the vicinity of the MWF is generally good with the exception of ozone (O_3) and seasonal wildfire smoke. There are also occasional exceptions caused by blowing dust due to arid conditions and high winds.

4.2.1. Non-Radioactive Air Pollutants

In Washington State, non-radioactive air pollutants are regulated under two categories of air pollutants: criteria air pollutants and hazardous air pollutants (HAPs)/toxic air pollutants (TAPs).

The criteria air pollutants include six air pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), O_3, particulate matters (PMs), and sulfur dioxide (SO_2).

Common sources of CO include (Ecology 2021a):

- motor vehicles
- wood stoves and fireplaces
- outdoor burning
- industrial combustion

Common sources of NO_2 include (Ecology 2021d):

- motor vehicle
- ships and locomotives
- industrial power plant

Common sources of O_3 include (Ecology 2021b):

- vehicle exhaust
- gasoline vapors
- chemical solvents
- industrial emissions

Common sources of PMs include (Ecology 2020a):

- wood stove
- vehicles
- dusts
- outdoor burning
- industrial facilities
- wildfires

Common sources of SO_2 include industrial facilities and ships and locomotives (Ecology 2021e).

Common sources of Pb include industrial facilities (Ecology 2021c).

The federal *Clean Air Act Amendment of 1990* requires USEPA to set National Ambient Air Quality Standards (NAAQS, 40 CFR Part 50) for six criteria air pollutants which can be harmful to public health and the environment (USEPA 2021b). The standards define the maximum acceptable level in the air for the six criteria air pollutants. Washington State set the state-wide ambient air quality standards in WAC 173-476, which was adopted from NAAQS. Since 2005, Benton County consistently has not violated any of the federal, health-based air quality standards set by USEPA (BCAA 2019a).

Table 15 presents the current ambient air quality standards for the six criteria air pollutants in Washington State.

Table 15: Ambient Air Quality Standards for Criteria Air Pollutants in Washington State

Criteria Air Pollutants	Averaging Period	Standards
CO	8 hours	9 ppm; Not to be exceeded more than once per year
CO	1 hour	35 ppm; Not to be exceeded more than once per year
NO_2	Annual	53 ppb; Annual mean
NO_2	1 hour	100 ppb; 98^{th} percentile of 1-hour daily maximum concentrations, averaged over 3 years.
O_3	8 hours	0.070 ppm; Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years.
PM- PM_{10}	24 hours	150 µg/m^3; Not to be exceeded more than once per year on average over 3 years.
PM- $PM_{2.5}$	Annual	12.0 µg/m^3; Annual mean, averaged over 3 years.
PM- $PM_{2.5}$	24 hours	35 µg/m^3; 98^{th} percentile, averaged over 3 years.
SO_2 [a]	Annual	0.02 ppm; Not to be exceeded in a calendar year.
SO_2 [a]	24 hours	0.14 ppm; Not to be exceeded more than once per calendar year.
SO_2	3 hours	0.5 ppm; Not to be exceeded more than once per calendar year.
SO_2	1 hour	75 ppb; Annual 99^{th} percentile of 1-hour daily maximum concentrations, averaged over 3 years.
Pb	Rolling 3-month	0.15 µg/m^3; Not to be exceeded.

Source: USEPA 2021b and WAC 173-476

a State only standard

b USEPA's NAAQS for NO2 is designed to protect against exposure to the entire group of nitrogen oxides (NOx). NO2 is the component of greatest concern and is used as the indicator for the larger group of NOx. The sum of nitric oxide (NO) and NO2 is commonly called NOx. Other nitrogen oxides include nitrous acid and nitric acid. NOx reacts with volatile organic compounds to form ozone (USEPA 2018).

µg/m3 = microgram per square meters

CO = carbon monoxide NO2 = nitrogen dioxide O3 = ozone Pb = lead PM = particulate matter

ppb = parts per billion: 1 ppm = 1,000 ppb. ppm = parts per million SO_2 = sulfur dioxide

HAPs and TAPs are other chemical contaminants regulated by federal and state regulations as they are known or suspected to cause cancer or other serious health effects. The federal *Clean Air Act Amendment of 1990* included a list of 189 HAPs that are considered dangerous to human health and the environment. Since 1990, USEPA has modified the list through rulemaking to include 188 HAPs as of 2024 (USEPA 2024). In addition to the federal HAP list, the Washington Administrative Code lists TAPs that include federal HAPs and additional substances and compounds. There are 438 TAPs listed in the Washington Administrative Code, including benzene, toluene, and xylene, etc.

4.2.1.1. Pollutants of concern in the vicinity

USEPA designates areas in the United States with NAAQS for each criteria air pollutant as:

- attainment (i.e., meeting a standard)
- nonattainment (i.e., not meeting a standard)
- unclassifiable (i.e., not enough information to classify)

Benton County is currently considered to be attainment/unclassifiable with NAAQS for all criteria pollutants (BCAA 2019b). However, Ecology and BCAA monitors air pollution levels for both O_3 and PMs ($PM_{2.5}$ and PM_{10}) in the area to continue to meet air quality standards.

O_3

While O_3 in upper atmosphere zone shields people from the sun's harmful ultraviolet radiations, O_3 near ground level is harmful to human health. Ground-level O_3 is a harmful pollutant that contributes to smog. O_3 forms at ground-level when NO_x and VOCs react with heat and sunlight. NO_x and VOCs are known to come from vehicle exhaust, gasoline vapors, chemical solvents, and industrial emissions (Ecology 2018).

O_3 level in summer has been high in Tri-Cities in the recent years. The numbers of days above both federal and state air quality standard of 70 parts per billion (ppb) in 2017 and 2018 are 9 and 6, respectively. The Tri-Cities Ozone Precursor Study, conducted by Ecology, BCAA, and WSU in 2016, found that local vehicle emissions are a large contributor to ozone formation in the Tri-Cities. O_3 levels are still in attainment for Tri-Cities currently; however, the area is closely monitored during summer months by BCAA (Ecology 2018).

PM

PMs (PM_{10} and $PM_{2.5}$) are made of a complex mixture of extremely small particles and liquid droplets. It is made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles (BCAA 2019a). Common sources include, but not limited to, wood stove and fireplaces, vehicles, dust from construction and agriculture, outdoor burning, industrial facilities, and wildfires (Ecology 2020a).

Benton County occasionally has a concern with increased PM levels primarily from diesel exhaust and smoke from wood burning (BCAA 2019b).

4.2.2 Radioactive Air Pollutants

Emission of radioactive air pollutants from the PFNW operations (both the MWF and LLF operations) is regulated under USEPA's National Emissions Standards for Hazardous Air Pollutants regulations in 40 CFR Part 61, Subpart H, WAC 173-480, "Ambient Air Quality Standards and Emission Limits for Radionuclides", and WAC 246-247, "Radiation Protection – Air Emissions". Emissions of radionuclides shall not cause any member of the public to receive an effective dose equivalent of 10 millirem (mrem) per year (40 CFR Part 61 Subpart H, WAC 173-480, and WAC 246-247).

The PFNW site has a total of 5 stacks from the MWF and LLF operations: 2 stacks from the MWF and 3 stacks from the LLF. Table 16 presents the 2018 actual stack emissions of radionuclides from the PFNW site in comparison to the 2018 total radionuclide emissions from the Hanford site.

Table 16: Radionuclides discharged to the Atmosphere from the PFNW Site and the Hanford Site (Curies)

Emission Points	Gross Alpha	Gross Beta	Co-60	Cs-137	H-3	C-14	Radio-Iodine (125 & 129)
MWNT (MWF Operation)	4.90×10^{-11}	2.95×10^{-11}	1.86×10^{-11}	-2.01×10^{-11}	NA	NA	1.48×10^{-9}
MWT (MWF Operation)	6.30×10^{-12}	7.97×10^{-12}	1.28×10^{-11}	1.70×10^{-11}	3.16×10^{-1}	NA	NA
3 LLF Stacks	2.76×10^{-11}	1.84×10^{-10}	4.90×10^{-11}	-5.33×10^{-11}	1.19×10^{-1}	1.31	3.68×10^{-9}
Total PFNW	8.29×10^{-11}	2.21×10^{-10}	8.04×10^{-11}	-5.64×10^{-11}	1.23×10^{-1}	1.31	5.16×10^{-09}
Hanford site	3.00×10^{-5}	8.70×10^{-5}	7.70×10^{-8}	1.50×10^{-5}	8.25×10^{1}	1.10×10^{-4}	1.30×10^{-03}

C-14 = Carbon-14 Co-60 = Cobalt-60 Cs-137 = Cesium-137 H-3 = Tritium LLF = low level facility
MWF = mixed waste facility MWNT = mixed waste non-thermal area MWT = mixed waste thermal area
NA = not applicable, monitoring not performed for the radionuclide.

PFNW = Perma-Fix Northwest, Inc.

Source: PFNW Annual Environmental Monitoring Report for 2018 (PFNW 2019a) and Hanford Annual Site Environmental Report for Calendar Year 2018 (USDOE 2019c)

4.2.3 Greenhouse Gas

The term "greenhouse gases" covers a wide variety of gases that, once they are released into the atmosphere, trap the sun's heat. When the sun's energy reaches the Earth's atmosphere, some of it is reflected back to space and the rest is absorbed and trapped in the lower atmosphere, heating the Earth. This is called the "greenhouse effect".

Naturally occurring greenhouse gases include water vapor (H_2O), ozone (O_3), carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Human-made greenhouse gases include chlorofluorocarbons (CFCs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). Atmospheric concentrations of both the natural and human-made greenhouse gases have been rising over the last few centuries due to the Industrial Revolution, population growth, and our dependence on fossil fuels (Ecology 2021f). Greenhouse gas emission contributes to climate change.

According to Washington State Greenhouse Gas Emissions Inventory report, Washington State emitted 99.6 million metric tons of greenhouse gases in CO_2 equivalent in 2018. In 2018, Washington's largest contributors of greenhouse gases were:

- Transportation sector at 44.9 %.
- Residential, commercial, and industrial space and/or process heating at 23.4 %.
- Electricity sector at 16.3 % (Ecology 2021g).

Starting in 2012, Washington State requires facilities that emit at least 10,000 tons of carbon pollution annually to report their greenhouse gas emissions (Ecology 2020c). In Benton County, the following three facilities currently emit at least 10,000 tons of greenhouse gases in CO_2 equivalent annually:

- Agrium Kennewick Fertilizer Operations in Kennewick.
- Lamb Weston in Richland.
- Horn Rapids Sanitary Landfill in Richland (Ecology 2021h).

In 2020, the Washington Legislature set new greenhouse gas emission limits in order to combat climate change. Under the law, the state is required to reduce emissions levels:

- 2020 - reduce to 1990 levels.
- 2030 - 45% below 1990 levels.
- 2040 - 70% below 1990 levels.
- 2050 - 95% below 1990 levels and achieve net zero emissions (Ecology 2021f).

In 2021, the Washington Legislature passed the Climate Commitment Act, which establishes a comprehensive program to reduce carbon pollution and achieve the greenhouse gas limits set in state law. The program went into effect in 2023 (Ecology 2021i).

4.3 Water Resources

4.3.1 Surface Water

There are no naturally occurring surface water bodies or wetlands in the PFNW site as described in the 1998 Final EIS. Furthermore, the area in the vicinity of the MWF is not designated as the 100-year flood plain area. The MWF is located on a topographical high area as shown in Figure 12.

4.3.2 Groundwater

Water table in the PFNW varies from approximately 10 feet in the west to 21 feet to the east as groundwater flows east toward the Columbia River (PFNW 2019a). Since the MWF is located in the west side, its water table is slightly above 10 feet below ground as also described in the 1998 Final EIS. Information regarding the water resources at the MWF and its vicinity has not changed with the existing MWF operation.

4.4 Ecological Resources

No threatened, endangered, sensitive, or candidate wildlife species are known to be present within or near the current property of PFNW, consistent with the 1998 Final EIS. The site is located within the Horn Rapids Industrial Park in north Richland, which “has been envisioned as an employment and economic center in the region” (City of Richland 2017b)(City of Richland 2021). This area has not been a suitable habitat for any wildlife or plant species due to the nature of growing industrial area and absence of native vegetation.

4.5 Energy

Electricity through Richland Energy Services (RES) is the main energy source for the MWF’s waste treatment activities. Diesel and gasoline are the main fuels utilized for the current waste transportation to and/or from the MWF and employee commuting.

In 2018, RES supplied approximately 932.2 gigawatt-hour (932,200,000 kWh) to 24,526 customers in its 48 square miles service area. Electricity supplied from RES primarily came from hydropower (86.47 percent) and nuclear power (10.75 percent) (City of Richland 2020a).

4.6 Human Health

4.6.1 Routine Operation

Individual doses from radiation are most often expressed in “mrem.” Collective doses, which represent more than one person, are most often expressed in “person-rem.” One person-rem equals 1,000 person-mrem. A latent cancer fatality (LCF) is a death resulting from cancer that has been caused by exposure to ionizing radiation with the assumption that there is a latent period between the time an exposure occurs and the time a cancer becomes active. LCF is calculated by multiplying the total worker dose by 0.0006 (using a risk estimator of 600 LCF per 1 M person-rem) (USDOE 2019a).

It is assumed that the primary sources and levels of background radiation exposure to the individuals in the vicinity of the PFNW site would be comparable to those to the average individual in the United States. Table 17 presents average background radiation exposure in the vicinity of the PFNW site that is not related to the MWF operation.

Table 17: Average Radiation Exposure of Individual in the United States

Radiation Sources	Natural or Other Background	Effective Dose (mrem per year)
Cosmic and external terrestrial radiation	Natural	54
Internal terrestrial radiation	Natural	29
Radon-220 and -222 in homes (inhaled)	Natural	228
Diagnostic x-rays and nuclear medicine	Other	300
Occupational	Other	0.5
Industrial, security, medical, educational, and research	Other	0.3
Consumer products	Other	13
Total (rounded)	Both Natural and Other	620

Source: (National Council on Radiation Protection and Measurements 2009)

Release of radionuclides to the environment through stacks from the MWF operation provides an additional source of radiation exposure to the individual in the vicinity of the PFNW site. The other sources with potential air emissions of radioactive air pollutants within an 8-km (5-mi) radius of the MWF include, but are not limited to the following facilities:

- LLF within the PFNW site
- Framatome to the northwest
- PNNL to the northeast
- The Hanford site to the north
- Columbia Generating Station to the north

Possible sources of radionuclide releases to MEI resulting from the MWF operation include both stack emissions and direct exposures at the perimeter fence line. The dose to the MEI from air emission from the PFNW operation (both the MWF and LLF operations) in 2018 was estimated to be 8.08×10^{-3} (0.00808) mrem. For Perspective, the estimated dose to MEI from air emission from the 2018 Hanford site operations was estimated to be 0.22 mrem (USDOE 2019c). These doses from air emission are well below the dose limits of 10 mrem per year for individual members of public required by both federal and state standards. The direct radiation dose to the MEI from the PFNW perimeter was estimated to be 0.23 mrem in 2018 (PFNW 2019a). There is no excess fatal cancers (LCFs) expected from the general public through both stack emission and direct exposure associated with the current PFNW operation.

Table 18 present the estimated radiation dose to general public from PFNW and Hanford site.

Table 18: 2018 Estimated Radiation Dose to General Public

Receptor	Annual Radiation Dose (mrem)	LCF Risk[a]
MEI from PFNW air emission	0.00808	4.8×10^{-09}
MEI from PFNW direct exposure	0.23	1.4×10^{-07}
MEI from the Hanford site air emission	0.22	1.3×10^{-07}

LCF = Latent Cancer Fatality
mrem = millirem; 1 rem = 1,000 mrem
MEI = maximum exposed individual
PFNW = Perma-Fix Northwest, Inc.
[a] LCF risk is calculated by multiplying the dose (rem) by 0.0006.
Source: (USDOE 2019c) (PFNW 2019a)

Currently, PFNW has approximately 70 employees at the PFNW site. Out of all the employees at the PFNW site, 90 percent of them are directly involved in waste treatment for both the MWF operation and LLF operation. Therefore, the number of involved workers (who would be directly involved in waste treatment) are estimated to be 63 for the current MWF operation.

A radiation dose limit to a worker of 5 rem (5,000 mrem) per year is established in 10 CFR Part 20 by USNRC. PFNW established the maximum administrative control limit as 1.5 rem (1,500 mrem) per year (B. Wiegman, personal communication, Jan 3, 2020). For perspective, Hanford contractors established the maximum administrative control limit as 2 rem (2,000 mrem) per year (USDOE 2019d).

Table 19 presents average annual radiation dose among the involved workers relative to the actual waste quantity processed in the PFNW site from 2014 to 2018. Average involved worker received 61.2 mrem per year as the five year average and 117 mrem from 2018 as the highest from the five years (R. Huckfeldt, personal communication, March 2, 2020) (B. Wiegman, personal communication, January 8, 2020).

Table 19: Average Annual Dose among PFNW involved workers relative to the waste quantity processed (2014-2018)

Year	Average Annual Dose (mrem)	MLLW processed at the MWF (metric ton)	LLW processed at the LLF (metric ton)
2018	117	289	1,644
2017	42	175	797
2016	49	392	1,138
2015	36	334	1,443
2014	62	147	1,737
Average (2014 - 2018)	61.2	267	1,352

LLF = low level facility
LLW = low-level radioactive waste
MLLW = mixed low-level radioactive waste
mrem = millirem; 1 rem = 1,000 mrem
MWF = mixed waste facility
PFNW = Perma-Fix Northwest, Inc.
Source: (R. Huckfeldt, personal communication, March 2, 2020) (B. Wiegman, personal communication, January 8, 2020)

4.6.2 Accident

In the past recent years, incidents that had actual or potential health impacts to workers have occurred in the MWF partition.

In 2019, there were two fires in the MWF; however, no injury or release of radioactive contaminants were reported from either incident.

- May 2019, fire started on wood pallet and the packaging material that the glass monolith was sitting on.
- December 2019, a small fire in a metal disposal box of low-level, nonhazardous depleted uranium waste.

PFNW submitted to Ecology an incident report within 15 days after each of the incidents with a brief description of causal analysis and corrective action to prevent reoccurrence of these incidents in accordance with its contingency plan and WAC 173-303-360, “Emergencies”.

