Formerly Utilized Sites Remedial Action Program (FUSRAP)

ADMINISTRATIVE RECORD

for Maywood, New Jersey

U.S. Department of Energy

0489-0613.1

Department of Energy

Oak Ridge Operations
P.O. Box 2001
Oak Ridge, Tennessee 37831—8723

April 24, 1996

Ms. Angela Carpenter
Federal Facilities Section
U.S. Environmental Protection Agency, Region II
290 Broadway
18th Floor
New York, New York 10007-1866

Dear Ms. Carpenter:

MAYWOOD SITE - PROPOSED USE OF SUPPLEMENTAL STANDARDS

The purpose of this letter is to present the final hazard assessment for the area of residual radioactive material above criteria on the rear of residential properties at 18, 20, and 22 Long Valley Road in Lodi, New Jersey. The final hazard assessment incorporates the changes you suggested in your letter of January 24, 1996. As we have discussed, supplemental standards may be appropriate when the removal of radioactive materials to the cleanup criteria would produce harm to the environment that is clearly excessive when compared to a small reduction of risk.

The area of interest contains mature trees that are the only sound barrier and aesthetic element between the above referenced residential properties and Interstate-80. Our project representatives have met with the affected property owners to explain that DOE is presenting a hazard assessment to EPA, and all have expressed a strong desire to keep the trees if at all possible.

Enclosed please find the hazard assessment for the subject properties (Attachment A). The scenarios are modeled using RESRAD Version 5.61 to obtain dose and risk information. Attachment B contains a summary of additional sampling data for this area that is based on samples collected in March 1996. Attachment C presents supporting documentation for the statistical analysis of data outlined in Attachment A.

Your suggestions, which have been incorporated, were to include a drinking water pathway, to use the $UCL_{0.95}$ instead of the arithmetic mean activity concentration values, and to include a future use scenario that evaluates soil disturbance. The 95% upper confidence level of the mean activity concentration values are used throughout the final dose analysis. A future worker scenario has been included, evaluating the dose to a worker who cuts down and removes the trees. The future resident scenario includes a drinking water and a produce ingestion (garden) pathway.

The maximum dose to current residents from the area of interest is 5.9 mrem/yr. The excess cancer risk is estimated to be 5.1×10^{-5}. The future one-time dose to a worker cutting down the trees is estimated to be 1.4 mrem with an incremental cancer risk of 1.2×10^{-5}.

The maximum dose to a future resident (including drinking water and produce ingestion pathways) is estimated to be 12 mrem/yr with an excess cancer risk of 7.8×10^{-5}. The maximum dose results for all three scenarios are below the EPA proposed guideline of 15 mrem/yr and the DOE guideline of 100 mrem/yr. The maximum excess cancer risks are all within the EPA target risk range of 10^{-6} to 10^{-4}.

At this time, I am requesting your approval to establish supplemental criteria for this area at the existing radionuclide activity concentration values. As we have discussed, the application of supplemental criteria is considered an acceptable approach and has been implemented at a number of sites by both DOE and EPA. Their use is explicitly provided for under DOE directives (DOE Order 5400.5 and proposed 10 CFR 834 regulations) and EPA regulations pertaining to residual radioactive materials similar to those at the Maywood site (40 CFR 192).

If you have any questions or would like to discuss the enclosed information in greater detail, please call me at (423) 576-5724.

Sincerely,

Susan M. Cange, Site Manager
Former Sites Restoration Division

Enclosures

cc: Nick Marton, NJDEP
Alexander Williams, DOE-HQ

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ATTACHMENT A

18,20, AND 22 LONG VALLEY ROAD
HAZARD ASSESSMENT

18, 20, AND 22 LONG VALLEY ROAD HAZARD ASSESSMENT

A.1. Introduction

This analysis presents estimates of incremental doses and cancer risks to current and potential receptors at 18, 20, and 22 Long Valley Road (Figure 1). A row of old-growth trees is present along the back of these three Maywood vicinity properties (Figure 2). This row of trees acts as a sound and aesthetic barrier between the properties and Interstate-80. Residual radioactive material above criteria is present in this area ranging from the surface to approximately 1 m in depth. Recent data indicates an average depth of 0.5 m and an areal extent of 441 m^2. The area for which supplemental criteria will be developed is shown with a blue line on both Figure 1 and Figure 2. The additional areas will be remediated including the hot spot outlined with a green line on Figure 2.

The risk estimates for these properties have been computed using RESRAD Version 5.61 computer code (Yu et. al. 1993a) which has been developed to implement the DOE guidelines for residual radioactive material as specified in DOE Order 5400.5 (DOE 1990).

Exposure assumptions for the residual risk analysis were selected to maintain consistency with those previously used in the *Baseline Risk Assessment for the Maywood Site* (DOE 1993) and the DOE statement of position regarding the dispute on cleanup criteria (Price 1993). Key exposure parameter assumptions are presented within each scenario discussion (current resident, future worker, future resident). Parameter values assumed for site-specific geotechnical characteristics are summarized in Table A-1. The unsaturated zone thickness is assumed to be 0 m based on recent data that indicates that the groundwater table is high in this area and is in contact with the contaminated zone.

Estimates of residual dose and risk are presented out to a period of 1000 years (except for the future worker scenario which is a one-time exposure). The 1000-year period was selected as a reasonable maximum time horizon, as predictions at longer times become increasingly uncertain.

A.2. Determination of the 95% Upper Confidence Level of the Mean Activity Concentration Values

In "Supplemental Guidance to RAGS (Risk Assessment Guidance for Superfund): Calculating the Concentration Term", the EPA describes its rationale behind the use of and provides examples of how to calculate the 95% UCL of the mean (EPA 1992b). The 95% UCL of a mean is defined as a value that, when calculated repeatedly for randomly drawn subsets of site data, equals or exceeds the true mean 95% of the time. The 95% UCL therefore accounts for uncertainties due to limited sampling data. As the quantity of sampling data increases, uncertainties decrease, and the UCL moves closer to the true mean. Historical sampling data from Superfund sites have shown that

