**SHINE MEDICAL TECHNOLOGIES, INC.**

# SHINE MEDICAL TECHNOLOGIES, INC. APPLICATION FOR CONSTRUCTION PERMIT RESPONSE TO ENVIRONMENTAL REQUESTS FOR ADDITIONAL INFORMATION

**PUBLIC VERSION**

The NRC staff determined that additional information was required (Reference 1) to enable the continued review of the SHINE Medical Technologies, Inc. (SHINE) application for a construction permit to construct a medical isotope facility (References 2 and 3). The following information is provided by SHINE in response to the NRC staff's request.

## AIR QUALITY

### Air Quality Request #1

*Air emissions during construction need to be quantified to evaluate potential impacts. Please provide air emission estimated quantities and durations for construction activities, including emissions from construction equipment (onsite equipment use, onsite vehicle emissions, site disturbing activities, etc.), construction-related traffic (commuting workforce), and fugitive dust emissions. Please identify all emission sources, estimate emissions from each source, identify references used and emission factors, and describe all assumptions (e.g., number of workers and workforce commute, construction duration, etc.) and calculations used to estimate emissions.*

### SHINE Response

Construction air emissions have been estimated in CALC-2013-0007, and are provided in Table 1.

**Table 1. Total Calculated Air Emissions for Construction Activities**

| | Annual Emissions (Tons/year) |
|---|---|
| CO | 96 |
| NOx | 180 |
| PM | 13 |
| Hydrocarbons | 21 |
| $SO_2$ | 12 |
| $CO_2$ | 8802 |

Table 19.2.0-2 of Reference (2) lists equipment that would be present during construction activities. Request for Information (RFI) AMEC-2011-0033, provided as Attachment 1, provides a bounding estimate of the construction equipment necessary over the duration of construction activities, which was assumed to be 24 months. The total annual emissions provided in Table 1 include emissions from both the construction equipment and personal vehicles.

RFI AMEC-2011-0033 was only used to estimate the amount of construction equipment that would be present during construction activities. The start and end dates of construction activities provided in the RFI are no longer accurate.

Tables 2 and 3 provide the calculated construction air emissions for each type of equipment used during construction and the personal vehicles used during construction, respectively. The fuel for the construction equipment was assumed to be diesel fuel. The units for the calculated emissions are in tons/year (T/yr).

Reference (4) provides the emission factors for standard automobiles. Table 3.3-1, Emission Factors for Uncontrolled Gasoline Engines and Diesel Industrial Engines, of Reference (5) provides the emission factors SHINE used to calculate the annual emissions for carbon monoxide (CO), nitrogen oxide ($NO_x$), particulate matter (PM), hydrocarbons, sulfur dioxide ($SO_2$), and carbon dioxide ($CO_2$).

**Table 2. Emissions from Equipment Used During Construction Activities**

| Type of Vehicle | Engine Horse-power (hp) | Total Amount of Equipment (24 month period) (equip.-months) | Average per Month | CO (T/yr) | $NO_x$ (T/yr) | PM (T/yr) | Hydro-carbons (T/yr) | $SO_2$ (T/yr) | $CO_2$ (T/yr) |
|---|---|---|---|---|---|---|---|---|---|
| Asphalt Compactor Cat CB434C | 107 | 5 | 0.208 | 0.093 | 0.432 | 0.031 | 0.034 | 0.029 | 16.022 |
| Asphalt Paver, Barber Greene AP-1000 | 174 | 5 | 0.208 | 0.151 | 0.702 | 0.050 | 0.056 | 0.046 | 26.055 |
| Backhoe/Loader Cat 430 | 105 | 67 | 2.792 | 1.224 | 5.679 | 0.403 | 0.453 | 0.376 | 210.684 |
| Boom Lift JLG 800AJ | 65 | 76 | 3.167 | 0.859 | 3.988 | 0.283 | 0.318 | 0.264 | 147.943 |
| Concrete Pump Putzmeister 47Z-Meter | 300 | 29 | 1.208 | 1.513 | 7.023 | 0.498 | 0.560 | 0.464 | 260.547 |
| Crane (Lattice Boom, Manitowoc 8000-80t) | 205 | 13 | 0.542 | 0.464 | 2.151 | 0.153 | 0.171 | 0.142 | 79.811 |
| Crane (Picker, Grove RT530E-2 30t) | 160 | 55 | 2.292 | 1.531 | 7.104 | 0.504 | 0.566 | 0.470 | 263.542 |
| Crane (Picker, Grove RT600E-50t) | 173 | 11 | 0.458 | 0.331 | 1.536 | 0.109 | 0.122 | 0.102 | 56.991 |
| Dump, Dual axel (15 cy) Mack | 350 | 47 | 1.958 | 2.862 | 13.280 | 0.942 | 1.058 | 0.878 | 492.643 |
| Excavator (Large, Cat 345D L) | 380 | 5 | 0.208 | 0.331 | 1.534 | 0.109 | 0.122 | 0.101 | 56.901 |

| Type of Vehicle | Engine Horse-power (hp) | Total Amount of Equipment (24 month period) (equip.-months) | Average per Month | CO (T/yr) | $NO_x$ (T/yr) | PM (T/yr) | Hydro-carbons (T/yr) | $SO_2$ (T/yr) | $CO_2$ (T/yr) |
|---|---|---|---|---|---|---|---|---|---|
| Excavator (Medium, Cat 321D LCR) | 148 | 13 | 0.542 | 0.335 | 1.553 | 0.110 | 0.124 | 0.103 | 57.620 |
| Extended Forklift Lull 1044C-54 | 115 | 97 | 4.042 | 1.941 | 9.005 | 0.639 | 0.718 | 0.596 | 334.069 |
| Fuel Truck, Mack MP6 | 150 | 14 | 0.583 | 0.365 | 1.695 | 0.120 | 0.135 | 0.112 | 62.891 |
| Material Truck 2-½t F-650 | 270 | 31 | 1.292 | 1.456 | 6.757 | 0.480 | 0.538 | 0.447 | 250.664 |
| Mechanic's Truck 2-½t F-650 | 270 | 27 | 1.125 | 1.268 | 5.885 | 0.418 | 0.469 | 0.389 | 218.320 |
| Motor Grader Cat 140M | 183 | 15 | 0.625 | 0.478 | 2.216 | 0.157 | 0.177 | 0.147 | 82.207 |
| Pickup Truck F-250 | 300 | 183 | 7.625 | 9.550 | 44.320 | 3.145 | 3.531 | 2.931 | 1644.141 |
| Semi Tractor and Trailer (20 cy) Mack MP8 | 450 | 69 | 2.875 | 5.401 | 25.066 | 1.779 | 1.997 | 1.658 | 929.883 |
| Skidsteer Loader Case SR200 | 75 | 79 | 3.292 | 1.031 | 4.783 | 0.339 | 0.381 | 0.316 | 177.441 |
| Tracked Dozer Cat D6 | 150 | 21 | 0.875 | 0.548 | 2.543 | 0.180 | 0.203 | 0.168 | 94.336 |
| Tracked Dozer Cat D7 | 235 | 26 | 1.083 | 1.063 | 4.933 | 0.350 | 0.393 | 0.326 | 182.982 |
| Tracked Dozer Cat D8 | 310 | 19 | 0.792 | 1.025 | 4.755 | 0.337 | 0.379 | 0.314 | 176.393 |
| Tracked Loader Cat 973C | 242 | 43 | 1.792 | 1.810 | 8.401 | 0.596 | 0.669 | 0.556 | 311.638 |
| Vibratory Soil Compactor Cat C874 | 156 | 14 | 0.583 | 0.380 | 1.763 | 0.125 | 0.140 | 0.117 | 65.406 |
| Water Truck Mack MP6 | 150 | 11 | 0.458 | 0.287 | 1.332 | 0.095 | 0.106 | 0.088 | 49.414 |
| Portable Air Compressors | 50 | 54 | 2.250 | 0.470 | 2.180 | 0.155 | 0.174 | 0.144 | 80.859 |
| Portable Generators | 50 | 61 | 2.542 | 0.531 | 2.462 | 0.175 | 0.196 | 0.163 | 91.341 |
| Portable Welders | 50 | 45 | 1.875 | 0.391 | 1.816 | 0.129 | 0.145 | 0.120 | 67.383 |
| Walk Behind Compactor | 50 | 23 | 0.958 | 0.200 | 0.928 | 0.066 | 0.074 | 0.061 | 34.440 |
| **Total** | | **1158** | **48** | **38** | **176** | **12** | **14** | **12** | **6523** |

**Table 3. Emissions from Personal Vehicles Used During Construction Activities**

| Type of Vehicle | Fuel Type | Engine Horse-power (hp) | Peak Number of Vehicles | CO (T/yr) | $NO_x$ (T/yr) | Hydro-carbons (T/yr) | PM-10 (T/yr) | PM-2.5 (T/yr) | $CO_2$ (T/yr) |
|---|---|---|---|---|---|---|---|---|---|
| Standard Passenger Automobile (50 Miles Daily Commute) | Gasoline | 150 | 391 | 50.643 | 3.734 | 5.802 | 0.024 | 0.022 | 1984.774 |
| Standard Passenger Automobile (100 Miles Daily Commute) | Gasoline | 150 | 29 | 7.512 | 0.554 | 0.861 | 0.004 | 0.003 | 294.417 |
| **Total** | | | **420** | **58** | **4** | **7** | **0.03** | **0.03** | **2279** |

SHINE used the equation from Section 13.2.3, Heavy Construction Operations, of Reference (5) to calculate the fugitive dust emissions from construction activities. The amount of fugitive dust generated during construction activities that affect 51.0 acres of land is 734 tons/year. For the fugitive dust calculations, SHINE assumed that no mitigative measures were taken to reduce the amount of fugitive dust generated during construction activities. The equation provided in Section 13.2.3 of Reference (5) assumes that the construction activities will be performed in a semiarid climate. The location of the construction activities for the SHINE site (Janesville, WI) is not in a semiarid climate zone. Therefore, the amount of dust at the Janesville site would be less than the amount of dust in a semiarid climate and the results of the fugitive dust calculations are conservative.

The following assumptions were made to calculate the emissions from construction activities:

- The daily shift duration was assumed to be 10 hours/day. Construction activities were assumed to occur 5 days/week for 50 weeks/year. For the construction equipment, it was assumed that the equipment was running for 5 hours/day. From these assumptions, it was calculated that the construction equipment would be in use for 1250 hours annually.
- The equipment used during construction was found in Table 19.2.0-2 of Reference (2). The quantity of the construction equipment was found in RFI AMEC-2011-0033.
- The fuel for the construction equipment is assumed to be diesel fuel. This is a bounding assumption as diesel fuel has higher emission rates than gasoline.
- The number of passenger automobiles for construction was assumed to be 420 automobiles per month (the peak number of automobiles) (Subsection 19.4.7.1.1 of Reference (2)). The number of workers commuting 50 miles daily was assumed to be 391, and the number of workers commuting 100 miles daily was assumed to be 29.
- The fuel for the passenger automobiles was assumed to be gasoline. A standard passenger automobile was assumed as the type of personal vehicle.
- The duration of construction activities was assumed to be 24 months (Subsection 19.4.7.1 of Reference (2)). The actual construction schedule is 12 months. However, using 24 months is conservative because this duration over-predicts the expected amount of equipment needed for construction of the facility, thereby over-predicting the total amount of emissions as a result of the amount of equipment used.

- For fugitive dust calculations, the total number of acres affected due to construction activities was assumed to be 51.0 acres (Section 19.2 of Reference (2)). The amount of land permanently converted to industrial facilities will be 25.67 acres (Subsection 19.4.1.1.1 of Reference (2)) and the remaining 25.1 acres will only be temporarily disturbed during construction activities (Subsection 19.2 of Reference (2)). Fugitive dust was not calculated for the personal vehicles because the automobiles will be parked at the site during construction activities.

**Air Quality Request #2**

*Please describe how air emission estimates from the isotope production activities were quantified. Provide assumptions and calculations for the isotope production air emission estimates provided in Section 19.4.2.1.2.1.1 of the environmental report (ER).*

**SHINE Response**

Non-radioactive air emission estimates were quantified in Calculation CALC-2013-0005, "Annual release of NOx gas and sulfuric acid," Revision 0, provided as Attachment 2. Assumptions are described in Section 5 of the calculation.

**Air Quality Request #3**

*Air emission control systems for the SHINE process operations need to be described in detail to assess effectiveness. Please provide ventilation system capture efficiencies, equipment design sizing information (air flow rates, carbon adsorption capacities and breakthrough times, air-to-cloth ratios, etc.), and equipment control efficiencies for the high efficiency particulate air filters and activated carbon beds used in venting.*

**SHINE Response**

The SHINE radiologically controlled area (RCA) utilizes a three-zone heating, ventilation, and air conditioning (HVAC) philosophy. RCA ventilation system Zone 1 (RVZ1) represents the most potentially contaminated areas of the SHINE facility, including the irradiation unit (IU) cells and hot cells. RCA ventilation system Zone 2 (RVZ2) represents RVZ1 access ways, fume hoods, etc. RCA ventilation system Zone 3 (RVZ3) is the least potentially contaminated of the RCA zones, and represents those areas used for operations. The RCA ventilation system Zone 2 Supply Air (RVZ2SA) provides intake air directly to RVZ2 and RVZ3. Air is directly exhausted from RVZ1 and RVZ2 by way of RVZ1 exhaust and RVZ2 exhaust, respectively. Additional RCA ventilation system details are discussed in Section 9a2.1 of the SHINE Preliminary Safety Analysis Report (PSAR) (Reference 3).

Due to the potential for contamination in the RCA, the RCA ventilation system utilizes a "once through" approach, in which none of the exhaust air is recycled into the inlet. Air changes per hour (ACH) for the three RCA ventilation zones are provided in Table 4.

**Table 4. Air Exchange Rates for HVAC Zones within the SHINE RCA**

| Zone | Air Exchange Rate |
|---|---|
| RVZ3 | Maximum of 4 ACH or 0.5 cfm/ft$^2$ |
| RVZ2 | 6 ACH |
| RVZ1 | 10 ACH |

As discussed in Section 9a2.1 of the SHINE PSAR (Reference 3), the RCA exhaust air is filtered through two stages of high efficiency particulate air (HEPA) filtration and one stage of high efficiency gas adsorber (HEGA) filtration. Both HEPA stages are qualified, and have a minimum capture efficiency of 99.97% of 0.3 μm particles. The HEGA stage is also qualified, and maintains a minimum mechanical capture efficiency of 99.9%.

**Air Quality Request #4**

*Section 19.4.2.1.2.2.4 of the ER describes air quality modeling, but does not provide detailed input and output data. Please provide the air modeling input and output files, when available. Include associated building, terrain, and meteorological data files. Also, include a scale site map showing modeled stacks, buildings, and property lines.*

**SHINE Response**

SHINE does not currently have access to the air quality modeling performed to support the development of Reference (2). SHINE re-performed the air quality modeling analysis utilizing the U.S. Environmental Protection Agency (EPA) AERMOD air dispersion modeling system. Based on the results of the SHINE-performed air quality modeling analysis, revisions to the values in Tables 19.4.2-10, Table 19.4.2-11, Subsection 19.4.2.1.2.2.4.2, and Subsection 19.4.2.1.2.2.4.3 of Reference (2) are required.

Maximum Predicted Impact values for pollutants CO, $NO_2$, $SO_2$, and $PM_{10}$, and each value's corresponding Year, provided in Table 19.4.2-10 of Reference (2), require revision as a result of the SHINE performed air quality modeling analysis. Revised values are provided in Table 5.

**Table 5. Pollutant Impacts Compared to the SIL**

| Pollutant | Averaging Period | Maximum Predicted Impact ($\mu g/m^3$)[b] | Year | SIL ($\mu g/m^3$) |
|---|---|---|---|---|
| CO | 1-hr. | 26.45 | 2009 | 2000 |
| | 8-hr. | 12.16 | 2007 | 500 |
| $NO_2$ | 1-hr. | 61.57 | 2007 | 7.5 |
| | Annual | 1.722 | 5-yr | 1 |
| $SO_2$ | 1-hr. | 0.2266 | 2009 | 7.9 |
| | 3-hr. | 0.1238 | 2010 | 25 |
| | 24-hr. | 0.0584 | 2008 | 5 |
| | Annual | 0.0062 | 5-yr | 1 |
| $PM_{10}$ | 24-hr. | 0.7318 | 2008 | 5 |
| | Annual | 0.0786 | 5-yr | 1 |
| $PM_{2.5}$[a] | 24-hr. | 0.75 | 5-yr | 1.2 |
| | Annual | 0.09 | 5-yr | 0.3 |

a) A recent court decision (US Court of Appeals, For the District of Columbia Circuit), January 22, 2013, Sierra Club vs. EPA (No. 10-1413) vacated the PM2.5 SIL and remanded it to EPA. The SILs for other pollutants remain in effect.
b) Values represent the highest predicted impacts for each pollutant and averaging time.