4.7 Land Use

Although the area around the PFNW site has grown rapidly as Horn Rapids Industrial Park, the zoning for the PFNW site and its vicinity has been consistently designated as heavy manufacturing with the existing MWF operation. With the growth in housing development in north Richland, the nearest residential dwelling is currently an apartment complex, just 1.7 km (1.1 miles) to the southeast. The nearest childcare facility is 1.3 km (0.8 mile) to the east.

4.8 Transportation

Transportation used for waste shipment associated with the current MWF operation is described in section 2.9. Currently a truck is used to transport all waste types to or from the MWF.

Traffic volume in north Richland has substantially increased since the MWF operation started in 1999, due to the growth in both population and development in north Richland and the vicinity of the PFNW site. Traffic volume is anticipated to continue to increase in the future.

The following are the current estimates of all-day traffic counts for four major streets in the vicinity of the PFNW site, as described in Figure 15 (City of Richland 2017b) (City of Richland 2020b).

- Battelle Blvd.: 1,001 to 5,000 vehicles (1,721 in 2018 traffic count)
- Kingsgate Way: 1,001 to 5,000 vehicles (3,560 in 2018 traffic count)
- Highway 240: 5,001 to 10,000 vehicles (6,126 in 2018 traffic count)
- Stevens Drive: 10,001 to 20,000 vehicles (1,2710 in 2018 traffic count)

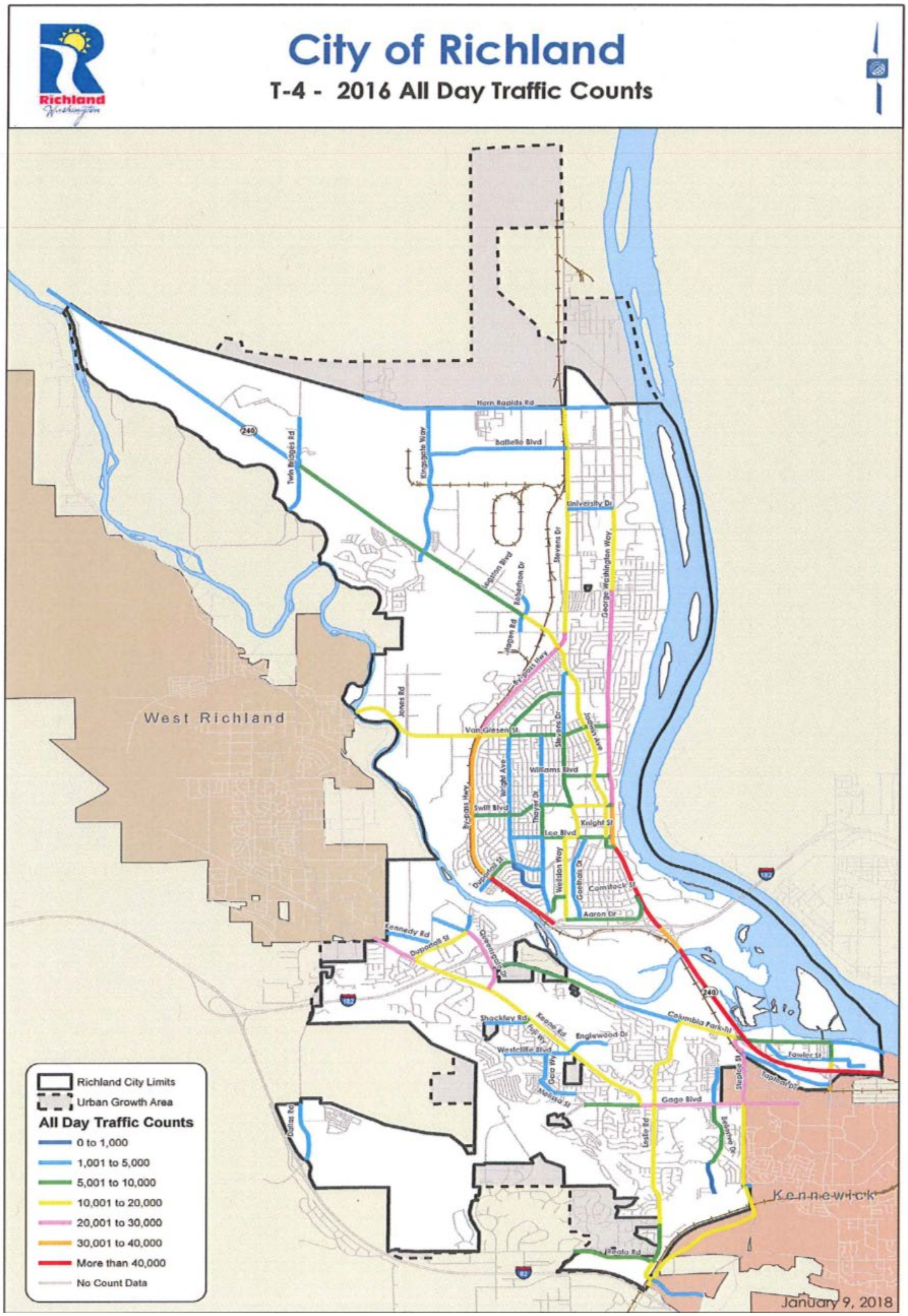

Figure 15: Current All-Day Traffic Counts in the Vicinity of the PFNW Site (Source: City of Richland 2017b)

The rail system in the vicinity of the PFNW site is owned by City of Richland, Port of Benton, and either Union Pacific Railroad, or Burlington Northern Santa Fe, LLC. Current rail users in the Horn Rapids Industrial Park include Preferred Freezer Services and Central Washington Corn Processors. One-way railcar volume on the Port/City rail line is approximately 8,750 railcars each year (Port of Benton and City of Richland 2017).

4.9 Environmental Justice

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, or policies.

- **Fair Treatment** means that no group of people should bear a disproportionate burden of environmental harms and risks, including those resulting from the negative environmental consequences of industrial, governmental and commercial operations or programs and policies.
- **Meaningful Involvement** means that: (1) potentially affected populations have an appropriate opportunity to participate in decisions about a proposed activity that will affect their environment and/or health; (2) the public's contribution can influence the regulatory Agency's decision; (3) the concerns of all participants involved will be considered in the decision-making process; and (4) the rule-writers and decision–makers seek out and facilitate the involvement of those potentially affected.

4.9.1 Potentially Affected Population

Minority is defined as all but Non-Hispanic White alone. Minority populations include Hispanic, Black or African-American, American Indian, Asian, Pacific islander, or some other race alone or combined. Low income population reflects the percent of population whose household income is less than or equal to twice the federal poverty level (USEPA 2021a).

In both 1-mile and 2-mile radius of PFNW facility, the majority of the population are self-identified as White. The percentages of minority population within a 1-mile and 2-mile radius are estimated as 14 % and 24 %, respectively. The percentages of low income population within 1-mile and 2-mile radius are both 10 %. When compared with City of Richland and Washington State, both 1-mile and 2-mile radius of PFNW facility has lower percentages of both minority and low income population.

Table 20 presents the minority and low income population within a 1-mile and 2-mile radius of PFNW facility. Additionally, the minority and low income populations in the City of Richland and Washington State are provided in the table for comparison.

Table 20: Minority and Low Income Population within the 1-mile, 2-mile, City of Richland, and WA.

Population	1 mi. radius of PFNW	2 mi. radius of PFNW	City of Richland	Washington State [a]
Total Population	15	3,594	54,249	7,614,893
White	89 %	82 %	83 %	78.5 %
Minority [b]	14 %	24 %	22 %	32.5 %
Hispanic (of any race)	4 %	9 %	11 %	13 %
Black alone	0 %	1 %	2 %	4.4 %
American Indian	0 %	0 %	1 %	1.9 %
Asian alone	9 %	11 %	5 %	9.6 %
Pacific Islander	0 %	0 %	0 %	0.8 %
Other race	0 %	0 %	0 %	4.8 %
Two or more races	0 %	2 %	4 %	4.9 %
Low income population (%)[c]	10 %	10 %	24 %	27 %

Source from EJSCREEN (ACS 2014-2018 and 2010 Census combined)
WA = Washington State
[a] Source: US Census Bureau Quick Facts (2019); estimates are not comparable to other geographic level due to methodology differences that may exist between different data sources.
[b] Minority is defined as all but Non-Hispanic White Alone.
[c] Low income population reflects the percent of population whose household income is less than or equal to twice the federal poverty level (USEPA 2021a).

4.10 Cultural and Historic Resources

A cultural resources review, conducted by Ecology during the siting process for the MWF in 1995, found that "the proposed MWF is not located within an archeological or historic site". Additionally, the review found that "the Site is not located within proposed or existing historic districts" (City of Richland, 1998). The 1998 Final EIS concluded that the potential for disturbance of cultural and archeological resources from the construction and operation of the MWF would be minimal because the soil at the ATG Facility has been previously disturbed by Site activities or agricultural production (City of Richland, 1998).

Consistent with the 1998 Final EIS, the PFNW site is located within the Horn Rapids Industrial Park in North Richland (shown in Figure 16), which "has been envisioned as an employment and economic center in the region" (City of Richland, 2017b). There are no historic sites or archaeological site in the vicinity of PFNW, according to the 2017 City of Richland Comprehensive Plan (City of Richland, 2017a).

Figure 16 shows the map of Horn Rapids Industrial park and Business Center (City of Richland, 2021).

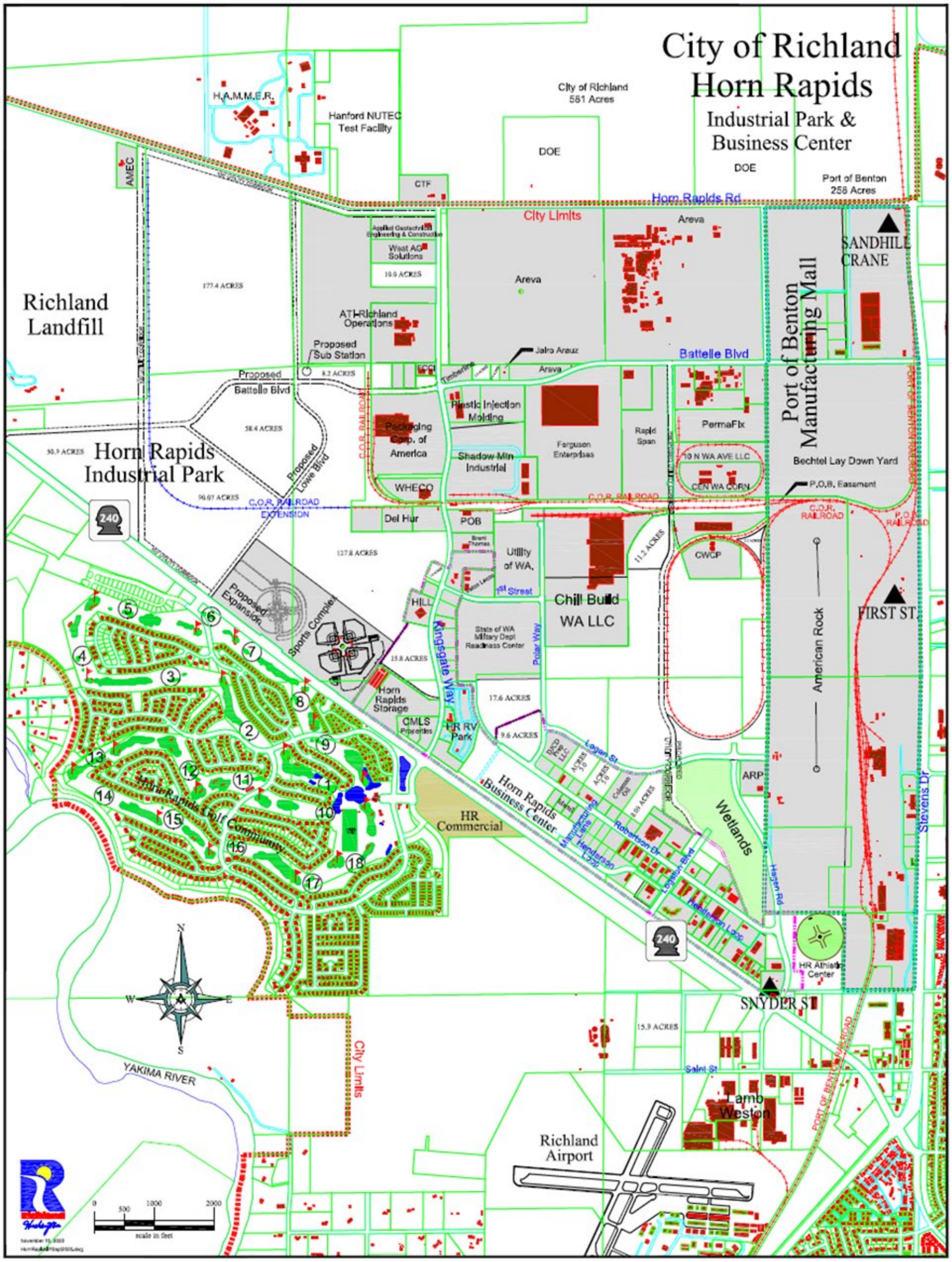

Figure 16: Horn Rapids Industrial park and Business Center
Source: (City of Richland, 2021)

4.10.1 Tribes and Indigenous People

The PFNW is located within 1 mile of the southern boundary of the Hanford Site. There are three federally recognized tribes affected by the Hanford Site and its operations, including the Confederated Tribes and Bands of the Yakama Nation, the Confederated Tribes of the Umatilla Indian Reservation and the Nez Perce Tribe. These Tribal Bands and Nations are contesting USDOE-imposed access restrictions to the Hanford site that impede exercising treaty rights on ceded lands. In addition, the Wanapum People who still live near Hanford at Priest Rapids, are a non-federally recognized tribe who have strong cultural ties to the Hanford site and have consulted with DOE since its formation in the 1940s (USDOE 2021). The southern part of the Hanford facility may be the location of traditional cultural areas for those tribes and indigenous people.

No activities in the alternatives were expected to impact cultural or historic resources. Therefore, Ecology did not offer consultation with area Tribes on this project. However, Ecology does communicate routinely about upcoming permitting changes and public comment opportunities with representatives from the Confederated Tribes and Bands of the Yakama Nation and the Nez Perce Tribe.

Chapter 5 - Impacts and Mitigation Measures

This chapter identifies probable adverse environmental impacts of each alternative for the PFNW DWR Permit Renewal and discusses reasonable mitigation measures that could be implemented to mitigate the impacts to the environment.

Consistent with the previous chapter, this chapter is organized by the elements of the environment to discuss probable adverse environmental impacts of each alternative for the PFNW proposal to renew its DWR Permit. Elements from Natural environment include:

- Earth resources
- Air quality
- Water Resources
- Ecological Resources
- Energy

Elements from Built/Human Environment include:

- Human Health
- Noise
- Land Use
- Transportation
- Environmental Justice
- Cultural and Historical Resources

Due to the uncertainty of how long PFNW will operate the MWF, the impacts are annual based unless otherwise noted. Cumulative and indirect impacts from the continuous MWF operation will include combination of additional impacts from the LLF operation, nearby facilities (e.g. PNNL, Hanford site, Framatome, and Columbia Generating Station), and the duration of operations at the MWF and other facilities. Cumulative impacts are discussed in section 5.13.

Probable adverse environmental impacts for all action and no action alternatives are described in the following sections and summarized in Table 21.

Table 21: Summary of Environmental Impacts

Element	Impact Summary
Earth Resources	*Alternatives 1, 2, and 3;* Minor impact; the continuous MWF operation would not require additional land disturbance and would not change the building design of the existing MWF. *No Action Alternative;* Minor Impact; Impact from the possible soil disturbance (e.g. soil erosion) during the closure activities would be short-term.
Air Quality	*Alternatives 1, 2, and 3;*

Element	Impact Summary
	Each alternative includes potentially increased quantities of waste processed. Air quality impacts are potentially proportional to the quantities processed. Potentially significant impact on the air quality; the emissions of non-radioactive air pollutants can substantially increase beyond the current emissions, which may exceed the SQER for TAPs, violate the ambient air quality standards for criteria air pollutants, and exceed the dose limit of 10 mrem per year for any member of public. The impacts are mitigated in the approval order and radioactive air emissions license, which may require restricted processing rates if monitoring found exceedance of approval order or license limits. Minor impact on the greenhouse gas emission from both emergency generators and waste transportation. *No Action Alternative* Minor Impact on the air quality; Emission during the closure activities would be short-term. Minor impact on the greenhouse gas emission from both emergency generators and waste transportation.
Water Resources	*Alternatives 1, 2, and 3;* Minor impact; the continuous MWF operation would not require additional land disturbance activities and would not likely affect both groundwater and surface water in the vicinity. Water demand is somewhat proportional to the quantities processed; however, the increased demand would be small compared with both overall consumption in the area and the capacity of City of Richland Water Utility. *No Action Alternative* Minor impact; Impact from possible soil disturbance (e.g. soil erosion) during the closure activities would be short-term and would not likely affect both groundwater and surface water in the vicinity.
Ecological Resources	*Alternatives 1, 2, and 3;* Minor impact; the continuous MWF operation would not likely pose impact on any wildlife habitat in the vicinity. *No Action Alternative;* Minor Impact; Impact from possible soil disturbance (e.g. soil erosion) during the closure activities would be short-term and would not likely pose impact on any wildlife habitat in the vicinity.
Energy	*Alternatives 1, 2, and 3;* Minor impact; with potentially increased quantities of waste processed, the continuous MWF operation could increase the electricity demand. Energy demand is somewhat proportional to the quantities processed; however, the increased demand would be still relatively small compared with overall energy supplied in the RES's service area. *No Action Alternative;*

Element	Impact Summary
	Minor impact; Energy demand during the closure activities would be short-term and less than the demand for the current MWF operation.
Human Health: Routine Operation	*Alternatives 1 and 2;* Moderate impact for general public. Potentially significant impact for both involved and noninvolved workers. The alternatives potentially increase quantities of waste processed. Radiation doses are potentially proportional to the quantities processed. The potential impacts are mitigated by the WSDOH license limits including ALARA requirements. If monitoring and dosimetry indicated exceedance of license limits, WSDOH could potentially restrict operating rates *Alternative 3;* Similar to Alternatives 1 and 2. Additionally, GeoMelt® Process Unit, a new thermal treatment unit would have probable adverse impact that would need to be mitigated in the regulatory process of a thermal risk assessment. *No Action Alternative;* Minor Impact for involved, noninvolved workers, and general public; Impact would be limited to the closure activities.
Human Health: Accident	*Alternatives 1 and 2;* Significant impact from a fire and HEPA failure; uncontrolled release of both radioactive and non-radioactive air pollutants can violate the ambient air quality standards for criteria air pollutants and/or exceed the dose limit of 10 mrem per year for any member of public if not mitigated. PFNW had two fires in 2019 and needed to complete a causal analysis and operating changes to reduce the likelihood of future fires. The impact would need to be mitigated in the permit conditions and internal procedures. Minor impact from a spill/release accident; No LCF is expected among workers and general public. *Alternative 3;* Significant impact from a fire and HEPA failure, similar to Alternatives 1 and 2. Additionally, GeoMelt® Process Unit, a new thermal treatment unit would have probable adverse impact that would need to be mitigated in the regulatory process of a thermal risk assessment. Minor impact from a spill/release accident; No LCF is expected among workers and general public. *No Action Alternative;* Minor impact from a spill/release accident; No LCF is expected among workers and general public.
Land Use	*Alternatives 1, 2, and 3;* No additional impact. *No Action Alternative;* Minor impact.