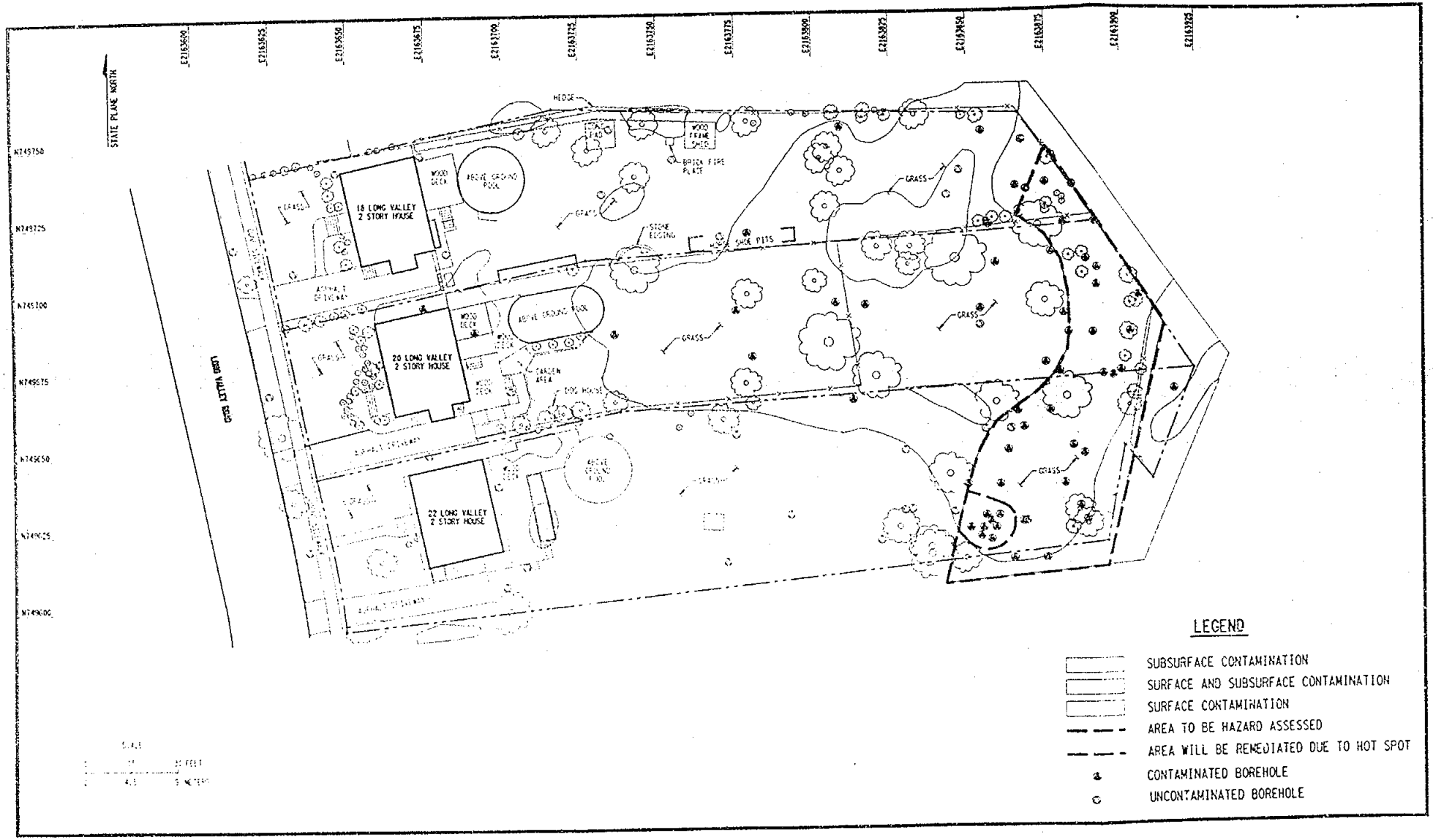
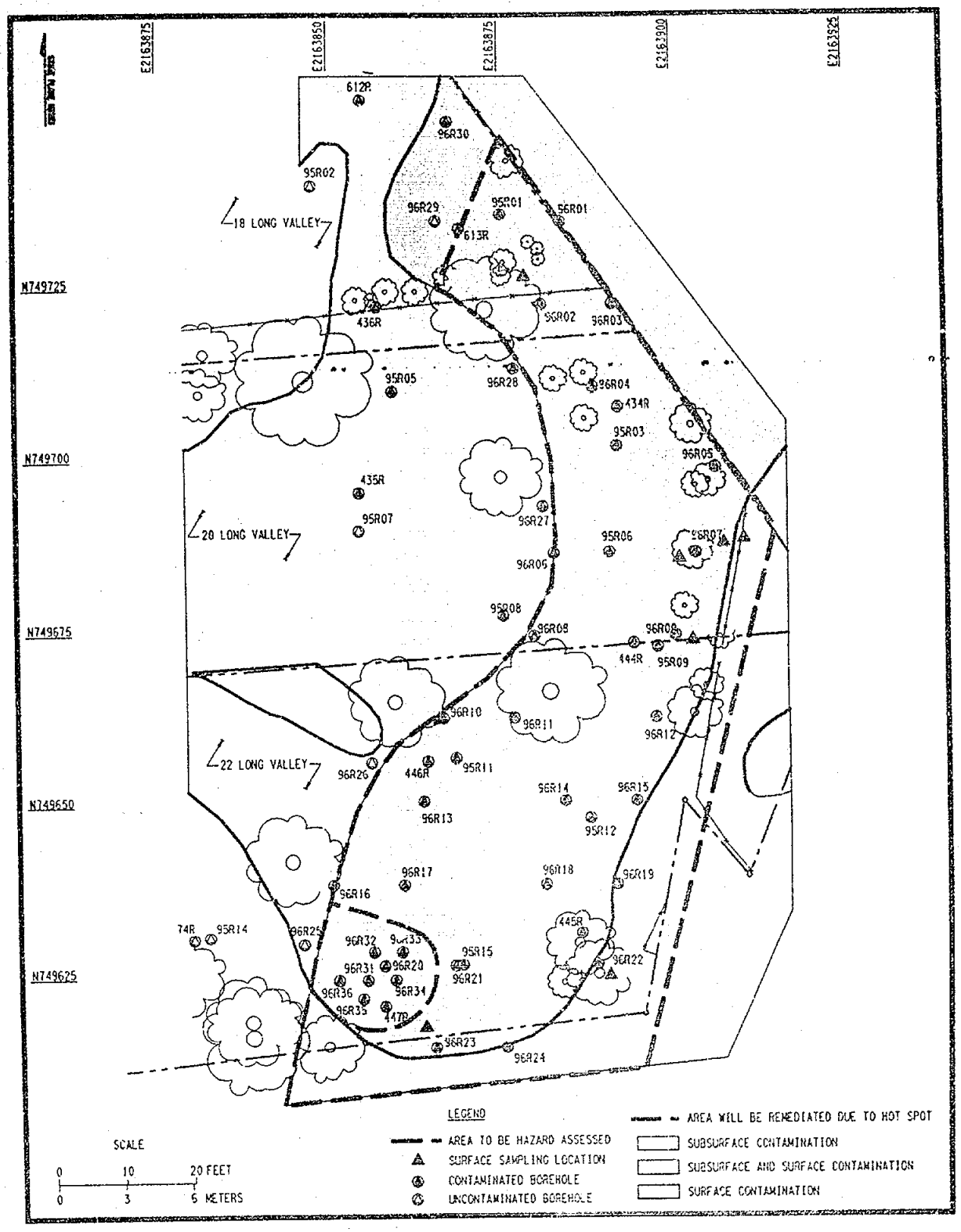


Figure 1
18, 20, and 22 Long Valley Properties
Hazard Assessment Area



138VP043.DGN

Figure 2
18, 20, and 22 Long Valley Properties
Hazard Assessment Detail

Table A-1. Geotechnical Parameter Assumptions.

Parameter	Assumed Value
Contaminated zone total porosity	0.45
Contaminated zone effective porosity	0.26
Contaminated zone hydraulic conductivity	1.23 m/yr
Saturated zone total porosity	0.45
Saturated zone effective porosity	0.26
Saturated zone hydraulic conductivity	123 m/yr
Saturated zone hydraulic gradient	0.01
Unsaturated zone thickness	0 m
Precipitation rate	1.07 m/yr
Runoff coefficient	0.25
Average annual wind speed	4.6 m/s
Soil specific b	5.3
Soil density	1.6 g/cm^3
Well pump intake depth below water table	1 m
Soil erosion rate[a]	6 x 10^{-5} m/yr
Distribution coefficient, K_d[b]	
Thorium	60,000
Radium	450
Uranium	450
Lead	900
Actinium	1,500
Protactinium	2,500

[a] Reference: Yu et.al. 1993b.

[b] Reference: Baes et.al. 1984; Sheppard and Thibault 1990.

data sets with 20 to 30 samples per exposure area provide fairly consistent estimates of the mean (i.e., the 95% UCL is close to the sample mean).

A.2.1. Additional Sampling

Historically, only seven subsurface samples in this area had been analyzed for activity concentrations. The remainder had only gamma radiation readings. A statistically-based sampling plan was developed to augment the existing data and allow for the use of the 95% upper confidence limit (UCL) of the mean activity concentrations in the dose calculations for this hazard assessment.

A classical random sampling design was used to locate 24 additional boreholes in the area of concern. The EPA "Guidance for Data Useability in Risk Assessment (Part A)" asserts that a classical random sampling design is appropriate for use in sampling any medium to define the representative concentration value over the exposure area (EPA 1992a). It is not subject to judgmental biases, and produces known estimates as well as recognized statistical measures and guidelines.

In order to develop a random sampling design, a 10 ft x 12 ft grid was superimposed on the area. A random number generator was used to generate 24 sets of random grid coordinates. Soil samples and downhole gamma radiation readings were collected from the boreholes located as these grid coordinates. Samples were analyzed from the depth with the highest gamma reading from each borehole. This strategy skews the mean concentration for the area high and provides conservative dose and risk estimates. Four additional samples were analyzed from the area of concern in order to present a more representative data set. This data is presented in Table B-1 along with activity concentration data that was collected last year. Last year's borehole identifiers begin with "95R"; the most recent borehole identifiers begin with "96R". Borehole locations are shown on Figure 2.

Historical surface soil sample results were also used in developing the 95% UCL of the mean activity concentration. This data is shown in Table B-2 and corresponds to surface soil sampling locations indicated on Figure 2.