Predicted Impact values for pollutants CO, $NO_x$, $PM_{10}$, and $SO_2$, and the corresponding Rank, Year, Total Concentration, and percent of NAAQS, provided in Table 19.4.2-11 of Reference (2) require revision as a result of the SHINE-performed air quality modeling analysis. Revised values are provided in Table 6.

**Table 6. Pollutant Impacts Compared to the NAAQS**

| Pollutant | Averaging Period | Rank | Predicted Impact ($\mu g/m^3$) | Year[(a)] | Bkgd. Conc. ($\mu g/m^3$) | Total Conc. ($\mu g/m^3$) | NAAQS[(b)] ($\mu g/m^3$) | % of NAAQS | PSD Increment ($\mu g/m^3$) |
|---|---|---|---|---|---|---|---|---|---|
| CO | 1-hr. | H1H[(c)] | 26.45 | 2009 | 1363 | 1389 | 40,000 | 3 | None |
| | 8-hr. | H1H[(c)] | 12.16 | 2007 | 1191 | 1203 | 10,000 | 12 | None |
| $NO_x$ | 1-hr. | H1H[(c)] | 61.57 | 2007 | 55 | 116.6 | 188.7 | 62 | None |
| (as $NO_2$)[(d)] | Annual | H1H[(c)] | 1.72 | 2007 | 24.1 | 25.8 | 100 | 26 | 25 |
| $PM_{10}$[(e)] | 24-hr. | H1H[(c)] | 0.7318 | 2008 | 47 | 47.7 | 150 | 32 | 30 |
| $PM_{2.5}$ | 24-hr. | $98^{th}$% | 0.54 | 5-yr | 28.9 | 29.4 | 35 | 84 | 9 |
| | Annual | H1H[(c)] | 0.09 | 5-yr | 10.2 | 10.3 | 12 | 86 | 4 |
| $SO_2$[(f)] | 1-hr. | H1H[(c)] | 0.2266 | 2009 | 13 | 13.2 | 195 | 7 | None |
| | 3-hr. | H1H[(c)] | 0.1238 | 2010 | 43.2 | 43.3 | 1300 | 3 | 512 |

a) 5-yr indicates an average over the 5 modeled years
b) Primary standards except $SO_2$ 3-hr., which is a secondary standard
c) H1H is the high, first high and H2H is the high, second high concentration of ranked concentrations at all receptors
d) $NO_x$ modeled; assume a 100% conversion rate of $NO_x$ to $NO_2$
e) Although there is an SIL for the annual $PM_{10}$ impacts, there is no NAAQS standard
f) 24-hr. and Annual standards revoked June 22, 2010 (75 FR 35520)

The 1-hr. $NO_2$ impact discussed in Subsection 19.4.2.1.2.2.4.2 of Reference (2) requires revision as a result of the SHINE-performed air quality modeling analysis. Subsection 19.4.2.1.2.2.4.2 currently states, “The 1-hr. and annual $NO_2$ impacts, which do exceed the respective SILs, are about 53 percent and 26 percent of the respective NAAQS.” This statement is revised to state, “The 1-hr. and annual $NO_2$ impacts, which do exceed the respective SILs, are about 62 percent and 26 percent of the respective NAAQS.”

The 1-hr. and annual $NO_2$ impacts discussed in Subsection 19.4.2.1.2.2.4.3 of Reference (2) also require revision as a result of the SHINE-performed air quality modeling analysis. Subsection 19.4.2.1.2.2.4.3 currently states, “Applying AERMOD without limitations on the operating schedule, the 1-hr. $NO_2$ impacts at the residence and at the church are 35.4 micrograms per cubic meter ($\mu g/m^3$) and 29.7 $\mu g/m^3$, respectively. For the annual $NO_2$ exposure, the impacts are 0.36 $\mu g/m^3$ and 0.21 $\mu g/m^3$ for the residence and church, respectively.” These statements are revised to state, “Applying AERMOD without limitations on the operating schedule, the 1-hr. $NO_2$ impacts at the residence and at the church are 30.13 micrograms per cubic meter ($\mu g/m^3$) and 22.66 $\mu g/m^3$, respectively. For the annual $NO_2$ exposure, the impacts are 0.157 $\mu g/m^3$ and 0.206 $\mu g/m^3$ for the residence and church, respectively.”

The AERMOD input file for the SHINE-performed air quality modeling analysis is provided as Attachment 3. The AERMOD output files for pollutants CO, $NO_2$, $PM_{10}$, and $SO_2$ are provided as Attachments 4, 5, 6, and 7, respectively.

The AERMOD building data input and output files are provided as Attachments 8 and 9, respectively. The AERMOD terrain data input file is provided as Attachment 10. The AERMOD terrain data output files are provided as Attachment 11, Attachment 12 (receptor locations), and Attachment 13 (source locations). The AERMOD meteorological profile data is provided as Attachment 14. The AERMOD meteorological surface data is provided as Attachment 15.

A simplified site drawing, including modeled stacks, buildings, and property lines, is provided as Attachment 16.

The results of the SHINE-performed air quality modeling analysis do not affect the conclusions provided in Section 19.4.2.1.2.2.4 of Reference (2).

**Air Quality Request #5**

*Air emissions during decommissioning need to be quantified to determine potential impacts. Please provide estimated emission quantities and durations for decommissioning activities. Please identify all emission sources, estimate emissions from each source (including fugitive dust emissions), identify references used and emission factors, and describe all assumptions (e.g., number of workers and workforce commute, decommissioning duration, etc.) and calculations used to estimate emissions.*

**SHINE Response**

Decommissioning air emissions have been estimated in CALC-2013-0007, and are provided in Table 7.

**Table 7. Total Calculated Air Emissions for Decommissioning Activities**

| | **Annual Emissions (Tons/year)** |
|---|---|
| CO | 74 |
| NOx | 174 |
| PM | 12 |
| Hydrocarbons | 18 |
| $SO_2$ | 11 |
| $CO_2$ | 7782 |

Table 19.2.0-2 of Reference (2) lists equipment that would be present during decommissioning activities. RFI AMEC-2011-0033, provided as Attachment 1, provides a bounding estimate of the construction equipment necessary over the duration of construction activities. It was assumed that half the amount of each equipment type would be needed for decommissioning because the duration of decommissioning activities would be 12 months (half the duration of construction activities). The total annual emissions listed provided in Table 7 include emissions from both decommissioning equipment and personal vehicles.

RFI AMEC-2011-0033 was only used to estimate the amount of construction equipment that would be present during construction activities. The start and end dates of construction activities provided in the RFI are no longer accurate.

Tables 8 and 9 provide the calculated decommissioning air emissions for each type of equipment used during decommissioning and the personal vehicles used during decommissioning, respectively. The fuel for the decommissioning equipment was assumed to be diesel fuel. The units for the calculated emissions are in tons/year (T/yr).

Reference (4) provides the emission factors for standard automobiles. Table 3.3-1, Emission Factors for Uncontrolled Gasoline Engines and Diesel Industrial Engines, of Reference (5) provides the emission factors SHINE used to calculate the annual emissions for carbon monoxide (CO), nitrogen oxide ($NO_x$), particulate matter (PM), hydrocarbons, sulfur dioxide ($SO_2$), and carbon dioxide ($CO_2$).

**Table 8. Emissions from Equipment Used During Decommissioning Activities**

| Type of Vehicle | Engine Horse-power (hp) | Total Amount of Equipment (24 month period) (equip.-months) | Average per Month | CO (T/yr) | $NO_x$ (T/yr) | PM (T/yr) | Hydro-carbons (T/yr) | $SO_2$ (T/yr) | $CO_2$ (T/yr) |
|---|---|---|---|---|---|---|---|---|---|
| Backhoe/Loader Cat 430 | 105 | 34 | 2.833 | 1.242 | 5.764 | 0.409 | 0.459 | 0.381 | 213.828 |
| Boom Lift JLG 800AJ | 65 | 38 | 3.167 | 0.859 | 3.988 | 0.283 | 0.318 | 0.264 | 147.943 |
| Crane (Lattice Boom, Manitowoc 8000-80t) | 205 | 7 | 0.583 | 0.499 | 2.317 | 0.164 | 0.185 | 0.153 | 85.951 |
| Crane (Picker, Grove RT530E-2 30t) | 160 | 28 | 2.333 | 1.559 | 7.233 | 0.513 | 0.576 | 0.478 | 268.333 |
| Crane (Picker, Grove RT600E-50t) | 173 | 6 | 0.500 | 0.361 | 1.676 | 0.119 | 0.134 | 0.111 | 62.172 |
| Dump, Dual axel (15 cy) Mack | 350 | 24 | 2.000 | 2.923 | 13.563 | 0.963 | 1.081 | 0.897 | 503.125 |
| Excavator (Large, Cat 345D L) | 380 | 3 | 0.250 | 0.397 | 1.841 | 0.131 | 0.147 | 0.122 | 68.281 |
| Excavator (Medium, Cat 321D LCR) | 148 | 7 | 0.583 | 0.360 | 1.673 | 0.119 | 0.133 | 0.111 | 62.052 |
| Extended Forklift Lull 1044C-54 | 115 | 49 | 4.083 | 1.961 | 9.098 | 0.646 | 0.725 | 0.602 | 337.513 |
| Fuel Truck, Mack MP6 | 150 | 7 | 0.583 | 0.365 | 1.695 | 0.120 | 0.135 | 0.112 | 62.891 |
| Material Truck 2-½t F-650 | 270 | 16 | 1.333 | 1.503 | 6.975 | 0.495 | 0.556 | 0.461 | 258.750 |
| Mechanic's Truck 2-½t F-650 | 270 | 14 | 1.167 | 1.315 | 6.103 | 0.433 | 0.486 | 0.404 | 226.406 |

| Type of Vehicle | Engine Horse-power (hp) | Total Amount of Equipment (24 month period) (equip.-months) | Average per Month | CO (T/yr) | $NO_x$ (T/yr) | PM (T/yr) | Hydro-carbons (T/yr) | $SO_2$ (T/yr) | $CO_2$ (T/yr) |
|---|---|---|---|---|---|---|---|---|---|
| Motor Grader Cat 140M | 183 | 8 | 0.667 | 0.509 | 2.364 | 0.168 | 0.188 | 0.156 | 87.688 |
| Pickup Truck F-250 | 300 | 92 | 7.667 | 9.603 | 44.563 | 3.163 | 3.551 | 2.947 | 1653.125 |
| Semi Tractor and Trailer (20 cy) Mack MP8 | 450 | 35 | 2.917 | 5.480 | 25.430 | 1.805 | 2.026 | 1.682 | 943.359 |
| Skidsteer Loader Case SR200 | 75 | 40 | 3.333 | 1.044 | 4.844 | 0.344 | 0.386 | 0.320 | 179.688 |
| Tracked Dozer Cat D6 | 150 | 11 | 0.917 | 0.574 | 2.664 | 0.189 | 0.212 | 0.176 | 98.828 |
| Tracked Dozer Cat D7 | 235 | 13 | 1.083 | 1.063 | 4.933 | 0.350 | 0.393 | 0.326 | 182.982 |
| Tracked Dozer Cat D8 | 310 | 10 | 0.833 | 1.079 | 5.005 | 0.355 | 0.399 | 0.331 | 185.677 |
| Tracked Loader Cat 973C | 242 | 22 | 1.833 | 1.852 | 8.596 | 0.610 | 0.685 | 0.568 | 318.885 |
| Vibratory Soil Compactor Cat C874 | 156 | 7 | 0.583 | 0.380 | 1.763 | 0.125 | 0.140 | 0.117 | 65.406 |
| Water Truck Mack MP6 | 150 | 6 | 0.500 | 0.313 | 1.453 | 0.103 | 0.116 | 0.096 | 53.906 |
| Portable Air Compressors | 50 | 27 | 2.250 | 0.470 | 2.180 | 0.155 | 0.174 | 0.144 | 80.859 |
| Portable Generators | 50 | 31 | 2.583 | 0.539 | 2.503 | 0.178 | 0.199 | 0.165 | 92.839 |
| Portable Welders | 50 | 23 | 1.917 | 0.400 | 1.857 | 0.132 | 0.148 | 0.123 | 68.880 |
| Walk Behind Compactor | 50 | 12 | 1.000 | 0.209 | 0.969 | 0.069 | 0.077 | 0.064 | 35.938 |
| **Total** | | | **48** | **37** | **171** | **12** | **14** | **11** | **6345** |

**Table 9. Emissions from Personal Vehicles Used During Decommissioning Activities**

| Type of Vehicle | Fuel Type | Engine Horse-power (hp) | Peak Number of Vehicles | CO (T/yr) | $NO_x$ (T/yr) | Hydro-carbons (T/yr) | PM-10 (T/yr) | PM-2.5 (T/yr) | $CO_2$ (T/yr) |
|---|---|---|---|---|---|---|---|---|---|
| Standard Passenger Automobile (50 Miles Daily Commute) | Gasoline | 150 | 239 | 30.956 | 2.282 | 3.547 | 0.014 | 0.014 | 1213.199 |
| Standard Passenger Automobile (100 Miles Daily Commute) | Gasoline | 150 | 22 | 5.699 | 0.420 | 0.653 | 0.003 | 0.002 | 223.351 |
| **Total** | | | **261** | **37** | **3** | **4** | **0.02** | **0.02** | **1437** |

The equation from Section 13.2.3, Heavy Construction Operations, of Reference (5) was used to calculate the fugitive dust emissions from decommissioning activities. The amount of fugitive dust generated during decommissioning activities that affect 25.67 acres of land is 370 tons/year. For the fugitive dust calculations, SHINE assumed that no mitigative measures were taken to reduce the amount of fugitive dust generated during decommissioning activities. The equation provided in Section 13.2.3 of Reference (5) assumes that the decommissioning activities will be performed in a semiarid climate. The location of the decommissioning activities for the SHINE site (Janesville, WI) is not located in a semiarid climate zone. Therefore, the amount of dust at the Janesville site would be less than the amount of dust in a semiarid climate and the results of the fugitive dust calculations are conservative.

The following assumptions were made to calculate the emissions from decommissioning activities:

- The equipment used for decommissioning activities was found in Table 19.2.0-2 of Reference (2). It was assumed that for each equipment type, the amount of equipment to be used during decommissioning activities was equal to half the amount used during construction activities (and rounded up to the nearest whole number value). This is a valid assumption because the duration of decommissioning activities is assumed to be half the duration of construction activities.
- The fuel for the decommissioning equipment is assumed to be diesel fuel. This is a bounding assumption as diesel fuel has higher emission rates than gasoline.
- The number of passenger automobiles was assumed to be 261 automobiles (Subsection 19.4.7.1.1 of Reference (2)). The number of workers commuting 50 miles daily was assumed to be 239, and the number of workers commuting 100 miles daily was assumed to be 22.
- The fuel for the passenger automobiles was assumed to be gasoline. A standard passenger automobile was assumed as the type of personal vehicle.
- The duration of decommissioning activities was assumed to be 12 months. As stated in SHINE Response to Air Quality Request #1, 24 months was a conservative estimate for the duration of construction activities. The duration of decommissioning activities was assumed to be half the duration of construction activities.

- For fugitive dust calculations, the total number of acres assumed to be affected by decommissioning activities is 25.67 acres (the amount of acreage that was permanently converted to industrial facilities during construction activities). Fugitive dust was not calculated for the personal vehicles because the automobiles will be parked at the site during decommissioning activities.