Element	Impact Summary
Transportation: Routine Transportation	*Alternative 1;* Minor impact on the traffic volume in the vicinity by trucks and employees commuting. Minor impact on worker dose; No LCF is expected among workers from the routine waste transportation. Emission of greenhouse gas and other air pollutants are negligible from waste transportation. *Alternative 2;* Minor impact on the traffic volume in the vicinity by trucks and employees commuting. Minor impact on worker dose; No LCF is expected among workers from the routine waste transportation. *Alternative 3;* Minor impact on the traffic volume in the vicinity by trucks and employees commuting. Minor impact on worker dose; No LCF is expected among workers from the routine waste transportation. *No Action Alternative;* No adverse impact on the traffic volume in the vicinity by trucks and employees commuting. Negligible Impact on worker dose; Waste transportation limited to waste inventories during the closure activities.
Transportation: Accident	*Alternatives 1, 2, and 3;* Minor impact; the probability that a crash would occur from waste transportation is very low. There is no traffic fatality expected among the workers and public from a severe transportation accident by trucks. Likewise, no LCF is expected among the public from a severe transportation accident by trucks. *No Action Alternative;* Negligible Impact; Waste transportation limited to waste inventories during the closure activities.
Environmental Justice	*Alternatives 1, 2, and 3;* Negligible impact on low-income or minority populations. There is no indication of populations who may have particular barriers to engagement or access to information. *No Action Alternative;* No additional impacts.
Cultural and Historic Resources	*Alternatives 1, 2, and 3;* No additional impacts. *No Action Alternative;* No additional impacts.

5.1 Mitigation Common to All Action Alternatives

Mitigation includes avoidance, minimization, rectification, compensation, reduction, or elimination of adverse impacts to built/human and natural elements of the environment (WAC 197-11-768). The purpose of identifying mitigation measures is to avoid and minimize environmental impacts associated with the PFNW DWR Permit Renewal. The following requirements are applied to all action and no action alternatives.

- Have all applicable federal, state, and local permits and licenses updated.
- Compliance with a DWR Permit and other applicable local, state, and federal requirements (e.g. WSDOH, BCAA, USDOT, USEPA, and USNRC) associated with the MWF operation. For example:
  - Per WAC 246-221-005 (2), WSDOH license requires PFNW to "use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses to members of the public that are as low as is reasonably achievable (ALARA)".
  - Per WAC 246-221-005 (4), WSDOH license requires PFNW to constrain the total effective dose equivalent to the maximally exposed individual (MEI) member of the public to 10 mrem per year from air emission (PFNW 2019a).
  - WSDOH license requires continuous sampling of soil, and groundwater, and air emission, ambient air for radionuclides.
  - Per 40 CFR Part 262.84, USEPA requires PFNW (or the foreign exporter) to provide a notification to USEPA for its intent to import mixed waste at least 60 days before the first shipment is expected.
- An owner-controlled boundary established around the MWF in addition to all four sides of the PFNW site surrounded by fence. These boundaries are set to limit the public from accessing the facility and protect them from potential direct exposure to the ionizing radiation.

Based on the impact analyses of the current and foreseeable operation at the MWF in this SEIS, the following are the proposed mitigation measures that would apply to all action alternatives.

- One integrated/combined contingency plan to be compliant with both Ecology and WSDOH requirements are suggested to minimize the impacts from potential accidents.
- PFNW had two fires in 2019 and needed to complete a causal analysis and operating changes to reduce the likelihood of future fires. Both the causal analysis and operating changes should be reviewed by Ecology to mitigate the impact through the permit conditions and internal procedures.

5.2 Earth Resources

No adverse impacts in earth resources are found under all action and no action alternatives as discussed in the following sections.

5.2.1 Geology and Soil

PFNW periodically collects surface soil samples to analyze for radionuclides in compliance with the WSDOH license. According to the PFNW's Annual Environmental Monitoring Report for 2018 (PFNW 2019a), PFNW collected soil samples quarterly from 17 locations and annually from 7 locations throughout the PFNW site and analyzed for gross alpha, gross beta and gamma-emitting radionuclides using gamma spectroscopy. Soil disturbance from these routine sampling activities and occasional remediation activities as necessary is minimal considering the benefits from these activities for human health and the environment.

The continuous MWF operation under any action alternatives would not require additional land disturbance activities and would not likely affect current land use in the PFNW site. Therefore, impact on the geology and soil from the MWF operation under all action alternatives would be minor. Termination of the MWF operation under No Action Alternative would likely require a soil disturbance due to the closure activities of the MWF; however, the impact would be a short-term and therefore minor. PFNW would continue the routine soil sampling under its existing WSDOH license at the LLF.

5.2.2 Topography

The DWR Permit Renewal under any action alternatives would not affect the current topography. Under no action alternative, impacts from the possible soil disturbance (e.g. soil erosion) during the closure activities would be short-term and would not affect the current topography. therefore, the impact on this element would be negligible under all action and no action alternatives.

5.2.3 Seismicity

The frequency of an earthquake with magnitude 4 to 4.9 and 5 to 5.9 are assumed to be 0.002 and 0.0004 per year, respectively, as discussed in section 4.1.

The entire MWF facility is built with steel frame, metal side, and a reinforced concrete substructure. The continuous MWF operation under any action alternatives would not change the building design of the existing MWF that could affect its ability to withstand during such seismic events.

Impacts of seismically induced accident is discussed in the section 5.7.2.

5.3 Air Quality

PFNW periodically monitors air emissions from these stacks for both non-radioactive and/or radioactive air pollutants in compliance with BCAA and WSDOH requirements.

5.3.1 Non-Radioactive Air Pollutants

Emissions of both criteria air pollutants and HAPs/TAPs are covered by the existing BCAA approval orders. PFNW is classified as a Class 2 Toxic Sources by BCAA (Geosyntec Consultants, Inc. 2018). Class 2 Toxic Sources are sources whose actual emissions are greater than those by Class 1 Toxic Source, but less than 10 tons per year of any single TAP (listed in WAC 173-460-

150) or less than 25 tons per year of a combination of TAPs. For comparison, Class 1 Toxic Source facility has actual emissions less than 1.0 ton per year of a single TAP or 2.5 tons per year of a combination of TAPs (BCAA 2017).

BCAA determined that the emissions of criteria air pollutants from the current MWF operation would not cause or contribute to a violation of both the federal NAAQS and state ambient air quality standards (BCAA 2008). BCAA Regulation requires PFNW to "take reasonable precautions to prevent the release of air contaminants from the operation" (BCAA Regulation 1 Section 4.02 (B) adopted from WAC 173-400-040(4)(a)). The current mitigation to control emissions of air pollutants including fugitive emissions of PMs from the MWF operation is primarily through HEPA filtration. The air from the MWF operation (both MWNT and MWT areas) passes through a building ventilation system with a filter bank, consisting of a pre-filter, HEPA filter, and carbon adsorption filter stages, and released through the individual stacks (MWT facility stack and MWNT facility stack) (PFNW 2018a). Per vender specifications, the HEPA filter banks used at the facility controls 99.97% of PMs. The activated carbon filter controls 95% of volatile and semi-volatile compound emissions (Geosyntec Consultants, Inc. 2018).

In addition to the building ventilation system, the MWNT area employs the process off-gas HEPA filter systems (process ventilation system) prior to being mixed with building ventilation system. Air pollutants generated through various waste treatment activities are confined, collected, and treated in the process ventilation system. The air pollutants that are left untreated in the process ventilation system would be confined, collected, and treated in the building ventilation system before being released to the environment.

The air from the LLF operation also passes through HEPA filters prior to being monitored and released through their three individual stacks. PFNW is currently required to continuously monitor emissions of combustion by-product gases through a thermal stack from the LLF: hydrogen chloride (HCl, TAP), SO_2 (criteria air pollutant), NOx (including NO_2, criteria air pollutant), and CO (criteria air pollutant).

BCAA determined that the emissions of TAPs from the current MWF operation is below the small quantity emission rate (SQER) listed in WAC 173-460-150 at the time of applicability. In other words, PFNW demonstrated that TAP emissions from the MWF operation are sufficiently low to protect human health and safety from potential carcinogenic and/or other toxic effects as required in WAC 173-460-070. Therefore, emissions monitoring for TAPs from the MWF operation are not currently required. However, WAC 173-460-080 requires PFNW to submit to BCAA a new notice of construction which includes a first tier review if PFNW decides to add new or modified TAP source in the MWF operation and if any of the TAP emissions would be greater than the de minimis emission level specified in WAC 173-460-150.

Air quality impacts are potentially proportional to the quantities processed. The MWF processed 267 metric tons of waste per year on average from 2014 to 2018, as shown in Table 8 in Section 2.7. This quantity is less than 0.19 percent of 140,267 metric tons of the annual waste treatment capacity for the current MWF operation.

Under Alternative 1, there would be no additional waste treatment units or processes to the existing MWF operation. The annual waste treatment capacity would stay the same from the current 140,267 metric tons (0 percent increase). Considering that the actual quantity of waste (267 metric tons) currently processed at the MWF is much less than this waste treatment capacity under the current DWR Permit, the quantity of waste being processed at the MWF could substantially increase beyond the current quantity. In addition to the possible increase in the quantity of waste processed in the MWF, there might be a new waste stream of waste PFNW may propose to accept for processing in the MWF. The emissions of non-radioactive air pollutants can substantially increase beyond the current emissions, which may exceed the SQER for TAPs, and/or violate the ambient air quality standards for criteria air pollutants. Therefore, under Alternative 1, impact from emission of non-radioactive air pollutants would be potentially significant. Impacts would be mitigated through the notice or construction review process (WAC 173-400-110 and WAC 173-460-080) and in the BCAA approval orders, which may require restricted processing rates if monitoring found exceedance of approval order.

Under Alternative 2, PFNW will add new waste treatment units and processes to the existing MWF operation. The annual waste treatment capacity would increase from the current 140,267 metric tons to 240,984 metric tons (71.8 percent increase). The MWF operation has a substantial increase in the treatment capacity from the new waste treatment units and processes, possible increase in the quantity of waste processed in the MWF, and possible addition of a new waste stream such as DFLAW secondary waste. The emissions of non-radioactive air pollutants can substantially increase beyond the current emissions, which may exceed the SQER for TAPs, and/or violate the ambient air quality standards for criteria air pollutants. Therefore, under Alternative 2, impact from emission of non-radioactive air pollutants would be potentially significant. Impacts would be mitigated through the notice or construction review process (WAC 173-400-110 and WAC 173-460-080) and in the BCAA approval orders, which may require restricted processing rates if monitoring found exceedance of approval order.

Under Alternative 3, PFNW will add GeoMelt® Process Unit in addition to the new waste treatment units and processes to the existing MWF operation. The annual waste treatment capacity would increase from the current 140, 267 metric tons to 241,011 metric tons (71.8 percent increase). The MWF operation has a substantial increase in the treatment capacity from new waste treatment unit(s) and processes, possible increase in the quantity of waste processed in the MWF, and possible addition of a new waste streams such as DFLAW secondary waste and reactive waste. The emissions of non-radioactive air pollutants can substantially increase beyond the current emissions, which may exceed the SQER for TAPs, and/or violate the ambient air quality standards for criteria air pollutants. Furthermore, there would be probable adverse impact from GeoMelt Process Unit, a new thermal treatment unit. In the routine Geomelt® treatment, waste (reactive metal) would not be combusted, and the gases from the melter would be drawn through an air pollution control system (off gas system). Ecology will need to assess both the design and safety of GeoMelt® Process Unit and off gas system once PFNW submits a thermal risk assessment followed by demonstration tests and other requirements in WAC 173-303 to establish any necessary mitigations. Therefore, under

Alternative 3, impacts from emission of non-radioactive air pollutants would be potentially significant. Impacts would be mitigated through the notice of construction review process (WAC 173-400-110 and WAC 173-460-080), in the BCAA approval orders, which may require restricted processing rates if monitoring found exceedance of approval order, and the thermal risk assessment review process.

Under No Action Alternative, there would possibly be temporary emissions through closure activities; however, the emissions would be smaller than the emissions from the current MWF operation as long as those activities are done in compliance with the closure plan in accordance with the current DWR Permit, Attachment HH Closure and Financial Assurance, rev. 4 (Ecology 2012). During the closure activities, waste treatment would be continued only for the in-process waste inventories before packaged and transported offsite. Waste inventories for which waste treatment had not initiated would be returned to the generators. Therefore, impact from emission of non-radioactive air pollutants would be minor under No Action Alternative.

Another source for emissions of non-radioactive air pollutants includes two diesel-powered emergency back-up generators which PFNW has onsite and are permitted by BCAA currently for both the MWF and LLF operations. Diesel combustion creates criteria air pollutants such as PM, VOCs, NOx, CO, SO_2, as well as TAPs, such as particulate diesel engine exhaust, benzene, toluene, and xylene. BCAA determined the emissions of TAPs from these generators to be below the small quantity emission rate (SQER) listed in WAC 173-460-150 at the time of applicability, and they would not cause a violation of National or State ambient air quality standards.

Additionally, fossil fuel (gasoline and diesel) combustion through transportation (both waste transportation and employee commuting) causes emission of diesel engine exhaust particulate matter as well as criteria air pollutants such as PM, VOCs, NOx, CO, SO_2, and O_3. Impacts of the non-radioactive pollutants related to transportation are further discussed in section 5.9.4.2.

5.3.2 Radioactive Air Pollutants

Under all action and no action alternatives, radionuclide emission associated with the MWF operation in addition to the LLF operation would be regulated under the WSDOH license to be compliant with both federal and state dose limit of 10 mrem per year for any member of public as required in WAC 173-480 and WAC 246-247. Also included in WAC 173-480 are the following standards in addition to the dose limit to the public:

1. ALARA (as low as reasonably achievable) means as low as reasonably achievable making every reasonable effort to maintain exposures to radiation as far below the dose standards as is practical, consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to the state of technology, the economics of improvements in relation to benefits to the public health and safety, and other socioeconomic considerations, and in relation to the utilization of nuclear energy, ionizing radiation, and radioactive materials in the public interest.

2. ALARACT (as low as reasonably achievable control technology) means the use of radionuclide emission control technology that achieves emission levels that are consistent with the philosophy of ALARA.
3. BARCT (best available radionuclide control technology) means technology which will result in a radionuclide emission limitation based on the maximum degree of reduction for radionuclides which would be emitted from any proposed new or modified emission units which the permitting authority on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such emission unit or modification through application of production processes or available methods, systems, and techniques. In no event shall application of best available radionuclide technology result in emissions of radionuclides which would exceed the ambient annual standard limitation specified in this chapter (WAC 173-480-030).

Under Alternative 1 and 2, the emissions of radioactive air pollutants can substantially increase beyond the current emissions if the quantity of waste being processed at the MWF increases from the current quantity. The emission from the MWF operation could result in exceeding the federal and state dose limit of 10 mrem per year for any member of public. Therefore, impact from emission of radioactive air pollutants under these alternatives would be potentially significant. The impact would be mitigated in the radioactive air emissions license, which would result in restricted processing rates if monitoring found exceedance of license limits.

Under Alternative 3, the emissions of radioactive air pollutants can substantially increase beyond the current emissions if the quantity of waste being processed at the MWF increases from the current quantity. In addition to the probable increase in the quantity of waste being processed under this alternative, there would be probable adverse impact from GeoMelt® Process Unit, a new thermal treatment unit. Ecology will need to assess both the design and safety of GeoMelt® Process Unit and off gas system once PFNW submits a thermal risk assessment followed by demonstration tests and other requirements in WAC 173-303 to establish any necessary mitigations. Therefore, impact from emission of radioactive air pollutants under this alternative would be potentially significant. The impact would be mitigated in the radioactive air emissions license, which would result in restricted processing rates if monitoring found exceedance of license limits.

Under No Action Alternative, there would possibly be temporary emissions through closure activities; however, the emissions would be smaller than the current emissions from the MWF operation as long as those activities are done in compliance with the closure plan in accordance with the current DWR Permit, Attachment HH Closure and Financial Assurance, rev. 4 (Ecology 2012) and WSDOH license. During the closure activities, waste treatment would be continued only for the in-process waste inventories before packaged and transported offsite. Waste inventories for which waste treatment had not initiated would be returned to the generators. Therefore, impact from emission of radioactive air pollutants under this alternative would be minor.

5.3.3 Greenhouse Gas Emissions

The primary source of energy for the MWF operation is electricity through RES that come from over 97 percent hydropower and nuclear power. Besides electricity used in the routine operation at the MWF, PFNW occasionally uses two diesel-powered emergency back-up generators for maintenance, testing, and emergency purposes in accordance with BCAA approval order. One of the two backup generators has an engine of 609 horsepower, and the other has an engine of 1,850 horsepower's (BCAA 2008). Ecology assumes that PFNW continues operating these back-up generators under all action and no action alternatives.

