SECTION 19.2

PROPOSED ACTION

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Acronyms and Abbreviations

Acronym/Abbreviation	Definition
°F	degrees Fahrenheit
°C	degrees Celsius
μS/cm	micro-Siemens per centimeter
AEA	Atomic Energy Act of 1954
ac.	acre
AHA	acetohydroxamic acid
[Proprietary Information]	[Proprietary Information]
[Proprietary Information]	[Proprietary Information]
[Proprietary Information]	[Proprietary Information]
Btu/hr	british thermal units per hour
Btu/scf	british thermal units per standard cubic feet
Ce	cerium
cfm	cubic feet per minute
CFR	Code of Federal Regulations
Ci	curies
CO_2	carbon dioxide
CP	Construction Permit
Cs-137	cesium-137
d or D	deuterium
D-T	deuterium-tritium
DSSI	Diversified Scientific Services, Inc.
EPA	U.S. Environmental Protection Agency
ER	Environmental Report
ES	EnergySolutions
FDA	U.S. Food and Drug Administration
ft.	feet

Acronyms and Abbreviations (cont'd)

Acronym/Abbreviation	Definition
ft^3	cubic feet
FP	fission product
g/L	grams/liter
gpm	gallons per minute
GTCC	greater than Class C
gU/L	grams of uranium per liter
H_2	hydrogen
^4He	helium
ha	hectare
HNO_3	nitric acid
hr	hour
HVAC	heating, ventilation, and air conditioning
I	iodine
I-129	iodine-129
I-131	iodine-131
IU	irradiation unit
k_{eff}	effective multiplication factor
kg	kilograms
km	kilometer
kV	kilovolts
lbs	pounds
LEL	lower explosive limit
LEU	low enriched uranium

Acronyms and Abbreviations (cont'd)

Acronym/Abbreviation	**Definition**
LSA	low specific activity
m	meters
M	molar
MBtu/hr	million british thermal units per hour
MeV	million electron volts
mi.	mile
MLLW	mixed low level waste
Mo	molybdenum
Mo-99 or ^{99}Mo	molybdenum-99
n	neutron
NO_x	nitrogen oxides
NRC	U.S. Nuclear Regulatory Commission
O_2	oxygen
OL	Operating License
PPE	personal protective equipment
PSAR	Preliminary Safety Analysis Report
psig	pound-force per square inch gauge
Pu	plutonium
RCA	radiologically controlled area
RCRA	Resource Conservation and Recovery Act
scf	standard cubic feet
SHINE	SHINE Medical Technologies, Inc.
sol'n	solution
[Proprietary Information]	[Proprietary Information]
t or T	tritium

Acronyms and Abbreviations (cont'd)

Acronym/Abbreviation	**Definition**
TBP	tri-butyl phosphate
Tc	technetium
Tc-99m	technetium-99m
TCLP	Toxicity Characteristic Leaching Procedure
TDN	thermal denitration
TRCS	TSV Reactivity Control System
TRPS	TSV Reactivity Protection System
TS	target solution
TSV	target solution vessel
U	uranium
U-235	uranium-235
U_3O_8	triuranium octoxide (yellowcake)
UO_3	uranium trioxide (yellowcake)
UREX	uranium extraction
USGS	United States Geological Survey
WCS	Waste Control Specialists
WI	Wisconsin
Xe-133	xenon-133
yr	year

CHAPTER 19

19.2 PROPOSED ACTION

The proposed federal action is issuance of a Construction Permit (CP) and Operating License (OL) to SHINE Medical Technologies, Inc. (SHINE) for a radioisotope production facility to produce molybdenum-99 (Mo-99), iodine 131 (I-131), and xenon-133 (Xe-133). The decay product of Mo-99, technetium-99m (Tc-99m), is used for diagnostic medical isotope procedures.

The applicant for this CP and the OL and owner of the radioisotope facility is SHINE Medical Technologies, Inc., a Wisconsin corporation.

SHINE has the necessary authority, control, and rights related to the construction and operation of the isotope production facility once the CP and the OL are approved.

The projected schedule for the SHINE facility is as follows:

- Start date of construction: January 2015.
- End date of construction: December 2015.
- Date of commercial operation: June 2016.
- Date of decommissioning: June 2046.

SHINE plans on performing activities in accordance with 10 CFR 50.10(a)(2) prior to receiving the CP.

