

# Nevada National Security Site (NNSS) Site-Wide Environmental Impact Statement (SWEIS)

## Transportation Analysis



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# Current Transportation Practices

- Recognizes previous agreements
- Primarily all truck transport
  - FY 2008: 11% of shipments were rail-to-truck
  - FY 2009: 3% of shipments were rail-to-truck
  - FY 2010: less than 1% of shipments were rail-to-truck



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# Ten-Year SWEIS Waste Disposal Estimates (ft<sup>3</sup>)

	No Action Alternative	Expanded Operations Alternative	Reduced Operations Alternative
Low-Level Waste	15,000,000	48,000,000	15,000,000
Mixed Low-Level Waste	900,000	4,000,000	900,000
Total	15,900,000	52,000,000	15,900,000

- No Action and Reduced Operations Alternatives reflect recent trends on LLW receipt at the NNSS and MLLW permit limits
- Expanded Operations Alternative:
  - Reflects long-term waste forecasts
  - Seeks to maintain flexibility for the Department of Energy (DOE) complex to dispose waste at the NNSS
  - Recognizes that DOE may make other disposal site decisions



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# Estimated Number of Shipments of Radioactive Waste and Materials

	No Action Alternative	Expanded Operations Alternative	Reduced Operations Alternative
<b>Truck</b>			
In-state radioactive waste shipments	2,300	15,400	2,300
Out-of-state radioactive waste shipments	24,700	79,000	24,700
Out-of-state radioactive material shipments	240	10,700	180
<b>Rail-to-Truck</b>			
Out-of-state radioactive waste shipments (rail only)	12,300	38,200	12,300
Out-of-state radioactive waste shipments (rail and truck)	37,000	92,600	37,000