**Air Quality Request #6**

*Greenhouse gases (GHG) emissions need to be quantified for construction, operation, and decommissioning. Please provide estimates of GHG emissions during construction, operation, and decommissioning. Please identify all GHG emission sources, estimate GHG emissions from each source, identify emission factors used in the calculations and references, and describe all assumptions (e.g., frequency, distance traveled, and type of truck deliveries, and waste shipments, the number of workers and workforce commute distance assumptions, and construction and decommissioning duration, etc.) and calculations used to estimate GHG emissions.*

**SHINE Response**

Construction

SHINE estimated greenhouse gas (GHG) emissions for construction, operation, and decommissioning based on the results of CALC-2013-0007. SHINE reviewed the U.S. Environmental Protection Agency's Overview of Greenhouse Gases (http://www.epa.gov/climatechange/ghgemissions/gases.html) to determine which gaseous emissions from the calculation were considered GHG emissions. SHINE determined that carbon dioxide ($CO_2$), methane ($CH_4$), and nitrous oxide ($N_2O$) are the only GHGs of significant quantities that will be emitted during construction, operation, and decommissioning of the facility.

During construction, GHG emission sources include both equipment used during construction activities (provided in Table 2 of the SHINE Response to Air Quality Request #1) and personal vehicles. Construction equipment-specific $CO_2$ emissions are also provided in Table 2 of the SHINE Response to Air Quality Request #1. For the estimate of $CH_4$ and $N_2O$ emissions from construction equipment, SHINE used Section 19.2 of Reference (2), which states approximately 24,587 gallons of diesel fuel will be used per month of construction activities, equivalent to 295,044 gallons annually. Table A-6, $CH_4$ and $N_2O$ Emission Factors for Non-Highway Vehicles, of Reference (6) provides the emission factors SHINE used to calculate the annual construction equipment emissions of $CH_4$ and $N_2O$, based on the estimated annual consumption of diesel fuel during construction. Table 10 provides the total GHG emissions from equipment used during construction activities.

**Table 10. Total Calculated GHG Emissions for Construction Equipment**

| | **Annual Emissions (Tons/year)** |
|---|---|
| $CO_2$ | 6523 |
| $CH_4$ | 0.189 |
| $N_2O$ | 0.085 |

Table 11 provides GHG emissions for personal vehicles used during construction. Table 3.3-1, Emission Factors for Uncontrolled Gasoline Engines and Diesel Industrial Engines, of Reference (5) provides the emission factors SHINE used to calculate the annual emissions for $CO_2$. Table 2, $CH_4$ and $N_2O$ Emission Factors for Highway Vehicles, of Reference (6) provides the emission factors SHINE used to calculate annual GHG emissions of $CH_4$ and $N_2O$ from personal vehicles.

**Table 11. Greenhouse Gas Emissions from Personal Vehicles Used During Construction**

| Type of Vehicle | Fuel Type | Engine Horsepower (hp) | Monthly Average (# of vehicles) | $CO_2$ (T/yr) | $CH_4$ (T/yr) | $N_2O$ (T/yr) |
|---|---|---|---|---|---|---|
| Standard Passenger Automobile (50 Miles Daily Commute) | Gasoline | 150 | 391 | 1985 | 0.093 | 0.019 |
| Standard Passenger Automobile (100 Miles Daily Commute) | Gasoline | 150 | 29 | 294 | 0.014 | 0.003 |
| **Total** | | | **420** | **2279** | **0.107** | **0.022** |

Assumptions made in calculating GHG emissions during construction activities are provided in the SHINE Response to Air Quality Request #1.

Operation

During operation, GHG emission sources include personal vehicles, trucks providing monthly deliveries and waste shipments, and stationary sources, which include the standby diesel generator, the natural gas fired boiler providing heating water to the HVAC air handlers, and the natural gas fired heaters located in the Administration Building, Support Facility Building, Waste Staging and Shipping Building, and Diesel Generator Building.

Table 12 provides GHG emissions for personal vehicles used during operation. Table 3.3-1, Emission Factors for Uncontrolled Gasoline Engines and Diesel Industrial Engines, of Reference (5) provides the emission factors SHINE used to calculate the annual emissions for $CO_2$. Table 2, $CH_4$ and $N_2O$ Emission Factors for Highway Vehicles, of Reference (6) provides the emission factors SHINE used to calculate annual GHG emissions of $CH_4$ and $N_2O$ from personal vehicles.

**Table 12. Greenhouse Gas Emissions from Personal Vehicles Used During Operation**

| Type of Vehicle | Fuel Type | Engine Horsepower (hp) | Monthly Average (# of vehicles) | $CO_2$ (T/yr) | $CH_4$ (T/yr) | $N_2O$ (T/yr) |
|---|---|---|---|---|---|---|
| Standard Passenger Automobile (50 Miles Daily Commute) | Gasoline | 150 | 139 | 706 | 0.033 | 0.007 |
| Standard Passenger Automobile (100 Miles Daily Commute) | Gasoline | 150 | 11 | 112 | 0.005 | 0.001 |
| **Total** | | | **150** | **818** | **0.038** | **0.008** |

Table 13 provides GHG emissions for trucks providing shipments and deliveries to and from the SHINE site, and waste shipments. SHINE estimated trucks designated for monthly deliveries will transport approximately nine product shipments per week, one non-radioactive waste shipment per week, and the remainder of the truck deliveries will be used for the delivery of consumables, parts, and other miscellaneous supplies needed to operate the SHINE facility. In addition to the monthly deliveries, SHINE estimated there will be one radioactive waste shipment per month. Table 3.3-1, Emission Factors for Uncontrolled Gasoline Engines and Diesel Industrial Engines, of Reference (5) provides the emission factors SHINE used to calculate the annual emissions for $CO_2$.

Table 2, $CH_4$ and $N_2O$ Emission Factors for Highway Vehicles, of Reference (6) provides the emission factors SHINE used to calculate annual GHG emissions of $CH_4$ and $N_2O$ from truck shipments. For $CH_4$ and $N_2O$ emissions from monthly truck shipments and deliveries, SHINE assumed shipments and deliveries are made via round trips between the SHINE site and the farthest SHINE customer location, located in North Billerica, Massachusetts (a round trip distance of 2200 miles). For waste shipments, SHINE assumed waste shipments are made via round trips from the SHINE site and the farthest disposal facility, located in Clive, Utah (a round trip distance of 2900 miles).

**Table 13. Greenhouse Gas Emissions from Monthly Truck Deliveries and Waste Shipments During Operation**

| Type of Vehicle | Fuel Type | Engine Horsepower (hp) | Monthly Average (# of trips) | $CO_2$ (T/yr) | $CH_4$ (T/yr) | $N_2O$ (T/yr) |
|---|---|---|---|---|---|---|
| Semi Tractor and Trailer (20 cy) Mack MP8 (Shipments/Deliveries) | Diesel | 450 | 36 | 11,644 | 0.005 | 0.005 |
| Semi Tractor and Trailer (20 cy) Mack MP8 (Waste Shipments) | Diesel | 450 | 1 | 323 | 0.0002 | 0.0002 |
| **Total** | | | **37** | **11,967** | **0.005** | **0.005** |

Table 14 provides GHG emissions from stationary sources at the SHINE site during operations. Table 3.4-1, Gaseous Emission Factors for Large Stationary Diesel and All Stationary Dual-Fuel Engines, of Reference (5) provides the emission factors SHINE used to calculate the annual $CO_2$ emissions from the standby diesel generator. The standby diesel generator was assumed to operate 96 hours per year. Table A-6, $CH_4$ and $N_2O$ Emission Factors for Non-Highway Vehicles, of Reference (6) provides the emission factors SHINE used to calculate the annual emissions of $CH_4$ and $N_2O$ from the standby diesel generator.

Table 1.4-2, Emission Factors for Criteria Pollutants and Greenhouse Gases from Natural Gas Combustion, of Reference (5) provides the emission factors SHINE used to calculate the annual GHG emissions from the natural gas fired boiler and heaters. GHG emission calculations for the natural gas fired boiler and heaters assumed 8400 operating hours per year (50 weeks per year, 7 days per week). The contribution of $CH_4$ and $N_2O$ from stationary sources was determined to be negligible.

**Table 14. Greenhouse Gas Emissions from Stationary Sources During Operation**

| Stationary Source | $CO_2$ (T/yr) |
|---|---|
| Standby Diesel Generator | 345 |
| Production Facility Building – Natural Gas Fired Boiler | 14,822 |
| Administration Building – Natural Gas Fired Heater | 143.2 |
| Support Facility Building – Natural Gas Fired Heater | 207.5 |
| Waste Staging and Shipping Building – Natural Gas Fired Heater | 89.0 |
| Diesel Generator Building – Natural Gas Fired Heater | 35.7 |
| **Total** | **15,642** |

Decommissioning

During decommissioning, GHG emission sources include both equipment used during decommissioning activities (provided in Table 8 of the SHINE Response to Air Quality Request #5) and personal vehicles. Decommissioning equipment-specific $CO_2$ emissions are also provided in Table 8 of the SHINE Response to Air Quality Request #5. For the estimate of $CH_4$ and $N_2O$ emissions from decommissioning equipment, SHINE used Section 19.2 of Reference (2), which states approximately 28,607 gallons of diesel fuel will be used per month of decommissioning activities, equivalent to 343,284 gallons annually. Table A-6, $CH_4$ and $N_2O$ Emission Factors for Non-Highway Vehicles, of Reference (6) provides the emission factors SHINE used to calculate the annual decommissioning equipment emissions of $CH_4$ and $N_2O$, based on the estimated annual consumption of diesel fuel during decommissioning. Table 15 provides the total GHG emissions from equipment used during decommissioning activities.

**Table 15. Total Calculated GHG Emissions for Decommissioning Equipment**

| | Annual Emissions (Tons/year) |
|---|---|
| $CO_2$ | 6345 |
| $CH_4$ | 0.219 |
| $N_2O$ | 0.098 |

Table 16 provides GHG emissions for personal vehicles used during decommissioning. Table 3.3-1, Emission Factors for Uncontrolled Gasoline Engines and Diesel Industrial Engines, of Reference (5) provides the emission factors SHINE used to calculate the annual emissions for $CO_2$. Table 2, $CH_4$ and $N_2O$ Emission Factors for Highway Vehicles, of Reference (6) provides the emission factors SHINE used to calculate annual GHG emissions of $CH_4$ and $N_2O$ from personal vehicles.

**Table 16. Greenhouse Gas Emissions from Personal Vehicles Used During Decommissioning Activities**

| Type of Vehicle | Fuel Type | Engine Horsepower (hp) | Peak Number of Vehicles | $CO_2$ (T/yr) | $CH_4$ (T/yr) | $N_2O$ (T/yr) |
|---|---|---|---|---|---|---|
| Standard Passenger Automobile (50 Miles Daily Commute) | Gasoline | 150 | 239 | 1213 | 0.057 | 0.012 |
| Standard Passenger Automobile (100 Miles Daily Commute) | Gasoline | 150 | 22 | 223 | 0.011 | 0.002 |
| **Total** | | | **261** | **1436** | **0.068** | **0.014** |

Table 17 provides total GHG emissions for construction, operation, and decommissioning activities.

**Table 17. Total Greenhouse Gas Emissions**

| | Construction (Tons/year) | Operation (Tons/year) | Decommissioning (Tons/year) |
|---|---|---|---|
| $CO_2$ | 8802 | 28,427 | 7781 |
| $CH_4$ | 0.296 | 0.043 | 0.287 |
| $N_2O$ | 0.107 | 0.013 | 0.112 |

**Air Quality Request #7**

*Emission rates for hazardous air pollutants and toxic chemicals regulated under Wisconsin regulations need to be quantified. Please provide emission estimates during construction, operation, and decommissioning for hazardous air pollutants and other toxic pollutants regulated under Wisconsin air regulations. Please identify all emission sources (e.g., construction equipment, vehicle emissions, etc.), estimate emissions from each source, and describe all assumptions and calculations used to estimate emissions.*

**SHINE Response**

Wisconsin Administrative Code NR 460.02 defines hazardous air pollutants as any air pollutant included in the list in Section 112(b)(1) of the act (42 USC 7412(b)(1)), as revised by 40 CFR 63, Subpart C. Except for radionuclides, the SHINE facility will not emit any of the hazardous air pollutants in the list. Except for incidental amounts (e.g., gasoline in lawnmowers and snowblowers, cleaning fluids), SHINE will not have any of these hazardous air pollutants on site. The emission of radionuclides is discussed in Subsection 19.4.8.2.4.1 of Reference (2).

Toxic chemical emissions are discussed in the SHINE Response to Human Health Request #5.

During construction or decommissioning, SHINE does not plan to use any products or processes that would emit hazardous air pollutants. SHINE also does not plan to have on site or use any toxic chemicals in excess of the threshold amounts listed in the Wisconsin Administrative Code WEM 3.04 during construction or decommissioning.

**Air Quality Request #8**

*Boiler and heating system load design and firing rate are provided in Tables 19.4.2-3 through 19.4.2-7. Please provide details about the design firing rate and heating load estimated from the natural gas fired boiler and natural gas fired heaters. Please provide details on the assumptions and calculations.*

**SHINE Response**

The design firing rate and heating load from the natural gas fired boiler and natural gas fired heaters are estimated in Calculation SL-011348, "SHINE Medical Isotope Production Facility Emergency Diesel Generator and Building Heating Emissions Evaluation," Revision 2, provided as Attachment 17. Assumptions are described in Section 2 of the calculation.

**Air Quality Request #9**

*Section 19.2.4.2 states that multiple natural gas fired boilers will provide heating water to the HVAC air handlers. However, Section 19.4.2.1.2.1.2 discusses only one natural gas boiler used in the production facility. Details on the natural gas fired boilers that provide heating water to the HVAC air handlers needs to be quantified and documented. Please provide details on the number, characteristics, and air emissions from each of the gas fired boilers.*

**SHINE Response**

Subsection 19.2.4.2 of Reference (2) contains an administrative error stating multiple natural gas fired boilers provide heating water to the HVAC air handlers. A single natural gas fired boiler provides heating water to the HVAC air handlers. An Issues Management Report (IMR) has been initiated to address the issue.

The natural gas fired boiler providing heating water to the HVAC air handlers will require a minimum boiler horsepower of 220 BHP (7,363,840 Btu/hr), assuming a heating supply air temperature of 98°F and a maximum heating water temperature of 138°F. The estimated design firing rate and air emissions for the natural gas fired boiler providing heating water to the HVAC air handlers are provided in Attachment 17. Estimated heating loads, design firing rates, and air emissions for the natural gas fired heaters located in the Administration Building, Support Facility Building, Waste Staging and Shipping Building, and Diesel Generator Building are also provided in Attachment 17.

**Air Quality Request #10**

*Vehicle emissions need to be quantified and documented. Please provide estimated vehicle emissions for all operational activities such as workforce commuting and truck deliveries. Describe all assumptions (e.g., frequency, distance traveled, and type of truck deliveries and waste shipments, the number of workers and workforce commute distance assumptions, emission factors) and identify references used.*

**SHINE Response**

Vehicle air emissions for operational activities have been estimated in CALC-2013-0007, including workforce commuting and truck deliveries. SHINE also estimated vehicle emissions from workforce commuting during construction and decommissioning activities.

Vehicle air emissions from personal vehicles used during construction activities are provided in Table 3. The duration of construction activities was assumed to be 24 months (Subsection 19.4.7.1 of Reference (2)). The actual construction schedule is 12 months. However, using 24 months is conservative because this duration over-predicts the expected amount of equipment needed for construction of the facility, thereby over-predicting the total amount of emissions as a result of the amount of equipment used.

Tables 18 and 19 provide the vehicle air emissions for personal vehicles and trucks providing monthly deliveries and waste shipments during operations, respectively. The fuel for the personal vehicles was assumed to be gasoline and the fuel for the trucks designated for monthly deliveries is assumed to be diesel fuel. Units for the calculated vehicle air emissions are in tons/year (T/yr).

Reference (4) provides the emission factors for standard automobiles. Table 3.3-1, Emission Factors for Uncontrolled Gasoline Engines and Diesel Industrial Engines, of Reference (5) provides the emission factors SHINE used to calculate the annual emissions for carbon monoxide (CO), nitrogen oxide ($NO_x$), particulate matter (PM), hydrocarbons, sulfur dioxide ($SO_2$), and carbon dioxide ($CO_2$).