The construction phase of this project requires an average of 248 workers (421 at peak times) and a monthly average of 303 truck deliveries and 9 off-site waste shipments. Materials consumed are shown in Table 19.2.0-1 and also include approximately 24,587 gallons of diesel fuel (as a bounding assumption fuel is assumed to be diesel) on an average monthly basis. The different types of construction equipment used during the construction phase are shown in Table 19.2.0-2. These construction activities affect 51.0 acres (ac.) (20.6 hectares [ha]) of land of which approximately 25.1 ac. (10.2 ha) of land are only temporarily affected.

Prior to full commercial operation, the SHINE facility equipment undergoes a thorough commissioning phase involving a series of test operations designed to ensure the facility is functioning as designed. Once the equipment has been commissioned, it is used to produce and ship quantities of Mo-99, I-131, and Xe-133 for customer qualification and input to the U.S. Food and Drug Administration (FDA) approval process. This preoperational phase requires an average of 390 workers (451 at peak times) and a monthly average of 190 truck deliveries and 9 off-site waste shipments. Materials consumed include approximately 11,721 gallons of diesel fuel (as a bounding assumption fuel is assumed to be diesel) on a monthly basis. The different types of construction equipment used during the preoperational phase are shown in Table 19.2.0-2.

After the FDA approves SHINE's customer's final products for commercial use, the facility produces and ships several batches of Mo-99, I-131, and Xe-133 per week. Production devices are normally operated on a weekly basis and the operation schedules for the devices are normally staggered to accommodate customer requirements. Operational activities require an average of 150 workers and a monthly average of 36 truck deliveries and 1 off-site waste shipment. Materials to be stored on-site in small quantities include 55 gallon drums of lubricating oil and grease for fans, pumps, hoists, trolleys and rotating equipment and hydraulic oil for heating, ventilation, and air conditioning (HVAC) dampers and hydraulically operated equipment. Limited on-site storage of acid and caustic chemicals for regeneration of the water treatment demineralizer beds and processes are required. A bounding value of approximately 30,000 gallons (113,562 liters) of diesel fuel for the standby diesel generator are contained in an outside, underground storage tank. Approximately 25.9 acres (10.5 hectares) of land are permanently affected due to operational activities.

Once the facility reaches the end of its useful life, it will be decommissioned. Any radioactive equipment and materials will be disposed of according to local and federal laws and regulations. Post-operational decommissioning activities require an average of 205 workers (257 at peak times) and a monthly average of 72 truck deliveries and 191 off-site waste shipments. Materials consumed include approximately 28,607 gallons (108,290 liters) of diesel fuel (as a bounding assumption fuel is assumed to be diesel) on a monthly basis. The different types of construction equipment used during the decommissioning phase are shown in Table 19.2.0-2.

Table 19.2.0-1 Estimated Materials Consumed During Construction Phase

Material	Amount
Concrete	27,700 cubic yards
Structural Steel	140 tons
Misc. Steel	30 tons
Steel Liner	100 tons
Asphalt	2200 cubic yards
Stone Granular Material	16,000 cubic yards
Roofing	150 tons

Table 19.2.0-2 Proposed Construction/Demolition Equipment Used in the Construction, Preoperational, and Decommissioning Phases (Sheet 1 of 2)

Equipment	Present During Construction (Y or N)	Present During Preoperation (Y or N)	Present During Decommissioning (Y or N)
Asphalt Compactor, Cat CB434C, 107 Hp	Y	Y	N
Asphalt Paver, Barber Greene AP-1000, 174 Hp	Y	Y	N
Backhoe/Loader, Cat 430, 105 Hp	Y	Y	Y
Boom Lift, JLG 800AJ, 65 Hp	Y	Y	Y
Concrete Pump, Putzmeister 47Z-Meter, 300 Hp	Y	N	N
Crane, Lattice Boom, Manitowoc 8000, 80t, 205 Hp	Y	N	Y
Crane, Picker, Grove RT530E-2 30t, 160 Hp	Y	N	Y
Crane, Picker, Grove RT600E-2 50t, 173 Hp	Y	N	Y
Dump, Duel Axel (15 cy) Mack, 350 Hp	Y	Y	Y
Excavator, Large, Cat 345D L, 380 Hp	Y	N	Y
Excavator, Medium, Cat 321D LCR,148 Hp	Y	N	Y
Extended Forklift, Lull 1044C-54, 115 Hp	Y	Y	Y
Fuel Truck, Mack MP6, 150 Hp	Y	N	Y
Material Truck, 2½ ton, F-650, 270 Hp	Y	Y	Y
Mechanic’s Truck, 2½ ton, F-650, 270 Hp	Y	Y	Y