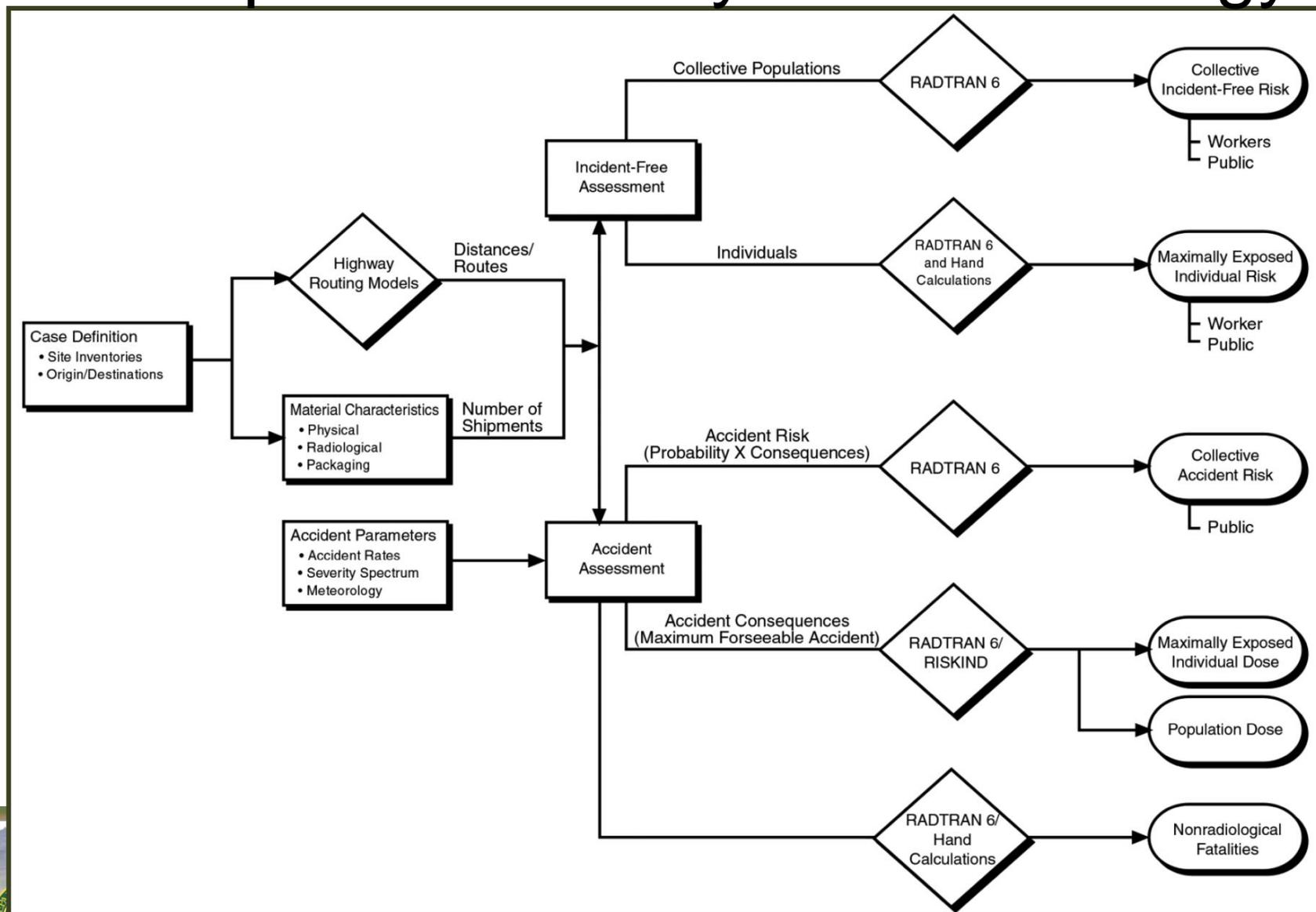


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# Transportation Analysis Methodology



# Regions of Origination

All generators are assigned to eight geographic regions

- All waste shipments from a region are assumed to use a representative truck or rail route
- All shipments are assumed to come from the farthest reasonable point within the region



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# Transportation Models used to estimate Impacts

- **TRAGIS** (Transportation Routing Analysis Geographic Information System) – TRAGIS is a GIS-based transportation analysis computer program used to choose representative truck and rail routes and associated distances and population densities
- **RADTRAN 6** (Radioactive Material Transportation Code 6) – Used to calculate incident-free and accident risk on workers and public on a per-shipment basis. Uses information from TRAGIS along with properties of material shipped and route-specific accident frequencies
- **RISKIND** (Risks and Consequences of Radioactive Material Transport) – Used to estimate doses to the public as a result of maximum reasonably foreseeable accidents



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# SWEIS Transportation Analysis

- SWEIS analyzes two cases:
  - Constrained Case
    - The status quo is maintained avoiding truck shipment through I-15/U.S.-95 interchange in Las Vegas and via Hoover Dam or the new O’Callaghan-Tillman bridge and continue transloading at Parker, AZ & West Wendover, NV
    - Transportation by (a) all truck and (b) the combination rail-to-truck are analyzed
  - Unconstrained Case
    - Analyzed several routes for truck transport through Southern Nevada
    - Analyzed additional rail-to-truck transload locations: Apex and Arden, NV and Kingman, AZ
    - Transportation by (a) all truck and (b) the combination rail-to-truck are analyzed