**Table 18. Emissions from Personal Vehicles Used During Operations**

| Type of Vehicle | Engine Horse-power (hp) | Monthly Average | CO (T/yr) | $NO_x$ (T/yr) | Hydro-carbons (T/yr) | PM-10 (T/yr) | PM-2.5 (T/yr) | $CO_2$ (T/yr) |
|---|---|---|---|---|---|---|---|---|
| Standard Passenger Automobile (50 Miles Daily Commute) | 150 | 139 | 18.004 | 1.327 | 2.063 | 0.008 | 0.008 | 705.585 |
| Standard Passenger Automobile (100 Miles Daily Commute) | 150 | 11 | 2.849 | 0.210 | 0.326 | 0.001 | 0.001 | 111.675 |
| **Total** | | **150** | **21** | **2** | **2** | **0.01** | **0.01** | **817** |

**Table 19. Emissions from Monthly Truck Deliveries and Waste Shipments During Operation**

| Type of Vehicle | Engine Horse-power (hp) | Monthly Average | CO (T/yr) | $NO_x$ (T/yr) | PM (T/yr) | Hydro-carbons (T/yr) | $SO_2$ (T/yr) | $CO_2$ (T/yr) |
|---|---|---|---|---|---|---|---|---|
| Semi Tractor and Trailer (20 cy) Mack MP8 (Shipments/Deliveries) | 450 | 36 | 67.635 | 313.875 | 0.018 | 25.009 | 20.756 | 11,643.750 |
| Semi Tractor and Trailer (20 cy) Mack MP8 (Waste Shipments) | 450 | 1 | 1.879 | 8.719 | 0.000 | 0.695 | 0.577 | 323.438 |
| **Total** | | **37** | **70** | **323** | **0.02** | **26** | **21** | **11,967** |

SHINE estimated trucks designated for monthly deliveries will transport approximately nine product shipments per week, one non-radioactive waste shipment per week, and the remainder of the truck deliveries will be used for the delivery of consumables, parts, and other miscellaneous supplies needed to operate the SHINE facility. In addition to the monthly deliveries, SHINE estimated there will be one radioactive waste shipment per month.

Vehicle air emissions from personal vehicles used during decommissioning activities are provided in Table 9. The duration of decommissioning activities was assumed to be 12 months, half the duration of construction activities.

Fugitive dust was not calculated for personal vehicles because the automobiles will be parked at the site during construction, operations, and decommissioning activities. Fugitive dust was not calculated for the monthly truck shipments that will occur during operations because the roads that will be in use will be paved.

**Air Quality Request #11**

*The SHINE ER Section 19.4.2.1.1, describes mitigation measures that may be implemented to minimize the impacts of air emissions during construction to air quality. During the scoping period, NRC staff received comments from the Environmental Protection Agency (ML13238A121) regarding specific emission reduction techniques. Please clarify and identify if SHINE will be implementing applicable emission reduction techniques during construction and decommissioning of the facility as discussed in the comments provided by the EPA.*

**SHINE Response**

During construction and decommissioning, SHINE plans to implement the following diesel emissions reduction techniques, where practical:

1. Diesel equipment will use ultra-low sulfur diesel fuel (15 parts per million sulfur maximum).
2. Exhaust filtration devices (diesel oxidation catalyst, diesel particulate matter filters and/or catalytic converters) will be used.
3. Diesel fumes from exhaust pipes will be directed away from workers and operators of equipment.
4. New diesel equipment that is purchased will have required emission control systems.
5. Engine idling time will be minimized.
6. Diesel equipment inspection and necessary maintenance will be performed to ensure proper condition of the exhaust filtration devices.
7. Contractor(s) will be responsible for implementing diesel equipment recommended maintenance, procedures, and periodic checks to ensure emissions are kept low.
8. Diesel equipment which operates indoors will be vented to the outside using fitted hoses or portable ductwork.

**Air Quality Request #12**

*In accordance with RAI 10 under Proposed Action, please update Table 19.1.2-1 regarding air permits that will be required for construction and operation (e.g. diesel generator). Table 19.1.2-1 only identifies the Air Pollution Control Construction Permit.*

**SHINE Response**

An update to Table 19.1.2-1 of Reference (2), including the status of each permit, is provided as Attachment 18. The updated table includes an Air Pollution Control Operating Permit.

**ALTERNATIVES**

**Alternatives Request #1**

*Please provide any site selection studies or summaries prepared to support the site evaluation and selection process. For example, please provide the Phase 1 Environmental Site Assessment for Steven's Point and Golder's 2012 Geotechnical & Hydrological Investigation.*

**SHINE Response**

The SHINE site selection process is described in Subsection 19.5.2.1.1 of Reference (2). No additional comparative site selection studies or summaries were prepared to support the site evaluation and selection process. However, a Phase I Environmental Site Assessment was performed and four groundwater monitoring wells were installed at the Stevens Point site.

The Draft Phase I Environmental Assessment for the Stevens Point site is provided as Attachment 19. SHINE currently does not have access to Revision 0 of the Phase I Environmental Assessment for the Stevens Point site. When Revision 0 becomes available, SHINE will provide the finalized Phase I Environmental Assessment for the Stevens Point site to the NRC. An IMR has been initiated to track submittal of the Revision 0 Phase I Environmental Site Assessment to the NRC.

The Data Report of Well Installation, Stevens Point, Wisconsin, is provided as Attachment 20. Groundwater levels were measured at the wells on the Stevens Point site during December 2011, January 2012, and February 2012, and are provided as Attachment 21.

**Alternatives Request #2**

*In describing the alternative technologies, Section 19.5.2.2.1 of the ER states "...the linear accelerator-based approach is not able to produce medical isotopes other than Mo-99, and therefore, does not address the need for domestic SHINE as effectively as the SHINE technology." Other many accelerator-produced medical radioisotopes exist (i.e., see Adelsten, J. and F. Manning, Isotopes for Medicine and the Ufe Sciences, 1995). Please clarify why these linear accelerators could not meet SHINE's need.*

**SHINE Response**

The referenced statement in Section 19.5.2.2.1 of Reference (2) was intended to refer to the other SHINE-produced radionuclides, which are coproduced by the fission process.

For the linear accelerator facility alternative, molybdenum-99 (Mo-99) would be produced through (γ,n) reactions on targets containing Mo-100. The ideal production of Mo-99 through the (γ,n) method requires accelerated electron energies in the range of a few 10s of MeV (approximately 30-40 MeV) given the (γ,n) cross section and the electron to gamma conversion energy losses. These energies are sufficient to produce some other medical isotopes, but production of iodine-131 (I-131) and xenon-133 (Xe-133) would not be cost competitive with fission-based sources on a commercial scale.

The referenced statement was only intended to be made in reference to the co-produced fission radionuclides that SHINE produces (Xe-133 and I-131), and SHINE has initiated an IMR to address the required clarification of the referenced statement in Section 19.5.2.2.1 of Reference (2). The referenced statement is revised to state, "The linear accelerator-based approach is not readily able to produce fission product radionuclides other than Mo-99, and therefore, does not address the need for domestic supplies of Xe-133 and I-131."

**ECOLOGY**

**Ecology Request #1**

*Section 19.3.5 describes aquatic biota stream surveys conducted in an unnamed tributary to the Rock River. Please describe the survey equipment and methods, such as the length of the seine nets, distance of stream sampled by seine, time of each kick net sample, and mesh size on seines and kick nets.*

*In addition, please provide a copy of the Draft Work Plan that describes the methodology used to conduct the ecological, land use, and water resources surveys. When available, please provide the Final Work Plan.*

**SHINE Response**

Aquatic biota surveys conducted in the unnamed tributary to the Rock River consisted of fish surveys and benthic macroinvertebrate surveys. Aquatic location 2 was the only location along the unnamed stream that contained water, therefore, no samples were collected from aquatic location 1 (Figure 19.3.5-3 of Reference (2)). The unnamed stream is characterized as having a channel that is 3 to 4 feet wide at the ordinary high water mark, and having a depth of up to approximately 1 foot.

Fish surveys were conducted utilizing a seine on a quarterly basis (October 2011, January 2012, April 2012, and July 2012). As stated in the Draft AMEC Environment and Infrastructure, Inc. (AMEC) ER Work Plan in Support of the Environmental Report, provided as Attachment 22, fish sampling stations were to be marked using a GPS receiver and depths were to be recorded. All specimens were to be identified. Fish were to be identified to the lowest practical taxonomic level, typically species, and the first 20 individuals of each species were to be counted, measured (total length or fork length for species with forked tails, in millimeters) and examined for external abnormalities. Other large aquatic organisms encountered during fish surveys were to be measured by carapace length.

Macroinvertebrate surveys were conducted in October 2011 and April 2012 by use of a kicknet in representative in-stream habitats. As stated in the Draft AMEC ER Work Plan in Support of the Environmental Report, benthic macroinvertebrates were to be collected by Petite Ponar or Eckman dredge samplers. Two separate samples were to be collected from each station in each survey period. A sample was to consist of a single grab with the dredge. Samples were to be sieved through a No. 35 (approximately 500 µ mesh) wash frame or sieve bucket. In the laboratory, samples were to be rinsed through a 500 µ mesh sieve to remove preservative and fine sediments. For each sample, macroinvertebrate data was summarized by calculating Abundance, Taxa Richness, EPT Richness, Shannon Diversity Index, and the Biotic Index (Table 19.3.5-2 of Reference (2)).

SHINE currently does not have access to Revision 0 of the AMEC ER Work Plan in Support of the Environmental Report. When Revision 0 becomes available, SHINE will provide the finalized AMEC ER Work Plan in Support of the Environmental Report to the NRC. An IMR has been initiated to track submittal of the Revision 0 AMEC ER Work Plan to the NRC.

**Ecology Request #2**

*Section 19.3.5.5 and Table 19.3.5-2 states that SHINE used a biotic index to assess the ecological integrity of the unnamed tributary to the Rock River. Please clarify what biotic index SHINE used and provide a citation, as appropriate.*

**SHINE Response**

As stated in the Draft AMEC ER Work Plan in Support of the Environmental Report (Attachment 22), the biotic index SHINE used to assess the ecological integrity of the unnamed tributary of the Rock River was developed by William L. Hilsenhoff (Reference 7).

**Ecology Request #3**

*Section 19.3.5.6 of the ER describes the potential for wetlands to exist on or near the proposed SHINE site. Please clarify who conducted the wetland delineation studies.*

**SHINE Response**

Wetland delineation activities were conducted by personnel from AMEC Environment and Infrastructure, Inc.

**Ecology Request #4**

*Section 19.3.5.7 of the ER describes plant communities, wildlife, mammals, and herpetofauna that are likely to occur on or near the proposed SHINE site. For each ecological assemblage, describe the survey methods SHINE used, including the sampling level of effort (time of each sample, distance for each sample, total number of samples per season) and survey locations. In addition, for several ecological assemblages, the ER states that SHINE referred to databases to collect occurrence data. Provide a citation for all databases or other references that SHINE used to research the potential ecological assemblages on or near the SHINE site.*

**SHINE Response**

Plant Communities

Table 19.3.5-3 of Reference (2), Terrestrial Plants Observed on or near the SHINE Site, lists the terrestrial plants observed within land cover areas on or near the SHINE site, observed during pedestrian surveys. Pedestrian surveys were performed during the growing season in fall 2011, spring 2012, and summer 2012, to identify and record terrestrial plant species for a qualitative inventory of the flora on and in proximity to the site. As stated in the Draft AMEC ER Work Plan in Support of the Environmental Report (Attachment 22), walking surveys were to be conducted over the entire SHINE project site for the terrestrial vegetation assessment. Qualitative characterization of land cover was also to be performed on the immediate surrounding areas via roadside observation, and considered the airfield area west and southwest of the SHINE project site; developed lands northwest, north, northeast, and south of the SHINE project site; agricultural lands north, northeast, east, and southeast of the SHINE project site; and riparian/drainage corridors southeast and south of the SHINE project site.

Mammals

Table 19.3.5-4 of Reference (2), Mammals Potentially Occurring on or near the SHINE Site, lists those mammals with a distributional range which includes the SHINE project site, and those mammals observed during field surveys on or near the SHINE project site. Field surveys included general field reconnaissance, including road kills, tracks, scat, nests, or other indicated evidence. Specific mammal survey locations were not developed. Mammal species were also recorded based on general field reconnaissance and incidental observations at the aquatic survey locations and along bird survey routes (Figure 19.3.5-3 of Reference (2)). A quarterly walk through of the SHINE project site was also conducted for evidence of wildlife use.

To identify mammals potentially occurring on or near the SHINE site, in addition to field studies, SHINE reviewed the American Society of Mammalogists' listing of Mammals of Wisconsin (http://www.mammalogy.org/mammals-wisconsin).

Birds

Table 19.3.5-5 of Reference (2), Avifaunal Species Potentially Occurring on or near the SHINE Site, identifies those bird species potentially occurring on or near the SHINE project site based on field surveys and a review of records. Field surveys included general field reconnaissance and observation, site surveys, and roadside bird surveys. Figure 19.3.5-3 of Reference (2) depicts the roadside survey route that was surveyed seasonally (fall, winter, spring, summer) for birds. Observers stopped at half-mile intervals to record all birds seen or heard during a 3 minute survey period. The route was driven on two separate dates during each season with observations initiated approximately at sunrise each day.

To identify avifaunal species potentially occurring on or near the SHINE site, in addition to field studies, SHINE reviewed both the Wisconsin Bird Breeding Atlas (WBBA) and the North American Breeding Bird Survey. Table 19.3.5-5 of Reference (2) contains those species listed in the Janesville East Quad and/or Janesville West Quad of the WBBA (http://www.uwgb.edu/birds/wbba/). Table 19.3.5-5 of Reference (2) also contains those species listed in Route 91320 (Beloit) of the North American Breeding Bird Survey (http://www.pwrc.usgs.gov/BBS/).

Herpetofauna

Table 19.3.5-6 of Reference (2), Reptiles and Amphibians Potentially Occurring on or near the SHINE Site, lists those reptiles and amphibians with a distributional range which includes the SHINE project site, and those reptiles and amphibians observed during field surveys on or near the SHINE project site. Field surveys included general field reconnaissance and site surveys. Supplemental field studies within the site and near the site were used in part to characterize the assemblage of amphibian and reptile species and to aid in the identification of protected species near the SHINE site. Specific herpetofauna survey locations were not developed. Herpetofauna were recorded based on general field reconnaissance and incidental observations at the aquatic survey locations and along the bird survey route (Figure 19.3.5-3 of Reference (2)). A quarterly walk through of the entire site was also conducted for evidence of wildlife use.

To identify reptiles and amphibians potentially occurring on or near the SHINE site, in addition to field surveys, SHINE reviewed the Wisconsin Department of Natural Resources publication, "Wildlife Primer: Reptiles and Amphibians" (http://dnr.wi.gov/topic/WildlifeHabitat/yourland.html).

## GEOLOGY AND SOILS/WATER RESOURCES

### Geology and Soil/Water Resources Request #1

*Please provide a reference for Figure 19.3.3-5, "Site Cross Section" and Figure 19.3.3-4, "Regional Structural Geology."*

### SHINE Response

Figure 19.3.3-5 of Reference (2), "Site Cross Section," was developed from Figure 3.2-5, "Schematic E-W Cross Section," of the Preliminary Hydrological Analyses; Janesville, Wisconsin; August 3, 2012 (Attachment 23).

Figure 19.3.3-4 of Reference (2), "Regional Structural Geology," was developed from Figure 2.1-3 of the Seismic Hazard Assesment Report; Janesville, Wisconsin; August 3, 2012 (Attachment 24).

### Geology and Soil/Water Resources Request #2

*Please make available the following documents and references:*

- *A non-propriety water balance-flow diagram for the proposed facility (similar to ER Figure 19.2.3-1);*
- *Preliminary Geotechnical Engineering Report, Janesville, Wisconsin: August 3, 2012 (ER Section 19.3.3.1);*
- *Preliminary Hydrological Analyses, Janesville, Wisconsin: August 3, 2012 (ER Section 19.3.3.1);*
- *Seismic Hazard Assessment Report, Janesville, Wisconsin: August 3, 2012 (ER Section 19.3.3.1); and*
- *American Engineering Testing, Inc.: 2011. Report of Subsurface Exploration. (Section 19.5.2.1.2.1.4).*

### SHINE Response

A non-proprietary water balance-flow diagram for the proposed facility is provided as Attachment 25.

The Preliminary Geotechnical Engineering Report for the Janesville, Wisconsin site is provided as Attachment 26.

The Preliminary Hydrological Analyses for the Janesville, Wisconsin site is provided as Attachment 23.