Table 19.2.0-2 Proposed Construction/Demolition Equipment Used in the Construction, Preoperational, and Decommissioning Phases (Sheet 2 of 2)

Equipment	Present During Construction (Y or N)	Present During Preoperation (Y or N)	Present During Decommissioning (Y or N)
Motor Grader, Cat 140M, 183 Hp	Y	Y	Y
Pickup Truck, F-250, 300 Hp	Y	Y	Y
Semi Tractor & Trailer (20 cy), Mack MP8, 450 Hp	Y	N	Y
Skidsteer Loader, Case SR200, 75 Hp	Y	Y	Y
Tracked Dozer, Cat D6, 150 Hp	Y	Y	Y
Tracked Dozer, Cat D7, 235 Hp	Y	Y	Y
Tracked Dozer, Cat D8, 310 Hp	Y	N	Y
Tracked Loader, Cat 973C, 242 Hp	Y	Y	Y
Vibratory Soil Compactor, Cat CS74, 156 Hp	Y	Y	Y
Water Truck, Mack MP6, 150 Hp	Y	Y	Y
Portable Air Compressors, <50 Hp	Y	Y	Y
Portable Generators, <50 Hp	Y	Y	Y
Portable Welders, <50 Hp	Y	Y	Y
Walk Behind Compactor, <50 Hp	Y	Y	Y

19.2.1 SITE LOCATION AND LAYOUT

19.2.1.1 Site Location

The SHINE site is located approximately 4 miles (mi.) (6.4 kilometers [km]) south of Janesville, Rock County, Wisconsin. The SHINE facility is centered at approximately 42° 37' 26.9" N latitude, and 89° 1' 29.5" W longitude.

The sensitive populations (e.g., schools, daycare facilities, hospitals), nearest resident, and landmarks (including highways, transportation facilities, rivers and other bodies of water) within 5 mi. (8 km) of the site are provided in Table 19.2.1-1. There are no daycare centers or retirement homes located within 5 mi. (8 km) of the SHINE facility.

19.2.1.2 Site Layout

Figure 19.2.1-1 shows the layout of major structures and the site boundary. The site boundaries cover approximately 91 ac. (36.8 ha). The following structures shown in Figure 19.2.1-1 are located on the site:

- Production facility building
- Support facility building
- Waste staging and shipping building
- Diesel generator building
- Administration building
- Security station

19.2.1.2.1 Chemical, Diesel Fuel, and Hazardous and Radioactive Material Receipt, Holding, and Storage Areas

The following buildings and areas receive, store, hold, retain or process chemicals used in the facility and support buildings on the site:

- Production facility building
    - Rejected material
    - Receiving area
    - Receipt inspection
    - Target solution preparation
    - Materials lab
    - Caustics room
    - Acids room
    - Hot cell
    - CO_2-compressed gases room
    - Mechanical room
    - Boiler room
    - HVAC chiller room
    - Trade spaces
    - General storage

- Fire brigade
- Health physics (hot)
- Health physics (cold)
- Ion exchange assembly
- FDA lab
- Hot lab
- Isolation pack room
- Radioactive waste packaging
- Product packing
- Material shipping
- High voltage breakers
- Diesel generator room
- Day tank room
- Janitorial closet

• Diesel generator building

  - Diesel room
  - Underground storage tank

• Waste staging and shipping facility building

• Support facility building

  - Receiving area
  - Chemicals room
  - General storage
  - Janitorial closet
  - Propane canister storage (for fork lifts)

19.2.1.2.2 Underground, Stormwater, and Sewage Features

An underground storage tank near the diesel generator building provides storage for the diesel generator.

A sanitary sewer pipeline carries wastewater from the SHINE facility to the city main sewage pipeline. A natural gas pipeline provides commercial natural gas to the SHINE facility. An underground electrical distribution line connecting to the electric transformers provides electricity to the SHINE site. A municipal water line lateral is accessed to provide the SHINE facility with water supply. Infrastructure improvements are discussed in Subsection 19.4.13.7.1.

Per Figure 19.2.1-1, the SHINE facility buildings, storage, and miscellaneous structures/areas are surrounded by an exterior stormwater runon diversion berm with an interior and exterior ditch. The exterior ditch directs stormwater and farm field runoff to flow spreaders, which direct the excess water to the surrounding fields. The interior ditch directs excess water to the stormwater vegetated swale, which slopes towards an existing road side drainage. A stormwater overflow storage area is provided for beyond-design events. The stormwater systems are designed to address 1-year, 2-year, 24-hour storm events per state regulations, and are also designed to address 10-year and 100-year events, as required by the City of Janesville.