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# Constrained Case Routes

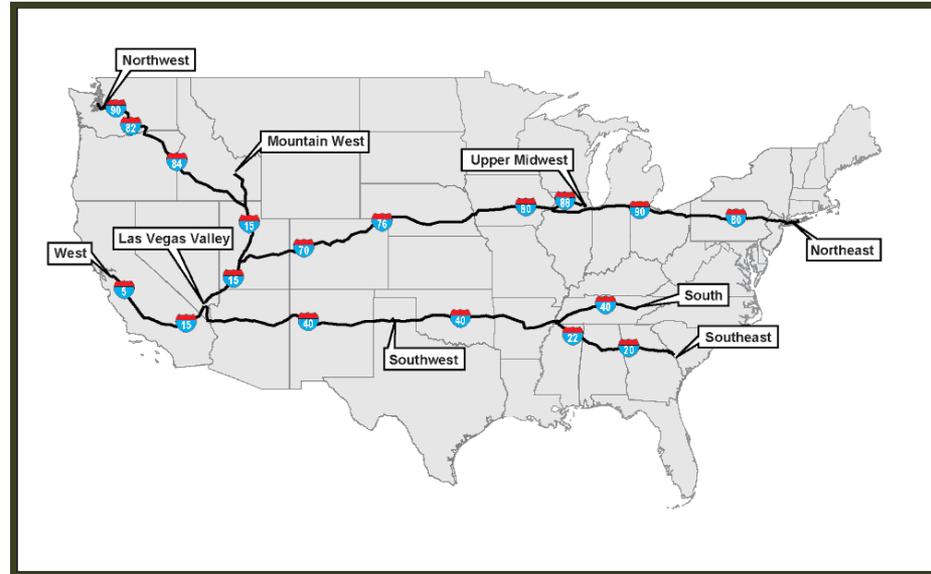
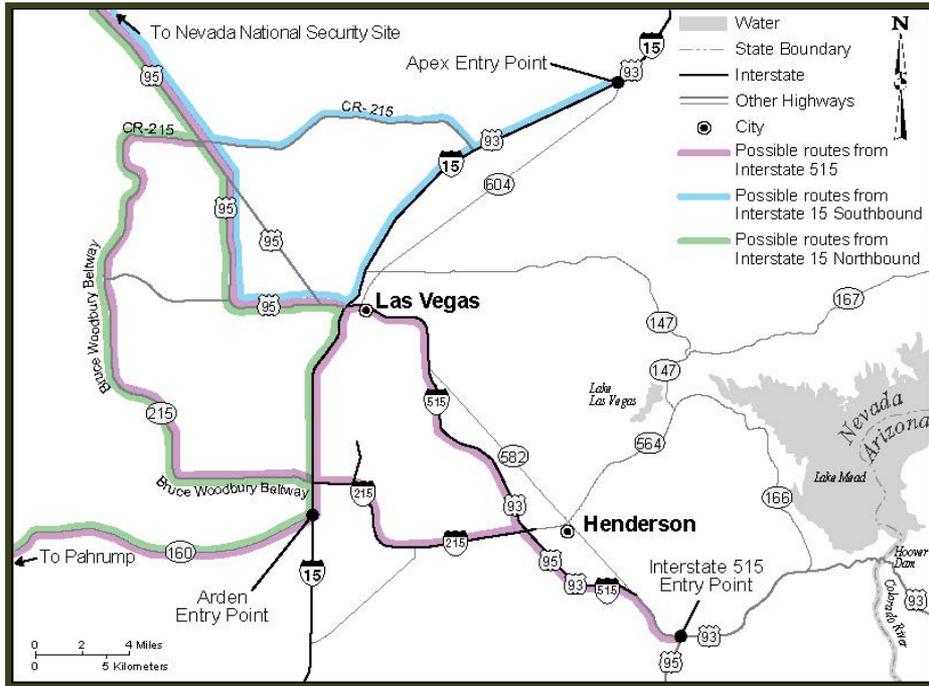


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# Unconstrained Case Routes (Truck)



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# Unconstrained Case Routes (Rail-to-Truck)



## Rail Routes to Transfer Stations at Apex and Arden, NV

(Rail routes to transfer stations at Parker and Kingman, AZ and West Wendover, NV are not shown, but are included on Maps 6 and 7 in the NNSS SWEIS Summary)



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# Rail-to-Truck Transloading

- Status quo for existing transload in Parker, AZ plus West Wendover, NV for constrained case
- Five representative locations for transload: Arden, Apex and West Wendover, NV and Parker and Kingman, AZ for unconstrained case
  - These are representative sites for impact analysis. Other sites could be chosen by industry
  - Any transload location would be industry's responsibility to develop



*Transload Facility – Parker, AZ*



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# Terminology

- **Maximally Exposed Individual (MEI)** – A hypothetical individual whose location and habits result in the highest total radiation exposure (and thus dose) from a particular source for all relevant exposure routes (e.g., inhalation, ingestion, direct exposure)
- **Rem** – A unit of radiation dose used to measure the biological effects of different types of radiation on humans. The estimation of dose in rem accounts for the type of radiation, the total absorbed dose, and the tissues involved. One thousandth of a rem is a millirem. The average dose to an individual in the U.S. including both natural background and medical sources is about 620 millirem per year
- **Person-rem** – a unit of collective radiation dose applied to a population or group of individuals. It is calculated as the sum of the estimated doses, in rem, received by each individual of the specified population. For example if 1,000 people each received a dose of 1 millirem, the collective dose would be 1 person-rem (1,000 persons x 0.001 rem)



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# Terminology

(continued)