Based on the conservative assumption that PFNW operates these emergency back-up generators for 500 hours in one year, Ecology estimates these generators to emit 646 metric tons of CO_2 per year. Starting in 2012, Washington State requires facilities that emit at least 10,000 metric tons of carbon pollution annually to report their greenhouse gas emissions (Ecology 2020c). The estimated annual greenhouse gas emission from these generators is well below the 10,000 metric tons of carbon pollution for which PFNW would be required to report the emissions to Ecology. Furthermore, this estimate is very conservative considering that generally emergency back-up generators engines are operated 0.5-2 hours per month for maintenance/testing, and it is an unlikely situation that PFNW would need to operate these generators for 500 hours in one year. Therefore, the impact of the greenhouse gas emission from operating these generators would be minor under all action and no action alternatives.

Greenhouse gas emissions from transportation sources are discussed in the section 5.9.4.1.

5.4 Water Resources

5.4.1 Surface Water

There are no naturally occurring surface water bodies or wetlands in the vicinity of the PFNW site.

The MWF has a secondary containment system with the entire floor constructed of concrete within the building. RLA and TLA are also designed and constructed to capture and contain any spills or leaks while railcars or trucks are loaded or unloaded as required in WAC 173-303. There are no drain valves, floor drains, sewer lines, or other openings that will allow liquids to flow from the curbed areas within the MWF, TLA, and RLA. Chemical-resistant water-stops made of polyvinyl chloride or rubber were applied for all construction joints that were sealed with a heat-resistant silicone sealant. Furthermore, the area around the building is graded to promote drainage away from the building to minimize the risk of precipitation and any run-on/run-off mixed with the process water.

The continuous MWF operation under any action alternatives would only pose a minor impact on the surface water in the vicinity. Termination of the MWF operation under the No Action Alternative would likely require a soil disturbance due to the closure activities of the MWF; however, such an impact would be short-term, and therefore minor where there is no surface water in the vicinity. Therefore, this element is not discussed further for impact analyses.

5.4.2 Groundwater

As required by WSDOH, PFNW takes groundwater samples semiannually for gross alpha, gross beta, gamma-emitting radionuclides by gamma spectroscopy, and tritium from three well locations in the PFNW site. According to the Annual Environmental Monitoring Report for 2018, the sampling results from 2018 were below the Washington State drinking water standards (PFNW 2019a).

The other type of wells PFNW has on its property is only for monitoring stormwater runoff. With the secondary containment system in the MWF and LLF in the PFNW site and the periodic groundwater sampling and reporting requirement by WSDOH, impact to the groundwater are not further analyzed in this SEIS.

The continuous MWF operation under any action alternatives would not require additional land disturbance activities and would not affect groundwater, therefore the impact on the groundwater from all action alternatives would be minor. Termination of the MWF operation under No Action Alternative would likely require a soil disturbance due to the closure activities of the MWF; however, such impact would be short-term, and therefore minor to the groundwater. Therefore, this element is not discussed further for impact analyses.

5.4.3 Water Demand

PFNW is serviced for potable water by the City of Richland Water Utility. The current sources of water supply system in Richland include North Richland Wellfield, Wellsian Way Wells, and the City's Columbia River Surface Water Treatment Plant. In 2015, approximately 5,300 million gallons of water was consumed by the population of 54,466 within the existing 46.6 square miles water service area (City of Richland 2017c). According to City pf Richland Comprehensive Water System Plan, the combined capacity of the existing sources are sufficient to meet both current and foreseeable future demands in its service area (City of Richland 2017c).

Currently, water is used in the MWF operation as a reagent during stabilization in Low-Capacity Mixer and In-Container Mixer. Additionally, water is used to make decontamination solution to decontaminate equipment (such as pump, pump hoses, and accessories) and tanker truck upon a request by its client. Following the decontamination activities, the water used for decontamination would be analyzed for waste characterization before treated as a waste or secondary waste as required under the current DWR Permit. Any water use associated with the MWF operation would not go to the drain for the city sewer line. PFNW estimates that approximately 800 gallons of water as a reagent and 100 gallons of water as a decontamination solution were used annually in both 2018 and 2019 (R. Huckfeldt, personal communication, March 24, 2020).

The continuous MWF operation under all action alternatives would require water as a reagent during stabilization and/or solidification in In-Container Mixer, Low-Capacity Mixer, and Bench Scale Treatment (under Alternative 2 and 3) in addition to a decontamination solution. Water demand is somewhat proportional to the waste quantities processed. The MWF processed 267 metric tons of waste per year on average from 2014 to 2018. This quantity is less than 0.19

percent of 140,267 metric tons of the annual waste treatment capacity for the current MWF operation. The continuous MWF operation could substantially increase the water demand if the quantity of waste being processed at the MWF increases under any action alternatives; however, the probable increased demand would be small compared with both overall consumption in the area and the capacity of City of Richland Water Utility. Therefore, the water demand in the continuous MWF operation under all action alternatives would have minor impact to the water supply system in the area. Termination of the MWF operation under No Action Alternative would possibly require additional water use for decontamination during the closure activities of the facility; however, it would be a short-term demand. The water demand from such activities would not exceed the demand from the current MWF operation. Therefore, the impact from No Action Alternative would be minor.

5.5 Ecological Resources

The information about the vicinity area of the PFNW site as a wildlife habitat has been unchanged with the current MWF operation at the time of this draft SEIS. The continuous MWF operation under any action alternatives would not likely require additional land disturbance activities, therefore the impact on the existing ecological resources would be minor under all action alternatives. Termination of the MWF operation under No Action Alternative would likely require a soil disturbance due to the closure activities of the facility; however, such impact would be short-term, and therefore minor to any wildlife habitats. Therefore, this element is not discussed further for impact analyses.

5.6 Energy

Electricity is the primary source of energy for both the MWF and LLF operations. The continuous MWF operation under any action alternatives would not require new sources of energy for waste treatment.

Table 22: Electricity Consumption for the MWF and LLF Operations (2015-2019)

Year	The MWF Operation (kWh)	The LLF Operation (kWh)	Total PFNW Operation (kWh)
2019	4,005,900	2,689,500	6,695,400
2018	3,840,080	2,782,020	6,622,100
2017	4,081,100	2,305,080	6,386,180
2016	3,876,760	2,449,400	6,326,160
2015	3,719,340	2,592,280	6,311,620
Average (2015 – 2019)	3,904,636	2,563,656	6,468,292

kWh = kilowatt-hour
LLF = low level facility
MWF = mixed waste facility
PFNW = Perma-Fix Northwest, Inc.
Source: (R. Huckfeldt, personal communication, February 13, 2020)

Among the total energy use of 932.2 gigawatt-hour (932,200,000 kWh) supplied by RES to its service area in 2018, 14 percent, or 136 gigawatt-hour (136,000,000 kWh), was supplied to industrial sector in Richland (City of Richland 2020a). In 2018, the MWF operation used 3,840,080 kilowatt-hours (kWh), which is 2.8 percent of energy supplied to all industries and 0.41 percent of entire energy supplied in the RES's service area in that year.

Energy demand is somewhat proportional to the waste quantities processed. The continuous MWF operation could substantially increase the electricity demand if the quantity of waste being processed at the MWF increases under any action alternatives; however, the increased demand would be still relatively small compared with overall energy supplied in the RES's service area.

The GeoMelt® Process Unit, the new thermal treatment unit at the MWF under Alternative 3, would contribute to a relatively higher amount of electricity for short periods of time. Although the electricity demand in the GeoMelt® treatment fluctuates with the volume of the waste being treated, a full melt peak would typically require 245 kWh of electricity over a period of 31 hours, totaling 7,500 kWh in a melt peak and 9,400 kWh in a full melt (R. Huckfeldt, personal communication, February 12, 2020). With a conservative assumption that there would be one melt every week (totaling 52 melts in one year), the annual electricity demand for the GeoMelt® treatment would be approximately 488,800 kWh. The GeoMelt® treatment would add additional electricity demand by 12.5% to the current MWF operation and 7.6 % to the entire

PFNW operation (both the MWF and LLF operations). The GeoMelt® treatment would contribute less than 0.36 percent of the energy used by the entire industry sector and 0.05 percent of the entire energy currently supplied in the RES's service area. Therefore, the impact from the GeoMelt® treatment under Alternative 3 would be minor to the electricity supply system in the area.

Therefore, the continuous MWF operation under all action alternatives would have minor impact to the electricity supply system in the area. Termination of the MWF operation under No Action Alternative would possibly require other sources of energy (e.g. diesel) during the closure activities of the facility; however, it would be a short-term demand. The energy demand from such activities would not exceed the demand from the current MWF operation. Therefore, the impact from No Action Alternative would be minor.

Termination of the MWF operation under No Action Alternative would require only a temporary energy use including electricity, gasoline, and diesel (both freight and heavy diesel equipment). Therefore, this element is not discussed further for impact analyses.

5.7 Human Health

This section discusses the impact on human health from the MWF operation. Transportation related impacts to human health are discussed in section 5.9.

5.7.1 Routine Operation

5.7.1.1 Involved Worker

PFNW anticipates the number of employees in the PFNW site to grow from the current number of 70 up to 100 in the foreseeable future operations. Out of all the employees in the PFNW site, 90 percent of them are directly involved in waste treatment for both the MWF operation and LLF operations. Therefore, the number of involved workers (who would be directly involved in waste treatment) are conservatively estimated to be 90 for all action alternatives.

The administrative control limit of 1.5 rem (1,500 mrem) per year was assumed for maximum exposed individual (MEI) among involved workers for the entire PFNW operation (both the MWF and LLF operations) (B. Wiegman, personal communication, Jan 3, 2020).

Between 2014 and 2018, the average radiation dose among involved workers was 61.2 mrem per year from processing a total of 1,619 metric tons (267 metric tons of waste in the MWF and 1,352 metric tons of waste in the LLF), as shown in Table 19, Section 4.6. Assuming that the radiation dose is potentially proportional to the quantities of waste processed, most of radiation dose would come from LLF operation.

Based on the information about the treatment units and processes under the current DWR Permit, Attachment BB Part A Form, rev. 4 (Ecology and USEPA 2020), the annual waste treatment capacity for the current MWF operation is 140,267 metric tons, which is much higher than the average of 267 metric tons of waste currently processed at the MWF. Likewise, the annual waste treatment capacities under all action alternatives would be substantially higher than 267 metric tons of waste currently processed at the MWF.

Table 23 presents possible change in the quantity of waste to be processed under each alternative relative to the current annual waste treatment capacities for the MWF operation and the actual quantity of waste currently processed at the MWF.

Table 23: Possible Change in Waste Quantity under each Alternative

Alternatives	Annual Waste Treatment Capacities (metric tons)	Increase in Treatment Capacities from the Current MWF Operation[a] (%)	Maximum Percent Change in the Waste Quantity from the Current PFNW Operation[b] (%)
Alternative 1	140,267	0 %	8,747 %
Alternative 2	240,984	71.8 %	14,968 %
Alternative 3[c]	241,011	71.8 %	14,970 %
No Action Alternative	0	--	83.5 %

% = percent
MWF = mixed waste facility
PFNW = Perma-Fix Northwest, Inc.
[a] The change is calculated by the annual waste treatment capacity divided by the annual treatment capacity under the current MWF operation (140,267 metric tons).
[b] The 2014-2018 average annual quantity of waste being processed in the PFNW site (MWF and LLF), 1,619 metric tons, is assumed to be the current annual quantity of waste processed in the PFNW site. Assuming that there would be no change in the quantity of waste processed in the LLF, the maximum percent change is calculated by dividing the sum of the annual waste treatment capacity and the average annual quantity of waste processed in the LLF (1,352 metric tons) by the current quantity of waste processed in the PFNW site (1,619 metric tons).

The average radiation dose from 2014 to 2018, 61.2 mrem per year to an involved worker, is assumed to be the estimated annual dose for the current MWF and LLF operations.

Currently, average involved worker would receive a radiation dose of 61.2 mrem per year, which equates to 0.24 mrem a day (assuming 260 days of work per year) and 0.029 mrem per hour (assuming 2,080 hours of work per year).

Radiation doses are potentially proportional to the quantities of waste processed. Assuming that the average dose to an involved worker would increase as the quantity of waste being processed at the MWF increases, annual worker dose for each alternative was conservatively estimated based on the maximum percent change in waste quantity from the current operation.

Under Alternative 1, the MWF operation could result in an average involved worker dose of up to 5,353 mrem (5.353 rem) and a total worker dose of 481 person-rem. The annual estimated LCF associated with this level of radiation exposure is 0.0032 for an average involved worker and 0.29 among the involved worker population. The average annual dose to an involved worker could increase substantially beyond the current dose of 61.2 mrem from the current MWF and LLF operations and the current administrative control limit of 1.5 rem (1,500 mrem) per year. Therefore, impact on the health among involved workers would be potentially significant. The potential impact would be mitigated by the WSDOH license limits including ALARA requirements. If monitoring and dosimetry indicated exceedance of license limits, WSDOH could potentially restrict operating rates.

Under Alternative 2, the MWF operation could result in an average involved worker dose of up to 9161 mrem (9.161 rem) and a total worker dose of 824 person-rem. The annual estimated LCF associated with this level of radiation exposure is 0.0055 for an average involved worker and 0.49 among the involved worker population. Considering the DFLAW starting in 2025, PFNW may resolve the possible increase in the average involved worker dose and its associated LCF by hiring more workers to spread the dose. Nevertheless, the average annual dose to an involved worker could increase substantially beyond the current dose of 61.2 mrem from the current MWF and LLF operations, the current administrative control limit of 1.5 rem (1,500 mrem) per year, and the USNRC's dose limit of 5 rem (5,000 mrem) per year. Therefore, impact on the health among involved workers would be potentially significant. The potential impact would be mitigated by the WSDOH license limits including ALARA requirements.

Under Alternative 3, the MWF operation could result in an average involved worker dose of up to 9,162 mrem (9.162 rem) and a total worker dose of 825 person-rem. The annual estimated LCF associated with this level of radiation exposure is 0.0055 for an average involved worker and 0.49 among the involved worker population. Considering the DFLAW starting in 2025 and processing of GeoMelt® Process Unit, PFNW may resolve the possible increase in the average involved worker dose and its associated LCF by hiring more workers to spread the dose. Nevertheless, the average annual dose to an involved worker could increase substantially beyond the current dose of 61.2 mrem from the current MWF and LLF operations and the USNRC's dose limit of 5 rem (5,000 mrem) per year. In addition to the probable increase in the quantity of waste being processed under this alternative, there would be probable adverse impact from GeoMelt® Process Unit, a new thermal treatment unit without necessary mitigation, such as regulatory process of a thermal risk assessment required in WAC 173-303. Therefore, impact on the health among involved workers would be potentially significant. The potential impact would need to be mitigated in the regulatory process of a thermal risk assessment and WSDOH license limits including ALARA requirements.

Under No Action Alternative, the potential impact to the involved workers in the MWF are limited to the closure activities, in accordance with the closure plan described in the current DWR Permit, Attachment HH Closure and Financial Assurance, rev. 4 (Ecology 2012). The number of involved workers is estimated to be 63. The administrative control limit of 1.5 rem per year would be placed under No Action Alternative. It is not expected that the average dose to the involved workers from such activities would increase beyond the current dose of 61.2 mrem from the current MWF and LLF operations. Therefore, impact on the health among involved workers would be minor under No Action Alternative.

Table 24 presents the LCF risk associated with these worker doses under each alternative.

Table 24: Estimated Annual Rad Risk among Involved Workers from the Routine MWF and LLF Operations

Alternatives	Receptor	Annual Radiation Dose	LCF Risk [a]
Current MWF Operation	Average Involved Worker	61.2 mrem	0.000037
Current MWF Operation	Involved Worker Population[b]	3.86 person-rem	0.0023
Alternative 1	Involved Worker	5,353 mrem	0.0032
Alternative 1	Involved Worker Population[b]	482 person-rem	0.29
Alternative 2	Involved Worker	9,161 mrem	0.0055
Alternative 2	Involved Worker Population[b]	825 person-rem	0.49
Alternative 3	Involved Worker	9,162 mrem	0.0055
Alternative 3	Involved Worker Population[b]	825 person-rem	0.49
No Action Alternative	Involved Worker	61.2 mrem	0.000037
No Action Alternative	Involved Worker Population[b]	3.86 person-rem	0.0023
All Alternatives	MEI Control Limit	1.5 rem	0.00090

LCF = Latent Cancer Fatality
LLF = low level facility
MEI = maximum exposed individual
mrem = millirem; 1 rem = 1,000 mrem
MWF = mixed waste facility
[a] LCF calculated by multiplying the total worker dose by 0.0006 (using a risk estimator of 600 LCF per 1 million person-rem).
[b] Average involved worker population dose among involved workers were based on the annual dose to an involved worker and the number of workers.

5.7.1.2 Noninvolved Worker

Approximately 10 percent of all the employees in the PFNW site are categorized as noninvolved workers, who are not directly involved in waste treatment for both the MWF and LLF operations. Therefore, there would be 10 noninvolved workers under all action alternatives. Under No Action Alternative, there would be 7 noninvolved workers, who would not be directly involved in closure activities, either. Noninvolved workers are assumed to receive much lower radiation dose and subsequently lower LCF risk than involved workers under all action and no action alternatives.

Under Alternative 1 and 2, the radiation dose to noninvolved worker would likely increase if the quantity of waste being processed increases beyond the current quantity. Therefore, human health related impact to noninvolved workers would be potentially significant, and the potential impact would be mitigated by the WSDOH license limits including ALARA requirements.

Under Alternative 3, the radiation dose to noninvolved worker would likely increase if the quantity of waste being processed increases beyond the current quantity. Additionally, there would be probable adverse impact from GeoMelt® Process Unit, a new thermal treatment unit. Impact from GeoMelt® treatment would need to be mitigated in the regulatory process of a thermal risk assessment required in WAC 173-303. Therefore, human health related impact to noninvolved workers would be potentially significant. The potential impact would need to be mitigated in the regulatory process of a thermal risk assessment and WSDOH license limits including ALARA requirements.