19.2.1.2.3 Monitoring Stations

Refer to Figure 19.4.8-1 for environmental monitoring station locations. The need for monitoring stations is discussed in the following subsections:

- Air monitoring – Subsection 19.4.2
- Groundwater monitoring – Subsection 19.4.4
- Surface water monitoring – Subsection 19.4.4
- Meteorological monitoring – Subsection 19.4.2
- Ecological monitoring – Subsection 19.4.5
- Radiological monitoring – Subsection 19.4.8.3

Table 19.2.1-1
Sensitive Populations, Nearest Resident, and Landmarks within 5 Miles (8 km) of the Site
(Sheet 1 of 2)

Facility Type	Location of Interest	Distance to Project Site Boundary
Residential	Nearest Full-Time Resident	0.33 mi. (0.53 km) northwest
Park	Airport Park	0.30 mi. (0.48 km) northwest
	Paw Print Park	1.16 mi. (1.87 km) northwest
Medical	First Choice Women's Health Center	1.37 mi. (2.20 km) north
	Mercy Clinic South	1.58 mi. (2.54 km) north
	Mercy Hospital	4.21 mi. (6.78 km) north
Educational	Blackhawk Technical College Aviation Center	0.89 mi. (1.43 km) southwest
	Rock County Christian School	1.14 mi. (1.83 km) south
	Jackson Elementary School	1.28 mi. (2.06 km) south
Community Center	Caravilla Education and Rehabilitation Comm Center	1.62 mi. (2.61 km) south
Animal Production	Dairy Production	0.51 mi. (0.82 km) east
	Horse Pasture	0.52 mi. (0.84 km) east
	Goat Production	0.69 mi. (1.11 km) northwest
	MacFarland Pheasants, Inc.	0.86 mi. (1.38 km) north
	Beef Production Area	0.97 mi. (1.56 km) southwest

Table 19.2.1-1 Sensitive Populations, Nearest Resident, and Landmarks within 5 Miles (8 km) of the Site (Sheet 2 of 2)

Facility Type	Location of Interest	Distance to Project Site Boundary
Rivers/Creeks	Rock River	1.9 mi. (3.1 km) west
	Spring Brook	3 mi. (4.8 km) north
	Turtle Creek	4.5 mi. (7.2 km) southeast
	Fisher Creek	3 mi. (4.8 km) northwest
	Markham Creek	2.5 mi. (4.0 km) northwest
Airports	Southern Wisconsin Regional Airport	0.4 mi. (0.6 km) west
Railroad	Union Pacific Railroad	1.7 mi. (2.7 km) northwest
Highways	U.S. Highway 51	Adjacent to the site boundary
	U.S. Highway 14	3.75 mi. (6.0 km) northeast
	Interstate 39/90	2.1 mi. (3.4 km) east

19.2.2 RADIOISOTOPE FACILITY DESCRIPTION

SHINE proposes to build a radioisotope facility. This facility produces Mo-99, I-131, and Xe-133. The SHINE facility consists of eight irradiation units (IUs) capable of producing up to 8200 6-day curies per week of Mo-99. Figure 19.2.2-1 provides a flow diagram of the isotope production process.

[Proprietary Information]

19.2.2.1 General Description of the Isotope Production Process

The SHINE facility produces Mo-99, I-131, and Xe-133 as fission products of uranium-235 (U-235) in a subcritical, low enriched uranium (LEU) target solution. The subcritical solution is located in an annular target solution vessel (TSV) and driven by an accelerator-based neutron source located on the center axis of the TSV annulus. The neutron source consists of a deuterium (d or D) beam impacting a tritium (t or T) gas target which produces energetic neutrons via the $d(t,^{4}He)n$ reaction. The neutron source is supplied with tritium gas from a tritium purification system.

The neutron population from the driver is increased as it travels through a neutron multiplier on its way to the TSV, and then further multiplied in the target solution itself via subcritical fission reactions. As the target solution is irradiated, radiolysis and fission will create off-gases that are handled by a system designed to recombine hydrogen and oxygen and trap certain volatile fission products.

During normal operation, the IUs are operated on a weekly basis. At the end of each irradiation cycle, the target solution is removed from the TSV and transferred to a hot cell where isotopes are selectively extracted. Purified Mo-99, I-131, and Xe-133 are tested by quality control, packaged, and shipped to customers.