For purposes of the hazard assessment, it is equally important to determine the areal and vertical extent of the contamination. Six boreholes were intentionally placed to assist in refining the areal boundary (boreholes #96R25 - #96R30 shown on Figure 2). The data obtained from these boreholes is presented in Table B-3.

During the sampling effort, borehole #96R20 on 22 Long Valley showed unusually high gamma radiation levels. Six additional boreholes (#96R31-#96R36 shown on Figure 2) were placed to determine the areal and vertical extent of the hot spot. The borehole data is presented in Table B-4. This area is outlined with a green line on Figures 1 and 2 and will be excavated during remediation of the rest of the property.

A.2.2. Data Analysis

Distribution analysis was performed on the data contained in Tables B-1 and B-2 to determine the appropriate statistical methods needed to calculate the mean and the 95% UCL activity

concentrations. Attachment C contains the results of the distribution analysis for radium-226, thorium-232, and uranium-238 data. The best-fit distribution is indicated by a value in the box labelled "Prob > D" which is greater than 0.05. The Ra-226 data is normally distributed, the Th-232 data is lognormally distributed, and the U-238 data does not fit either distribution. Further analysis was not performed on U-238 because of the proliferation of results that are below the detection limit. The highest detected value of 12.73 pCi/g was used as the U-238 activity concentration in the dose assessment.

The statistical program used to analyze the 49 sample results for Ra-226 calculates the mean and standard deviation for normally distributed data. The following equation is used to determine the 95% UCL of the mean activity concentration for the Ra-226 normally distributed data (Gilbert 1987).

$$UCL_{0.95} = X + t_{0.95,n-1}\frac{s}{\sqrt{n}}$$

where:
- X = mean activity concentration, 1.35 pCi/g from printout
- s = standard deviation, 0.50 pCi/g from printout
- n = number of samples, 49
- $t_{0.95,n-1}$ = student t statistic given in Gilbert 1987, 1.6775

Ra-226 $UCL_{0.95}$ = 1.47 pCi/g

For the Th-232 data, the mean and variance must be calculated using lognormal statistics. In lognormal statistics, the data is transformed using the natural logarithm of the concentration values. The mean and variance of the transformed data is used to find the 95% UCL of the mean of the untransformed (original) data. The data in Tables B-1 and B-2 were entered into a spreadsheet shown in Table C-1. Each concentration value, x, was transformed by taking the natural log, ln(x). The mean of the transformed data, y, was found to be 2.55. The variance, s_y^2, is calculated by the spreadsheet using the following equation (Gilbert 1987):

$$s_y^2 = \frac{\sum (\ln(x) - y)^2}{n-1}$$

where:
- y = mean of the transformed data, 2.55
- ln(x) = natural logarithm of each concentration value
- n = number of samples, 49

The mean of the untransformed (original) data is calculated using the following equation (Gilbert 1987):

$$X=\exp\left(y+\frac{s_y^2}{2}\right)$$

Th-232 Mean = 15.5 pCi/g

The 95% UCL of the mean is derived by using the following equation (Gilbert 1987):

$$UCL_{0.95}=\exp\left(y+0.5s_y^2+\frac{s_y H_{0.95}}{\sqrt{n-1}}\right)$$

where:

y	=	mean of transformed data, 2.55
s_y^2	=	variance of transformed data, 0.38
$H_{0.95}$	=	H statistic (Gilbert 1987), 1.96
n	=	number of samples, 49

Th-232 $UCL_{0.95}$ = 18.4 pCi/g

Since the 95% UCL is close to the mean for both Ra-226 and Th-232, the data set is sufficient to support the statistical analysis performed. The 95% UCL concentrations are very conservative because the majority of the analyzed samples were taken from the highest gamma radiation reading throughout the depth of each borehole. For U-238, the maximum measured concentration is used for this analysis. The activity concentration values used in the RESRAD analyses are:

Th-232:	18.4 pCi/g
Ra-226:	1.47 pCi/g
U-238:	12.7 pCi/g

A.3. Current Resident Scenario

The current resident scenario mimics the current site usage. The current resident scenario includes external exposure, particulate inhalation, and incidental soil ingestion pathways. Produce ingestion is not included in this analysis because it is unlikely that a homeowner would place a garden in this area of trees and brush. On-site production of meat, milk, or fish is not considered, and all water is obtained from a municipal water supply. Site-specific source term assumptions are summarized in Table A-2 and are used in the future worker and the future resident scenario as well. Exposure parameter assumptions for the current resident scenario are shown in Table A-3.

Table A-2. Source Term Assumptions for Long Valley Properties.

Parameter	Units	Long Valley Rd Trees
Area of contaminated zone	m^2	441
Thickness of contaminated zone	m	0.5
Cover depth	m	0
Radionuclide concentrations	pCi/g	
Th-232 + Progeny		18.4
Ra-226 + Progeny		1.47
U-238 + Progeny		12.73
U-234		0.59
U-235 + Progeny[a]		

[a] Assumed 4.6% of U-238 concentration, based on relative isotopic abundance.

Table A-3. Exposure Parameter Assumptions for Current Resident Scenario.

Parameter	Units	Input value
Outdoor occupancy factor	%	2
Exposure duration	yrs	30
Inhalation rate	m^3/yr	7300
Dust loading	$\mu g/m^3$	200
Dust from soil origin	%	50
Dust respirable fraction	%	30
Soil ingestion rate	g/yr	35
Fraction of drinking water from onsite well	-	0

Indoor exposure is not considered in this analysis because the exposure rate in each home has actually been measured. The results are summarized in Table A-4 and compared to the background exposure rate for the area as determined in the *Remedial Investigation Report for the Maywood Site* (DOE 1992). The exposure rates measured in the three homes are equivalent to background even before any remediation of the property is performed. This indicates that there is no additional dose to the homeowner inside his home from the residual radioactive material above criteria.

Table A-4. Indoor Exposure Rate Measurements.

Property	Indoor Exposure Rate[a] (uR/h)	Background Exposure Rate[b] (uR/h)
18 Long Valley Road[c]	5	9
20 Long Valley Road[d]	6	9
22 Long Valley Road[e]	6	9

[a] Measurements include background.
[b] Data source: DOE 1992.
[c] Data source: BNI 1988a.
[d] Data source: BNI 1988b.
[e] Data source: BNI 1988c.

The homeowner is assumed to spend 2% of his time outside in the area of interest. This is conservative because currently this area is not included in the yards of 20 and 22 Long Valley and is difficult to access. The risk analysis assumes no cover material even though the trees themselves provide shielding from the trunk and roots.

The total effective dose equivalent (TEDE) and incremental risk estimates for the current homeowner from the residual radioactive material are summarized in Table A-5. The maximum dose from this scenario is well below the EPA proposed guideline of 15 mrem and the maximum cancer risk is within the EPA target risk range of 10^{-4} to 10^{-6}.

Table A-5. Estimated Dose and Risk from Current Resident Scenario.

Time Increment	TEDE (mrem/yr)	Lifetime Excess Cancer Risk
0 yrs	5.8	4.8×10^{-5}
Maximum at 1000 yrs	5.9	5.1×10^{-5}

A.4. Future Worker Scenario

– The future worker scenario assumes that a worker cuts down and removes the old-growth trees in the area. External exposure, particulate inhalation, and incidental soil ingestion are the exposure pathways assumed for the future worker scenario. This activity is conservatively estimated to take one week (40 hrs/week which is 0.5% of one year). Source term assumptions are shown in Table A 2. Exposure parameter assumptions are summarized in Table A-6.

Table A-6. Exposure Parameter Assumptions for Future Worker Scenario.

Parameter	Units	Input value
Outdoor occupancy factor	%	0.5
Exposure duration	yrs	1
Inhalation rate	m^3/yr	7300
Dust loading	$\mu g/m^3$	200
Dust from soil origin	%	50
Dust respirable fraction	%	30
Soil ingestion rate	g/yr	35
Fraction of drinking water from onsite well	-	0

The estimated dose from this activity is 1.4 mrem; the estimated cancer risk is 1.2×10^{-5}. Both values are within current and proposed EPA guidelines.