Under No Action Alternative, the potential impact to the noninvolved workers are limited to the closure activities of the MWF, in accordance with the closure plan described in the current DWR Permit Attachment HH Closure and Financial Assurance, rev. 4 (Ecology 2012). During the closure activities, waste treatment would be continued only for the in-process waste inventories before being packaged and transported offsite. Waste inventories for which waste treatment hadn't initiated would be returned to the generators. It is not expected that the radiation dose to noninvolved worker from such activities would increase beyond the existing risk from the current MWF operation. Therefore, human health related impact to noninvolved workers would be minor.

5.7.1.3 General Public

Based on U.S. Census population data of 2012, the population within an 80-km (50-mi) radius of the PNNL Site, approximately 1.0 km (0.6 mile) east to the MWF, was estimated to be approximately 466,000 (USDOE 2013). Under all action and no action alternatives, a cancer risk to any general public from the radionuclide emission from the PFNW site should be no more than 6.0×10^{-6} per year with the federal and state dose limit of 10 mrem per year for any member of public as discussed in section 5.3.2.

Under Alternative 1 and 2, the emission of radioactive air pollutants can substantially increase beyond the current emissions if the quantity of waste being processed at the MWF increases from the current quantity. However, considering that the dose to the MEI general public from the current radionuclide emission from the MWF operation is estimated to be 8.08×10^{-3} (0.00808) mrem, the increased emissions under these alternatives would not likely cause a radiation dose to exceed the federal and state dose limit of 10 mrem per year for any member of public. Therefore, human health related impact to general public would be moderate, and the potential impact would be mitigated by the WSDOH license limits including ALARA requirements.

Under Alternative 3, the radiation dose to general public would likely increase if the quantity of waste being processed increases beyond the current quantity. Additionally, there would be probable adverse impact from GeoMelt® Process Unit, a new thermal treatment unit. Impact from GeoMelt® treatment would need to be mitigated in the regulatory process of a thermal risk assessment required in WAC 173-303. Therefore, human health related impact to general public would be potentially significant. The potential impact would need to be mitigated in the regulatory process of a thermal risk assessment and WSDOH license limits including ALARA requirements.

Under No Action Alternative, the emission of radioactive air pollutants from closure activities would not likely increase beyond the current emission from the MWF operation. During the closure activities, waste treatment would be continued only for the in-process waste inventories before packaged and transported offsite. Waste inventories for which waste treatment hadn't initiated would be returned to the generators. Human health related impact to the general public from such emission would be minor as long as those activities are done in compliance with the closure plan in accordance with the current DWR Permit, Attachment HH Closure and Financial Assurance, rev. 4 (Ecology 2012) and WSDOH license.

5.7.2 Accidents

Accidents resulting in uncontrolled release of radioactive and chemical contaminants could be initiated by a number of scenarios including, but not limited, to natural phenomena (e.g. seismic event, lightening, wildfire), externally initiated events (e.g. airplane crash), and internally initiated operational events (e.g. mechanical failures/defects, human error), or a combination of two or more of those. Under SEPA, impacts from the "reasonably foreseeable" accidents should be evaluated in this SEIS.

In January 2023, USDOE prepared a NEPA supplemental analysis (SA) to evaluate its proposal to transport and treat DFLAW secondary waste at licensed and permitted commercial treatment facilities off the Hanford Site (USDOE 2023). SEPA rules allow Ecology to adopt relevant NEPA evaluations in whole or in part. The NEPA SA concludes that treatment and stabilization of secondary LLW and MLLW at PFNW (included in Alternatives 2 and 3) would not change the types of accidents that could occur at the facility or the potential impacts from accidents compared to current operations evaluated as part of the licensing or permitting processes by Washington State (USDOE 2023).

Considering the fact that two incidents of small fires in the PFNW site were reported in 2019, this SEIS discusses impact from a fire that would cause a release of radioactive and chemical contaminants (Accident 1-for all action and no action alternatives). Second accident scenario is when the HEPA filtration fails due to an earthquake, followed by an uncontrolled release of radioactive and chemical contaminants (Accident 2-all action and no action alternatives). The third accident scenario is a spill/release of untreated liquid mixed waste from a primary container prior to treatment (Accident 3- all action and no action alternatives).

The followings include examples of initiating events to a possible accident at the MWF with estimated frequencies of occurrence expressed as occurrences per unit of times:

- Human error: 0.01 per year
- Earthquake with magnitude 4 to 4.9 and 5 to 5.9: 0.002 and 0.0004 per year, respectively, as discussed in section 4.1
- Wild/Range Fire: 0.01 per year (USDOE 2012)
- Accidental aircraft crash into a specific hazardous facility: less than 0.000001 per year (USDOE 2012)
- Transfer error/waste release accidents: 0.01 to 0.001 per year (USDOE 2019a)

5.7.2.1 Accident 1: Fire

A fire could be initiated at the MWF under all action and no action alternatives by a number of scenarios, such as human error, transfer error/waste release accident, seismic event, accidental aircraft crash, and so on. Among these possible scenarios to initiate a fire at the MWF, a fire initiated by a human error would be among the most likely scenarios. One likely scenario that would apply to all action and no action alternatives would be a fire initiated by a reaction of ignitable (D001) and reactive (D003) waste with incompatible materials that should not be stored or placed nearby.

Under Alternative 1 and 2, the MWF could substantially increase the quantity of waste being processed beyond the current quantity, as discussed in section 5.3. The uncontrolled release of both radioactive and non-radioactive air pollutants from a fire can violate the ambient air quality standards for criteria air pollutants and/or exceed the dose limit of 10 mrem per year for any member of public if not mitigated. Therefore, impact from a fire would be significant under these alternatives. Furthermore, PFNW had two fires in 2019 and needed to complete a causal analysis and operating changes to reduce the likelihood of future fires, as discussed in section 4.6 in Chapter 4. The impact would need to be mitigated in the permit conditions and facility's internal procedures.

Under Alternative 3, in addition to the probable increase in the quantity of waste being processed, the GeoMelt® treatment as a thermal treatment process and characteristics of reactive metal would increase the likelihood of initiating a fire from the current MWF operation.

A fire could start from the exothermic reaction between reactive metal (for the GeoMelt® treatment) and water. Also, the nature of the GeoMelt® thermal treatment process raising the temperature up to 2,822 degrees Fahrenheit (1,550 degrees Celsius) is more prone to initiating a fire compared with any thermal treatment processes. Impact from GeoMelt® treatment would need to be mitigated in the regulatory process of a thermal risk assessment required in WAC 173-303. Therefore, impact from a fire would be significant under this alternative, and it would need to be mitigated in the regulatory process of a thermal risk assessment in addition to the permit conditions and facility's internal procedures.

Under No Action Alternative, impact from a fire would be short-term, limited to the closure activities for waste inventories. However, the consequence from a fire could be as severe as that under any action alternatives. Therefore, impact would be significant. The impact would need to be mitigated in the permit and permit conditions.

There is no fire sprinkler system in the MWF due to the characteristic of the waste processed at the MWF and the concerns with spreading radiological contamination, therefore, ability to control a fire in the early stage relies on fire alarm and worker response, followed by response by Richland Fire Department. Mitigation through training and procedure could reduce both the likelihood and impact of such fire accidents. Those include personnel training, record keeping, and routine inspection (e.g. fire alarm). Currently, PFNW has two separate contingency plans to be compliant with Ecology and WSDOH. One integrated/combined contingency plan to be in compliance with both regulators would minimize the impact from fire accidents.

5.7.2.2 Accident 2: HEPA failure

An uncontrolled release of radioactive and chemical contaminants caused by HEPA failure could occur by a number of initiating events under all action alternatives. Among these possible scenarios to cause HEPA to fail, either mechanical failures/defects or human error would be among the most likely scenarios. HEPA filter banks are assumed to have a removal efficiency of 99.97% or greater at the routine operation. If the HEPA filtration failed in such accident, theoretically both radioactive and nonradioactive air pollutants could be emitted at a concentration as high as 3,333 times the level from the routine operation otherwise for the entire duration of accident.

The MWF under all action alternatives could substantially increase the quantity of waste being processed beyond the current quantity, as discussed in section 5.3. The uncontrolled release of both radioactive and non-radioactive air pollutants from HEPA failure can violate the ambient air quality standards for criteria air pollutants and/or exceed the dose limit of 10 mrem per year for any member of public if not mitigated. Therefore, impact from uncontrolled release during such an accident would be significant. The impact would need to be mitigated in the permit and permit conditions.

Under No Action Alternative, impact from HEPA failure would be short-term, limited to the closure activities for waste inventories. However, the consequence from HEPA failure could be as severe as that under any action alternatives. Therefore, impact could be significant. The impact would need to be mitigated in the permit and permit conditions.

Training and the facility's internal procedure to ensure compliance with BCAA approval order and WSDOH license could reduce both the possibility and impact of such accidents. Those include personnel training, record keeping, and routine inspection in compliance with BCAA approval order and WSDOH license.

5.7.2.3 Accident 3: Release/Spill

A spill/release of untreated liquid waste from a primary container prior to treatment could occur under any action and no action alternatives. A release of the entire 55 gallons of liquid waste could potentially occur from a 55-gallon drum of waste in storage or the In-Container

Mixer during the treatment under any action alternatives. Such release would be the least likely but could potentially occur during the closure activities under No Action Alternative.

A draft NEPA EA for the USDOE Savannah River Site (SRS) evaluated an impact from a transfer error/waste release accident involving 600 gallons of Defense Waste Processing Facility Recycle Wastewater from a primary containment. Transfer error/waste release accidents are estimated to have a probability of occurrence of 0.01 to 0.001 per year (USDOE 2019a).

Incorporating the impact analyses by reference to evaluate the impact from a release of 55 gallons of liquid mixed waste, the unmitigated and mitigated off-site consequences to the MEI is conservatively estimated to be less than or equal to 17 to 28 mrem (derived from USDOE 2019a). The MEI's chance of developing an LCF would be 0.000010 to 0.000017. When the probability is taken into account, the risk to the MEI of developing an LCF would be a maximum of 0.00000010 to 0.00000017.

Based on a release of 55 gallon of liquid mixed waste, the population dose to the 50-mile population surrounding the PFNW site would be approximately 14.5 person-rem with a LCF of 0.0087. When the probability if taken into account, the risk that LCF would occur within the 50-mile population from this accident scenario would be a maximum of 0.000087.

The potential consequences to the MEI involved worker is conservatively estimated to be less than or equal to 30 to 38 mrem (derived from USDOE 2019a). These consequences would be below PFNW's administrative control limit of 1,500 mrem per year for an involved worker. The potential for a LCF associated with this level of radiation exposure would be 0.000018 to 0.000023. When probability is taken into account, the risk to the MEI involved worker of developing an LCF from this accident scenario would be a maximum of 0.00000018 to 0.00000023.

There is no LCF expected for both involved worker and general public from a release of 55 gallons of liquid mixed waste. The impact from this accident scenario would be minor under all action and no action alternatives.

Table 25 presents consequences associated with Accident 3.

Table 25: Accident 3 Potential Consequences

Off Site MEI Dose (mrem)	Off Site MEI LCF[ab]	Population Dose[c] (person-rem)	Population LCF[a]	MEI involved worker (mrem)	MEI involved worker LCF[a]
17 - 28	0.000010 – 0.000017	14.5	0.0087	30 - 38	0.000018 – 0.000023

LCF = Latent Cancer Fatality
MEI = maximum exposed individual
mrem = millirem; 1 rem = 1,000 mrem
[a] Risk can be obtained by multiplying these consequences and the accident probability (0.01 – 0.001)
[b] LCF calculated by multiplying the dose by 0.0006.
[c] Population within an 80-km (50-mile) radius of the PFNW site is estimated as 466,000.

5.8 Land Use

The DWR Permit Renewal under any action alternatives would not require additional land disturbance activities, therefore there would be no adverse impact on the land use around the PFNW site. Under No Action Alternative, closure activities would likely require a soil disturbance due to the closure activities of the facility; however, such impact would be short-term, and therefore minor. Therefore, this element is not discussed further for impact analyses.

5.9 Transportation

The current volume of waste transportation has not increased beyond the 1998 Final EIS in terms of the numbers of waste deliveries as discussed in section 2.9.1. However, the MWF operation has expanded since the 1998 Final EIS in terms of waste types processed at the MWF and the treatment capacity. Considering that rail transportation has neither been used for PFNW operation for both MWF and LLF nor is there active rail transportation for waste to and from the Hanford site, Ecology has determined that rail shipment is not among the transportation means for the foreseeable MWF operation. Therefore, rail transportation was not included in the transportation impact analysis.

This section evaluates impacts of transportation associated with the foreseeable MWF operation under each action and no action alternative. According to its annual dangerous waste reports (Ecology 2020d), a majority of waste processed in the current MWF operation comes from the Hanford site, as discussed in section 2.9.1 and Table 11. Therefore, impacts are evaluated within the boundary of Washington State based on the information provided from PFNW.

5.9.1 Traffic Volume

5.9.1.1 Waste Transportation

As discussed in section 2.9 in Chapter 2, PFNW received 99 trucks delivering waste to the MWF in 2019 with 101 trucks on average annually from 2010 and 2019. Table 26 shows the estimated numbers of trucks delivering waste to the MWF per day under the 1998 Final EIS, the current MWF operation, Alternative 1, 2, 3, and No Action Alternative. These estimates are provided assuming the foreseeable peak operating capacity in which the MWF operates on 365 days a year, therefore these estimated numbers are shown higher than actual numbers with conservative measures for the impact analysis.

Table 26: Estimated numbers of trucks delivering waste to the MWF per day

Waste Types	1998 Final EIS	Current MWF Operation	Alt. 1	Alt. 2	Alt. 3	No Action[a]
Solid MLLW	2	2	2	5	5	
Liquid MLLW		1	1	2	2	
TRUM		1	1	1	1	
Reactive Metal					1	
Total to the MWF	2	4	4	8	9	
Total to the PFNW site[b]	9	11	11	15	16	7

Cell shaded in grey = not applicable or zero.
Alt. = alternative
EIS = environmental impact statement
MLLW = mixed low-level radioactive waste
MWF = mixed waste facility
PFNW = Perma-Fix Northwest, Inc.
TRUM = transuranic mixed waste
[a] Waste transportation would be limited to the waste inventories during the closure activities, therefore there would be no trucks delivering any waste to the MWF.
[b] Total numbers of trucks delivering waste to the PFNW site is the total numbers of trucks delivering waste to both the MWF and the LLF.
Source: (City of Richland 1998) (B. Wiegman, personal communication, December 17, 2019) (USDOE 2023)

Total number of trucks to the MWF would be the total numbers of trucks delivering mixed waste (e.g. solid MLLW, liquid MLLW, TRUM, and reactive metal) to the MWF. For perspective, total number of trucks to the PFNW site would be the total number of trucks delivering waste to both the MWF and the LLF in the PFNW site.

Under Alternative 1, the number of trucks delivering waste to the MWF would be the same as that under the current DWR Permit; the MWF would receive 2 trucks delivering solid MLLW, 1 truck delivering liquid MLLW, and 1 truck delivering TRUM per day. The total number of trucks delivering waste to the MWF would be 4, which would be unchanged from the numbers under the current DWR Permit. Therefore, there would be a minor impact on the current traffic volume from routine waste transportation associated with the MWF operation under Alternative 1.

Under Alternative 2, the MWF would receive 5 trucks delivering solid MLLW, 2 trucks delivering liquid MLLW, and 1 truck delivering TRUM per day. The total number of trucks delivering waste to the MWF would be 8 per day. Alternative 2 would result in an additional 4 trucks to the MWF per day to the number under the current DWR Permit. The increase of 4 truck deliveries would represent less than 1 percent increase to the current traffic counts in the vicinity of the PFNW site, as described in section 4.8. Therefore, there would be a minor impact on the current traffic volume from routine waste transportation associated with the MWF operation under Alternative 2.

Under Alternative 3, the MWF would receive 5 trucks delivering solid MLLW, 2 trucks delivering liquid MLLW, 1 truck delivering TRUM, and 1 truck delivering reactive metal per day. The total number of trucks delivering waste to the MWF would be 9 per day. Alternative 3 would result in an additional 5 trucks to the MWF per day above the number under the current DWR Permit. The increase by 5 truck deliveries would represent less than 1 percent increase to the current traffic counts in the vicinity of the PFNW site, as described in section 4.8. Therefore, there would be a minor impact on the current traffic volume from routine waste transportation associated with the MWF operation under Alternative 3.

Under No Action Alternative, waste transportation by trucks would be limited to the waste inventories during the closure activities. Upon completion of closure activities at the MWF, there would be no trucks delivering any waste to the MWF. The number of trucks to the LLF would be 7, which would be the same for all action and no action alternative. Therefore, there would be no adverse impact on the current traffic volume from routine waste transportation associated with the MWF operation under No Action Alternative.

5.9.1.2 Employee Commuting

Currently PFNW has approximately 70 employees working in the PFNW site although the number fluctuate with the operational needs. PFNW anticipates the number to expand to approximately 100 in their planned future operation.

Under all action alternative, the number of employees would range from 70 to 100 although the number is expected to be the highest under Alternative 3. With the conservative assumption that the number of employees for all action alternatives would be 100, additional 30 employees would represent the following increase to the current traffic volume in the vicinity of the PFNW site:

- Battel Blvd: 3.5 % increase to the current traffic counts of 1,721
- Kingsgate Way: 1.7 % increase to the current traffic counts of 3,560
- Highway 240: 1.0 % increase to the current traffic counts of 6,126
- Steven Drive: 0.5 % increase to the current traffic counts of 12,710

Therefore, the continuous MWF operation under all action alternatives would have a minor impact on the traffic volume in the vicinity of the PFNW site by employees commuting. Under No Action Alternative, the number of employees in the PFNW site (limited to the LLF operation) are expected to be the same as that for the current operation, or approximately 70. There would be no adverse impact on the traffic volume.