After the target solution passes through the extraction column, it is evaluated for re-use. In most cases, the solution is returned to the TSV with minimal adjustment. At some point, however, certain fission products that have built up over time may need to be removed from the solution, in which case the solution undergoes a clean-up process.

Target solution preparation and clean-up, isotope extraction and purification, and any tanks containing target solution (besides the TSV) generate radioactive off-gases that are captured by a radioactive gas treatment system. The neutron generator, target solution preparation, tritium purification, TSV off-gas handling, radioactive gas treatment, target solution clean-up, isotope extraction, and isotope purification generate radioactive waste in various forms that is processed, packaged, (in some cases) staged, and disposed of according to its classification. Subsection 19.2.5 provides additional information on the radioactive waste treatment systems. Refer to Figure 19.2.2-1 for a flow diagram of the radioisotope production process.

19.2.3 WATER CONSUMPTION AND TREATMENT

19.2.3.1 Water Consumption

The Janesville municipal water system will supply the water needs of the SHINE facility. A water use diagram for the facility is provided in Figure 19.2.3-1. Water uses for the facility include the following:

- Isotope production
- Isotope processing
- Potable water
- Fire protection
- Facility heating and cooling

For isotope production, water is required for the preparation of the target solution. Water required for isotope production amounts to 175 gallons/day (gpd) (662 liters/day [lpd]). Processing including isotope extraction and purification, target solution clean-up, and waste processing requires 1051 gpd (3979 lpd) of water. There will be no liquid discharges from the radiologically controlled area (RCA) to the Janesville municipal sanitary system.

Wastewater from outside the RCA will be discharged to the Janesville municipal sanitary system.

Potable water demand is 3270 gpd (12,378 lpd) and blowdown and makeup to the facility heating water system is 2580 gpd (9766 lpd). The makeup requirement to the fire protection system is 5 gallons per minute (gpm) (19 liters per minute [lpm]). The largest automatic fire suppression system demand in the event of a fire is 390 gpm (1476 lpm). The automatic fire suppression demand will be supplied by a fire water tank. The makeup water requirement for the facility chilled water supply and distribution system is 5 gpm (19 lpm). The makeup water requirement for the facility heating water system is 5 gpm (19 lpm).

19.2.3.2 Water Treatment

The SHINE facility includes the following water treatment processes:

- Demineralization (i.e., deionization).
- Cooling water treatment.
- Facility heating water system treatment.

19.2.3.2.1 Water Demineralization

Within the SHINE facility, most of the water used within the process is demineralized in order to control the addition of chemicals within the water to process streams. This is particularly important given the radiological nature of some parts of the process (and the resultant potential for the formation of activation products), and the necessity of a highly pure Mo-99 product.

19.2.3.2.2 Cooling Water Treatment

Water for use in the closed-loop cooling water system is typically treated prior to addition to the loop, and then dosed periodically. The dosing is determined by testing. The types of chemicals added to the water are:

- Biocides – added to inhibit microbial growth in the water, which can lead to fouling.
- Corrosion inhibitors – added to inhibit corrosion of piping and components the cooling water flows through. Often corrosion is inhibited by halogen-based biocides.
- Scale inhibitors – added to reduce scale formation, particularly within heat exchangers. The specific inhibitor(s) is selected based on the chemistry of the makeup water for the cooling water system.

19.2.3.2.3 Facility Heating Water System Treatment

The SHINE facility uses a closed-circuit heated water system for building heating. This is referred to as a boiler by HVAC engineers, but the water does not change phases. The feedwater for this system is treated to reduce corrosion and to reduce scaling.

The magnitude of corrosion and scaling in any specific application is a function of the feedwater chemistry and the operating conditions of the boiler system. In some instances, feedwater is demineralized prior to being fed to the boiler.

The boiler capacity is calculated based on 100 pound-force per square inch gauge (psig) steam, and using a combined 5 percent blowdown and losses (i.e., make-up water is 5 percent of steam flow). The peak annual facility HVAC heat load (Btu/hr) is used as the sizing criteria for the required steam flow rate with a 50 percent margin included for other facility heating usage.

19.2.4 COOLING AND HEATING DISSIPATION SYSTEMS

19.2.4.1 Cooling Systems

Water used for SHINE facility cooling is produced at a central location by multiple air-cooled chillers. The chilled water is circulated in primary-secondary fashion, utilizing heat exchangers (shell and tube type) to isolate the process and HVAC loops from the central chilled water loop. This allows for temperature regulation of the water loops. Chillers have N+1 redundancy (i.e., there will be one redundant unit). They shut down upon a loss of power event.