A.5. Future Resident Scenario

A future resident scenario is modelled by assuming that the area of trees has been cleared and a garden and a well have been installed in the area. Thus, the future resident scenario included the external exposure, particulate inhalation, incidental soil ingestion, produce ingestion, and drinking water ingestion pathways. This future resident scenario represents the worst-case, but highly unlikely, future use for the property.

A residential scenario incorporating a house built in the former area of trees has not been evaluated due to the improbability that a house would ever be built in this area. The basis for this hazard assessment is that the trees provide a shield from Interstate-80. The houses presently on these properties are more than 90 m from I-80. A house built in the area of the trees would be less than 30 m from the interstate. Additionally, this area has a high groundwater table (approximately 0.6 m to 1.5 m below grade) which would prevent the construction of a house unless considerable fill

material is used, such as was used in the Branca Court area. The Branca Court area was originally the same elevation as the back of the Long Valley Road properties. In order to develop the area, approximately 1.2 m of fill was added and slab-on-grade houses were built. Due to the proximity to Interstate-80 and the groundwater problems, it is extremely unlikely that a house would ever be built on the back of the Long Valley properties; therefore, this scenario is not evaluated.

Source term assumptions are shown in Table A-2. Exposure parameter assumptions are given in Table A-7. Again, indoor exposure is not evaluated due to existing exposure rate data. This would not change in the future resident scenario.

Site-specific values were developed for several of the garden pathway parameters to better approximate actual site conditions. As shown in Table A-7, the amount of fruit and non-leafy vegetables consumed yearly is estimated to be 105 kg/yr and the amount of leafy vegetables consumed yearly is given as 14 kg/yr. These values were computed with information from the EPA *Exposure Factors Handbook* (EPA 1989) and NUREG/CR-5512 (NRC 1992). The NRC estimates that Americans eat 11 kg/yr of leafy vegetables, 51 kg/yr of other vegetables, and 46 kg/yr of fruit. EPA estimates slightly higher consumption rates of 70 kg/yr of vegetables and 49 kg/yr of fruits. Using the NRC data to determine that approximately 20% of consumed vegetables are leafy and 80% are non-leafy, the EPA data yields consumption rates of 105 kg/yr of non-leafy vegetables and fruit and 14 kg/yr of leafy vegetables.

Since the size of a home garden in the future in this area is unknown, the amount of fruit and vegetables consumed from a home garden must be estimated. The draft *Exposure Factors Handbook* (EPA 1996) estimates that 8% of the fruit and 4.4% of the vegetables consumed yearly come from home gardens in suburban areas in the Northeast. A combined percentage of 5.2% was used in the analysis.

Plant/soil transfer factors were computed from data in NUREG/CR-5512. The NRC presents plant/soil transfer factors by leafy vegetables, other vegetables, and fruits. The data discussed above for consumption rates were used to obtain weighted average plant/soil transfer factors for each element of interest. These weighted average plant/soil transfer factors are given in Table A-7.

The dose and incremental cancer risk from the future resident scenario are summarized in Table A-8. The resulting values are within current and proposed EPA guidelines.

A.6. Conclusions

Results of these analyses (summarized in Table A-9) indicate that the current and future usage scenarios for 18, 20, and 22 Long Valley Road will not exceed the proposed EPA TEDE guideline of 15 mrem/yr or the DOE guideline of 30 mrem/yr. Estimates of excess cancer risk are within EPA's target risk range of 10^{-6} to 10^{-4}. Due to the conservative nature of the analysis, actual doses and risks from the residual radioactive material above criteria around the tree area are expected to be lower. Therefore, supplemental standards of current radionuclide concentrations should be established for this area.

Table A-7. Exposure Parameter Assumptions for Future Resident Scenario.

Parameter	Units	Input value
Outdoor occupancy factor	%	2
Exposure duration	yrs	30
Inhalation rate	m^3/yr	7300
Dust loading	$\mu g/m^3$	200
Dust from soil origin	%	50
Dust respirable fraction	%	30
Soil ingestion rate	g/yr	35
Fraction of drinking water from onsite well	-	1
Fraction of irrigation water from onsite well	-	1
Fruit and non-leafy vegetables consumed yearly	kg/yr	105
Leafy vegetables consumed yearly	kg/yr	14
Fraction of produce from home garden	-	0.052
Plant/soil transfer factors	-	
Lead		5.9E-3
Radium		1.2E-2
Actinium		6.7E-4
Thorium		7.7E-4
Protactinium		4.8E-4
Uranium		1.0E-2

Table A-8. Estimated Dose and Risk from Future Resident Scenario.

Time Increment	TEDE (mrem/yr)	Lifetime Excess Cancer Risk
0 yrs	7.6	5.7×10^{-5}
Maximum at 0.58 yrs	11.9	7.8×10^{-5}

Table A-9. Estimated Dose and Risk from Supplemental Criteria.

Scenario	TEDE[a] (mrem/yr)	Lifetime Excess Cancer Risk[a]
Current Resident	5.8 5.9	4.8×10^{-5} 5.1×10^{-5}
Future Worker	1.4 (one-time only)	1.2×10^{-5}
Future Resident	7.6 11.9	5.7×10^{-5} 7.8×10^{-5}

[a] Top value represents time=0; bottom value is maximum dose/risk over the period of analysis (t=1000 yrs), if different from t=0.

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ATTACHMENT B

Additional Sampling Data

Table B-1
Hazard Assessment Area
Borehole Data

Hazard Area	Borehole	Coordinates (ft)	Sample	Depth (ft)	Qc (tsf)					
18 Long Valley	96R01	N 749735	138RS455	0 - 0.5	26100					
		E 2163883	138RS456	0.5 - 1.0	50860	13.42	0.59	1.31	0.12	6.05	1.47
			138RS457	1.0 - 1.5	49590						
			138RS458	1.5 - 2.0	35100						
			138RS459	2.0 - 2.5	26900						
			138RS460	2.5 - 3.0	16760						
	96R02	N 749723	138RS403	0 - 0.5	28050						
		E 2163881	138RS404	0.5 - 1.0	40000	6.84	0.31	0.87	0.08	3.87	
			138RS405	1.0 - 1.5	41780						
			138RS406	1.5 - 2.0	56600	10.68	0.47	1.47	0.11	4.41	
			138RS407	2.0 - 2.5	54500						
			138RS408	2.5 - 3.0	REFUSAL						
	96R03	N 749723	138RS386	0 - 0.5	24330						
		E 2163891	138RS386A	0.5 - 1.0	39470						
			138RS387	1.0 - 1.5	42550	6.03	0.29	0.83	0.08	3.58	
			138RS388	1.5 - 2.0	42250						
			138RS389	2.0 - 2.5	37500	5.40	0.28	0.92	0.10	3.69	
			138RS390	2.5 - 3.0	19230						
20 Long Valley	95R03	N 749702	138RS080	0 - 0.5	25109						
		E 2163891	138RS081	0.5 - 1.0	44128						
			138RS082	1.0 - 1.5	67500						
			138RS083	1.5 - 2.0	72210	13.20	0.44	1.63	0.13	5.66	
			138RS084	2.0 - 2.5	57693						
			138RS085	2.5 - 3.0	49101						
			138RS086	3.0 - 3.5	26906						
			138RS087	3.5 - 4.0	16086						

Table B-1
Hazard Assessment Area
Borehole Data

Property	Borehole	Coordinates	Sample	Depth (ft)	Cadmium (mg/kg)					
20 Long Valley	95R06	N 749687	138RS072	0 - 0.5	59407	13.10	0.46	1.60	0.15	9.68	2.57
		E 2163890	138RS073	0.5 - 1.0	54055						
			138RS074	1.0 - 1.5	25424						
			138RS075	1.5 - 2.0	12669						
	96R04	N 749711	138RS380	0 - 0.5	24790						
		E 2163888	138RS381	0.5 - 1.0	31350						
			138RS382	1.0 - 1.5	31480	5.34	0.29	1.21	0.12	6.72	1.21
			138RS383	1.5 - 2.0	27120						
			138RS384	2.0 - 2.5	19880						
			138RS385	2.5 - 3.0	15330						
	96R05	N 749699	138RS362	0 - 0.5	22070						
		E 2163906	138RS363	0.5 - 1.0	24500						
			138RS364	1.0 - 1.5	25600						
			138RS365	1.5 - 2.0	29700						
			138RS366	2.0 - 2.5	38460	5.15	0.26	0.09	0.08	3.42	
			138RS367	2.5 - 3.0	25200						
	96R06	N 749687	138RS443	0 - 0.5	34750	10.98	0.53	1.33	0.13	5.91	1.43
		E 2163882	138RS444	0.5 - 1.0	25000						
			138RS445	1.0 - 1.5	13580						
			138RS446	1.5 - 2.0	12550						
			138RS447	2.0 - 2.5	10200						
			138RS448	2.5 - 3.0	REFUSAL						
	96R07	N 749687	138RS374	0 - 0.5	50000						
		E 2163903	138RS375	0.5 - 1.0	79370	14.06	0.57	1.15	0.13	8.46	1.65
			138RS376	1.0 - 1.5	40000						
			138RS377	1.5 - 2.0	16140						
			138RS378	2.0 - 2.5	9460						
			138RS379	2.5 - 3.0	8510						

