

**National SNF Transportation Risk Calculations for ISP ES for Single Phase**  
PAL 12/3/2019

Calculated Population Dose and Health Effects for 425 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	0.15	1.07	0.03	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.
Maine Yankee to Deaf Smith Population Health Effects	0.01	0.06	0.002	See Table 1	
INEL to Deaf Smith, TX Population Dose	0.07	0.41	0.03	See Table 1	
INEL to Deaf Smith, TX Population Health Effects	0.00	0.02	0.002	See Table 1	

**Inputs:**

Number of Proposed SNF Shipments	425	Source: ISP, 2019 (phase average, calculated from ISP RAI response information indicating approximately 3400 canisters shipped during total of 8 phases)
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)

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	5.30E-05
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: 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

Note: values in red are further described below\*\*

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	5.18E-04	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 (1.64E-4 Sv per inspection-hr) for a long 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 RAIs 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.