- Cooling water is used in the SHINE facility for process cooling. A water supply temperature of 85 degrees Fahrenheit (°F) (29 degrees Celsius [°C]) with a return average temperature of 100°F (38°C) is assumed.

- Chilled water may be used in the facility for process cooling and is used for HVAC cooling. A chilled water supply temperature of 40°F (4°C) with a 50°F (10°C) return temperature is assumed.

The air-cooled chillers operate year-round, rejecting heat directly to the atmosphere through a sensible heat transfer process (forced air blowing over coils). No water is consumed or lost by evaporation in this arrangement. The total estimated heat of rejection witnessed by the chillers:

- Estimated peak process load: 2.64×10^6 british thermal units per hour (Btu/hr) (2.79×10^6 kilojoules per hr [kJ/hr]).
- Estimated peak HVAC load: 4.66×10^6 Btu/hr (4.92×10^6 kJ/hr).
- Estimated heat of compression: 1.83×10^6 Btu/hr (1.93×10^6 kJ/hr).
- Estimated total heat rejection load: 9.13×10^7 Btu/hr (9.63×10^6 kJ/hr).

For bounding purposes, the units are considered to run continuously (i.e., 24 hrs per day, 7 days per week).

Being a closed-loop system, makeup water is periodic and minimal (less than 10 percent of the system capacity per year). Makeup water is treated. Water treatment is standard chemical treatment.

The chillers contain non-chlorofluorocarbon refrigerant and are located outdoors. The SHINE facility does not use cooling towers.

19.2.4.2 Heating System

Multiple natural gas fired boilers provide heating water to the HVAC air handlers. The peak boiler load is 6.6 MBtu/hr (6.3 kJ/hr), with a total annual natural gas consumption of 7.67×10^7 standard cubic feet (scf) (2.17×10^6 cubic meters [m^3]). Ultimately, all of this heat ends up in the environment.

This assumes a natural gas heat content of 900 Btu/scf, an 80 percent efficient boiler, no recirculation, operation 24 hours per day and 7 days per week, supply air volume of 156,000 cubic feet per minute (4417 cubic meters per minute) at site altitude and a reheat capability up to 75°F (24°C).

19.2.5 WASTE SYSTEMS

19.2.5.1 Sources of Radioactive Liquid, Solid, and Gaseous Waste Material

19.2.5.1.1 Facility

The sources of radioactive liquid, solid, gaseous waste generated by the operation of the SHINE facility are as follows:

- Neutron generators.

- Waste generated by the TSV solution preparation process includes used cans in which new uranium metal is received, personnel protective equipment (PPE), and spent filters.

- Waste generated by the operation of the TSV off-gas system includes spent zeolite beds.

- Waste generated by operation of the Mo-99 recovery system includes the spent extraction columns, spent wash solution, and rotovap condensate.

- Waste generated by the target vessel solution cleanup process includes [Proprietary Information] UREX raffinate, non-RCRA (Resource Conservation and Recovery Act) spent solvent when replaced infrequently, spent resin columns, and spent caustic scrubber solution.

- Routine waste from maintenance activities.

- The Mo-99 purification process produces waste consisting of glassware and liquid waste.

19.2.5.1.2 Nearby Operating Facilities

Facilities that handle and store radioactive materials in the area of the SHINE facility are discussed in Subsection 19.3.8.5.

19.2.5.2 Type and Quantity of Radionuclides and Hazardous Materials

The type and quantity of radionuclides and hazardous materials is provided in Table 19.2.5-1.

19.2.5.3 Description of Waste Systems

19.2.5.3.1 Solid Radioactive Waste Handling System

Class A solid waste consists of Class A trash (e.g., personal protective equipment [PPE], Mo-99 purification glassware, filters), extraction columns, and the neutron generators. The Class A trash is consolidated for low specific activity (LSA) shipment. Extraction columns are replaced after each TSV processing batch. After a two week decay period in the Mo extraction cell, the columns are stored within the facility for further decay and consolidated for LSA shipment. The neutron generators are planned to be replaced on an approximately yearly basis. After replacement, the neutron generators are size-reduced and consolidated for shipment as LSA. The Class A trash, extraction columns, and the neutron generators are shipped approximately yearly to EnergySolutions' (ES) disposal site.