Table B-1
Hazard Assessment Area
Borehole Data

Property	Borehole	Coordinates	Sample	Depth (ft)	Gamma (cpm)	Th-232 (pCi/g)	Eu	Ra-226 (pCi/g)	Bi-214	Cs-137	Pb-210
20 Long Valley	96R08	N 749675	138RS449	0 - 0.5	62830						
		E 2163879	138RS450	0.5 - 1.0	62440	9.02	0.43	0.80	0.09	0.42	
			138RS451	1.0 - 1.5	20570						
			138RS452	1.5 - 2.0	12460						
			138RS453	2.0 - 2.5	10030						
			138RS454	2.5 - 3.0	9980						
	96R09	N 749675	138RS284A	0 - 0.5	68580						
		E 2163900	138RS285	0.5 - 1.0	93900	7.00	0.34	0.85	0.95	3.05	0.97
			138RS286	1.0 - 1.5	24430						
			138RS287	1.5 - 2.0	14030						
			138RS288	2.0 - 2.5	9800						
				REFUSAL							
22 Long Valley	95R09	N 749673	138RS068	0 - 0.5	52632						
		E 2163829	138RS069	0.5 - 1.0	92310	22.70	0.68	2.15	0.18	7.98	2.78
			138RS070	1.0 - 1.5	58824						
			138RS071	1.5 - 2.0	16305						
	95R11	N 749657	138RS062	0 - 0.5	30003						
		E 2163867	138RS063	0.5 - 1.0	38123						
			138RS064	1.0 - 1.5	54302	4.60	0.24	0.64	0.10	0.14	
			138RS065	1.5 - 2.0	50822						
			138RS066	2.0 - 2.5	47994						
			138RS067	2.5 - 3.0	30481						
	95R12	N 749648	138RS058	0 - 0.5	48145						
		E 2163886	138RS059	0.5 - 1.0	73765						
			138RS060	1.0 - 1.5	85075						
			138RS061	1.5 - 2.0	88250	11.40	0.39	0.88	0.12	0.13	

Table B-1
Hazard Assessment Area
Borehole Data

Topo	Borehole	Coordinates	Sample	Depth (ft)	Gamma (cpm)	Th232 (pCi/g)	EPR	U238 (pCi/g)	EPR	K40 (pCi/g)	EPR
22 Long Valley	95R15	N 749627	138RS052	0 - 0.5	35598						
		E 2163868	138RS053	0.5 - 1.0	54130						
			138RS054	1.0 - 1.5	100304	15.30	0.51	1.78	0.16	6.03	2.38
			138RS055	1.5 - 2.0	70288						
			138RS056	2.0 - 2.5	29097						
			138RS057	2.5 - 3.0	12921						
	96R10	N 749663	138RS326	0 - 0.5	45800						
		E 2163865	138RS327	0.5 - 1.0	62120						
			138RS328	1.0 - 1.5	69450	7.57	0.46	1.16	0.12	5.24	
			138RS329	1.5 - 2.0	24790						
			138RS330	2.0 - 2.5	13190						
			138RS331	2.5 - 3.0	11340						
	96R11	N 749663	138RS368	0 - 0.5	135140	49.28	1.68	2.31	0.22	12.73	2.70
		E 2163876	138RS369	0.5 - 1.0	157900						
			138RS370	1.0 - 1.5	57150	17.72	0.69	1.60	0.14	8.16	1.76
			138RS371	1.5 - 2.0	21500						
			138RS372	2.0 - 2.5	14635						
			138RS373	2.5 - 3.0	11930						
	96R12	N 749663	138RS251	0 - 0.5	60310						
		E 2163879	138RS252	0.5 - 1.0	85840	12.95	0.51	1.08	0.10	5.06	
			138RS253	1.0 - 1.5	41670						
			138RS254	1.5 - 2.0	13920						
			138RS255	2.0 - 2.5	9000						
			138RS256	2.5 - 3.0	REFUSAL						
	96R13	N 749651	138RS320	0 - 0.5	35720						
		E 2163863	138RS321	0.5 - 1.0	51280	12.35	0.52	1.13	0.12	5.87	1.43
			138RS322	1.0 - 1.5	33330						
			138RS323	1.5 - 2.0	22140						
			138RS324	2.0 - 2.5	17810						
			138RS325	2.5 - 3.0	14020						

Table B-1
Hazard Assessment Area
Borehole Data

Property	Borehole	Coordinates	Sample	Depth (ft)	Gamma (cpm)	Th-232 (pCi/g)	±RR	Ra-226 (pCi/g)	±RR	K-40 (pCi/g)	±RR
22 Long Valley	96R14	N 749651	138RS302	0 - 0.5	33150						
		E 2163883	138RS303	0.5 - 1.0	63700						
			138RS304	1.0 - 1.5	75100	21.80	0.87	1.60	0.15	11.40	2.09
			138RS305	1.5 - 2.0	38220						
			138RS306	2.0 - 2.5	24790						
			138RS307	2.5 - 3.0	19430						
	96R15	N 749651	138RS273	0 - 0.5	50860						
		E 2163894	138RS274	0.5 - 1.0	72270						
			138RS275	1.0 - 1.5	158740	42.20	1.44	2.44	0.19	7.51	2.12
			138RS276	1.5 - 2.0	97460						
			138RS277	2.0 - 2.5	44480						
			138RS278	2.5 - 3.0	21280						
	96R16	N 749639	138RS295	0 - 0.5	31100						
		E 2163849	138RS296	0.5 - 1.0	43170	9.89	0.45	1.28	0.12	6.97	1.59
			138RS297	1.0 - 1.5	18130						
			138RS298	1.5 - 2.0	11390						
			138RS299	2.0 - 2.5	11650						
			138RS300	2.5 - 3.0	10990						
	96R17	N 749639	138RS338	0 - 0.5	28570						
		E 2163860	138RS339	0.5 - 1.0	44450						
			138RS340	1.0 - 1.5	50900	12.40	0.58	1.57	0.16	8.98	1.90
			138RS341	1.5 - 2.0	17050						
			138RS342	2.0 - 2.5	10800						
			138RS343	2.5 - 3.0	10230						
	96R18	N 749639	138RS308	0 - 0.5	36730						
		E 2163880	138RS309	0.5 - 1.0	42470						
			138RS310	1.0 - 1.5	46150	6.71	0.34	0.78	0.09	4.67	
			138RS311	1.5 - 2.0	25000						
			138RS312	2.0 - 2.5	14470						
			138RS313	2.5 - 3.0	11950						