5.9.2 Impacts of Routine Transportation on Worker Dose

Ecology identified the following conditions as necessary to evaluate the impacts for the transportation associated with the MWF operation under each alternative:

- Impacts are to be evaluated for one year within the geographic boundary of Washington State.
- The largest percentage of this waste would continue to come from USDOE's Hanford site.
- A package or shipment is defined as the amount of waste transported on a single truck or a single railcar (USDOE 2012).
- All types of waste would be transported to and from the MWF by trucks only.
- The number of trucks transporting waste are estimated based on the treatment process (e.g. stabilizing agent), the type of packaging PFNW anticipates using for each waste type and waste stream, and other transportation regulations and requirements.
- USDOT and USNRC compliant packages would be used to transport all waste to and from the MWF in accordance with 40 CFR Part 178 and 10 CFR Part 71.
- Workers in truck shipment are assumed to be a driver and a back-up driver per each truck shipment.
- The dose rates at 1 meter (3.3 feet) for MLLW, TRUM, and reactive metal were conservatively estimated as 3 mrem, 4 mrem, and 2 mrem per hour.

In January 2023, USDOE prepared a NEPA supplemental analysis (SA) to evaluate its proposal to transport and treat DFLAW secondary waste at licensed and permitted commercial treatment facilities off the Hanford Site (USDOE 2023), including PFNW. The NEPA SA includes the transportation impact analysis specific to the MWF to treat DFLAW secondary waste in the foreseeable future operation under Alternatives 2 and 3. Therefore, this draft SEIS adopts the transportation impact analysis for the MWF operation found in the following documents. The Notice of Adoption for these documents can be found in Appendix B.

- Tank Closure & Waste Management EIS (USDOE 2012)
- Supplement Analysis of the Final TC&WM EIS for Offsite Secondary Waste Treatment and Disposal (USDOE 2023)

5.9.2.1 Alternative 1 Impact

Under Alternative 1, the waste types to be treated at the MWF would include MLLW and TRUM.

5.9.2.1.1 MLLW

Out of five ports of entry into Washington State, the majority of truck shipments would use either Plymouth or Spokane Ports of Entry for both the current and future MWF operation. Annual worker dose from routine transportation is calculated with a conservative assumption that both untreated MLLW (to be delivered to the MWF) and the treated waste form (to be shipped from the MWF for disposal or other facilities for further treatment) would use the Spokane Port of Entry.

Dose rate intensity decreases as a function of increased distance from the source. The ratio of dose rate intensity decreases by the square of the ratio of the increased distance (USDOE 2019a). The dose rates at 1 meter (3.3 feet) for MLLW was conservatively estimated to be 3 mrem per hour. Assuming the area occupied by a driver would be approximately 10 feet from the package on the bed of the truck, the expected worker dose to a single driver from the package would be 1/9th (11 percent) of the dose rate of 3 mrem, which equates to 0.33 mrem per hour. Therefore, the total worker dose to a single driver for a single shipment of untreated solid and liquid MLLW (from the Spokane Port of Entry to the MWF) would be 1.32 mrem. The total worker dose for the 1095 shipments would be approximately 2.89 person-rem. The potential for a LCF associated with this level of radiation exposure is 0.0017.

The total worker dose to a single driver for a single shipment of the treated waste form (from the MWF to Spokane Port of Entry) would be 1.32 mrem. The total worker dose for the 1,095 shipments would be approximately 2.89 person-rem. The potential for an LCF associated with this level of radiation exposure is 0.0017.

The total worker impacts from truck transportation associated with the treatment of MLLW at the MWF would be a combination of the impacts of transporting untreated MLLW (from Spokane Port of Entry to the MWF) and the treated waste form (from the MWF to Spokane Port of Entry). The total worker dose and the potential for a LCF from truck transportation associated with the treatment of MLLW under Alternative 1 would be 5.78 (person-rem) and 0.0035, respectively, as shown in Table 27.

5.9.2.1.2 TRUM

It is anticipated that the MWF would receive untreated TRUM from the Hanford site and the size-reduced TRUM would be transported back to the Hanford site (CWC) for interim storage.

The total worker dose for a single shipment of untreated TRUM from the Hanford site to the MWF would be 0.00176 person-rem. The total worker dose for the 365 shipments would be approximately 0.64 person-rem. The potential for a LCF associated with this level of radiation exposure is negligible (0.00039).

The total worker dose for a single shipment of the size-reduced TRUM from the MWF back to the Hanford site would be 0.00176 person-rem. The total worker dose for the 365 shipments would be approximately 0.64 person-rem. The potential for an LCF associated with this level of radiation exposure is negligible (0.00039).

The total worker dose and the potential for an LCF from transportation associated with the treatment of TRUM under Alternative 1 would be 1.28 (person-rem) and 0.00077, respectively, as shown in Table 27.

Table 27 shows the potential transportation-related impacts for workers for Alternative 1. The total worker dose and the potential for an LCF for Alternative 1 would be 7.07 (person-rem) and 0.0042, respectively, as shown in Table 27.

There is no LCF expected among workers from the routine waste transportation associated with the MWF operation under Alternative 1. Therefore, there would be a minor impact on worker dose from routine waste transportation under Alternative 1.

Table 27: Alternative 1 Annual Potential Transportation-Related Impacts to Workers

Type of Waste Packages		Waste to/from	Distance (mile)	Shipment Numbers	Worker Dose per shipment (person-rem)[a]	Total Worker Dose (person-rem)	Total Worker LCF Risk[b]
MLLW	Untreated	Spokane	170	1,095	0.0026	2.89	0.0017
	Treated	Spokane	170	1,095	0.0026	2.89	0.0017
	Total Worker Impacts for MLLW				NA[c]	5.78	0.0035
TRUM	Untreated	Hanford	35	365	0.0018	0.64	0.00039
	Size-reduced	Hanford	35	365	0.0018	0.64	0.00039
	Total Worker Impacts for TRUM				NA[c]	1.28	0.00077
Total Worker Impact						7.07	0.0042

LCF = latent cancer fatality; mrem = millirem; 1 rem = 1,000 mrem
MLLW = mixed low-level radioactive waste
TRUM = transuranic mixed waste
[a] Worker dose was calculated with the assumption that the external dose rate from MLLW and TRUM packages at 3.3 feet would be 3 and 4 mrem per hour, respectively, and the driver and the back-up driver sit about 10 feet from the packages in each truck shipment.(USDOE 2019a)(USDOE 2012).
[b] The LCF risk is based on a dose-to-risk conversion factor of 0.0006 per rem (USDOE 2019a).
[c] It would be very unlikely that the same driver would transport both untreated waste (to the MWF) and the treated waste form (from the MWF) from the same waste stream.

5.9.2.2 Alternative 2 Impact

Under Alternative 2, the additional waste types to be treated at the MWF in addition to the current MWF operation and under Alternative 1 would be DFLAW secondary waste from the Hanford Site. See Section 5.9.2.1 for impact analysis of routine transportation under Alternative 1.

As explained in Section 5.9.2, *Supplement Analysis of the Final TC&WM EIS for Offsite Secondary Waste Treatment and Disposal* (USDOE 2013) was adopted for additional routine transportation impact analysis under Alternative 2.

5.9.2.3 Alternative 3 Impact

Under Alternative 3, the additional waste types to be treated at the MWF in addition to the current MWF operation and under Alternative 1 would be DFLAW secondary waste from the Hanford Site and reactive metal. See Section 5.9.2.1 for impact analysis of routine transportation under Alternative 1.

As explained in Section 5.9.2, *Supplement Analysis of the Final TC&WM EIS for Offsite Secondary Waste Treatment and Disposal* (USDOE 2013) was adopted for additional transportation impact analysis for DFLAW secondary waste under Alternative 3. The following subsection will discuss the impact analysis for routine transportation for the MWF operation specific to treatment of reactive metal.

5.9.2.3.1 Reactive Metal

The MWF anticipates receiving reactive metal from the INL in Idaho Falls, the ORNL in Oak Ridge, TN, and from the Hanford site. Following the treatment at the MWF, the treated waste form (in the form of 10-ton monolith) would be shipped to NNSS in Nevada for final disposal. Impacts from routine transportation associated with the treatment of reactive metal are evaluated for trucks.

The MWF anticipates receiving reactive metal from the INL in Idaho Falls, the ORNL in Oak Ridge, TN, and from the Hanford site. Except for the Hanford site originated reactive metal, untreated reactive metal would enter the Washington State through either Plymouth or Spokane Ports of Entry. Following the GeoMelt® treatment in the MWF, all the treated waste form would be transported to NNSS in Nevada for final disposal. Therefore, annual worker dose from routine transportation are calculated with a conservative assumption that untreated reactive metal (to be delivered to the MWF) would enter the Washington State through Spokane Port of Entry and the treated waste form (to be shipped from the MWF for disposal at NNSS) would leave the Washington State through the Plymouth Port of Entry.

The total worker dose to a single driver for a single shipment of untreated reactive metal to the MWF from the Spokane Port of Entry would be 0.88 mrem. The total worker dose for the 365 shipments would be approximately 0.64 person-rem. The potential for a LCF associated with this level of radiation exposure is negligible (0.00039).

The total worker dose to a single driver for a single shipment of the treated waste form from the MWF to Plymouth Port of Entry would be 0.22 mrem. The total worker dose for the 53 shipments would be approximately 0.023 person-rem. The potential for an LCF associated with this level of radiation exposure is 0.000014.

The total worker dose and the potential for an LCF from truck transportation associated with the treatment of reactive metal at the MWF would be 0.67 (person-rem) and 0.00040, respectively, as shown in Table 28.

Table 28 shows the potential transportation-related impacts for workers associated with the MWF operation for treatment of reactive metal under Alternative 3. The total worker dose and the potential for an LCF would be 0.67 (person-rem) and 0.00040, respectively, as shown in Table 28. There is no LCF expected among workers from the routine waste transportation associated with the MWF operation for treatment of reactive metal under Alternative 3. Therefore, there would be a minor impact on worker dose from routine waste transportation associated with the MWF operation for treatment of reactive metal under Alternative 3.

Table 28: Alternative 3 Annual Potential Transportation-Related Impacts to Workers for Reactive Metal

Type of Waste Packages		Waste to/from	Distance (mile)	Shipment Numbers	Worker Dose per shipment (person-rem)[a]	Total Worker Dose (person-rem)	Total Worker LCF Risk[b]
Reactive Metal	Untreated	Spokane	170	365	0.0018	0.64	0.00039
	Treated	Plymouth	43	53	0.00044	0.023	0.000014
Total Worker Impacts						0.67	0.00040

LCF = latent cancer fatality; mrem = millirem; 1 rem = 1,000 mrem
MLLW = mixed low-level radioactive waste
TRUM = transuranic mixed waste
[a] Worker dose was calculated with the assumption that the external dose rate from MLLW and TRUM packages at 3.3 feet would be 3 and 4 mrem per hour, respectively, and the driver and the back-up driver sit about 10 feet from the packages in each truck shipment.(USDOE 2019a)(USDOE 2012)
[b] The LCF risk is based on a dose-to-risk conversion factor of 0.0006 per rem (USDOE 2019a).
[c] It would be very unlikely that the same driver would transport both untreated waste (to the MWF) and the treated waste form (from the MWF) from the same waste stream.

5.9.2.4 No Action Alternative

Under No Action Alternative, the MWF would cease its operation. There would be no incoming waste deliveries to the MWF, and the waste transportation associated with the MWF closure activities would be temporary, limited to waste inventories. Therefore, impact on worker dose from the waste transportation under this alternative would be negligible.

5.9.3 Impacts of Transportation on Accidents

5.9.3.1 Alternative 1

5.9.3.3.1 MLLW

Untreated MLLW (to be delivered to the MWF) could be in any physical forms (e.g. solid, debris, liquid, or sludge) while the stabilized waste form (following the treatment at the MWF) would be in solid form. For the purpose of the risk analysis, untreated MLLW is conservatively assumed to be liquid as use of the liquid waste into the risk analysis is more conservative as “liquid” waste is more prone to adverse impacts than “solid” waste during transportation.

With respect to accidents, data from the Federal Motor Carrier Safety Administration (FMCSA) for 2017 indicate that large trucks are involved in 35.9 accidents per 100 million miles traveled (FMCSA 2019). The probability that crash would occur during the 186,150 miles (170 miles times 1,095 trips) from Spokane Port of Entry to the MWF would be about one chance in 15 (0.067). Assuming that one non-radiological fatality could occur as a result of an LLW shipment of approximately nine million miles (USDOE 2019a), there would be 2.1 percent chance of a traffic fatality associated with the transportation of untreated MLLW to the MWF from Spokane

Port of Entry. In the event an accident did occur, the probability of a release of liquid mixed waste would be unlikely because of the stringent USDOT requirement for Type A package for liquid to pass a free-drop test from a height of at least 30 feet and a penetration test from a distance of at least 5.5 feet. Non-liquid Type A packages require a drop test from a height of 1 to 4 feet and penetration test from a distance of 3.3 feet. For Type A packages, which must pass stringent tests, only 1 percent of those involved in accidents have failed. Of those, only 39% have released their contents (USNRC 2003). In other words, the release of a Type A container's entire contents could potentially occur approximately 0.4 percent of the time, given that a truck accident occur (USDOE 2019a). Incorporating the probability of crash during the shipment of untreated MLLW (0.067), the probability of severe accident that causes the release of entire contents of packages would be one in 3,740 (0.00027). Based on the conservative assumption that the severe accident would happen in an urban area under a stable weather, the population risk for a LCF would be 0.00086.

The probability that a crash would occur during the 186,150 miles (170 miles times 1,095 trips) from the MWF to Spokane Port of Entry would be about one chance in 15 (0.067). There would be 2.1 percent chance of a traffic fatality associated with the transportation of the treated waste form from the MWF to Spokane Port of Entry. In the event an accident did occur, the probability of a release of treated waste form would be unlikely as Type A package is designed to withstand in accidents. The probability of a severe accident that causes the release of entire contents of packages would be one in 3,740 (0.00027). Furthermore, in the very unlikely event that the Type A package failed in a severe accident, the impact from release of its content would be very small as the treated waste form would be solid. Most solid radionuclides are nonvolatile and, therefore, are not dispersible unlike liquid.

5.9.3.1.2 TRUM

Both untreated TRUM (to be delivered to the MWF) and the size-reduced TRUM (following the treatment at the MWF) would be in solid form (including debris). Both untreated TRUM and the size-reduced TRUM would be transported by a federal driver in drums or boxes as IP-2 packages as a minimum requirement.

The probability that crash would occur during the 12,775 miles (35 miles times 365 trips) from Hanford site to the MWF would be less than one chance in 218 (0.0046). There would be 0.14-percent chance of a traffic fatality associated with the transportation of untreated TRUM to the MWF from the Hanford site. In the event an accident did occur, the probability of a release of untreated TRUM would be unlikely because of the USDOT requirement for IP-2 packages. IP-2 packages, designed to withstand minor accident conditions without failing or releasing the radiation, are subject to the same tests for Type A packages as required in 49 CFR Part 173.411(2). The probability of severe accident that causes the release of entire contents of packages would be less than one in 54,511 (0.000018). Furthermore, in the extremely rare event that the IP-2 packages failed in a severe accident, the impact from release of its content would be small as untreated TRUM would be in the solid form emitting primarily non-penetrating alpha and beta radiation.

The probability that a crash would occur during the 12,775 miles (35 miles times 365 trips) from the MWF to the Hanford site would be about one chance in 218 (0.0046). There would be 0.14-percent chance of a traffic fatality associated with the transportation of the size-reduced TRUM from the MWF to the Hanford site. In the event an accident did occur, the probability of a release of size-reduced TRUM would be unlikely as IP-2 packages are designed to withstand in minor accidents. The probability of severe accident that causes the release of entire contents of packages would be less than one in in 54,511 (0.000018). Furthermore, in the very unlikely event that the IP-2 packages failed in a severe accident, the impact from release of its content would be very small as the size-reduced TRUM in the solid form emitting primarily non-penetrating alpha and beta radiation.

Under Alterative 1, the probability that a crash would occur from waste transportation associated with the MWF operation is very low. There is no traffic fatality expected among the workers and public from a severe transportation accident by trucks. Likewise, no LCF is expected among the public from a severe transportation accident by trucks. Therefore, the impact would be minor. Table 29 summarize impacts to the population from severe accident during transportation under Alternative 1.

Table 29: Alternative 1 Potential Transportation-Related Impacts to the Population from Severe Transportation Accident

Type of Waste Packages		Distance (mile)	Shipment Numbers	Total Distance (mile)[a]	Crash[b]	Non-radiological Fatality[c]	Severe Accident[d]	Population Risk of Fatal Cancer Risk[e]
MLLW	Untreated	170	1,095	186,150	0.067	0.021	0.00027	0.00086
MLLW	Treated	170	1,095	186,150	0.067	0.021	0.00027	NA[f]
MLLW	Total				0.134	0.041	0.00036	0.00086
TRUM	Untreated	35	365	12,775	0.0046	0.0014	0.000018	NA[f]
TRUM	Size-reduced	35	365	12,775	0.0046	0.0014	0.000018	NA[f]
TRUM	Total				0.0092	0.0028	0.000037	NA[f]
Total					0.14	0.044	0.00040	0.00086

MLLW = mixed low-level radioactive waste
NA = not applicable
TRUM = transuranic mixed waste
[a] Calculated by multiplying the distance per shipment by the number of shipments in one year.
[b] Calculated assuming that large trucks are involved in 35.9 accidents per 100 million miles traveled (FMCSA 2019).
[c] Fatality is calculated assuming that one non-radiological fatality could occur as a result of LLW shipment of approximately nine million miles (USDOE 2019a).
[d] Calculated by multiplying the probability that crash would occur during the transport by the probability of 0.4 percent (USDOE 2019a) that the entire contents of a Type A packages would be released during the crash. The same probability 0.4 is used for IP-2 packages for TRUM transportation in this evaluation.
[e] Risk calculated by multiplying the probability of severe accident by 3.2 LCF in the conservative scenario given that the highest estimated radiological dose, for a hypothetical accident in an urban area under stable weather conditions, was reported as 143 mrem (0.00009 LCF) for the maximally exposed individual, and 5,260 person-rem (3.2 LCFs) (USDOE 2019a).
[f] Risk is not applicable because liquid waste shipments would not occur. The waste form would not be dispersible.