The zeolite beds are associated with the TSV off-gas system. The toxicity characteristic leaching procedure (TCLP) may or may not result in the classification of zeolite beds as Resource Conservation and Recovery Act (RCRA) waste; however, testing of untreated silver mordenite at Hanford indicated the material exceeds TCLP limits prior to solidification. The waste is also radioactive and would be a mixed low level waste (MLLW). Tritium, iodine, xenon, and krypton enters these beds. Only iodine is adsorbed in the zeolite beds. The waste classification for this material is a function of both the efficiency of the zeolite beds and the change out frequency of the beds. It is likely the beds, in terms of operational lifetime, could build up enough iodine-129 to be greater than Class C (GTCC) waste. The zeolite is shipped to an off-site processor. The shipment is a Type B shipment and occurs infrequently. The processor for the zeolite beds is Waste Control Specialists (WCS) in Andrews, Texas.

The ion exchange resin used for removal of cesium-137 (Cs-137) and cerium (Ce) has a high capacity for Cs-137 capture and will be changed out based on curie limits at the receiving facility and also based on shipping limits. The spent resins are solidified in a shielded waste processing hot cell. The used resin is classified as GTCC waste and is shipped as Type B to an off-site location for long-term storage at WCS.

As discussed above, the target solution cleanup system uses an anion exchange column to remove technetium and iodine. When the anion exchange resin is replaced, the spent resin is solidified on-site and sent off-site for disposal (WCS in Andrews, Texas).

There will be no solid waste disposal at the SHINE site.

19.2.5.3.2 Liquid Radioactive Waste System

Liquid waste discharged from the various processes at the SHINE facility (other than spent solvent) are combined into one of two tanks. Two tanks are needed to allow liquid waste to decay and also so that a somewhat consistent radiological environment exists for waste processing. Once the first tank is filled the other tank will begin to fill. At this point the pH is adjusted so that the waste can be passed through an ion exchange resin for removal of Cs-137 and Ce-144/Pr-144. This allows the majority of the liquid stream to become Class A waste. This cleaned-up material is then sent to an evaporator for volume reduction. The evaporator overheads are reused and the bottoms are solidified and shipped to ES for final disposal. The spent resin treatment is discussed in the section above. No liquid radioactive waste is discharged from the SHINE facility.

The spent solvent is not a RCRA waste and is replaced once per year. The solvent is sent to a processor (Diversified Scientific Services, Inc [DSSI], in Kingston, Tennessee) for thermal treatment.

[Proprietary Information] This waste is classified as Class B waste and is shipped as Type B to WCS in Andrews, Texas.

[Proprietary Information] The waste is solidified in a hot cell using Portland cement. Some additives may be required based on the final chemistry of incoming resin and precipitate. These shipments are Type B shipments.

There will be no liquid waste disposal at the SHINE site.

19.2.5.4 Proposed Hazardous Material Disposal Activity

The only hazardous (or potentially hazardous) materials are [Proprietary Information] and the zeolite beds. Although small quantities of [Proprietary Information] is expected to pass TCLP, and is not considered hazardous waste. Waste streams with a hazardous component are mixed low-level waste such as the zeolite beds and are handled as described in Subsection 19.2.5.3.1.

19.2.5.5 Direct Radiation Sources Stored On-Site or near the SHINE Facility

19.2.5.5.1 Direct Radiation Sources Stored On-Site

The wastes listed in Table 19.2.5-1 are stored on-site for a period of time before they are shipped off-site. The frequency of shipment of each type of waste is provided in Table 19.2.5-1.

LEU metal is stored in the target solution preparation area. Medical isotopes will not be stored for any significant time period as they must be shipped to clients as quickly as possible.

19.2.5.5.2 Direct Radiation Sources Stored near the SHINE Facility

There are no direct radiation sources stored near the SHINE facility. Facilities that handle and store radioactive materials in the area of the SHINE facility are discussed in Subsection 19.3.8.5.

19.2.5.6 Pollution Prevention and Waste Minimization

Pollution prevention and waste minimization planning provides the framework for promoting environmental stewardship and educating employees in the environmental aspects of activities occurring in the workplace, the community, and homes. The SHINE facility will have a program for pollution prevention and waste minimization that includes the following:

- Waste minimization and recycling for the various phases of the SHINE facility construction and operation.
- Employee training and education on general environmental activities and hazards regarding the facility, operations and the pollution prevention program, as well as waste minimization requirements, goals, and accomplishments.
- Employee training and education on specific environmental requirements and issues.
- Responsibilities for pollution prevention and waste minimization.
- Recognition of employees for efforts to improve environmental conditions.
- Requirements for employees to consider pollution prevention and waste minimization in day-to-day activities and engineering.