The Seismic Hazard Assessment Report for the Janesville, Wisconsin site is provided as Attachment 24.

The Report of Subsurface Exploration for the Chippewa Falls, Wisconsin site is provided as Attachment 27.

**Geology and Soil/Water Resources Request #3**

*Please provide any available well log/well construction data, depth to water, and groundwater quality data from the existing well(s) adjacent to the proposed SHINE site. In addition, please provide any available well log/well construction data, depth to water, and groundwater quality data at or near the two alternative sites, including for any and all site characterization/monitoring wells or borings.*

**SHINE Response**

The National Water Quality Monitoring Council (http://www.waterqualitydata.us/portal.jsp) provides a large amount of water quality data. None of the wells in the database are located directly on the Janesville or alternate sites; however, there is data available for many nearby wells.

SHINE used the U.S. Geological Survey Wisconsin Water Science Center website (http://wi.water.usgs.gov/data/groundwater.html) to collect historical groundwater depth data during the site selection process.

A search of the Wisconsin Department of Agriculture, Trade and Consumer Protection's Well Constructor's Reports Database (http://datcpgis.wi.gov/slv/index.html?Viewer=WellConstructorReports) yielded one Well Constructor's Report for the general area south of the site, completed on May 2, 1974 (Attachment 28). Discussions with the property lessee indicate that the private well just south of the site, near the old helicopter hangar, is currently being used to wash equipment and for one indoor sink. SHINE does not know of any water quality data available for this well.

As discussed in the SHINE Response to Alternatives Request #1, four groundwater monitoring wells were installed at the Stevens Point site. The Data Report of Well Installation, Stevens Point, Wisconsin, is provided as Attachment 20. Groundwater levels were measured at the wells on the Stevens Point site during December 2011, January 2012, and February 2012, and are provided as Attachment 21.

## HISTORIC AND ARCHAEOLOGICAL

### Historic and Archaeological Request #1

*Please clarify whether SHINE intends to disturb any additional land, beyond the current property boundary, for construction or decommissioning (i.e., temporary storage, laydown, and staging sites)?*

### SHINE Response

SHINE does not anticipate the need for any additional land development beyond the current property boundary for either construction or decommissioning. If temporary storage or staging is required, SHINE will use existing facilities in the local area.

### Historic and Archaeological Request #2

*Please clarify whether SHINE intends to construct any additional pipelines for the facility. The ER references connections to the main sewage, commercial natural gas, and underground electrical distribution, and municipal water lines.*

### SHINE Response

SHINE intends to make connections to the main sewage, commercial natural gas, underground electrical distribution, and municipal water lines. SHINE does not intend to construct any additional pipelines for the facility.

### Historic and Archaeological Request #3

*Please submit SHINE's Cultural Resource Management Plan, or provide a summary of SHINE's procedures for inadvertent finds. In addition, please provide a description of the Issues Management Report process as it would relate to an inadvertent find.*

### SHINE Response

The SHINE Cultural Resources Management Plan is provided as Attachment 29. This plan is a guide to manage and protect as yet unidentified cultural resources that could potentially be impacted by the construction, operation, and decommissioning of the SHINE facility. SHINE has provided the Cultural Resource Management Plan to the Wisconsin State Historic Preservation Office (SHPO) and the SHPO had no comments on the plan.

As stated in the SHINE Cultural Resource Management Plan, an inadvertent find would result in the initiation of an IMR, which would include documenting the immediate actions taken following the inadvertent find. Following initiation, an evaluation of the identified issue will take place, a significance level will be assigned, and a corrective action plan developed. Upon completion of the correction action plan, SHINE will conduct a final disposition of the IMR to confirm the actions have been completed, and the IMR will be formally closed.

## NOISE

### Noise Request #1

*Traffic volumes, vehicle mixes, and traffic speeds are critical elements of traffic models. Please identify and describe the model used to estimate noise levels due to highway traffic for the existing conditions. Please provide the supporting modeling input and output files. Please provide the traffic data used to model existing highway traffic noise levels (e.g. input and output files) and describe any assumptions or data manipulations used in preparing model inputs.*

### SHINE Response

SHINE does not currently have access to the traffic noise model performed to support the development of the Environmental Review. SHINE re-performed traffic noise modeling analysis using the Federal Highway Administration (FHWA) Traffic Noise Model version 2.5 (TNM 2.5). Based on the results of the SHINE-performed analysis, revision to the wording in Subsection 19.3.2.6.1 of Reference (2) is required.

Subsection 19.3.2.6.1 of Reference (2) currently states, "The existing daytime traffic volume on US 51 is modeled to result in a 67 dBA noise level approximately 81 ft. (25 m) east of the edge of the northbound driving lane, which attenuates to 57 dBA at 260 ft. (79 m) east of the edge of the northbound driving lane." This wording is revised to read, "The existing daytime traffic volume on US 51 is modeled to result in a 67 dBA noise level approximately 81 ft. (25 m) east of the edge of the northbound driving lane, which attenuates to 58 dBA at 260 ft. (79 m) east of the edge of the northbound driving lane."

Attachment 30 provides the TNM 2.5 roadway input data for the SHINE-performed traffic noise modeling analysis. Attachment 31 provides the TNM 2.5 traffic input data and Attachment 32 provides the TNM 2.5 receiver input data for the analysis. Attachment 33 provides the resultant sound level output data from the SHINE-performed traffic noise modeling analysis.

The analysis used the 2010 Lower Half, City of Janesville, Rock County, daily traffic counts, provided in Attachment 34, which shows a daily average of 9,000 vehicles for U.S. Highway 51, and the Wisconsin Department of Transportation Hourly Traffic Volume Report, provided as Attachment 35.

The SHINE-performed analysis used the following assumptions:

- The default temperature and humidity values of 68°F and 50% humidity are valid for this model.
- The highway pavement type is average for highways, and so the default type is sufficient.
- The four lanes of the highway are 48 ft wide in total.
- The peak rate of 465 vehicles per hour consists of 400 automobiles per hour (two axles and four wheels, less than 9900 lbs), 35 medium trucks per hour (9900-26,400 lbs), and 30 large trucks per hour (greater than 26,400 lbs).
- There are no significant terrain effects in the model.
- The surrounding ground areas are best described as consisting of field grass.

No barriers were used in the SHINE model.

**Noise Request #2**

*Noise measurements and simultaneous traffic counts are typically used to validate traffic models. Please provide any noise measurements collected for model validation or other purposes. If applicable, please provide copies of data sheets, instrument calibration sheets, and simultaneous traffic counts.*

**SHINE Response**

There were no traffic noise measurements collected at or near the SHINE site to validate the results of the FHWA TNM 2.5 model. However, the FHWA has performed TNM 2.5 validation, as described in Reference (8) and Reference (9).

**Noise Request #3**

*Clarify if SHINE intends to perform noise modeling for construction, operation, and decommissioning.*

**SHINE Response**

SHINE does not intend to perform noise modeling for construction, operation, or decommissioning. During SHINE facility construction, the noise levels from construction equipment will be below the local and state noise requirements for these temporary periods. During SHINE facility operations, external noise emissions are limited by the structural walls and other physical barriers. Also during operations, the standby diesel generator will be run periodically for testing or may operate during emergency conditions and will have specialized mufflers to minimize noise. Noise emissions will be within the applicable ordinances and regulations. During the SHINE decommissioning phase, most of the activities will be inside the main structure and noise generated will be minimized by the thick walls. Noise emissions will be from vehicular movements with truck deliveries and shipments, similar to construction.

**Noise Request #4**

*Please make available the following document:*

- *Southern Wisconsin Regional Airport, 2004 (Section 19.3.2.6.1)*

**SHINE Response**

The requested Southern Wisconsin Regional Airport Land Use Drawing is provided as Attachment 36.

**PROPOSED ACTION**

**Proposed Action Request #1**

*Please describe the power requirements to operate each accelerator and irradiation unit (IU) pair. Please provide an overall facility power requirement (i.e., load demand and annual energy consumption).*

**SHINE Response**

Each accelerator and irradiation unit (IU) pair power requirement consists of 480 VAC, 3-phase load at 50 kVA, and 208 VAC, 3-phase load at 11 kVA for the accelerator, and 16.6 kVA for the IU equipment and instrumentation. The total for each accelerator and IU pair is approximately 62.8 kW.

The overall facility power requirement is total connected capacity of approximately 2900 kVA and the load demand factor is approximately 70%. The annual energy consumption is approximately 17.5 million kWh.

**Proposed Action Request #2**

*Please provide an estimate of the amount of natural gas that the facility would use annually.*

**SHINE Response**

SHINE estimates the facility will use approximately $6.2 \times 10^4$ MMBtu of natural gas annually. This includes the HVAC air handlers' water boiler, Diesel Generator Building heater, Waste Staging and Shipping Building heater, Support Facility Building heater, and the Administration Building heater.

Section 19.2.4.2 of Reference (2) contains an administrative error. The units for peak boiler load should be MMBtu/hr, not MBtu/hr. An IMR has been initiated to address the issue.

**Proposed Action Request #3**

*Please provide an estimate of the amount of diesel fuel that the facility would use annually, both during construction and operations. Please explain if there is any equipment, other than the standby generator, that would use diesel fuel.*

**SHINE Response**

Construction, Preoperational, and Decommissioning

This estimate assumes a 12 month construction period and a 6 month preoperational period. Decommissioning is assumed to be 6 months. The amount of diesel fuel used per month is provided in the Section 19.2 of Reference (2).

Construction – 295,044 gal
Preoperational – 70,326 gal
Decommissioning – 171,642 gal

Operation

There are two diesel engines at the SHINE facility, a standby diesel generator and a diesel-driven fire pump. SHINE estimates that the standby diesel generator will be run one hour per month for testing and maintenance and will use approximately 1500 gal/year. SHINE estimates that the diesel-driven fire pump will be run weekly for testing and maintenance and use approximately 360 gal/year.

The total annual diesel fuel used is approximately 1860 gal/year. These estimates are based on a suitable representative diesel generator and diesel-driven fire pump. The actual devices will be chosen during final design.

**Proposed Action Request #4**

*Please provide a high-level non-proprietary schematic that visually describes the overall isotope production process. Please include target solution loading, tritium target loading, accelerator startup, chemical adjustment, off-gas removal, heat removal/dissipation, target solution removal, product separation, recycle of target solution, cleanup of target solution, removal of solid/liquid/gaseous discharges, and other relevant process steps that show input and output of resources and wastes.*

**SHINE Response**

Upon further review, SHINE determined that the benefits of the greater transparency afforded by releasing Figure 19.2.2-1 of Reference (2) to the public outweigh the potential harm caused to the company. The proprietary marking has been removed from the figure. Attachment 37 provides Revision 1 of PSAR Figure 19.2.2-1, Isotope Production System High-Level Flow Diagram. An IMR has been issued to address this change to Figure 19.2.2-1 of Reference (2).

SHINE requests the NRC replace Revision 0 of Figure 19.2.2-1 provided in Part One of the SHINE Medical Technologies, Inc. Application for Construction Permit (Reference 2) with Revision 1 of Figure 19.2.2-1, provided in Attachment 37.

**Proposed Action Request #5**

*Please describe the SHINE facility's total footprint in square feet, and clarify the footprint of the main production building footprint and each of the remaining areas (parking lots, roads, retention ponds, etc.).*

**SHINE Response**

The approximate footprints of the SHINE facility, individual buildings within the SHINE site, parking lots, and roads were calculated in SHINE calculation CALC-2013-001, Revision C. Measurements were taken from a printed copy of the Initial Site Utilization Plot Plan (SC-0SK001, Revision 1). The measurements were taken from the center of the boundary lines in the drawing, with the exception of the stormwater swale. The stormwater swale was approximated as a triangle. The dimensions were then multiplied to determine the approximate footprints of the areas in square inches. The graphic scale was then measured to determine a factor to convert the measured square inches to square feet. Significant figures were propagated throughout the calculation.

The SHINE facility will not have a retention pond. Per Subsection 19.4.4.1.1.2 of Reference (2), “No retention or detention ‘pond’ is to be constructed at the site to avoid larger water surface areas (even during temporary periods of storm runoff), thereby avoiding the potential for glare from the surface that might affect aircraft at the adjacent Southwestern Wisconsin Regional Airport.”
Approximate footprint measurements for the SHINE facility, including parking lots, roads, and the stormwater swale, provided in Table 20.

**Table 20. Approximate Footprint of Buildings and Features at the SHINE Facility**

| Area | Footprint ($ft^2$) |
|---|---|
| Production Facility | 54,000 |
| Administration Building | 10,000 |
| Fire Pump House | 2,600 |
| Security Station | 370 |
| Diesel Generator Building | 1,700 |
| Water Cooling Equipment | 1,400 |
| Waste Staging and Shipping Building | 5,300 |
| Support Facility Building | 15,300 |
| **Total Buildings Footprint** | **91,000** |
| Parking Lots | 64,000 |
| Roads | 100,000 |
| Stormwater Swale | 96,000 |
| **Total Footprint** | **350,000** |

**Proposed Action Request #6**

*The SHINE process uses tritium gas to produce neutrons. Tritium is required for start up, some is recycled by the tritium purification system, some is consumed by the process, and some is ultimately emitted. Please clarify where the initial input of tritium comes from and how much SHINE would initially used. In addition, please clarify how much tritium SHINE will consume annually that would need to be replaced from an external source. Please describe how much tritium the facility would emit. Please estimate the maximum tritium inventory that would be stored at the SHINE site.*

**SHINE Response**

The SHINE systems that process and use tritium are the Tritium Purification System (TPS) and Neutron Driver Assembly System (NDAS). Tritium is initially loaded into the TPS during plant startup, and is transferred to NDASs during operation of each individual unit.

Initial Source and Supply

The initial input of tritium is planned to be delivered from Savannah River National Laboratory (SRNL). Based on preliminary design, SHINE will require approximately [ Security-Related Information ] grams for the total facility inventory (TPS and eight NDASs). SHINE believes this is a conservative, bounding estimate.

SHINE is currently planning on acquiring the complete tritium inventory ([ Security-Related Information ] grams) at plant startup.

Tritium Consumption and Replacement

Tritium undergoes radioactive decay with a half-life of 12.32 years, and therefore, some tritium replacement is naturally required. Given this half-life, 5.5% of the tritium inventory will be converted to He-3 each year and will need to be replaced. This is equivalent to approximately [ Security-Related Information ] grams per year (5.5% x [ Security-Related Information ] grams).

Along with the natural decay, some tritium is released with the deuterium waste stream during the separation process (since the separation process is not 100% efficient), some tritium is released during NDAS maintenance activities, and some tritium is released due to TPS normal processes and maintenance activities. The release of gaseous tritium from these activities will be less than 4400 Ci/year (see below), which is equivalent to less than 0.5 grams/year.

The NDASs also consume a small amount of tritium from the fusion reaction, which is less than [ Proprietary Information ] grams/year with continuous operation of the eight units.

Some tritium will also be removed from the TPS in solid waste streams from maintenance operations (e.g., pump replacement, molecular sieve bed replacement). This quantity is estimated at less than [ Security-Related Information ] grams/year.

Given these consumption mechanisms, less than [ Security-Related Information ] grams of tritium per year is expected to be required to replace facility inventory losses.

Tritium Emissions

As specified in Table 19.4.2-1 of Reference (2), gaseous tritium emissions from the facility will be maintained below 4400 Ci/year in order to meet 10% of the 10 CFR 20 effluent concentration limit (ECL) (ALARA design limit). Given gaseous emissions from the facility of other isotopes specified in Table 19.4.2-1 of Reference (2), gaseous tritium release will be further restricted below 4400 Ci/year to ensure total gaseous emissions meet 10% of the 10 CFR 20 ECL. Calculations on expected gaseous tritium emissions for the facility will be performed for final design.

The final calculated tritium emissions from the facility will be less than 4400 Ci/year.

Tritium Inventory

The estimated maximum tritium inventory that would be stored on the SHINE site is approximately [ Security-Related Information ] grams.