Table B-1
Hazard Assessment Area
Borehole Data

Property	Boring No.	Coordinates	Sample No.	Depth (ft)	Cr (mg/kg)	Fe (%)	Ni (%)	Cu (%)	Zn (%)	Pb (%)
22 Long Valley	96R19	N 749639	138RS279	0 - 0.5	69610					
		E 2163891	138RS280	0.5 - 1.0	143550					
			138RS281	1.0 - 1.5	174420	23.76	0.84	1.42	0.13	0.46
			138RS282	1.5 - 2.0	81530					
			138RS283	2.0 - 2.5	27780					
			138RS284	2.5 - 3.0	14520					
	96R21	N 759627	138RS344	0 - 0.5	36715					
		E 2163867	138RS345	0.5 - 1.0	67040					
			138RS346	1.0 - 1.5	92310	15.49	0.69	1.43	0.14	0.52
			138RS347	1.5 - 2.0	56604					
			138RS348	2.0 - 2.5	22399					
			138RS349	2.5 - 3.0	10381					
	96R22	N 749627	138RS267	0 - 0.5	29850					
		E 2163888	138RS268	0.5 - 1.0	33900					
			138RS269	1.0 - 1.5	40540					
			138RS270	1.5 - 2.0	56080	11.81	0.49	1.24	0.12	0.01
			138RS271	2.0 - 2.5	57690					
			138RS272	2.5 - 3.0	24490					
	96R23	N 749615	138RS257	0 - 0.5	11650					
		E 2163874	138RS258	0.5 - 1.0	14960					
			138RS259	1.0 - 1.5	27600					
			138RS260	1.5 - 2.0	19000					
			138RS261	2.0 - 2.5	26560					
			138RS262	2.5 - 3.0	53100	16.60	0.67	1.54	0.14	5.55	1.70
			138RS263	3.0 - 3.5	48000					
			138RS264	3.5 - 4.0	22320					
			138RS265	4.0 - 4.5	11920					
			138RS266	4.5 - 5.0	10350					

Table B-1
Hazard Assessment Area
Borehole Data

Area	Site	Coordinates	Sample ID	Depth (ft)	Cs-137 (pCi/g)					
22 Long Valley	96R24	N 749615	138RS415	0 - 0.5	13590					
		E 2163885	138RS416	0.5 - 1.0	24590					
			138RS417	1.0 - 1.5	41670					
			138RS418	1.5 - 2.0	64520	12.57	0.53	1.11	0.12	
			138RS419	2.0 - 2.5	128210					
			138RS420	2.5 - 3.0	166670	55.96	1.90	2.64	0.24	
			138RS421	3.0 - 3.5	86270					
			138RS422	3.5 - 4.0	30300					
			138RS423	4.0 - 4.5	12690					
			138RS424	4.5 - 5.0	10290					
Shaded areas represent a result that was less than the detection limit (MDA).										

Table B-2
Hazard Assessment Area
Surface Soil Samples

Property	Coordinates	Depth (ft)	Th-232 (pCi/g)	Ra-226 (pCi/g)			
18 Long Valley[a]	N 749726	0 - 0.5	58.30	1.30	1.00			
	E 2163878	0.5 - 1.0	31.90	1.30	1.50	0.80		
20 Long Valley[b]	N 749686	0 - 0.5	17.60	3.00	1.30	0.30	0.40	
	E 2163900	0.5 - 1.0	11.40	0.60	2.50	0.50	10.50	4.10
	N 749688	0 - 0.5	7.90	0.90	1.70	0.40		
	E 2163906	0.5 - 1.0	6.80	1.30	1.70			
	N 749689	0 - 0.5	9.50	1.40	1.50	0.40	5.30	
	E 2163909	0.5 - 1.0	8.60	2.60	1.90		13.40	
22 Long Valley[c]	N 74961[illegible]	0 - 0.5	12.00	1.50	1.80	0.50		
	E 2163863	0.5 - 1.0	26.60	2.70	1.30	1.00		
	N 749625	0 - 0.5	9.90	1.50	1.90			
	E 2163889	0.5 - 1.0	10.10	1.20	0.80	0.10		
	N 749662	0 - 0.5	9.40	1.40	2.30			
	E 2163865	0.5 - 1.0	6.40	1.00	1.50	0.40		
	N 749674	0 - 0.5	27.70	2.70	1.90	0.50		
	E 2163902	0.5 - 1.0	16.40	2.00	2.60			

Shaded areas represent a result that was less than the detection limit (MDA).

[a] Data from *Radiological Characterization Report for 18 Long Valley Road*, DOE/OR/20722-170, 1988.

[b] Data from *Radiological Characterization Report for 20 Long Valley Road*, DOE/OR/20722-171, 1988.

[c] Data from *Radiological Characterization Report for 22 Long Valley Road*, DOE/OR/20722-172, 1988.

Table B-3
Boundary Samples for
Hazard Assessment Area

Property	Borehole	Coordinates	Sample	Depth (ft)	Gamma (cpm)	Th-232 (pCi/g)	Ra-226 (pCi/g)	Ra-228 (pCi/g)	K-40 (pCi/g)	TPU
18 Long Valley	95R01	N 749736	138RS088	0 - 0.5	34936					
		E 2163874	138RS089	0.5 - 1.0	39715	6.38	0.30	0.99	0.13	[illegible]
			138RS090	1.0 - 1.5	33116					
			138RS091	1.5 - 2.0	17606					
			183RS092	1.5 - 2.0	(a)					
	95R02	N 749740	138RS098	0 - 0.5	13004					
		E 2163847	138RS099	0.5 - 1.0	13878					
			138RS100	1.0 - 1.5	14131					
			138RS101	1.0 - 1.5	(a)					
			138RS102	1.5 - 2.0	16151	0.99	0.15	0.79	0.10	[illegible]
	96R29	N 749714	138RS461	0 - 0.5	23810					
		E 2163876	138RS462	0.5 - 1.0	22900					
			138RS463	1.0 - 1.5	15540					
			138RS464	1.5 - 2.0	29000					
			138RS465	2.0 - 2.5	31210	1.35	0.13	0.68	0.06	[illegible]
			138RS466	2.5 - 3.0	24600					
	96R30	N 749750	138RS467	0 - 0.5	18130					
		E 2163867	138RS468	0.5 - 1.0	26320	6.69	0.33	1.05	0.09	[illegible]
			138RS469	1.0 - 1.5	23540					
			138RS470	1.5 - 2.0	13630					
			138RS471	2.0 - 2.5	11650					
20 Long Valley	95R05	N 749710	138RS103	0 - 0.5	31790					
		E 2163858	138RS104	0.5 - 1.0	25119	1.68	0.16	1.02	0.10	[illegible]
			138RS105	0.5 - 1.0	(a)	2.16	0.16	0.92	0.09	[illegible]
			138RS106	1.0 - 1.5	14256					
				1.5 - 2.0	REFUSAL					

Table B-3
Boundary Samples for
Hazard Assessment Area

Property	Borehole	Coordinates	Sample	Depth (ft)	Gamma (cpm)	Th-232 (pCi/g)	Ra-226 (pCi/g)	Ra-226 (pCi/g)	Th-232 (pCi/g)	Ra-226 (pCi/g)
20 Long Valley	95R07	N 749690	138RS093	0 - 0.5	19834	2.27	0.17	1.24	0.11	5.36	1.43
		E 2163853	138RS094	0.5 - 1.0	12933						
			138RS095	1.0 - 1.5	9722						
			138RS096	1.0 - 1.5	(a)						
			138RS097	1.5 - 2.0	10351						
	95R08	N 749677	138RS076	0 - 0.5	36238	9.25	0.38	1.17	0.14	9.21	
		E 2163874	138RS077	0.5 - 1.0	30185	4.21	0.23	0.73	0.10	4.16	
			138RS078	1.0 - 1.5	12351						
			138RS079	1.5 - 2.0	11845						
	96R27	N 749693	138RS391	0 - 0.5	30000	5.57	0.30	1.23	0.10	6.97	1.23
		E 2163880	138RS392	0.5 - 1.0	18930						
			138RS393	1.0 - 1.5	12870						
			138RS394	1.5 - 2.0	10060						
			138RS395	2.0 - 2.5	9800						
			138RS396	2.5 - 3.0	9090						
	96R28	N 749713	138RS409	0 - 0.5	31220	10.18	0.48	1.21	0.13	11.26	1.87
		E 2163877	138RS410	0.5 - 1.0	23900						
			138RS411	1.0 - 1.5	15080						
			138RS412	1.5 - 2.0	14190						
			138RS413	2.0 - 2.5	12330						
			138RS414	2.5 - 3.0	9960						
22 Long Valley	95R10	N 749650	138RS048	0 - 0.5	20907	3.56	0.24	1.15	0.13	13.60	
		E 2163829	138RS049	0.5 - 1.0	18293						
			138RS050	1.0 - 1.5	13987						
			138RS051	1.5 - 2.0	12932						
	95R14	N 749631	138RS044	0 - 0.5	23999	2.43	0.20	0.65	0.12	3.73	
		E 2163831	138RS045	0.5 - 1.0	18536						
			138RS046	1.0 - 1.5	12864						
			138RS047	1.5 - 2.0	11542						

Table B-3
Boundary Samples for
Hazard Assessment Area

22 Long Valley	96R25	N 749630	138RS332	0 - 0.5	13730						
		E 2163845	138RS333	0.5 - 1.0	23800	3.54	0.23	0.77	0.09	3.03	0.86
			138RS334	1.0 - 1.5	17410						
			138RS335	1.5 - 2.0	12000						
			138RS336	2.0 - 2.5	11720						
			138RS337	2.5 - 3.0	12740						
	96R26	N 749656	138RS289	0 - 0.5	14850						
		E 2163855	138RS291	0.5 - 1.0	18640						
			138RS292	1.0 - 1.5	19740						
			138RS293	1.5 - 2.0	21350						
			138RS290	2.0 - 2.5	21200						
			138RS294	2.5 - 3.0	23450	3.55	0.20	0.74	0.07	1.88	0.68
Shaded areas represent a result that was less than the detection limit (MDA).											