Table 19.2.5-1 Estimated Type and Quantity of Radioactive Wastes Associated with the SHINE Facility (Sheet 1 of 3)

Description	Matrix	Class as Generated	Contents	Volume	Volume as shipped (ft^3)	55-gallon drum equivalent as shipped	Shipment Type	Number of Shipments/ yr	Destination
Neutron Generator	Solid	A	Activated metal parts	4338 ft^3/yr	4338	590	LSA	3.00	ES
Extraction Columns	Solid	A	Stainless resin columns						
Class A Trash	Solid	A	PPE, Mo-99 purification glassware, filters, etc						
Spent Solvent	Liquid[a]	A	n-dodecane, tributyl phosphate	22 gallons/ yr	--	0.4	LSA	1.00	DSSI
Tc/I columns	Resin	C	Resin	16	23	3.1	Type B	0.3	WCS
Zeolite Beds	Solid	GTCC	Silver coated beds	0.4 ft^3/yr	0.4	0.05	Type B	1.00	WCS
Cs/Ce Media	Resin	GTCC	Resin	16	23	3.1	Type B	0.3	WCS
[Proprietary Information]	[Proprietary Information]	B	[Proprietary Information]	295 gallons/yr	79	11	Type B	1.00	WCS

Table 19.2.5-1 Estimated Type and Quantity of Radioactive Wastes Associated with the SHINE Facility (Sheet 2 of 3)

Description	Matrix	Class as Generated	Contents	Volume	Volume as shipped (ft^3)	55-gallon drum equivalent as shipped	Shipment Type	Number of Shipments/ yr	Destination
Spent Washes	Liquid[(a)]	A	[Proprietary Information]	59,708 gallons/yr	9738	1324	LSA	18	ES
Rotvap Condensate	Liquid[(a)]	A	[Proprietary Information]						
UREX Raffinate	Liquid[(a)]	B	[Proprietary Information]						
Decontamination Waste	Liquid[(a)]	A	Decon fluid unknown						
Spent Eluate Solution	Liquid[(a)]	A	[Proprietary Information]						
NO_x Scrubber Solution	Liquid[(a)]	A	[Proprietary Information]						

Table 19.2.5-1 Estimated Type and Quantity of Radioactive Wastes Associated with the SHINE Facility (Sheet 3 of 3)

a) Liquid waste discharged from the various processes at the SHINE facility is either solidified and then shipped to a waste depository or reused.

19.2.6 STORAGE, TREATMENT, AND TRANSPORTATION OF RADIOACTIVE AND NONRADIOACTIVE MATERIALS, INCLUDING LEU, WASTE, RADIOISOTOPES, AND ANY OTHER MATERIALS

There are no storage needs for enriched uranium fuel, irradiated enriched uranium, or medical isotope product. LEU metal (not fuel) is stored in the target solution preparation area. Medical isotopes will not be stored for any significant time period as these items will be transported to clients as quickly as possible. Irradiated enriched uranium is not stored, as the facility cleans up and recycles this material.

The radiological wastes listed in Table 19.2.5-1 are stored on-site for a period of time before they are shipped off-site. The frequency of shipment of each type of waste is provided in Table 19.2.5-1. Enough storage capacity is provided on-site to accommodate the amount of waste between shipments to the off-site repositories. Subsections 19.2.5.3.1 and 19.2.5.3.2 discuss solid and liquid radioactive waste handling. Radioactive waste gases are discussed in Subsection 19.4.8.2.

The treatment and packaging for shipment of radioactive and nonradioactive wastes and medical isotopes are controlled with SHINE facility procedures.

The packaging systems used to transport enriched uranium, radioactive wastes, and medical isotopes are licensed for the class and type of material that is being transported.

The target solution for the SHINE irradiation unit is made on-site at the SHINE facility from LEU metal purchased from Y-12, located in Oak Ridge, Tennessee. Y-12 is approximately 650 miles by road from Janesville, Wisconsin.

The radioactive wastes will be transported to the destinations listed on Table 19.2.5-1. The distances from the SHINE facility to these facilities are provided in Subsection 19.4.10.1.1.

The medical isotopes produced by SHINE are shipped to three processing facilities, as discussed in Subsection 19.4.10.1.1. The distances from the SHINE facility to these facilities are provided in Subsection 19.4.10.1.1.