

**National SNF Transportation Risk Calculations for ISP ES for Full Buildout**  
PAL 12/3/2019

Calculated Population Dose and Health Effects for 3,400 SNF Shipments by Exposed Population (Person-Sv)

**Calculations** ----->

Population Dose = Number of Proposed SNF Shipments x Population Dose Per Shipment Factor  
Population Health Effects = Population Dose x Health Effects Conversion Factor

**Results:**

Representative Route-Specific Impact	Incident-Free Public	Incident-Free Worker	Accident Shielding Intact, No Release	Accident with Release
Maine Yankee to Deaf Smith Population Dose	1.24	8.56	0.22	See Table 1
Maine Yankee to Deaf Smith Population Health Effects	0.07	0.49	0.013	See Table 1
INEL to Deaf Smith, TX Population Dose	0.60	3.31	0.22	See Table 1
INEL to Deaf Smith, TX Population Health Effects	0.03	0.19	0.013	See Table 1

Note: Loss of shielding dose-risks were calculated in NUREG-2125 (NRC-2014) but are not included here because the low probability of the accidents severe enough to cause loss of shielding result in far lower dose-risks than accidents with shielding intact that were included here.

**Inputs:**

Number of Proposed SNF Shipments	3,400	Source: ISP, 2019 (ISP RA) response information indicates approximately 3400 canisters shipped at full buildout)
ICRP Pub 103 Health Effects Conversion Factor	0.057	Source: ICRP, 2007 (Pub 103) (Health effects/person-Sv)

**Table 1 Exposed Population Dose Per Shipment Factors Compiled from Results in NUREG-2125 (NRC, 2014)**

Representative Route	Exposed Population Collective Doses per Shipment (person-Sv)			
	Incident-Free Public	Incident-Free Worker	Accident Public Shielding Intact, No Release	Accident with Release
Maine Yankee to Deaf Smith, TX	3.64E-04	2.52E-03	6.60E-05	N/A for Rail-Steel
INEL to Deaf Smith, TX	1.76E-04	9.73E-04	6.60E-05	N/A for Rail-Steel

Note: Rail-Steel cask is for canistered SNF; NUREG-2125 analysis concluded no release from canistered SNF in an accident; ISP proposed transportation involves canistered SNF

**Supplemental Information and Calculations for Table 1**

NUREG-2125 (NRC, 2014, Table 2-15) Collective Doses for Exposed Subgroups per Shipment, Rail-Lead Cask (Person-Sv)

Note: External dose estimates for Rail-Lead cask were used because in NUREG-2125 the dose rate for that cask was set to the regulatory maximum

Maine Yankee to Deaf Smith, TX ----->	Railroad Workers and Inspectors (at stops), In-transit Train Crew, and Escorts			
	Residents Along Route	Occupants of Vehicles Sharing Route	Residents Near Stops	In-transit Train Crew, and Escorts
INEL to Deaf Smith, TX ----->	2.50E-04	6.10E-05	5.30E-05	2.52E-03
	6.70E-05	3.20E-05	7.70E-05	9.73E-04

Note: Railroad worker, crew, and escort dose was not described completely in NUREG-2125 so it was verified below using intermediate outputs in that report. The value from the verification calculation was used here because it was slightly higher than the reported value of 5.1E-4 person-Sv and therefore it was a conservative selection.

NUREG-2125 (NRC, 2014, Table 2-14) Occupational Dose Rates from Incident-Free Transportation	Maine Yankee to Deaf Smith, TX		INEL to Deaf Smith, TX	
	Calculated Collective Occupational Dose for Trip (person-Sv)			
4.30E-09 person-Sv/km	Rail Crew in Transit, Rail-Lead, Rural and Sub	1.35E-05	8.05E-06	
7.20E-09 person-Sv/km	Rail Crew in Transit, Rail-Lead, Urban	1.52E-06	2.88E-07	
5.80E-06 Sv/yr	Rail Escort in Transit, Rail-Lead, Rural and Sub	4.52E-04	2.69E-04	
5.80E-06 Sv/yr	Rail Escort in Transit, Rail-Lead, Urban	5.10E-05	9.67E-06	
		5.18E-04 Total	2.87E-04 Total	

Note: rail inspector average dose per inspection is addressed by NUREG-2125 truck inspector average dose in footnote c of Table 2-14 (1.6E-4 Sv per inspection-hr) for a lone route 3-4 hour inspections assumed based on NUREG-2125 Table 2-11; for shorter (repository) route one 4 hour inspection is assumed.