Table B-4
22 Long Valley
Hot Spot

Property	Borehole	Coordinates	Sample	Depth (ft)	Gamma (cpm)						
22 Long Valley	96R20	N 749627	138RS314	0 - 0.5	59400						
		E 2163857	138RS315	0.5 - 1.0	100400						
			138RS316	1.0 - 1.5	247900	60.70	2.00	2.75	0.22	10.95	
			138RS317	1.5 - 2.0	88000						
			138RS318	2.0 - 2.5	30420						
			138RS319	2.5 - 3.0	13510						
	96R31	N 749625	138RS356	0 - 0.5	94340	22.57	0.85	1.45	0.14	6.21	
		E 2163854	138RS357	0.5 - 1.0	179510						
			138RS358	1.0 - 1.5	256420	131.00	4.29	4.74	0.41	12.80	
			138RS359	1.5 - 2.0	116280						
			138RS360	2.0 - 2.5	37250						
			138RS361	2.5 - 3.0	15790						
	96R32	N 749629	138RS397	0 - 0.5	124490						
		E 2163855	138RS398	0.5 - 1.0	323100	108.50	3.14	4.79	0.33	14.40	
			138RS399	1.0 - 1.5	306840						
			138RS400	1.5 - 2.0	96470	36.83	1.31	2.11	0.18	7.06	
			138RS401	2.0 - 2.5	27860						
			138RS402	2.5 - 3.0	14290						
	96R33	N 749629	138RS425	0 - 0.5	44450	7.02	0.40	1.01	0.10	4.83	1.13
		E 2163859	138RS426	0.5 - 1.0	71800						
			138RS427	1.0 - 1.5	133040	23.80	0.90	1.66	0.15	5.69	
			138RS428	1.5 - 2.0	50420						
			138RS429	2.0 - 2.5	16950						
			138RS430	2.5 - 3.0	11340						

Table B-4
22 Long Valley
Hot Spot

22 Long Valley	96R34	N 749625	138RS350	0 - 0.5	37500	5.47	0.43	0.69	0.12	1.51	1.28
		E 2163858	138RS351	0.5 - 1.0	74450						
			138RS352	1.0 - 1.5	166210	26.35	0.94	1.53	0.13		
			138RS353	1.5 - 2.0	95850						
			138RS354	2.0 - 2.5	28050						
			138RS355	2.5 - 3.0	13275						
	96R35	N 749622	138RS431	0 - 0.5	29130						
		R 2163854	138RS432	0.5 - 1.0	44780						
			138RS433	1.0 - 1.5	145410	12.30	0.52	0.78	0.10		
			138RS434	1.5 - 2.0	170460						
			138RS435	2.0 - 2.5	66600	11.99	0.56	1.12	0.12		
			138RS436	2.5 - 3.0	22400						
	96R36	N 749525	138RS437	0 - 0.5	48980	7.21	0.11	0.80	0.11	3.25	1.01
		E 2163850	138RS438	0.5 - 1.0	112360						
			138RS439	1.0 - 1.5	123970	31.60	1.13	2.18	0.19	11.91	2.40
			138RS440	1.5 - 2.0	43220						
			138RS441	2.0 - 2.5	17600						
			138RS442	2.5 - 3.0	13300						

Shaded areas represent a result that was less than the detection limit (MDA).

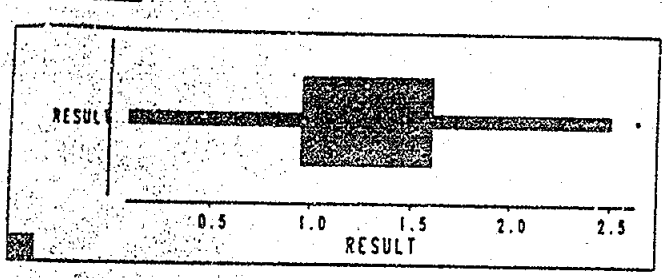
ATTACHMENT C

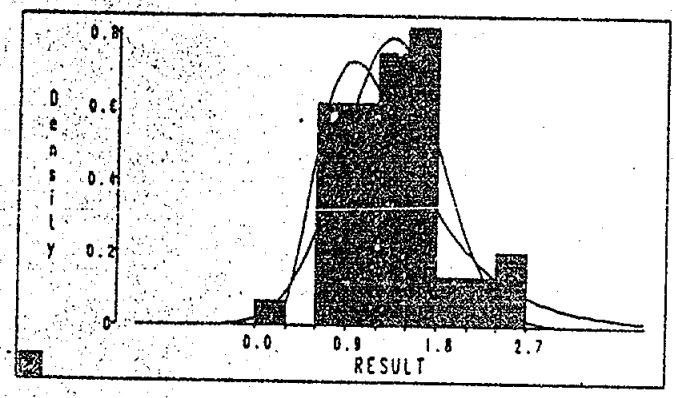
Statistical Analysis of Sampling Data

ANALYTE = Ra-226

RESULT

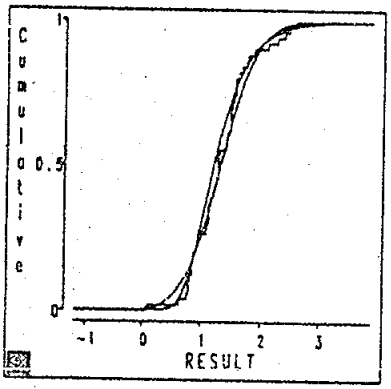
141348





Parametric Density Estimation

Curve	Distribution	Method	Mean/Theta	Sigma	Zeta/C	Mode
	Normal	Sample	1.3539	0.5021		1.3539
	Lognormal	MLE	0	0.5001	0.2128	0.9634



Test for Distribution

Curve	Distribution	Mean/Theta	Sigma	Zeta/C	Kolmogorov D	Prob > D
	Normal	1.3539	0.5021		0.1079	0.2000
	Lognormal	0	0.5053	0.2128	0.1398	0.0176

Moments

N	49.0000	Sum Wgts	49.0000
Mean	1.3539	Sum	66.3400
Std Dev	0.5021	Variance	0.2522
Skewness	0.5044	Kurtosis	0.8177
USS	101.9196	CSS	12.1034
CV	37.0897	Std Mean	0.0717

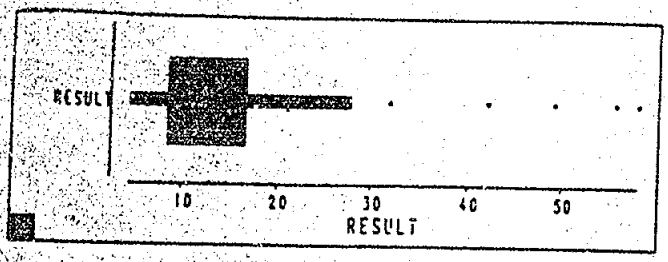
Quantiles

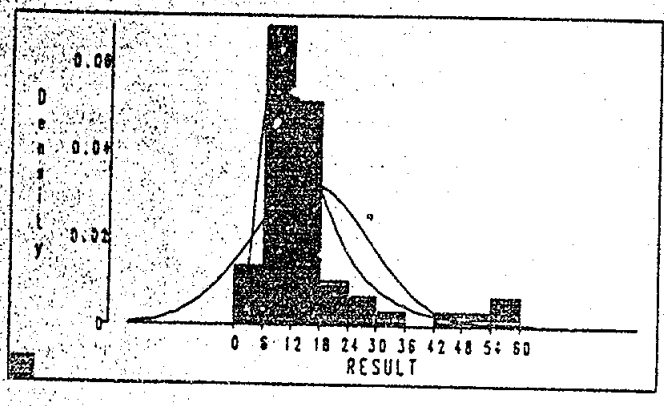
100% Max	2.6400	99.0%	2.6400
75% Q3	1.6000	97.5%	2.5000
50% Med	1.3000	95.0%	2.4400
25% Q1	0.9500	90.0%	2.1500
0% Min	0.0900	10.0%	0.8000
Range	2.5500	5.0%	0.7800
Q3-Q1	0.6500	2.5%	0.6400
Mode	1.5000	1.0%	0.0900