5.9.3.2 Alternative 2

Under Alternative 2, the additional waste types to be treated at the MWF in addition to the current MWF operation and under Alternative 1 would be DFLAW secondary waste from the Hanford Site. See Section 5.9.3.1 for impact analysis of transportation on accidents under Alternative 1.

As explained in Section 5.9.2, *Supplement Analysis of the Final TC&WM EIS for Offsite Secondary Waste Treatment and Disposal* (USDOE 2013) was adopted for additional impact analysis of transportation on accidents under Alternative 2.

5.9.3.3 Alternative 3

Under Alternative 3, the additional waste types to be treated at the MWF in addition to the current MWF operation and under Alternative 1 would be DFLAW secondary waste from the Hanford Site and reactive metal. See Section 5.9.2.1 for impact analysis of transportation on accidents under Alternative 1.

As explained in Section 5.9.2, *Supplement Analysis of the Final TC&WM EIS for Offsite Secondary Waste Treatment and Disposal* (USDOE 2013) was adopted for additional transportation impact analysis for DFLAW secondary waste under Alternative 3. The following subsection will discuss the impact analysis for transportation on accidents for the MWF operation specific to treatment of reactive metal.

5.9.3.3.1 Reactive Metals

Untreated reactive metal for the GeoMelt® treatment would be in solid form (including debris). The treated waste form would be solid in the form of 10-ton monolith (7’ x 7’ x 3’).

The probability that a crash would occur during the 62,050 miles (170 miles times 365 trips) from Spokane Port of Entry to the MWF would be about one chance in 44 (0.022). There would be less than 0.69-percent chance of a traffic fatality associated with the transportation of untreated reactive metal from Spokane Port of Entry to the MWF. In the event an accident did occur, the probability of chemical or radioactive airborne release caused by a fire from the untreated reactive metal would be unlikely as long as the packaging withstands to keep moisture from contacting the reactive waste inside. Assuming that Type A packages were to be used to transport untreated reactive metal, there would be a 1 percent chance of those packages to fail in the event of accident that may potentially lead to a reaction with moisture and subsequently followed by a sodium fire. Therefore, there would be 0.022-percent chance of a severe accident, followed by the LCF of 7.1×10^{-4} (0.00071)

The probability that a crash would occur during the 2,279 miles (43 miles times 53 trips) from the MWF to Plymouth Port of Entry would be less than one chance in 1222 (0.00082). There would be 0.025-percent chance of a traffic fatality associated with the transportation of the treated waste form from the MWF to the Plymouth Port of Entry. The probability of severe accident that causes the release of entire contents of packages would be one in 305,563 (0.0000033). In the event such a severe accident did occur, the probability of a release of treated waste form would be very unlikely as the treated waste form would be stabilized (i.e., nonreactive with moisture), not causing a fire with any chemical or radioactive airborne release.

Table 30 shows the potential transportation-related impacts to population from severe transportation accident for reactive metal under Alternative 3.

Table 30: Alternative 3 Potential Transportation-Related Impacts to the Population from Severe Transportation Accident for Reactive Metal

Type of Waste Packages		Distance (mile)	Number of Ship-ments	Total Distance (mile)[a]	Crash[b]	Non-radio-logical Fatality[c]	Severe Accident[d]	Population Risk of Fatal Cancer Risk[e]
Reactive Metal	Untreat ed	170	365	62,050	0.022	0.0069	0.00022	7.1×10^{-4}
	Treated	43	53	2,279	0.000 82	0.00025	0.0000033	NA[f]
	Total				0.023	0.0071	0.00023	7.1×10^{-4}

MLLW = mixed low-level radioactive waste
NA = not applicable
TRUM = transuranic mixed waste
[a] Calculated by multiplying the distance per shipment by the number of shipments in one year.
[b] Calculated assuming that large trucks are involved in 35.9 accidents per 100 million miles traveled (FMCSA 2019).
[c] Fatality is calculated assuming that one non-radiological fatality could occur as a result of LLW shipment of approximately nine million miles (USDOE 2019a).
[d] Calculated by multiplying the probability that crash would occur during the transport by the probability of 0.4 percent (USDOE 2019a) that the entire contents of a Type A packages would be released during the crash. The same probability 0.4 is used for IP-2 packages for TRUM transportation in this evaluation. For the transportation of untreated reactive metal, a probability of 1 percent was used in the event of accident that the package would fail to potentially cause a sodium fire.
[e] Risk calculated by multiplying the probability of severe accident by 3.2 LCF in the conservative scenario given that the highest estimated radiological dose, for a hypothetical accident in an urban area under stable weather conditions, was reported as 143 mrem (0.00009 LCF) for the maximally exposed individual, and 5,260 person-rem (3.2 LCFs) (USDOE 2019a).
[f] Risk is not applicable because liquid waste shipments would not occur. The waste form would not be dispersible.
[g] Risk is not applicable because the treated waste form would be stabilized.

5.9.3.4 No Action Alternative

Under No Action Alternative, the MWF would cease its operation. There would be no incoming waste deliveries to the MWF, and the waste transportation associated with the MWF closure activities would be temporary, limited to waste inventories. Therefore, impact on transportation accidents from waste transportation under this alternative would be negligible.

5.9.4 Air Emissions from Transportation

5.9.4.1 Greenhouse Gas Emissions from Waste Transportation

Starting in 2012, Washington State requires facilities that emit at least 10,000 metric tons of carbon pollution annually to report their greenhouse gas emissions (Ecology 2020c). Greenhouse gas emissions from transportation sources include CO_2, CH_4, N_2O, and various HFCs. CO_2, CH_4, and N_2O are all emitted via the combustion of fuels, while HFC emissions are the result of leaks and end-of-life disposal from air conditioners used to cool people and/or freight (USEPA 2019a)

Waste transportation associated with the MWF operation would utilize trucks larger than 8,500 lbs, which would be categorized as medium- and heavy-duty trucks. Greenhouse gas emissions by this category of trucks increased by approximately 90 percent in the United States from 1990 to 2017 (USEPA 2019a).

According to USEPA, medium- and heavy duty trucks traveled 314,820 million vehicle miles in the United States, contributing 436.5 teragrams (Tg; 1 Tg is equal to 1 million metric tons) of greenhouse gas emission in CO_2 equivalent (USEPA 2019b). Under Alternative 1, it is estimated that 379.6 metric tons of greenhouse gas would be emitted from transporting waste for a total of 273,750 vehicle miles within the boundary of Washington State. Under Alternative 2, it is estimated that 723.7 metric tons of greenhouse gas would be emitted from transporting waste for a total of 521,950 vehicle miles. Under Alternative 3, it is estimated that 894.0 metric tons of greenhouse gas would be emitted from transporting waste for a total of 644,779 vehicle miles. The greenhouse gas emission from waste transportation within the Washington State would be well below the reporting thresholds of 10,000 metric tons per year under all action alternatives. Therefore, the impact of the greenhouse gas emission from waste transportation would be minor under all action alternatives.

Under No Action Alternative, the MWF would cease its operation. There would be no incoming waste deliveries to the MWF, and the waste transportation associated with the MWF closure activities would be temporary, limited to waste inventories. The greenhouse gas emission from waste transportation associated with the closure activities would be substantially less than the emission from the current MWF operation. Therefore, the impact of the greenhouse gas emission from waste transportation within the Washington State would be minor under this alternative.

Table 31 presents the estimate of greenhouse gas emission for each action alternative and no action alternative.

Table 31: Estimated Greenhouse Gas Emission

Alternative	Travel Distance (metric ton)[a]	Greenhouse Gas Emissions (metric ton)[b]
Alternative 1	264,260	366.4
Alternative 2	512,460	710.5
Alternative 3	638,955	885.9
No Action Alternative [c]	< 264,260	< 366.4

< = less than

[a] Travel distance is an estimate limited to the geographical area within the Washington State boundary.

[b] Greenhouse gas emission in CO_2 equivalent was calculated with the assumption that 436.5 Tg of greenhouse gas would be emitted from medium- and heavy duty trucks traveling 314,829 million vehicle miles (USEPA 2019b).

[c] Both waste transportation and greenhouse gas emission associated with the closure activities would be substantially less than those from the current MWF operation.

Currently, the greenhouse gas emissions from the PFNW site (both the MWF and PFNW LLF) appeared to be below the greenhouse gas reporting thresholds of 10,000 metric tons per year, and it is not expected to meet or exceed the threshold under all action and no action alternatives. However, Washington State Requirement of greenhouse gas reporting will take an effect if the emissions from the MWF operation contribute the cumulative emission from the entire PFNW operation to exceed 10,000 metric tons of greenhouse gasses in one year.

5.9.4.2 Other Air Pollutants from Transportation

Both waste transportation and employee commuting would lead to emission of the following air pollutants through fossil fuel (gasoline and diesel) combustion:

- PM (criteria air pollutant)
- VOCs
- NOx
- CO (criteria air pollutant)
- SO_2 (criteria air pollutant)
- O_3 (criteria air pollutant) - as a result of NOx and VOCs reacting under heat and sunlight
- diesel particulate matter (TAP)

Heavy duty trucks and railcars are among the largest sources of diesel exhaust in Washington State (Ecology 2020b). The numbers of trucks associated with the waste transportation under all action and no action alternatives would produce negligible air emissions, relative to the overall vehicle emissions by other private and commercial vehicles in the vicinity of the PFNW site and the waste transportation routes. Therefore, the impact of the diesel particulate matter emission from waste transportation within the Washington State would be minor under all action and no action alternatives.

5.10 Environmental Justice

Ecology evaluated Environmental Justice (EJ) indicators for this SEIS to help ensure fair treatment and meaningful involvement in renewal of the DWR Permit. Ecology used the USEPA EJSCREEN Tool in our evaluation (USEPA, 2021b). Ecology started by evaluating economic and demographic indicators within a 1-mile radius of the PFNW facility. Based on USEPA guidance on interpreting EJSCREEN data, Ecology examined screening results that were at or above the 80th percentile for the state as an indicator of potential EJ considerations. That first screen resulted in no indicators above the 80th percentile, and thus a very low likelihood that permitting decisions would impact low-income populations or would impact a minority community. Ecology conducted a second screen out to a 2-mile radius and EJSCREEN data were similar, with no indicators above the 80th percentile. The populations in the 1-mile and 2-mile radius screens show a lower percentage of low-income persons than the surrounding Richland area. The 1-mile and 2-mile populations show lower or similar percentages of minority persons that the surrounding Richland area (see Table 20).

The 1-mile screen does not indicate populations who may have particular barriers to engagement or access to information. The majority of the surrounding population have greater than a high school education, and the number of people who speak English “less than very well” is low. The population above age 5 years who speak English less than very well is estimated as 0%. The 2-mile screen indicates slightly larger populations who may have particular barriers to engagement or access to information; The population above age 5 who speak English less than very well is estimated as 198 (5.9 %). For comparison, City of Richland has 1,962 people (3.9 % of the population) who speak English less than very well. The percent in linguistic isolation, defined as "percent of households in which no one age 14 and over speaks English "very well" or speaks English only (as a fraction of households)", is estimated as 2 % in the 1-mile screen, 2-mile screen, and the City of Richland.

Table 32 represents the population within 1-mile and 2-miles who may have particular barriers to engagement or access to information. The population within the City of Richland, who may have particular barriers to engagement or access to information, is provided in the table for comparison.

Table 32: Population within the 1-mile, 2-mile, and City of Richland, who may have particular barriers to engagement or access to information.

Population	1 mi. radius of PFNW	2 mi. radius of PFNW	City of Richland
Total Population	15	3,594	54,249
Education level < HS (age 25+)	0 (0 %)	37 (1 %)	1,529 (5 %)
Speaks English less than very well (age 5+)	0 (0 %)	198 (6%)	1,962 (4 %)
Percent in linguistic isolation [a]	2 %	2 %	2 %

Source: EJSCREEN and ACS (2014-2018) (USEPA, 2021b)
HS = high school
[a] defined as percentage of people in household in which all members over age 14 years speak English less than "very well".

In reviewing other local considerations, Ecology sought to identify other vulnerable or sensitive populations potentially affected and who should be considered in the permitting decision. One day-care facility is located within 1 mile, and a second is located within 2 miles of the facility.

Based on the EJSCREEN evaluation of the facility location, there is no known impact associated with the current MWF operation that is likely to have high and disproportionate adverse impacts on low-income populations or a minority community as defined in Section 4.9. Therefore, impacts on environmental justice would be minor from both the continuous MWF operation under any action alternatives or termination of the MWF operation under No Action Alternative.

No mitigation is planned for potential disproportionate impacts to communities of interest. Also based on the EJSCREEN, no enhanced community outreach was conducted for this SEIS.

5.11 Cultural and Historic Resources

Cultural and Historic Resources are not evaluated in this SEIS. The 1998 Final EIS concluded that the potential for disturbance of cultural and archeological resources from the construction and operation of the MWF would be minimal and there is no proposed expansion of the MWF footprint. The continuous MWF operation under any action alternatives would not likely require additional land disturbance activities, therefore the impact on any existing cultural or historical resources would be minor under all action alternatives. Termination of the MWF operation under the No Action Alternative would likely require soil disturbance due to the closure activities of the facility; however, such impact would be short-term, and therefore minor to any cultural resources.

5.12 Processing of Non-Mixed Waste in the MWF

PFNW has processed non-mixed waste (waste not regulated under WAC 173-303) in the MWF. Processing of non-mixed waste is done pursuant to WSDOH licenses, and it does not require a DWR Permit. However, because the MWF operation is permitted through a DWR Permit with conditions issued by Ecology, it is essential to evaluate impact from the entire MWF operation, including possible processing of non-mixed waste in the facility.

This section discusses impacts from possible processing of non-mixed waste, specifically TRU and nonhazardous depleted uranium in the MWF in the DWR Permit Renewal.

5.12.1 TRU

PFNW has occasionally processed TRU in the MWF since 2010 as described in Chapter 2, Section 2.3. Over the past 10 years (2010-2019), PFNW has processed 28.0 metric tons (30.9 short tons) of TRU in the MWF, comprising approximately 20 % of total TRU PFNW received from the Hanford site. The largest quantity of TRU processed in the MWF in one year was 23.9 metric tons (26.3 short tons) from 2011, as shown in Table 4.

As described in Chapter 2, section 2.3.3, a major portion of TRU processed at PFNW has come from waste generated during demolition of the Plutonium Finishing Plant (PFP) at the Hanford site. There is no other on-going or foreseeable projects in the Hanford site from which PFNW anticipates receiving a large volume of TRU. Since USDOE's PFP demolition project is complete (USDOE 2022) PFNW would receive only a small volume of TRU from the Hanford site in the foreseeable future. Therefore, even if the MWF process the entire volume of TRU PFNW receives, the added volume would not increase substantially beyond the current volume of all waste being processed at the MWF. Impact from processing TRU in the MWF would be minor under all action and no action alternative.

5.12.2 Depleted Uranium

As described in Chapter 2, Section 2.3, PFNW has processed about 700 drums of depleted uranium in the past. Depleted uranium itself is exempt from the RCRA being a radiological source material per 40 CFR Part 261.4(a)(4); however, this nonhazardous/non-mixed waste is pyrophoric and therefore similar to the mixed waste with dangerous waste codes D001 (ignitable) and D003 (reactive). Depleted uranium is packaged in mineral oil in 33 gallon drums which are overpacked into 55 gallon drums (Ecology 2020e). The MWF currently macroencapsulates both hazardous and non-hazardous depleted uranium following draining and decanting the oil from the drum.

Because of the pyrophoric characteristic, depleted uranium in both storage and process could initiate a fire if not handled properly. Handling depleted uranium requires similar cautions to handling of any mixed waste with ignitable (D001) and reactive (D003) characteristics that is permitted in the MWF.

One likely example of fire caused by processing depleted uranium in the MWF is the fire incident in December 2019, as discussed in Chapter 4, section 4.6.2, and as follows:

- December 2019, a small fire in a metal disposal box of low-level, nonhazardous depleted uranium waste.

According to the latest permit application, PFNW estimates to receive 80 metric tons of ignitable (D001) and reactive (D003) mixed waste per year. Under the current WSDOH license for LLW, PFNW is permitted to possess and process up to 6,000 kg (6 metric tons) of non-hazardous depleted uranium at one time (WSDOH 2020b). Additional up to 6 metric tons of non-hazardous depleted uranium at one time would not substantially increase the quantity of ignitable and reactive waste to be processed at the MWF. Therefore, if handled properly, processing of non-hazardous depleted uranium in the MWF would not substantially increase the impact from fire already analyzed for each alternative. Therefore, the impact from fire would be potentially significant under all action and no action alternatives, similar to the impact from fire under all action and no action alternatives, as discussed earlier in this chapter, section 5.7.2.1.

5.13 Cumulative Impacts

PFNW operate both the MWF and LLF in the PFNW site. The continuous MWF operation would have a potentially significant impact on the air quality and human health under any action alternatives as discussed in sections 5.3 and 5.7. The LLF operation, not regulated under a DWR Permit, could contribute to cumulative impacts on air quality and human health. Impacts from the LLF operation are mitigated with WSDOH license and BCAA approval order similarly to those from the MWF operation.

Furthermore, there are other sources with potential air emissions of radioactive and nonradioactive air pollutants within an 8-km (5-mi) radius of the MWF. Those sources include:

- LLF within the PFNW site
- Framatome
- PNNL
- The Hanford site
- Columbia Generating Station

Those sources, in combination with both LLF operation and the continuous MWF operation under any action alternative, would contribute to cumulative impacts on air quality and human health elements.

