APPENDIX D
EXPOSURE FACTORS

Exposure factors are linearly related to risk results therefore it is possible to predict the effect of using the ingestion rates and exposure durations presented in the 1996 Exposure Factors handbook based upon their relationship to the factors used in the current analysis. Table D.1 presents the ingestion rates and exposure durations used in the current risk assessment, and the corresponding factors presented in the draft exposure factors handbook which are anticipated for incorporation in the final rule, and the ratio of these factors that may be used to estimate the effect on the final risk results.

$$Ed_{change} = (ED_{1996}/ED_{1990})$$

where

ED_{change} = Relative change in the exposure duration
ED_{1996} = Exposure duration from 1996 draft Exposure Factors Handbook
ED_{1990} = Exposure duration from 1990 Exposure Factors Handbook

and

$$IR_{change} = (IR_{1996}/IR_{1990})$$

where

IR_{change} = Relative change in the ingestion rate
IR_{1996} = Ingestion rate from 1996 draft Exposure Factors Handbook
IR_{1990} = Ingestion rate from 1990 Exposure Factors Handbook

Table D.1 Comparison of Current Exposure Factor Handbook Values and Values from the Draft 1996 Exposure Factors Handbook

Exposure Factor		Current Exposure Factors Handbook Values		Draft 1996 Exposure Factors Handbook Values		Ratio Exposure Factors Handbook (1990) to Draft Exposure Factors Handbook (1996)	
		Central Tendency	High End	Central Tendency	High End	Central Tendency	High End
Exposure duration for adult resident (yr)		9	30	9	30	1	1
Soil ingestion (mg/ day)		100	100	50	NA	0.5	NA
Exposure duration for home gardener (yr)		9	30	3.3	21.7	0.37	0.72
Ingestion of aboveground produce home gardener (g WW)	Vegetable	76	NA	53	218	0.70	NA
	Fruit	88		53	205	0.60	NA
Ingestion of belowground vegetables home gardener (g WW)		28	NA	40	169	1.43	NA
Exposure duration for subsistence farmer (yr)		20	40	10	48.3	0.5	1.21
Ingestion of aboveground produce subsistence farmer (g WW/day)	Vegetable	76	NA	83	361	1.09	NA
	Fruit	88		78	300	0.89	NA
Ingestion of belowground vegetables subsistence farmer (g WW/day)		28	NA	53	187	1.89	NA
Fish ingestion (g/day)		60	130	59	170	0.98	1.31
Exposure duration for subsistence fisher (yr)		9	30	3.3	21.7	0.37	0.72

The combination of the change in the exposure duration for each scenario may be applied to the relative change in the ingestion rate to determine the overall change to the risk estimate by pathway. The overall risk for the scenario is determined by summing the risk by pathway for each combination of high end modeling variables. The relative change for each pathway may be estimated with the following equation:

$$ED_{change} \text{ x } IR_{change} = \text{Total relative pathway change}$$

Table D.2 presents the relative change in the risk for each pathway in each scenario presented in the nongroundwater risk assessment performed for Clarified Slurry Oil Sludge managed in an onsite land treatment unit for the petroleum refining listing decision. The high end risk estimates all include the long exposure duration as one of the high end parameters, therefore, for this case the relative change in the long exposure duration is multiplied by the relative change in the central tendency ingestion rate to determine the total relative change in the risk estimate. The 1990 Exposure Factor Handbook does not include high end ingestion rates, thus, this option is not compared in Table D.2, however, the effect of using the high ingestion rate factors and/or central tendency exposure duration factors may be determined using the same method.

Table D.2   Relative Change in Risk Assessment Results Expected from
Converting to 1996 Exposure Factors for Clarified Slurry Oil Sludge
Managed in an Onsite Land Treatment Unit
Long Exposure Duration and Central Tendency Ingestion Rates

Scenario	Exposure Pathway	Relative Change in High End Risk
Adult Resident	Soil ingestion	0.5
Home gardener	Soil ingestion Vegetable ingestion Fruit ingestion Root vegetable ingestion	0.36 0.50 0.43 1.03
Subsistence Farmer	Soil ingestion Vegetable ingestion Fruit ingestion Root vegetable ingestion	0.605 1.32 1.07 2.29
Subsistence Fisher	Soil ingestion Fish ingestion	0.36 0.71