- **Latent Cancer Fatalities (LCFs)** – Deaths from cancer resulting from, and occurring sometime after exposure to ionizing radiation or other carcinogens. The NNSS SWEIS focuses on LCFs as the primary means of evaluating health risk from radiation exposure. The values reported for LCFs are the increased risk of a fatal cancer for a MEI or involved worker, or the increased risk of a single fatal cancer occurring in an identified population



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# Transportation Analysis Methodology

- **Incident-free radiological health impacts** are expressed in terms of **Latent Cancer Fatalities (LCFs)**. Worker or public dose is multiplied by a conversion factor of 0.0006 LCFs per rem or person-rem of exposure to obtain LCF risk
- Radiological impact of accidents is expressed in terms of **probabilistic risk** (i.e., dose-risk), which is defined as the accident probability (accident frequency) multiplied by the accident consequence (dose). The individual risks are then summed to obtain the overall radiological risk
- The SWEIS also assesses the **highest consequences of a maximum reasonably foreseeable accident** with a radioactive release frequency greater than  $1 \times 10^{-7}$  (1 chance in 10 million)

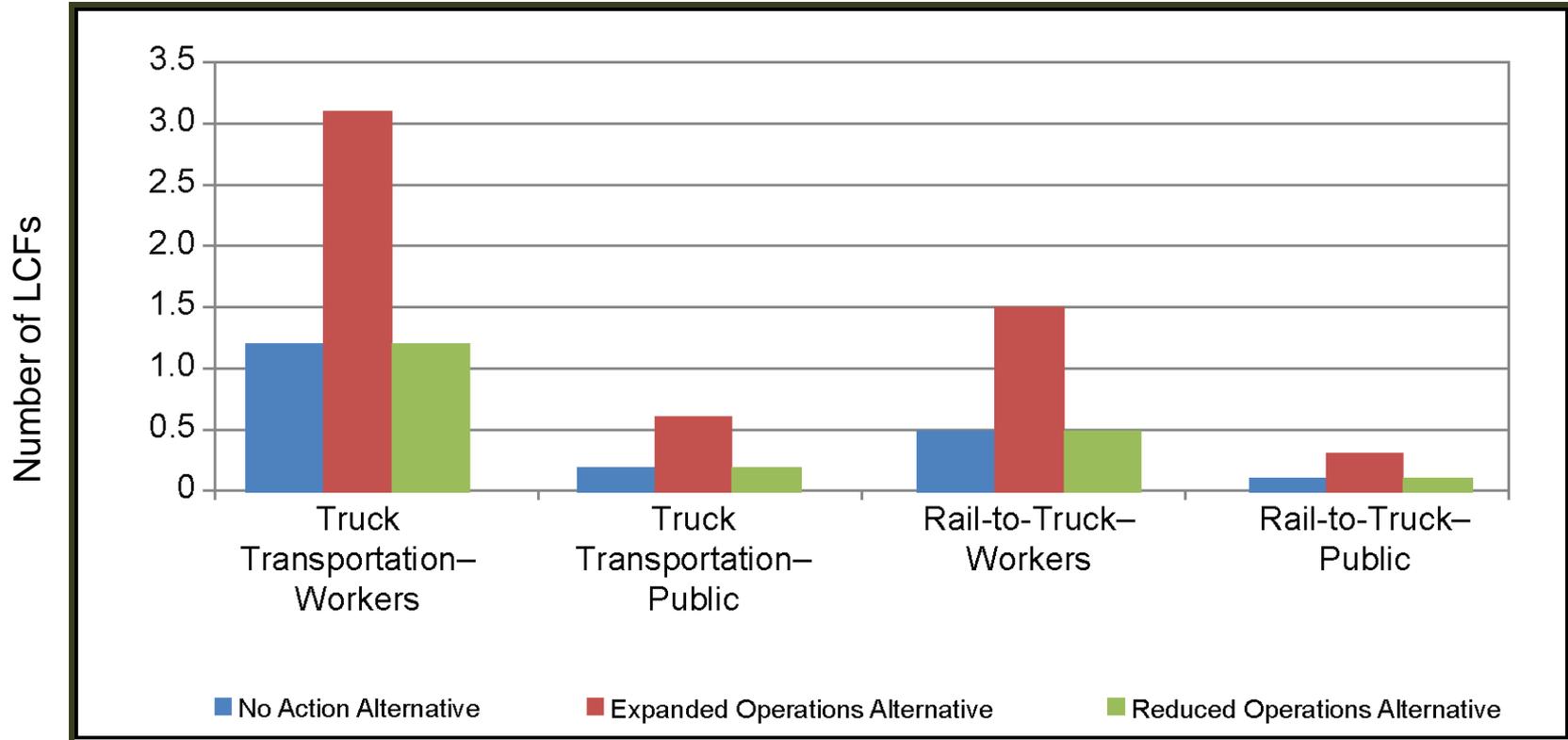


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# Latent Cancer Fatalities (LCFs) from Incident-Free Transportation (Constrained Case)