ANALYTE = Th-232

RESULT

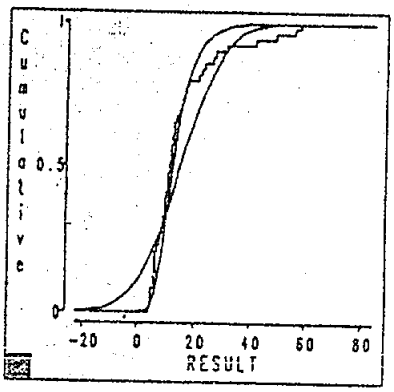
141348





Parametric Density Estimation

Curve	Distribution	Method	Mean/Theta	Sigma	Zeta/C	Mode
	Normal	Sample	15.7914	12.4711		15.7914
	Lognormal	MLE	0	0.6121	2.5467	8.7762



Test for Distribution

Curve	Distribution	Mean/Theta	Sigma	Zeta/C	Kolmogorov D	Prob > D
	Normal	15.7914	12.4711		0.2345	0.0010
	Lognormal	0	0.6184	2.5467	0.1208	0.0737

Moments

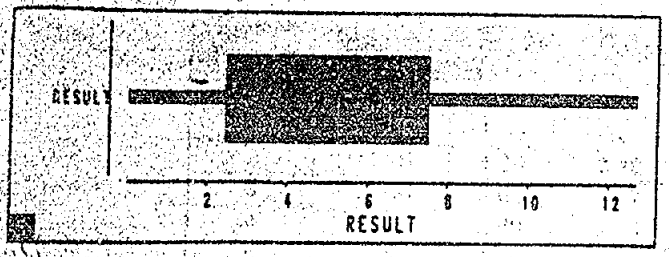
N	49.0000	Sum Wgts	49.0000
Mean	15.7914	Sum	773.7800
Std Dev	12.4711	Variance	155.5283
Skewness	2.1583	Kurtosis	4.4539
USS	19684.4510	CSS	7465.3594
CV	78.9739	Std Mean	1.7816

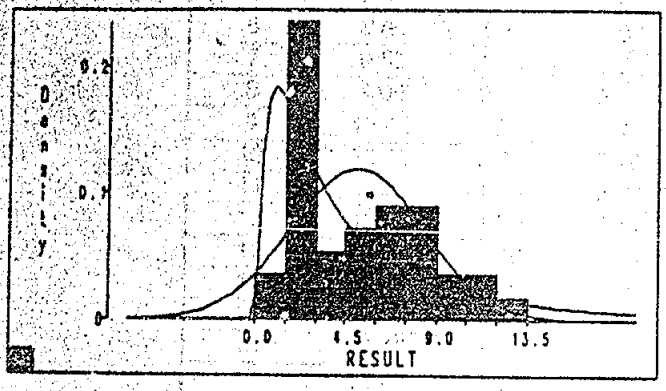
Quantiles

100% Max	58.3000	99.0%	58.3000
75% Q3	16.6000	97.5%	55.9600
50% Med	12.0000	95.0%	49.2800
25% Q1	8.6000	90.0%	31.9000
0% Min	4.6000	10.0%	6.0300
Range	53.7000	5.0%	5.3400
Q3-Q1	8.0000	2.5%	5.1500
Mode	11.4000	1.0%	4.6000

ANALYTE = U-23

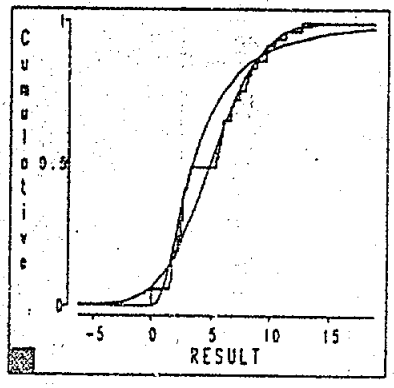
RESULT





Parametric Density Estimation

Curve	Distribution	Method	Mean/Theta	Sigma	Zeta/C	Mode
	Normal	Sample	5.1284	3.3310		5.1284
	Lognormal	MLE	0	1.1052	1.2835	1.0639



Test for Distribution

Curve	Distribution	Mean/Theta	Sigma	Zeta/C	Kolmogorov D	Prob > D
	Normal	5.1284	3.3310		0.1929	0.0010
	Lognormal	0	1.1205	1.2835	0.1943	0.0010

Moments

N	37.0000	Sum Wgts	37.0000
Mean	5.1284	Sum	189.7500
Std Dev	3.3310	Variance	11.0955
Skewness	0.4785	Kurtosis	-0.7439
USS	1372.5491	CSS	399.4393
CV	64.9522	Std Mean	0.5476

Quantiles

100% Max	12.7300	99.0%	12.7300
75% Q3	7.5100	97.5%	12.7300
50% Med	5.5500	95.0%	11.4000
25% Q1	2.5050	90.0%	9.7000
0% Min	0.0675	10.0%	1.7100
Range	12.6625	5.0%	0.0875
Q3-Q1	5.0050	2.5%	0.0675
Mode	1.7950	1.0%	0.0675

Table C-1
Mean and Variance of
Transformed Th-232 Data

1	58.30	1.30	4.07	2.55	2.31	18.36	0.38
2	31.90	1.30	3.46		0.84		
3	17.60	3.00	2.87		0.10		
4	11.40	0.60	2.43		0.01		
5	7.90	0.90	2.07		0.23		
6	6.80	1.30	1.92		0.40		
7	9.50	1.40	2.25		0.09		
8	8.60	2.60	2.15		0.16		
9	12.00	1.50	2.48		0.00		
10	26.60	2.70	3.28		0.54		
11	9.90	1.50	2.29		0.06		
12	10.10	1.20	2.31		0.05		
13	9.40	1.40	2.24		0.09		
14	6.40	1.00	1.86		0.48		
15	27.70	2.70	3.32		0.60		
16	16.40	2.00	2.80		0.06		
17	13.42	0.59	2.60		0.00		
18	6.84	0.31	1.92		0.39		
19	10.68	0.47	2.37		0.03		
20	6.03	0.29	1.80		0.56		
21	5.40	0.28	1.69		0.74		
22	13.20	0.44	2.58		0.00		
23	13.10	0.46	2.57		0.00		
24	5.34	0.29	1.68		0.76		
25	5.15	0.26	1.64		0.82		
26	10.98	0.53	2.40		0.02		
27	14.06	0.57	2.64		0.01		
28	9.02	0.43	2.20		0.12		
29	7.00	0.34	1.95		0.36		
30	22.70	0.68	3.12		0.33		
31	4.60	0.24	1.53		1.04		
32	11.40	0.39	2.43		0.01		
33	15.30	0.51	2.73		0.03		
34	7.57	0.46	2.02		0.27		
35	49.28	1.68	3.90		1.82		
36	17.72	0.69	2.87		0.11		
37	12.95	0.51	2.56		0.00		
38	12.35	0.52	2.51		0.00		
39	21.80	0.87	3.08		0.29		
40	42.20	1.44	3.74		1.43		
41	9.89	0.45	2.29		0.07		
42	12.40	0.58	2.52		0.00		
43	6.71	0.34	1.90		0.41		
44	23.76	0.84	3.17		0.39		
45	15.49	0.69	2.74		0.04		
46	11.81	0.49	2.47		0.01		
47	16.60	0.67	2.81		0.07		
48	12.57	0.53	2.53		0.00		
49	55.96	1.90	4.02		2.18		