**Proposed Action Request #7**

*SHINE intends to acquire water from the Janesville municipality to use for isotope production, product processing, potable water, blowdown and facility heating water, fire protection system makeup, and chilled water makeup, as described in the ER. Please provide an estimate of the volume of water expected to be required for various construction activities and supply source. Please estimate the annual water use by the chilled water cooling system that must be discharged to the sanitary sewer after treatment. Describe the nature of wastewater proposed for discharge to the Janesville Waste Treatment Facility, including source volume(s), expected constituents and concentrations (e.g., estimate of the thermal levels and chemical concentrations) (ER Section 19.2.3.1). Clarify whether any specific permits or limitations would apply to the discharge (e.g., industrial user provisions).*

**SHINE Response**

The water usage of the SHINE facility has been broken down into two phases: construction and operation.

During the construction phase, the majority of water consumption will be dedicated to construction (personnel) support, concrete mixing, and dust mitigation. With respect to personnel support, Section 19.4.7.1.3 of Reference (2) states that a conservatively assumed 30 gal/day will be consumed for each worker on site for 8 to 12 hours. With an estimated on-site workforce of 420, SHINE estimates 12,600 gal/day will be required for construction (personnel) support. This water will be supplied by the Janesville Water Utility.

Water needs for concrete mixing will be supplied by the Janesville Water Utility. SHINE estimates that 700,000 gal/year will be required to meet this need.

Dust mitigation/suppression will be accomplished by the use of water trucks during construction. The use of dust mitigation will be limited to initial site preparation and early construction setup. SHINE estimates that these activities will require a total of 10,000 gallons per day, for a duration of three months..

During the operational phase of the SHINE facility, cooling will be provided to the facility by way of chilled water. A final decision on the type of cooling unit to be used has not been made. This response assumes a closed-loop chilled water system is selected.

SHINE estimates that the volume of water used by a closed-loop chilled water system will be on the order of 10,000 gallons. It is assumed that the system will be flushed, on average, once per year, discharging 10,000 gal/year to the Janesville sanitary sewer system. The temperature of this water will not exceed 149°F at discharge and will not exceed 40°C (104°F) at its introduction to the Janesville Wastewater Treatment Plant, in accordance with Janesville City Ordinance 13.16.

Section 19.2.3.2.2 of Reference (2) states that the chilled water system may use biocides, corrosion inhibitors, and scale inhibitors in the closed-loop chilled water system. Although the particular chemicals to be used in the SHINE closed-loop chilled water system have not yet been determined, any water discharged to the Janesville sanitary sewer system from the SHINE facility will have concentrations of pollutants below the Maximum Day Limit allowed by Janesville City Ordinance 13.16.060, provided in Table 21.

**Table 21. Allowable Discharge Concentrations per Janesville City Ordinance 13.16.060**

| Pollutant | Maximum Day Limit (mg/L) |
|---|---|
| Cadmium (Total) | 0.30 |
| Chromium (Total) | 3.00 |
| Copper (Total) | 2.60 |
| Cyanide (Total) | 0.50 |
| Lead (Total) | 0.30 |
| Nickel (Total) | 0.90 |
| Zinc (Total) | 3.65 |
| Arsenic (Total) | 1.00 |
| Silver (Total) | 3.90 |
| Mercury | No Detectable Discharge |
| Total Toxic Organics (TTO) | 2.13 |
| Phosphorus | 18.0 |

Cooling water chemical additions and likely maximum concentrations under consideration by SHINE for the closed-loop cooling system are provided in Table 22.

**Table 22. Maximum Cooling Water Chemical Additions Under Consideration by SHINE**

| Chemical | Cooling Loop Concentration |
|---|---|
| Sodium sulfite | < 100 ppm |
| Sodium Lauroyl Sarcosinate | < 100 ppm |
| Non-phosphate buffer* | pH 9 to 9.5 |

* The buffer chosen will not include phosphorus to help the Janesville Wastewater Treatment Plant comply with its phosphorus discharge limits.

System water (and make-up water) may be softened to inhibit scale formation. The expected amount of wastewater to be discharged to the Janesville sanitary sewer system is provided in Attachment 25. Waste water permitting is discussed in the SHINE Response to Human Health Request #4.

**Proposed Action Request #8**

*Page 19.2-6 of the ER states "There are no daycare centers or retirement homes located within 5 mi. (8 km) of the SHINE facility." An internet search indicated that there are several daycare centers and at least one retirement home within the 5 mi. (8 km) radius. Please clarify whether SHINE conducted a physical surveyor used another source to determine the number of daycare centers and retirement homes within the 5 mi (8 km) radius.*

**SHINE Response**

To determine the number of daycare centers and retirement homes SHINE conducted a physical survey, comprised of field reconnaissance and interpretation of aerial photographs within two kilometers of the site, and U.S. Census Bureau and internet sources of information for the area outside of two kilometers. SHINE has determined that the information for sensitive populations (schools, daycares, and retirement homes) within five miles provided in Subsection 19.2.1.1 and Table 19.2.1-1 of Reference (2) is incomplete. The information reported in Reference (2) contained an administrative error (i.e., the number of facilities with sensitive populations is incomplete). An IMR has been initiated address this issue.

Table 19.3.7-5 of Reference (2) lists estimated transient populations within five miles of the SHINE site in 2010. The listing provided below reflects July 2013 data. The total number of schools is slightly changed.

The following information provides an update to the list of sensitive populations, specifically for schools, daycares, and retirement homes (nursing homes, adult family homes, and community-based residential facilities whose clients are aged or disabled), within five miles of the facility. This information was obtained using internet sources, primarily the Janesville School District, the Wisconsin Department of Children and Families, and the Wisconsin State Department of Health and Human Services.

<u>Schools</u>

Adams Elementary
Blackhawk Technical College
Cargill Christian Preschool
Christian Formation
Edison Middle School
F. J. Turner High School
Franklin Middle School
Head Start Janesville
Jackson Elementary
Janesville Academy of International Studies
Janesville Montessori
Joseph Craig High School
Lincoln Elementary
Madison Elementary
Oakhill Christian
Parker High School
Power Elementary
Rock County Christian School
Rock River Charter School
Roosevelt Elementary
Saint John Vianney Catholic School
Saint Mary's School
Saint Patrick’s Elementary
Saint Paul’s Lutheran
Saint Williams Congregation
Turner Middle School
University of WI Rock County
Van Buren Elementary
Washington Elementary
Wilson Elementary
Wisconsin Aviation Academy
Wisconsin Center for the Blind and Visually Impaired

Retirement and Assisted Living Homes (State Licensed 2013)

Cedar Crest Inc. Retirement
Mercy Manor Transition Center
Saint Elizabeth Nursing Home
Cornelia Corner
Harvest Home at Century Elms
REM Bond
Riverfront Blaine Ave
Beechwood
Cozy Lil Acre (Mineral Point Road)
Cozy Lil Acre (North Grant Street)
Dupont
Kellogg
Lee Lane
REM Canterbury
REM Jonathon
Sherman Home
Wright Home
Azura Memory Care Beloit (two homes)
Sun Valley Homes North
Goia Home

Daycares (State Licensed 2013)

Janesville Community Day Care Center
Janesville Montessori Children's House
Cargill Christian Preschool and Daycare
LSS Child's First Center
Bright Tykes Daycare
Community Kids Learning Center
Creative Childrens Learning Center
Faith's Little Friends
Jenece Betts
Kiddie Ranch Eastside Learning Center
Kids House
Lil Learning Center
Little Eagles Nest/Little Eaglets Preschool and Daycare
Lori's Day Care
The Peanut Palace
YWCA Adams Child Care Center
YWCA Discovery Center
YWCA Madison Child Care Program
YWCA Van Buren Child Care Program
YWCA Washington Child Care Center
Connie's Home Day Care
Cradles to Crayons
Elizabeth C. Carlton
Laura R. Juno
Little One of the Future
Nancy's Home Day Care

Pams Lambs
Stateline Family YMCA Sac Powers
Tinker Tots Child Care Center
YMCA Preschool Learning Center
YWCA Lincoln Child Care Center
Teeter Tots
Behm's Family Daycare
Brownie's Child Care
Gheri Family Day Care Home
Goelzer's First Step Nursery School
Hand in Hand Learning Center
Loving Arms Christian Preschool
RWCFS St Peters Church Head Start
YWCA Wilson Child Care Program
Lobby Family Child Care
YWCA Harrison Child Care Center
Busy Bees Family Child Care
Kiddie Care Family Daycare
YWCA Monroe Child Care Center
Toni E. Ruiz
Little Hands Learning Center

**Proposed Action Request #9**

*Please clarify the extent to which SHINE will conduct activities in accordance with 10 CFR 50.10(a)(2) prior to receiving a construction permit. If known, please provide a description of the activities that SHINE will conduct, the timeline for performing these activities, and any regulatory, or other requirements that must be met prior to commencing these activities.*

**SHINE Response**

SHINE has prepared a detailed permit, construction, and system startup schedule outlining key activities and milestones. Prior to receiving the construction permit, over 15 different permit applications will be completed to support early site preparation and support receipt of the construction permit. These permit applications are identified in Table 19.1.2-1 of Reference (2). SHINE plans to submit permit applications and perform these activities between the first quarter of 2014 through the first quarter of 2015. As allowed by 10 CFR 50.10(a)(2), SHINE may perform the following activities prior to receiving a construction permit:

- temporary fencing and other access control measures;
- access road entrance and exit;
- temporary power line and surveying for electrical substation;
- early site road grading with road gravel and construction signage;
- surveying markers and grading profiles;
- interface points for water, sewage, natural gas lines;
- temporary lighting and poles for communication;
- excavation borings to determine foundation conditions;
- installation of drainage and erosion control measures;
- erection of support buildings; and
- procurement or fabrication of components or portions of the facility at a location other than the final location.

Each of these early activities will be aligned with local and state permits to support the facility construction permit and the critical path activities.

The following list provides the construction activity and associated approximate timeframe. The timeframes are based on the current project schedule and are subject to change based on a number of variables.

1. Detailed site survey with markers to support grading – March 2014 through August 2014
2. Temporary fencing for site perimeter – April 2014 through September 2014
3. Early site grading with on-site road gravel and signage – May 2014 through October 2014
4. Temporary power line and substation surveying – May 2014 through September 2014
5. Site road entrance and exit from U.S. Highway 51 – May 2014 through October 2014
6. Placement of temporary construction trailers/support – May 2014 through September 2014
7. Clearing and installation of erosion and drainage control measures – May 2014 through September 2014
8. Excavation borings to determine foundation conditions – May 2014 through October 2014
9. Temporary lighting and poles for communication – May 2014 through October 2014
10. Construct interface points for water, sewage, natural gas lines – April 2014 through October 2014
11. Installation of drainage and erosion control measures – May 2014 through October 2014

**Proposed Action Request #10**

*For the permits identified in Table 19.1.2-1 of the ER, please provide a timeline or status update for when SHINE expects to apply for and receive the permits. If relevant, please provide a specific regulatory or other milestone on which a given permit may be dependent upon.*

**SHINE Response**

Attachment 18 provides a listing of the permits identified in Table 19.1.2-1 of Reference (2), the activity in which the permit covers, the timeframe in which SHINE expects to receive the permit, the current status of the permit, and any milestone (regulatory or other) that the permit is dependent upon. Significant project milestones for the SHINE project are provided below. Significant SHINE project milestones are based on the current project schedule and are subject to change based on a number of variables.

| | |
|---|---|
| Site Acquisition and Building Permit: | First Quarter, 2014 |
| Start pre-construction activities at the site: | Second Quarter, 2014 |
| Receive Construction Permit (CP): | First Quarter, 2015 |
| Receive Operating License (OL): | First Quarter, 2016 |

In general, SHINE could begin the permitting process for many of the permits provided in Attachment 18 immediately, since those permits do not depend on any regulatory or other milestone beyond the permitting process itself.

Since the initial submission of Table 19.1.2-1 via Reference (2), SHINE has determined that a direct Notification of Hazardous Waste Activity to the U.S. Environmental Protection Agency is not necessary when the State is authorized to operate its own hazardous waste program, as is the case in Wisconsin. The notification has been removed from the table provided in Attachment 18. An IMR has been initiated to address this issue.

**Proposed Action Request #11**

*Please provide a high-level discussion of the production process for iodine-131 (I-131) and xenon-133 (Xe-133), the methodology SHINE used to estimate environmental impacts for I-131 and Xe-133, and the assumed shipment routes and customers for I-131 and Xe-133.*

**SHINE Response**

Xe-133/I-131 Production and Packaging

The production of Xe-133 and I-131 occurs within the target solution directly from fission during the irradiation cycle and from the decay of parent radionuclides during and following the irradiation cycle. Some of the xenon and iodine is released from the target solution during the irradiation process, and some of the isotopes remain in solution. As stated in Subsection 19.5.3.1.1.5 of Reference (2), the SHINE facility is expected to produce approximately 100,000 Ci of Xe-133 and 100,000 Ci of I-131 per year (approximately 2,000 Ci per week for each isotope).

SHINE has two potential planned options for recovering Xe-133 and I-131 as commercial products. The primary option is to recover iodine offgas from the Mo extraction process within the supercells. The Mo extraction process separates Mo and some other radionuclides (including a portion of the iodine) from the bulk of the target solution. The other radionuclides are separated from the Mo in downstream extraction and purification steps to yield a high-purity Mo product. It is expected that iodine will be separated in sufficient quantities from the target solution during the initial extraction, and will then be recovered from the Mo-bearing solution. The recovered iodine is expected to meet the need of both the Xe-133 and I-131 supplies, as it will contain I-133 (which decays to Xe-133 with a half-life of 20.8 hours). The iodine is expected to be packaged in solution vials (less than 1 liter in size) containing the iodine in a solution of NaOH, which will then be packaged in an approved shipping container. The xenon is expected to be packaged in gas cylinders with an internal volume of less than 1 liter. These product cylinders would then be placed in approved shipping containers and transported to the customers.

The alternative option for recovering Xe-133 and I-131 as commercial products is to recover them from the target solution vessel (TSV) offgas system following an irradiation cycle. Xenon and iodine could both be obtained from the offgas system, or only iodine could be captured to yield both Xe-133 and I-131 isotopes through decay, as described above. The iodine and xenon would be chemically separated, packaged, and shipped, as described above.

Xe-133/I-131 Environmental Impacts

Along with Mo-99, the production of Xe-133 and I-131 was included in the environmental impacts analysis for the SHINE facility. For some of the environmental considerations, extraction and shipment of Xe-133 and I-131 as commercial products reduces impacts from the facility (e.g., gaseous emissions will be reduced). For some of the other environmental impacts, extraction and shipment of these isotopes results in greater impacts (e.g., incident-free radiological transportation doses). In general, when evaluating impacts where shipment of medical isotopes affected the environment, the more conservative approach was taken (shipment versus non-shipment of the isotopes).

For example, the gaseous effluent quantities described in Table 19.4.2-1 of Reference (2) do not assume Xe-133 and I-131 are packaged and shipped, therefore the gaseous releases stated are considered bounding estimates of emissions. Also, the incident-free radiological doses from transportation (Table 19.4.10-5 of Reference (2)) include the maximum expected shipments of Mo-99, Xe-133, and I-131; therefore, the shipment dose values are considered bounding.

Xe-133/I-131 Shipping Routes

Along with Mo-99, Xe-133 and I-131 produced at the SHINE facility will be transported by air and truck to the destination facilities. Due to the longer half-lives of Xe-133 and I-131 (5.2 days and 8.0 days, respectively), transportation by truck can occur with less decay of the product. Destination facilities, as discussed in Subsection 19.4.10.1.1 of Reference (2), include Covidien in Hazelwood, Missouri; Lantheus Medical Imaging in North Billerica, Massachusetts; and Nordion in Kanata, Ontario, Canada. Shipping routes from the SHINE facility to Hazelwood, Missouri and North Billerica, Massachusetts are provided in Figure 19.4.10-3 and Figure 19.4.10-4 of Reference (2), respectively. Shipping routes from the SHINE facility to Kanata, Ontario, Canada, were not developed, as the incident-free radiological dose analysis from the SHINE facility to North Billerica, Massachusetts was determined to be bounding.

## SOCIOECONOMICS

### Socioeconomics Request #1

*Please clarify the estimated annual total projected costs for materials, equipment, and services to be purchased in the local communities.*

### SHINE Response

Construction costs were estimated in Attachment 3 to Enclosure 3, General and Financial Information, of Reference (2).

The SHINE Design Build Plan has been based upon utilizing local contractors, services, and materials wherever possible. Presently, the SHINE Design Build Plan for the Production Facility has six construction work packages that cover areas of site fencing, roads, grading/landscaping, temporary trailers, guard services, site preparation, rental equipment and furnishings, electrical lighting and cabling, and specialized services (crane operations and materials). SHINE estimates that $15 to $25 million will be sourced locally, including the majority of the labor, electrical equipment and cabling, and concrete.