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# Health Impacts from Incident-Free Transportation - Expanded Operations Alternative (Unconstrained and Constrained Cases)

<i>Through Point-of-Entry to the NNSS</i>	<i>Number of Truck Shipments</i>	<i>Workforce</i>		<i>Population</i>	
		<i>Dose (person-rem)<sup>b</sup></i>	<i>Latent Cancer Fatality</i>	<i>Dose (person-rem)</i>	<i>Latent Cancer Fatality</i>
Apex	23,500	960 – 1,000 <sup>b</sup>	0.6	230 – 260	0.1 – 0.2
Arden	3,040	38 – 46	0.2 – 0.3	14 – 17	0.009 – 0.01
Henderson	27,400	3,100 – 3,200	2	510 – 540	0.3
Total Unconstrained	54,000	4,100 – 4,200	2 – 3	760 – 810	0.5
Total Constrained	54,000	4,900	3	830	0.5
<i>Through Transfer Station to the NNSS</i>	<i>Number of Rail and Truck Shipments</i>	<i>Workforce</i>		<i>Population</i>	
		<i>Dose (person-rem)</i>	<i>Latent Cancer Fatality</i>	<i>Dose (person-rem)</i>	<i>Latent Cancer Fatality</i>
Apex	81,000	1,300 – 1,500	0.8 – 0.9	360 – 470	0.2 – 0.3
Arden	81,000	1,300 – 1,400	0.8 – 0.9	390 – 410	0.2
Kingman	81,000	1,400 – 1,600	0.8 – 1	440 – 490	0.3
Parker	81,000	1,700 – 1,900	1	490 – 540	0.3
West Wendover	81,000	1,900 – 2,200	1	430 – 530	0.2 – 0.3
Total Unconstrained	81,000	1,300 – 2,200	0.8 – 1	360 – 540	0.2 – 0.3
Total Constrained	81,000	1,800	1	480	0.3



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# Transportation Accidents

- **Maximum reasonably foreseeable transportation truck accident involving the release of radiation** was estimated to occur at an annual frequency of  $3.1 \times 10^{-7}$  (about 1 chance in 3.3 million) for the No Action and Reduced Operations Alternative and about  $6.1 \times 10^{-7}$  under the Expanded Operations Alternative (about 1 chance in 1.6 million). This would result in less than 1 (0.1) Latent Cancer Fatality in the population if the accident were to occur in an urban area. The MEI was estimated to receive 34 millirem, resulting in a risk of contracting a fatal cancer of  $2 \times 10^{-5}$  (1 chance in 50,000)
- **Maximum reasonably foreseeable transportation rail accident involving the release of radiation** was estimated to occur at an annual frequency of  $9.8 \times 10^{-8}$  (about 1 chance in 10 million); and was not analyzed further due to the low probability of occurrence
- **Non-radiological accident risks** under the No Action and Reduced Operations Alternatives would be about  $\frac{1}{3}$  to  $\frac{1}{2}$  of those for the Expanded Operations Alternative. Risk would depend on, in part, on the number of rail cars per transport



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# Air Emissions from Transportation of Radioactive Wastes and Materials

- For all alternatives, **Criteria Pollutants and Hazardous Air Pollutants** are 3 to 5 times greater for truck transport compared to rail-to-truck (e.g., for the Expanded Operations Alternative 1,098.1 tons per year would be expected for truck only transportation and 321.1 tons per year would be expected for rail-to-truck transportation)
- **Greenhouse gas emissions** are also greater for truck transport, ranging from about 5 to 7 times greater than rail-to-truck transport (e.g., for the Expanded Operations Alternative about 36,000 carbon dioxide equivalent tons of greenhouse gas emissions would be created per year for truck only transportation and 5,000 tons per year for rail-to-truck)



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# QUESTIONS AND DISCUSSION



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