NUREG-2125 (NRC, 2014, Table 2-11) Classification Stops and In-transit Inspection Worker Collective Doses	Maine Yankee to Deaf Smith, TX		INEL to Deaf Smith, TX	
	Calculated Collective Occupational Dose for Trip (person-Sv)			
3.00E-05 person-Sv	Railroad Worker, Origin and Destination Classification stops	1.97E-03	1.97E-03	
1.97E-03 person-Sv	Rail Inspector, In-transit Inspection (sum of doses for three 4-hr inspections)	6.56E-04	6.56E-04	
6.56E-04 person-Sv	Rail Inspector, In-transit Inspection (dose from one 4-hr inspection)			

NUREG-2125 (NRC, 2014, Table 5-4) Collective Dose Risks to Public from No shielding loss, no release, accident, rail-lead cask (Person-Sv)

Maine Yankee to Deaf Smith, TX ----->	6.60E-05
INEL to Deaf Smith, TX ----->	6.60E-05

Vehicle speeds (NUREG-2125) (NRC, 2014)	Urban	Suburban	Rural	Units
	Truck	60	60	67
Rail	15	25.25	25.25	mph

  

Trip Distances (NUREG-2125) (NRC, 2014) and Calculated Durations	Urban	total	Sub and Rural	
	Maine Yankee to Deaf Smith, TX	211	3362	3151
	132	2101	1969	mi
	1.6			km per mi
Trip Duration	9		78	hrs

  

INEL to Deaf Smith, TX	Urban	total	Sub and Rural	
		40	1913	1873
	25	1196	1171	mi
	1.6			km per mi
Trip Duration	2		46	hrs

\*\*Note: values in red above were corrected from values reported in NUREG-2125 (NRC, 2014). RADTRAN outputs results in person-rem which is a factor of 100 greater than person-Sv. The crew values in the NUREG-2125 Table were labeled person-Sv but were found to be actually in units of person-rem and were therefore corrected by dividing the report crew dose values in Table 2-14 (for Rail-lead cask) by 100. The mislabeling in the report was evident from the calculated occupational doses using intermediate results presented in NUREG-2125 (calculation results herein agree w/ reported values with the correction) and from review of the similar output information reported in Table B-27 of NUREG-2125 (note the Rail-lead urban crew dose entry in B-27 appears to have an additional typo in the exponent as there is no reason that this individual result would be over 10 times greater than the preceding rural/sub value in that table nor the following rail-steel crew dose values in that table where the ratio of urban to sub/rural results is 1.66). No other/similar discrepancies were identified in these tabulated results in NUREG-2125.

**References:**

ICRP (International Commission on Radiological Protection). "The 2007 Recommendations of the International Commission on Radiological Protection." *Annals of the International Commission on Radiological Protection*. ICRP Publication 103. Amsterdam Netherlands: Elsevier, Inc. March, 2007. <http://www.sciencedirect.com/science/journal/01466453/37/2-4> (Accessed 28 June 2019).

NRC. "Spent Fuel Transportation Risk Assessment, Final Report." NUREG-2125. Accession No. 14031A323. Washington DC: U.S. Nuclear Regulatory Commission. 2014

ISP. "Submission of ISP Responses for RAs and Associated DocumentMarkups from First Request for Additional Information, Part 3, Docket 72-1050 CAC/EPID 001028/L-2017-NEW-0002" ADAMS Accession No. T8D. Andrews, Texas: Interim Storage Partners LLC. 2019.