The Support Facility will be planned for design build approach and is a much less technical facility than the Production Facility. As a result, a majority of these costs, approximately $5 million, can be sourced locally.

Most of the plant equipment is highly specialized, thus, SHINE expects that very little of the equipment can be purchased locally. Likewise, none of the uranium inventory will be purchased locally.

In total, SHINE estimates that roughly $20 to $30 million of the estimated construction costs can be sourced locally.

**TRANSPORTATION**

**Transportation Request #1**

*SHINE suggested that traffic could be optimized using traffic signals at the entrance and exit. Please clarify whether SHINE intends to obtain a traffic light (optimization) at the entrance and exit to mitigate traffic issues. If so, please describe the current status of obtaining this traffic light (i.e., has it been negotiated, or otherwise agreed upon?). In addition, please clarify whether SHINE expects employees to arrive within a staggered schedule due to shift changes, or all at one time.*

**SHINE Response**

SHINE will not be providing a traffic signal at the entrance and exit to the plant site. Access to the SHINE site will comply with Federal and Wisconsin Department of Transportation requirements for entrance and exit to the U.S. Highway.

SHINE plans to use a staggered construction work shift schedule to reduce the hourly traffic flow onto U.S. Highway 51. SHINE will also post signs near the construction entrances and exits to make the public aware of potential high traffic areas. SHINE will consider buses, vans, and carpools combined with the staggered shifts to optimize the traffic flow to and from U.S. Highway 51. To the extent possible, SHINE will plan for truck deliveries early in the day to help reduce traffic congestion.

**Transportation Request #2**

*Please describe in more detail the proposed methods and schedules of transporting radioactive materials (i.e., common carrier, exclusive use, etc.) for all the various radionuclides SHINE intends to transport and applicable Department of Transportation, NRC, and other applicable regulations. In addition, please clarify the number and frequency of incoming and outgoing shipments of radionuclides, and the radioactive levels of such radionuclides, during construction and operations.*

**SHINE Response**

SHINE will not ship product or waste radionuclides during construction. The following discussion relates to operations.

SHINE's preferred methods to ship radionuclides are by air from the Southern Wisconsin Regional Airport and by truck, with both methods using an exclusive use carrier. The schedule for transport is expected to be approximately nine shipments per week for 50 weeks per year. The shipments will contain up to approximately 3.7E4 Ci of Mo-99 (equivalent to 8200 6-day curies), 2000 Ci of Xe-133, and 2000 Ci of I-131 per week.

The estimated frequency and types of shipments are shown on Table 19.2.5-1 of Reference (2). Table 23 provides bounding estimates of the total annual activity levels for the radioactive waste shipments expected from SHINE.

**Table 23. Annual Activity Levels for Radioactive Waste Shipments from SHINE**

| Description | Activity (Ci) |
|---|---|
| Post-extraction target solution wastes | [ Security-Related Information ] |
| Extraction columns, spent washes, rotovap condensate, spent eluate solution waste, purification process waste | [ Security-Related Information ] |
| Neutron driver assembly waste material | [ Security-Related Information ] |
| Total | [ Security-Related Information ] |

10 CFR Part 71, establishes requirements for packaging, preparation for shipment, and transportation of licensed material; and procedures and standards for NRC approval of packaging and shipping procedures for fissile material and for a quantity of other licensed material in excess of Type A quantity. Subchapter XIII, Transportation, of Chapter DHS 157 of the Wisconsin Administrative Code contains the applicable State of Wisconsin regulations for transporting radioactive material. The Department of Transportation regulates the shipments while they are in transit, and sets standards for labeling and smaller quantity packages (Title 49, Transportation, of the Code of Federal Regulations).

49 CFR Part 175, Carriage by Air, prescribes the requirements that apply to the transportation of hazardous materials in commerce aboard aircraft. Part 175 applies to the offering, acceptance, and transportation of hazardous materials in commerce by aircraft to, from, or within, the United States.

49 CFR Part 177, Carriage by Public Highway, prescribes requirements that are applicable to the acceptance and transportation of hazardous materials by private, common, or contract carriers by motor vehicle. Specific requirements are found in 49 CFR 177.842, Class 7 (radioactive) material, and 49 CFR 177.843, Contamination of vehicles.

Additional regulations applicable to the shipment of radionuclides (considered a Class 7 hazardous material) include:

i. **Packaging:** 49 CFR 173; Shippers- General Requirements for Shipments and Packagings; Subpart A (General), Subpart B (Preparation of Hazardous Materials for Transportation), and Subpart I (Class 7 (Radioactive) Materials) and 49 CFR Part 178, Specifications for Packagings, Subpart K, Specifications for Packaging for Class 7 (Radioactive) Materials.

ii. **Marking and Labeling:** 49 CFR 172; Hazard Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, Training Requirements, and Security Plans; Subpart D (Marking), 49 CFR 172.400 through 172.407 and 49 CFR 172.436 through 172.441 of Subpart E (Labeling).

iii. **Placarding:** 49 CFR 172; Subpart F (Placarding), especially 49 CFR 172.500 through 172.519 and 49 CFR 172.556, including Appendix B and Appendix C.

iv. **Accident Reporting:** 49 CFR 171; General Information, Regulations, and Definitions; 49 CFR 171.15 and 171.16

v. **Shipping Papers and Emergency Information:** 49 CFR 172; Subpart C (Shipping Papers) and Subpart G (Emergency Response Information)

vi. **Hazardous Material Employee Training:** 49 CFR 172; Subpart H (Training)

vii. **Security Plans:** 49 CFR 172; Subpart I (Safety and Security Plans)

viii. **Hazardous Material Shipper/Carrier Registration:** 49 CFR 107; Hazardous Materials Program Procedures; Subpart G (Registration of Persons Who Offer or Transport Hazardous Materials)

SHINE will initially receive uranium metal, tritium for the neutron drivers, and various sources used for startup, testing, and instrument calibrations. These initial quantities will be supplemented occasionally during normal operation (expected yearly or less frequently), depending on consumption during production. The receipt of radioactive materials is described in Subsection 19.4.10.1.3 of Reference (2). The shipments will be made by qualified carriers who will meet applicable regulations.

The initial quantities of uranium ([ Proprietary Information ] low enriched uranium for the target solution) are expected to be less than [ Security-Related Information ] kg, and up to approximately [ Security-Related Information ] kg/yr is expected to be received to replace consumed uranium. The total curie content of the initial uranium shipment is expected to be less than [ Security-Related Information ] Ci, and the curie content of the yearly (or less frequent) replacement shipments is expected to be less than [ Security-Related Information ] Ci.

The initial quantity of tritium is [ Security-Related Information ] grams and the annual replacement quantity for consumption is less than [ Security-Related Information ] grams. This is approximately [ Security-Related Information ] Ci and [ Security-Related Information ] Ci, respectively.

**Transportation Request #3**

*Please provide information on the sources of raw materials, such as concrete/asphalt plants and structural steel distribution points, from which SHINE would transport construction materials to the proposed and alternate sites. Are there designated/restricted routes for these materials to and from the sites, and would any of these routes significantly impact residential or sensitive areas?*

**SHINE Response**

During construction of the SHINE facility, SHINE intends to have a concrete batch plant located on site, and the basic materials to support the concrete batch plant will be transported by commercial trucks to the SHINE site. SHINE has not selected the source of construction materials, and therefore, designated routes to the SHINE site have not yet been determined. SHINE expects all construction materials will be shipped to the project site by commercial truck, utilizing Interstate, U.S., State, and County Highways. The SHINE project site in Janesville, WI is accessed directly from U.S. Highway 51. SHINE does not expect deliveries to go through residential or sensitive areas.

The proposed Chippewa Falls site is bordered to the east by State Highway 178 and to the north by County Highway S, and the site is accessed via Commerce Parkway. The proposed Stevens Point site currently is not bordered by any public roads. Interstate 39 is located approximately one mile west of the proposed Stevens Point site, and provides long distance access to the site area. When transporting construction materials to the proposed Chippewa Falls or Stevens Point sites, SHINE would take prudent measures to ensure transport routes avoid residential or sensitive areas.

**HUMAN HEALTH**

**Human Health Request #1**

*Section 19.3.8.2, Background Radiation Exposure, discusses the background radiation levels in the vicinity of the proposed facility. The statement is made that "...there are no abnormal radiation hazards in the vicinity of the SHINE site; therefore, the background radiation exposure due to both natural and man-made sources is 6.2 millisievert per year (mSv/yr) (620 millirem [roentgen equivalent man] per year [mrem/yr])..." with a reference to an NRC document to support the statement. A site-specific evaluation of the background radiation levels prior to the operation of the facility is needed to provide baseline data that can be compared to the data obtained from the proposed radiological environmental monitoring program. Provide information on the type of radiological monitoring program that may be used to determine the baseline radiation levels.*

**SHINE Response**

SHINE plans to complete baseline radiological monitoring prior to beginning construction of the SHINE facility. The baseline radiological monitoring plan includes monitoring at on-site monitoring stations to be used during facility operation, four groundwater wells, and biota sampling. Additional details regarding preoperational baseline monitoring can be found in Subsection 11.1.7.4 of the SHINE PSAR (Reference 3).

**Human Health Request #2**

*Section 19.4.8.1, Nonradiological Impacts, contains a list of "potentially applicable" environmental management regulations. Provide, as appropriate, the applicable environmental management regulations that will apply to the proposed facility.*

**SHINE Response**

The following environmental management regulations will apply to the SHINE facility:

- Resources Conservation and Recovery Act (RCRA)
  - Wisconsin Administrative Code Chapter NR 666, Subchapter N – Conditional Exemption for Low-Level Mixed Waste Storage, Treatment, Transportation and Disposal
- Clean Air Act
  - Wisconsin Statutes Chapter 285 – Air Pollution
  - Wisconsin Administrative Code Chapter NR 406 – Construction Permits
  - Wisconsin Administrative Code Chapter NR 407 – Operation Permits
- Clean Water Act
  - 40 CFR 112 – Oil Pollution Prevention (will most likely apply, subject to final diesel fuel tank sizing)
  - Wisconsin Statutes Chapter 283 – Pollution Discharge Elimination
  - Wisconsin Administrative Code Chapter NR 216 – Storm Water Discharge Permits
  - City of Janesville Ordinance 13.16 – Wastewater Facilities and Sewer Use Ordinance
  - City of Janesville Ordinance 15.05 – Construction Site Erosion Control Ordinance
  - City of Janesville Ordinance 15.06 – Post-Construction Stormwater Management Ordinance
- Wisconsin Administrative Code Chapter NR 141 – Groundwater Monitoring Well Requirements
- Wisconsin Statutes Chapter 292.11 – Hazardous Substance Spills

**Human Health Request #3**

*Section 19.4.8.1.2.2, Gaseous Wastes, contains a discussion on the use of "zones" to control non-radiological gaseous wastes within the proposed facility. Provide a discussion, with examples, explaining the use of "zones" to manage gaseous waste.*

**SHINE Response**

The SHINE facility utilizes a ventilation scheme for the process operating area that is typical for nuclear processing facilities. The plant operating areas are divided into ventilation zones, with each zone representing specific hazards in terms of the potential for radioactive contamination. The SHINE facility contains three HVAC zones within the RCA (RVZ1, RVZ2, RVZ3), and one HVAC zone (facility ventilation zone 4 (FVZ4)) for non-radioactive areas. RVZ1, RVZ2, and RVZ3 provide service to the SHINE RCA with HEPA filtration and carbon absorbers. FVZ4 provides ventilation to the non-radioactive areas, which include switchgear rooms and storage areas.

Since the non-radiological process gaseous effluents are produced in the same process operating areas as the radiological gaseous effluents, they are removed by these same HVAC systems.

Additional HVAC ventilation system details are discussed in Section 9a2.1 of the SHINE PSAR (Reference 3).

**Human Health Request #4**

*Section 19.4.8.1.3, Nonradioactive Effluents Released, provides a general discussion of the release of non-radioactive chemicals to the Janesville wastewater treatment facility but provides no quantification of the projected releases. Provide quantification of the projected types and amounts of chemicals that may be sent to the Janesville wastewater limitations on the types, concentrations, and volume of chemical effluents the Janesville wastewater treatment facility will accept from the proposed facility.*

**SHINE Response**

Small amounts of non-radioactive liquid effluents at the SHINE facility will be generated in ancillary or support labs that will be used to manufacture extraction and purification consumables. These operations are expected, on an annual basis, to generate less than 250 L of dilute ammonium chloride solutions (0.05M) at pHs in the range of 7 to 8, and 5000 L of dilute sulfate solutions (0.02M) and 500 L of dilute nitrate solutions (0.02M), both at pHs in the range of 5 to 6.

Water and sewer ordinances for the site can be found in Title 13 of the City of Janesville Ordinances. Based on SHINE's water use projections, SHINE expects to be classified as an "Industrial User" but not a "Significant Industrial User" (City of Janesville Ordinance 13.16.150E). Accordingly, SHINE does not expect to be placed in the industrial pretreatment program or be subject to the associated requirements (City of Janesville Ordinance 13.16.150F).

Discharge prohibitions can be found in 13.16.050. For example, 13.16.050D prohibits "Any wastewater having a pH less than 5.0 or higher than 10.0 or having any other corrosive property capable of causing damage or hazard to structures, equipment, or personnel of the system." SHINE will treat its laboratory chemical liquid effluents on a batch basis and according to approved disposal procedures to ensure that they meet the requirements of the Janesville Wastewater Treatment Plant.

Some cooling water treatment chemicals will also be released to the city sewer system with cooling system bleed-off. The particular chemicals and dosages have not yet been selected, but will follow industry best practices. SHINE will ensure that effluent from cooling systems will be in accordance with city ordinances and meet the requirements of the Janesville Wastewater Treatment Plant.

The SHINE facility will also generate the usual sewer waste from bathrooms, break rooms, locker rooms, and janitorial functions. These wastes will be in line with those expected for a commercial facility employing up to 150 people.

On January 23, 2013, SHINE met with Janesville wastewater treatment officials to discuss local wastewater ordinances and SHINE water and sewer usage. Based on the very small quantities of chemicals expected to be sent to the Janesville Wastewater Treatment Plant, officials SHINE spoke to were not concerned. Janesville Wastewater Treatment Plant officials confirmed that SHINE will need to follow internal procedures to ensure the waste will meet the requirements of City ordinances before being disposed of.

**Human Health Request #5**

*Section 19.4.8.1.4.1, Air Emissions, discusses the projected gaseous chemical effluents. In a prior section, Table 19.4.2-1 lists sulfuric acid as a gaseous effluent. However, there is no discussion in this section on the projected impact from the release of gaseous sulfuric acid. Provide a discussion of the projected impact to the public from the release of gaseous sulfuric acid.*

**SHINE Response**

Table 19.4.2-1 of Reference (2) lists the amount of sulfuric acid to be released from the SHINE isotope production process as less than 50 lbs per year.

$$\frac{50\ \frac{\text{lbs}}{\text{year}}}{50\ \frac{\text{weeks}}{\text{year}} \times 7\ \frac{\text{days}}{\text{week}} \times 24\ \frac{\text{hours}}{\text{day}}} = 0.0060\ \frac{\text{lbs}}{\text{hour}}$$

As shown in Table 24, the amount of sulfuric acid estimated to be released from the SHINE isotope production process is below the Wisconsin Department of Natural Resources Thresholds for Emission Points.

**Table 24. Wisconsin Department of Natural Resources Thresholds for Emission Points vs. SHINE Bounding Sulfuric Acid Emissions**

| Thresholds for Emissions from Stacks < 25 ft Sulfuric Acid* | SHINE Bounding Sulfuric Acid Emissions |
|---|---|
| 0.0537 lbs/hour | 0.0060 lbs/hour |
| * From NR 445.07 Table A, “Emissions Thresholds, Standards and Control Requirements for All Sources of Hazardous Air Contaminants,” Column (c). | |

Therefore, SHINE will demonstrate compliance with NR 445.07 via 445.08(2)(a), by meeting the threshold in Table A, Column (c). SHINE ensures that the impacts to the public from the release of sulfuric acid are small through compliance with Wisconsin Department of Natural Resources regulations, which are designed for that purpose.