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Chapter 7- Distribution list

Type	Name
Tribes	Confederated Tribes and Bands of the Yakama Nation
	Confederated Tribes of the Umatilla
	Nez Perce Tribe
	Wanapum
Federal Agencies	U.S. Environmental Protection Agency
	U.S. Department of Energy
State Agencies	Washington State Department of Ecology - SEPA Register
	Washington State Department of Ecology – Nuclear Waste Program
	Washington State Department of Ecology - Central Region Office
	Washington State Department of Ecology - Headquarters
	Washington State Department of Health
	Oregon State Department of Energy
Local Agencies	Benton Clean Air Agency
	City of Richland
	Benton County
	Franklin County
Organizations	Perma-Fix Northwest
	Hanford Challenge
	Columbia Riverkeeper
	Heart of America NW
	Hanford Communities
	Hanford Advisory Board

Appendices

Appendix A - Determination of Significance for the proposed construction and operation of the MWF

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File No. EA6-97

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CITY OF RICHLAND
DETERMINATION OF SIGNIFICANCE
AND REQUEST FOR COMMENTS ON SCOPE OF EIS

Description of proposal: Construction and operation of a low level mixed waste treatment facility. The facility would be designed to process low-level mixed waste from U.S. Department of Energy (USDOE) facilities located on the Hanford Reservation and other private commercial facilities within the United States. Waste from USDOE facilities will comprise no more than 25% of the total capacity of the treatment facility. Treated waste from USDOE facilities will be returned to the Hanford site for land disposal. Treated waste from private commercial facilities will be disposed at a permitted Treatment Storage and Disposal (TSD) facility. No waste will be disposed at the ATG facility.

The proposed treatment system is a gasification/vitrification unit designed to destroy organic compounds, reduce the waste volume and to vitrify the solid residues of the thermal treatment process. When treated, the waste is converted into non-leachable glass blocks with an average volume reduction ratio of nine to one. The process byproduct is a gaseous stream that is subsequently treated before discharge to the atmosphere. The facility also will include non-thermal stabilization equipment for treatment of contaminated soils, debris and sludges.

Proponent: Allied Technology Group, Inc.

Location of proposal: 2025 Battelle Boulevard in Richland. The site is approximately .5 miles south of Horn Rapids Road within the NW 1/4 of Section 22, Township 10 North, Range 28 East, W.M.

Lead agency: City of Richland

EIS Required. The lead agency has determined this proposal is likely to have a significant adverse impact on the environment. An environmental impact statement (EIS) is required under RCW 43.21C.030(2)(c) and will be prepared. A copy of the draft NEPA Environmental Assessment (EA) DOE/EA-1135. "Offsite Thermal Treatment of Low-Level Mixed Waste", that provides detailed information on the type and volume of the USDOE waste stream and the thermal and gaseous treatment systems is available for review at our office at 925 George Washington Way.

The lead agency has identified the following areas for discussion in the EIS: Impacts of air emissions; risk associated with the transport of non-Hanford waste; discussion of non-thermal waste treatment process; discussion of PCB's and the Toxic Substance Control Act; and impacts associated with facility construction and operation, including traffic impacts.

Scoping: Agencies, affected tribes, and members of the public are invited to comment on the scope of the EIS. You may comment on alternatives, mitigation measures, probable significant adverse impacts, and licenses or other approvals that may be required. The method and deadline for giving us your comments is: Comments must be in writing and either mailed or faxed to the responsible official at the address and/or fax number listed below. Written comments must be submitted by 5:00 p.m. on April 2, 1997.

Responsible official: Herb Everett
Development and Permit Services Manager
P.O. Box 190
Richland, WA 99352
Phone: (509) 943-7598 Fax: (509) 943-7764

Date: 3/11/97

Signature Herb Everett

Appendix B - Notices of Adoption of Existing Environmental Documents

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Richland Field Office
3100 Port of Benton Blvd., Richland, WA 99354 • 509-372-7950

NOTICE OF ADOPTION OF EXISTING ENVIRONMENTAL DOCUMENTS

Description of Current Proposal:

Perma-Fix Northwest, Inc. (PFNW) manages and treats both Low-Level Radioactive Waste (LLRW) and Mixed Low-Level Radioactive Waste (MLLW) at its Richland site. The treatment, storage, and handling of MLLW at PFNW's Mixed Waste Facility (MWF) requires a permit from Washington State Department of Ecology (Ecology), in accordance with the State's Dangerous Waste Regulations (DWR) (Washington Administrative Code (WAC) 173-303). In conjunction with the original DWR permit application, in 1997, the City of Richland issued a Determination of Significance for the proposed construction and operation of the MWF. The Final Environmental Impact Statement for Treatment of Low-Level Mixed Waste (Final EIS) was issued in 1998. Ecology subsequently issued the initial DWR permit to the Allied Technology Group, Inc. (one of PFNW's predecessors) for operation of the MWF in 1999.

PFNW submitted an application to renew its DWR permit for operation of the MWF in 2009, with the latest revised application submitted to Ecology in August 2024.

The proposed waste types to be treated in the MWF are MLLW and Transuranic Mixed Waste. The proposed non-thermal treatment processes include solidification, stabilization, cutting and shearing, macroencapsulation, neutralization, chemical reduction, chemical oxidation, deactivation, physical extraction, size reduction, volume reduction, repackaging and physical separation. Additionally, PFNW proposed to include the additional treatment processes of draining and decanting.

Proponent:

Bryan Blair, General Manager
Perma-Fix Northwest, Inc.
(509) 375-5160

Location of Current Proposal:

2025 Battelle Boulevard, Richland, WA 99354

Title of Documents Being Adopted:

Determination of Significance and Request for Comments on Scope of EIS (Attached).
Final Environmental Impact Statement for Treatment of Low-Level Mixed Waste (EA6-97).

Agency that Prepared Documents being Adopted:

City of Richland, Washington

Date adopted documents were prepared:

Determination of Significance: March 11, 1997
Final EIS: February 23, 1998

Description of documents being adopted:

The Determination of Significance reflects the evaluation by the City of Richland and the conclusion that the proposed mixed waste treatment facility is likely to have a significant adverse impact on the environment.

The Final EIS is being adopted in whole. It includes the full description of the proposed action and mitigative measures as envisioned in 1998. The EIS also includes detailed descriptions of the affected natural environment of air and built environments of transportation and environmental health.

The documents being adopted are available:

Determination of Significance is attached to this adoption notice.
Final EIS is available online at https://fortress.wa.gov/ecy/ezshare/NWP/PFNW/EIS_PFNW.pdf.

Adoption Statement:

Because the proposal addressed in the City of Richland's March 11, 1997, Determination of Significance is substantially similar to the current proposal, we have identified and adopted the 1997 Determination of Significance as being appropriate for the current proposal after independent review. The Final EIS addresses some, but not all, of the current proposal's probable significant adverse environmental impacts. Therefore, we have identified and adopted the Final EIS as being appropriate for this proposal after independent review and it will accompany the proposal to decision makers.

Supplemental EIS Required:

Due to significant changes and updates to the PFNW MWF and operations since the Final EIS was prepared; Ecology has determined that a Supplemental EIS is necessary to evaluate the probable significant adverse environmental impacts specific to PFNW's proposal that were not addressed in the Final EIS.

Name of Agency Adopting Document:

State of Washington Department of Ecology (Ecology), Nuclear Waste Program.

Name of Agency Responsible Official:

Edward Holbrook
Deputy Program Manager, Nuclear Waste Program
Department of Ecology
3100 Port of Benton Blvd, Richland, WA 99354
(509) 940-7619

Digitally signed by Holbrook, Edward (ECY)

Signature__________________ Date 1/2/2025

This State Environmental Policy Act (SEPA) decision may be appealed in conjunction with an appeal on the underlying agency action. In this case, the permit may be appealed in accordance with Washington Administrative Code (WAC) 173-303-845.

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File No. EA6-97

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CITY OF RICHLAND
DETERMINATION OF SIGNIFICANCE AND REQUEST FOR COMMENTS ON SCOPE OF EIS

Description of proposal: Construction and operation of a low level mixed waste treatment facility. The facility would be designed to process low-level mixed waste from U.S. Department of Energy (USDOE) facilities located on the Hanford Reservation and other private commercial facilities within the United States. Waste from USDOE facilities will comprise no more than 25% of the total capacity of the treatment facility. Treated waste from USDOE facilities will be returned to the Hanford site for land disposal. Treated waste from private commercial facilities will be disposed at a permitted Treatment Storage and Disposal (TSD) facility. No waste will be disposed at the ATG facility.

The proposed treatment system is a gasification/vitrification unit designed to destroy organic compounds, reduce the waste volume and to vitrify the solid residues of the thermal treatment process. When treated, the waste is converted into non-leachable glass blocks with an average volume reduction ratio of nine to one. The process byproduct is a gaseous stream that is subsequently treated before discharge to the atmosphere. The facility also will include non-thermal stabilization equipment for treatment of contaminated soils, debris and sludges.

Proponent: Allied Technology Group, Inc.

Location of proposal: 2025 Battelle Boulevard in Richland. The site is approximately .5 miles south of Horn Rapids Road within the NW 1/4 of Section 22, Township 10 North, Range 28 East, W.M.

Lead agency: City of Richland

EIS Required. The lead agency has determined this proposal is likely to have a significant adverse impact on the environment. An environmental impact statement (EIS) is required under RCW 43.21C.030(2)(c) and will be prepared. A copy of the draft NEPA Environmental Assessment (EA) DOE/EA-1135. "Offsite Thermal Treatment of Low-Level Mixed Waste", that provides detailed information on the type and volume of the USDOE waste stream and the thermal and gaseous treatment systems is available for review at our office at 925 George Washington Way.

The lead agency has identified the following areas for discussion in the EIS: Impacts of air emissions; risk associated with the transport of non-Hanford waste; discussion of non-thermal waste treatment process; discussion of PCB's and the Toxic Substance Control Act; and, impacts associated with facility construction and operation, including traffic impacts.

Scoping: Agencies, affected tribes, and members of the public are invited to comment on the scope of the EIS. You may comment on alternatives, mitigation measures, probable significant adverse impacts, and licenses or other approvals that may be required. The method and deadline for giving us your comments is: Comments must be in writing and either mailed or faxed to the responsible official at the address and/or fax number listed below. Written comments must be submitted by 5:00 p.m. on April 2, 1997.

Responsible official: Herb Everett
Development and Permit Services Manager
P.O. Box 190
Richland, WA 99352
Phone: (509) 943-7698 Fax: (509) 943-7764

Date: 3/11/97 Signature Herb Everett

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Richland Field Office
3100 Port of Benton Blvd., Richland, WA 99354 • 509-372-7950

DETERMINATION OF SIGNIFICANCE AND ADOPTION OF EXISTING ENVIRONMENTAL DOCUMENT

Description of Current Proposal:

Perma-Fix Northwest, Inc. (PFNW) manages and treats both Low-Level Radioactive Waste (LLRW) and Mixed Low-Level Radioactive Waste (MLLW) at its Richland site. The treatment, storage, and handling of MLLW at PFNW's Mixed Waste Facility (MWF) requires a permit from Ecology, in accordance with the State's Dangerous Waste Regulations (DWR) (Washington Administrative Code (WAC) 173-303). In conjunction with the 1997 original DWR permit application, the City of Richland issued a Determination of Significance for the proposed construction and operation of the MWF. The Final Environmental Impact Statement for Treatment of Low-Level Mixed Waste (Final EIS) was issued in 1998. Ecology subsequently issued the initial DWR permit to the Allied Technology Group, Inc. (one of PFNW's predecessors) for operation of the MWF in 1999.

PFNW submitted an application to renew its DWR permit for operation of the MWF in 2009, with the latest revised application submitted to Ecology in August 2024.

The proposed waste types to be treated in the MWF are MLLW and Transuranic Mixed Waste. The proposed non-thermal treatment processes include solidification, stabilization, cutting and shearing, macroencapsulation, neutralization, chemical reduction, chemical oxidation, deactivation, physical extraction, size reduction, volume reduction, repackaging and physical separation. Additionally, PFNW proposed to include the additional treatment processes of draining and decanting.

Ecology is relying on several documents to evaluate impacts to the environment.
A determination of Significance and Request for Comments on Scope of EIS from 1997 and Final Environmental Impact Statement for Treatment of Low-Level Mixed Waste issued in 1998 by the City of Richland have been adopted in a separate notice. Ecology is issuing a draft Supplemental Environmental Impact Statement to address changes not addressed in the 1998 EIS. Ecology is also adopting portions of the Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington (Final TC&WM EIS) in this notice.

Proponent:

Bryan Blair, General Manager
Perma-Fix Northwest, Inc.
(509) 375-5160

<u>Location of current proposal:</u>

2025 Battelle Boulevard, Richland, WA 99354

<u>Title of documents being adopted:</u>

Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington (Final TC&WM EIS) (USDOE/EIS-0391).

Additionally, Ecology is adopting the following supplement analysis associated with the above Final TC&WM EIS:

- *Supplement Analysis of the Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington. Offsite Secondary Waste Treatment and Disposal* (TC&WM EIS SA3) (USDOE/EIS-0391-SA-03).

<u>Agency that prepared documents being adopted:</u>

United States Department of Energy (USDOE)

<u>Date adopted documents were prepared:</u>

Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site (Final TC&WM EIS), Richland, Washington: December 5, 2012.

Supplement Analysis of the Final Tank Closure and Waste Management Environmental Impact Statement for the Hanford Site, Richland, Washington - Offsite Secondary Waste Treatment and Disposal (TC&WM EIS SA3): January 2023.

<u>Description of document (or portion) being adopted</u>:

In the Final TC&WM EIS, USDOE analyzed 17 alternatives, 11 of which involved retrieval, treatment, storage, and disposal of tank wastes, 3 Waste Management alternatives, and 3 Fast Flux Test Facility decommissioning alternatives.

Ecology is adopting the Final TC&WM EIS Alternative 2 for tank waste treatment, “Implement the Tank Waste Remediation System EIS Record of Decision with Modifications.” Ecology is also adopting the Final TC&WM EIS “Waste Management Alternative 2: Disposal in Integrated Disposal Facility (IDF), 200-East Area Only.”

Note that while the Final TC&WM EIS calls it “Alternative 2 for Tank Closure” Ecology is not currently adopting any portion of the Final TC&WM EIS related to closing 149 Single Shell Tanks, because Ecology is not permitting tank closure at this time. In addition, Ecology is not currently adopting any portion of the Final TC&WM EIS related to (1) Tank Closure Alternatives 1, 3, 4, 5 or 6; (2) any of the Alternatives for Fast Flux Test Facility (FFTF) Decommissioning; or (3) Alternatives for Waste Management other than the one identified above. Although Ecology is not adopting the entire Final TC&WM EIS at this time, the lead agency may consider adopting the analysis for additional alternatives and/or elements of those alternatives, if and when such adoption would support Ecology permitting decisions.

Secondary waste, as described in the Final TC&WM EIS, is generated as a result of other activities, e.g., waste retrieval or waste treatment, that is not further treated by the WTP or supplemental treatment facilities and includes liquid and solid wastes. Liquid-waste sources could include process condensates, scrubber wastes, spent reagents, from resins, offgas, and vessel vent wastes, vessel washes, floor drain, and sump wastes, and decontamination solutions. Solid-waste sources could include worn filter membranes, spent ion exchange resins, failed, or worn equipment, debris, laboratory waste, high-efficiency particulate air filters, spent carbon absorbent, and other process-related wastes. Secondary waste can be characterized as low-level radioactive waste, mixed low-level radioactive waste, transuranic waste, or hazardous waste.

Due to technical issues with the Waste Treatment and Immobilization Plant (WTP), Pretreatment Facility, and High-Level Waste (HLW) Vitrification Facility, only the Low-Activity Waste (LAW) Vitrification Facility, analytical laboratory, and balance of facilities have been completed and are preparing for operations. To begin treating waste as soon as practicable, USDOE decided to use the Direct-Feed Low-Activity Waste (DFLAW) approach, which is a sequenced approach, that will treat a portion of the tank waste first.

The DFLAW approach and other, non-DFLAW activities that are planned or ongoing at the Hanford Site (e.g., tank farm and 222-S laboratory operations) will generate an increased volume of liquid and non-liquid secondary waste over normal tank farm operations. These wastes include secondary waste generated by, or derived from, the Vitrification of LAW using the DFLAW approach, as well as other secondary waste. The Final TC&WM EIS evaluated the management of secondary wastes from WTP and other tank farm operations.

As a result of projected increases in the volumes of secondary waste and the lack of sufficient onsite secondary waste treatment capability and capacity once LAW Vitrification Facility operations begin using the DFLAW approach, USDOE proposes to transport and treat certain solid and liquid secondary wastes at licensed and permitted commercial treatment facilities off the Hanford Site. These secondary wastes are described in Appendix A of Supplement Analysis of the Final TC&WM EIS - Offsite Secondary Waste Treatment and Disposal.

The Supplement Analysis of the Final TC&WM EIS for Offsite Secondary Waste Treatment and Disposal is being adopted in whole. This supplement analysis concludes that treatment and stabilization of secondary LLW and MLLW at PFNW (included in Alternatives 2 and 3) would not change the types of accidents that could occur at the facility or the potential impacts from accidents compared to current operations evaluated as part of the licensing or permitting processes by Washington State (USDOE 2023).

The documents being adopted are available:

Final TC&WM EIS and the Supplement Analysis are both available online at:
https://www.hanford.gov/index.cfm?page=1117&

Adoption Statement:

Because the proposal addressed in USDOE 2012 Final TC&WM EIS and 2023 Supplement Analysis includes wastes and waste treatment that is similar or will be included in the current proposal, we have adopted these documents as being appropriate for the current proposal after independent review. The Final TC&WM EIS addresses some, but not all, of the current proposal's probable significant adverse environmental impacts. Therefore, we have identified and adopted the Final TC&WM EIS and the Supplement Analysis as being appropriate for this proposal after independent review and it will accompany the proposal to decision makers.

Supplemental EIS Required:

Due to significant changes and updates to the PFNW MWF and operations since the Final EIS was prepared; Ecology has determined that a Supplemental EIS is necessary to evaluate the probable significant adverse environmental impacts specific to PFNW's proposal that were not addressed in the Final EIS.

Name of Agency Adopting Document:

Department of Ecology (Ecology), Nuclear Waste Program

Name of Agency Responsible official:

Edward Holbrook
Deputy Program Manager, Nuclear Waste Program
Department of Ecology
3100 Port of Benton Blvd, Richland, WA 99354
(509) 940-7619

Signature ______ Digitally signed by Holbrook, Edward (ECY) Date 1/15/2025

This State Environmental Policy Act (SEPA) decision may be appealed in conjunction with an appeal on the underlying agency action. In this case, the permit may be appealed in accordance with Washington Administrative Code (WAC) 173-303-845.