**Human Health Request #6**

*Section 19.4.8.1.5, Physical Occupational Hazards, discusses that the evaluation of the non-radiological hazards to the workforce will be defined when the operating strategies are finalized. This information is needed for the environmental review.*

**SHINE Response**

Physical occupational hazards to workers at the SHINE facility will be controlled and mitigated by an occupational safety program commensurate with those hazards and in compliance with 29 CFR 1910.

A high-level, preliminary hazard analysis for the SHINE site has been conducted and is presented in Table 25. Physical occupational hazards have been grouped by area of occurrence, including: the Production Facility, the Administration Building, outdoors, and general. For each hazard, the control and mitigation strategy is listed.

Employees expected to work in the Production Facility and be exposed to Production Facility hazards include:

- Operators
- Shift Supervisors
- Engineers
- Quality Control personnel
- Radiological Controls personnel
- Environment, Safety, and Health personnel
- Maintenance personnel
- Security personnel
- IT personnel

Employees expected to work in the Administration Building and be exposed to Administration Building hazards include:

- Executive Management
- Financial Accounting personnel
- Procurement personnel
- Employee Relations personnel
- Quality Assurance personnel
- Schedulers
- Licensing personnel
- IT personnel
- Engineers
- Drafters
- Administrative assistants

Employees expected to work outdoors include:

- Groundskeepers
- Maintenance personnel
- Environmental Monitoring personnel
- Security personnel

**Table 25. Preliminary Hazard Analysis for the SHINE Site**

| Area | Hazard | Mitigation |
|---|---|---|
| **Production Facility Hazards** | Slips, trips, and falls | Safety shoes required in facility; facility kept clean and uncluttered; tripping hazards removed or marked; spills cleaned up immediately |
| | Eye hazards (e.g., projectiles from power tools, chemical splashes) | Side-shield safety glasses required in the RCA and in labs |
| | Hazardous chemicals | Handling: Personal protective equipment (PPE) appropriate to the hazard (e.g., eye protection, gloves, lab coats, face shields); hazard communication plan and associated training (including safety data sheet (SDS) accessibility); facilities appropriate to the task (e.g., proper ventilation, fume hoods), spill procedures<br><br>Storage: Storage appropriate to the chemical (e.g., flammables in flame cabinets, acids and bases separated); berms to contain spills<br><br>Process: Pipes labeled; majority of pipes in trenches to contain leaks; lockout/tagout procedure |
| | Sharp edges or pinch points | Systems engineered to eliminate cut and pinch points; guards and warnings installed where not possible to eliminate |
| | Falls from heights | Fall protection equipment; fall protection procedure and associated training; guard rails where appropriate; ladder safety procedure and associated training |
| | Electrical hazards | Lockout/tagout procedure; PPE appropriate to the hazard; training and qualification program |
| | Welding or cutting torches | Appropriate PPE (e.g., welding helmet with appropriate lens shade, safety glasses, welding gloves, long-sleeved shirt and pants, leather apron); training |
| | Cranes/hoists | Maintenance schedule to ensure fitness for task; trained operators; procedures |
| | Confined spaces | Permit-required confined spaces procedure and associated training |
| | Machine tools | Machine guarding; training and qualification program; PPE appropriate to the hazard (e.g., safety glasses, hearing protection) |
| | Compressed gases | Compressed gas hygiene plan and associated training |
| | Hazardous noise | Engineered noise control; hearing protection when appropriate; warning signs for areas with loud noise |
| | Ergonomic risks | Workspaces designed to industry standards; adequate lighting provided; training (e.g., promote good posture, frequent stretching, heavy lifting training) |

| | | |
|---|---|---|
| **Administrative Building Hazards** | Slips, trips, and falls | Facility kept clean and uncluttered; tripping hazards removed or marked; spills cleaned up immediately; ladder safety procedure and associated training |
| | Ergonomic risks | Workspaces designed to industry standards; adequate lighting; training (e.g., promote good posture, frequent stretching, heavy lifting training) |
| | Sharp edges or pinch points | Systems engineered to eliminate cut and pinch points; guards and warnings installed where not possible to eliminate |
| **Outdoor Hazards** | Slips, trips, and falls | Close-toed, slip-resistant footwear appropriate for the terrain |
| | Fall from roof edge or ladders used to access | Fall protection procedure and associated training; ladder safety procedure and associated training |
| | Powered equipment (e.g., mowers, snow removal) | Training and qualification program; equipment maintenance program; PPE appropriate to the task (e.g., safety glasses, hearing protection, long pants and safety shoes for mowing) |
| | Hazardous chemicals (e.g., herbicides) | PPE appropriate to the hazard (e.g., eye protection); hazard communication plan and associated training |
| | Sunburn, heatstroke, dehydration | PPE appropriate to the task (e.g., brimmed hat, long sleeves, sunscreen); training (e.g., encourage frequent breaks on hot days) |
| | Chill; frostbite | PPE appropriate to the task (e.g., warm hat, coat, gloves, winter boots) |
| | Inclement weather: rain or snow storm | Avoid outdoor work if possible; PPE appropriate to the task if not (e.g., raincoat, waterproof boots) |
| | Insect bites/stings | Prevention and response training |
| **General** | Fire | Emergency action plan (evacuation) and associated training (including drills); fire suppression and detection system; fire alarms |
| | Tornados and inclement weather | Emergency action plan and associated training; weather alert radio monitored |
| | Medical emergencies | Emergency action plan and associated training; first aid, CPR, automated external defibrillator (AED), blood borne pathogen training; AEDs in each building |

**Human Health Request #7**

*Section 19.4.8.1.6, Chemical Exposure to the Workforce, discusses the impacts to the workforce from the use of hazardous chemicals. Provide some specific examples of the controls, industrial hygiene practices, and protective equipment and clothing that are expected to be used to minimize chemical exposure to the workforce.*

**SHINE Response**

To minimize chemical exposure to the workforce at the radioisotope production facility in Janesville, SHINE will have in place a Chemical Hygiene Plan. The Chemical Hygiene Plan will incorporate numerous mechanisms for maintaining a safe working environment and will be based on Occupational Safety and Health Administration (OSHA) requirements, industry standards, and the experience of the managerial staff. Plant and laboratory spaces will be kept clean and orderly. Hazardous material storage will be suited to the material stored (acids, bases, oxidizers, gases, pyrophoric metals, etc.). SHINE intends to set the example for industry in industrial safety matters.

In addition to a Radiation Safety Officer (RSO), SHINE will designate a Chemical Hygiene Officer (CHO). The main responsibilities of the CHO will be to oversee the effective implementation of the Chemical Hygiene Plan, in coordination with the RSO. This will help ensure the overall safety culture at SHINE is maintained. In addition to proper supervision and oversight of operations, SHINE will have an extensive training program that will emphasize safety.

In addition to training and supervision, the Chemical Hygiene Plan will direct the use of protective equipment as appropriate. These steps will range from directions on appropriate clothing (for example, no shorts or open-toed shoes in the plant or the labs) to PPE, such as latex gloves, safety glasses, and lab coats. For more potentially hazardous operations, such as target solution preparation (due to the larger quantities of acids and greater concentrations), face shields, aprons, and heavy nitrile gloves will be called for and utilized.

Extensive engineering controls are being designed into the SHINE facility in addition to administrative controls. Guards, shields, double-valving, proper ventilation, glove boxes, fume hoods, safety switches, appropriate storage facilities, etc. will be designed into plant and laboratory operations to minimize workforce exposure to hazardous chemicals.

**Human Health Request #8**

*Section 19.4.8.1.7, Environmental Monitoring Programs, discusses the non-radiological environmental monitoring programs to ensure compliance with Wisconsin's regulations. Provide specific examples of the environmental monitoring program that are expected to be used to ensure liquid and gaseous effluents comply with the regulations and permits listed in this section.*

**SHINE Response**

Liquid Effluents

Wisconsin Administrative Code Chapter NR 216.28 describes monitoring requirements for non-storm water discharges. SHINE will sample and report the results of non-storm water discharges into the storm drainage system as required by the Chapter NR 216.28, in accordance with approved procedures.

Gaseous Effluents

Except for major sources, the Wisconsin statutes do not require monitoring. SHINE will not be considered a major source. The Wisconsin Department of Natural Resources may require monitoring, but is not expected to do so. SHINE does not intend to monitor for non-radiological gaseous effluents.

**Human Health Request #9**

*Section 19.4.8.2.2.2, Liquid Sources of Radiation, discusses radioactive liquid waste produced at the proposed facility. However, there is no discussion of ways to minimize contamination of the facility in accordance with 10 CFR 20.1406, Minimization of Contamination.*

*10 CFR 20.1406 states the following:*

> *Applicants for licenses, other than early site permits and manufacturing licenses under part 52 of this chapter and renewals, whose application are submitted after August 20, 1997, shall describe in the application how facility design and procedures for operation will minimize, to the extent practicable, contamination of the facility and the environment, facilitate eventual decommissioning, and minimize, to the extent practicable the generation of radioactive waste.*

*As required by 10 CFR 20.1604, provide the information related to minimize contamination of the facility.*

**SHINE Response**

The SHINE facility will be designed to minimize contamination of the facility and the environment. The design will use engineered features such as berms, sumps, and drain collection systems with leak detection, hot cell and gloveboxes, and protective coatings on floors and walls. Management measures will include minimizing the transportation of contaminated materials out of the RCA and the introduction of unnecessary materials into the RCA, such as the use of a contaminated tool room inside the RCA and an uncontaminated tool room outside of the RCA.

Additional details on planned actions to minimize contamination are discussed in Subsection 11.1.6 of the SHINE PSAR (Reference 3).

**Human Health Request #10**

*In Table 19.4.8-4, "Annual Average Airborne Radioactivity ECL Fraction at Bounding Dose Receptors" and Table 19.4.8-5, "Annual Total Effective Dose Equivalent to the Public at Bounding Dose Receptors," tritium is listed as being released from the proposed facility. However the footnote to these tables states that tritium was not included in the dose assessment. Provide the dose contribution from tritium to the maximally exposed individual or provide an evaluation to demonstrate that the dose would be negligible.*

**SHINE Response**

The total dose contribution from tritium has not yet been calculated for the final plant design. Dose calculations have been performed to determine the effects to the public of potential airborne tritium releases. The calculations show that a tritium release of 4400 Ci/year results in a dose at the site boundary of 10 mrem/yr. As stated in Table 19.4.2-1 of Reference (2), gaseous tritium effluents will be less than 4400 Ci/year.

The details of the final design and maintenance processes will ensure that the total annual average airborne radioactivity ECL fraction for the maximally exposed individual (MEI) and nearest full-time resident (Table 19.4.8-4 of Reference (2)) will be less than $1.0 \times 10^{-1}$ (based on Regulatory Position C.2.a of Regulatory Guide 4.20 (Reference 10)) when including tritium releases.

The details of the final design and maintenance processes will also ensure the annual total effective dose equivalent to the public for the MEI and nearest full-time resident (Table 19.4.8-5 of Reference (2)) will be less than 10 mrem when including tritium releases.

**Human Health Request #11**

*Table 19.4.8-7, "Administrative Dose Limits," lists the 10 CFR Part 20 dose limit as the same value as the SHINE annual administrative limit. As listed, the administrative dose value appears to be an error. Provide the expected annual administrative dose limit.*

**SHINE Response**

SHINE does not intend to apply an administrative limit for Declared Pregnant Workers; therefore it is not appropriate to include an entry for Declared Pregnant Workers on Table 19.4.8-7 of Reference (2). The entry is removed (see Table 26).

While dose to the theoretical MEI will be monitored in accordance with 10 CFR 20, actual individual members of the public will not be monitored for radiation exposure by SHINE; therefore it is not possible for SHINE to apply an administrative limit to Individual Members of the Public. The entry for Individual Members of the Public is removed (see Table 26).

Table 26 provides the administrative dose limits applicable to SHINE. An IMR has been initiated to address this issue.

**Table 26. Administrative Dose Limits**

| Type of Dose | 10 CFR Part 20 Limit (rem/year) | SHINE Administrative Limit (rem/year) |
|---|---|---|
| **Adult Radiological Worker** | | |
| The more limiting of: | | |
| Total effective dose equivalent to whole body, or | 5 | 0.5 |
| Sum of deep-dose equivalent and committed dose equivalent to any organ or tissue other than lens of eye | 50 | 5 |
| Eye Dose equivalent to lens of eye | 15 | 1.5 |
| Shallow-dose equivalent to skin of the whole body or any extremity | 50 | 5 |

**Human Health Request #12**

*Section 19.4.13.8.1 of Section 19.4.13.8 Human Health, discusses the cumulative impacts associated with the proposed facility and the potential NorthStar facility and the operating Mercy Clinic South and Mercy Hospital for wastewater sent to the Janesville wastewater treatment facility. Provide information on discussions, if any, that have taken place with the Janesville wastewater treatment facility on whether the additional wastewater from the proposed facility in combination with the Mercy Clinic South and the Mercy Hospital will have any significant impacts to the wastewater treatment facility. There is a potential cumulative impact to the workers at the Janesville treatment facility if it is not able to adequately process the increased amounts of effluents and to the public if effluent discharges from the treatment facility are significantly increased.*

**SHINE Response**

During a visit to the Janesville Wastewater Treatment Plant on July 19, 2013, discussions were held with the Wastewater and Utilities Superintendent. SHINE informed the Superintendent that the maximum wastewater output of the proposed facility would not exceed 6000 gal/day (GPD). The Superintendent confirmed that the design peak flow of the wastewater treatment facility is approximately 25 Million GPD and that the average daily discharge flow is approximately 13 Million GPD. The average daily discharge flow accounts for the operating Mercy Clinic South and Mercy Hospital. Sanitary sewer and wastewater treatment for the proposed NorthStar facility will be provided by the City of Beloit, as indicated in the U.S. Department of Energy's Environmental Assessment of the proposed NorthStar facility (Reference 11). Therefore, the fraction of wastewater sent to the Janesville Wastewater Treatment Plant is small when compared to the reserve available and the cumulative impact to the workers at the Janesville Wastewater Treatment Plant and the public is insignificant.

**References**


(1) NRC letter to SHINE Medical Technologies, Inc., dated September 11, 2013, Requests for Additional Information for the Environmental Review of the SHINE Radioisotope Production Facility Construction Permit Application (ML13231A041)

(2) SHINE Medical Technologies, Inc. letter to NRC, dated March 26, 2013, Part One of the SHINE Medical Technologies, Inc. Application for Construction Permit (ML130880226)

(3) SHINE Medical Technologies, Inc. letter to NRC, dated May 31, 2013, Part Two of the SHINE Medical Technologies, Inc. Application for Construction Permit (ML13172A361)

(4) U.S. Environmental Protection Agency, Office of Transportation and Air Quality, "Average Annual Emissions and Fuel Consumption for Gasoline-Fueled Passenger Cars and Light Trucks," EPA420-F-08-024, October 2008

(5) U.S. Environmental Protection Agency, "Compilation of Air Pollutant Emissions Factors, Volume I: Stationary Point and Area Sources," AP-42, Fifth Edition, January 1995

(6) U.S. Environmental Protection Agency, "Climate Leaders, Greenhouse Gas Inventory Protocol Core Module Guidance – Direct Emissions from Mobile Combustion Sources," EPA430-K-08-004, May 2008

(7) Hilsenhoff, W. L., “An Improved Biotic Index of Organic Stream Pollution,” The Great Lakes Entomologist, 20:31-39

(8) U.S. Department of Transportation, Federal Highway Administration, “Validation of FHWA’s Traffic Noise Model® (TNM): Phase 1,” DOT-VNTSC-FHWA-02-01, August 2002

(9) U.S. Department of Transportation, Federal Highway Administration, “TNM VERSION 2.5 ADDENDUM to Validation of FHWA’s Traffic Noise Model® (TNM): Phase 1.” DOT-VNTSC-FHWA-02-01 Addendum, July 2004

(10) U.S. Nuclear Regulatory Commission, “Constraint on Releases of Airborne Radioactive Materials to the Environment for Licensees other than Power Reactors,” Regulatory Guide 4.20, Revision 1 (ML110120299)

(11) U.S. Department of Energy, “Environmental Assessment for NorthStar Medical Technologies LLC Commercial Domestic Production of the Medical Isotope Molybdenum-99,” DOE/EA-1929, August 2012