Table 2.3-13

INEEL MAXIMUM STORM EVENTS

Storm Duration	Return Period	Precipitation Amount (inches)
1 hour	10 years	1.5x 0.241= 0.36
	50 years	2.0x 0.241=0.48
	100 years	2.5x 0.241=0.63
3 hour	10 years	1.5x 0.423= 0.63
	50 years	2.0x 0.423=0.85
	100 years	2.5x 0.423=1.06
6 hour	10 years	1.5x 0.580= 0.87
	50 years	2.0x 0.580= 1.16
	100 years	2.5x 0.580= 1.45
12 hour	10 years	1.5x 0.769= 1.15
	50 years	2.0x 0.769= 1.54
	100 years	2.5x 0.769= 1.92
24 hour	10 years	1.5
	50 years	2.0
	100 years	2.5

Table 2.3.14

AVERAGE NUMBER OF DAYS WITH PRECIPITATION OF SPECIFIED AMOUNTS APPLICABLE TO THE TMI-2 ISFSI SITE[a]

	Trace or More	0.01 in. or More	0.10 in. or More	0.50 in. or More	1.0 in. or More
January	12.3	7.7	2.2	0.2	0.0
February	9.0	5.9	2.0	0.2	0.0
March	9.8	6.5	2.1	0.0	0.0
April	9.3	6.0	2.2	0.1	0.0
May	10.7	7.4	3.9	0.5	0.0
June	10.1	7.0	3.2	0.6	0.1
July	5.4	3.4	1.2	0.1	0.0
August	6.4	4.0	1.6	0.3	0.1
September	5.7	3.8	1.8	0.3	0.1
October	6.1	3.7	1.7	0.2	0.0
November	8.0	5/5	2/0	0.2	0.0
December	10.7	7.3	2.7	0.1	0.0
ANNUAL	103.5	68.2	27.6	2.8	0.2

a. CFA -- January 1950 through September 1983.

Table 2.3.15

NUMBER OF DAYS WITH SPECIFIED SNOWFALL AMOUNTS, AVERAGES, AND EXTREMES EXPECTED AT TMI-2 ISFSI SITE[a]

	≥ 0.1 in.			≥ 1.0 in			_ 3.0 in.		
	Average	Maximum	Minimum	Average	Maximum	Minimum	Average	Maximum	Minimum
January	9.3	19	0	1.8	5	0	< 1	2	0
February	5.8	12	0	1.0	4	0	< 1	2	0
March	5.3	13	0	1.1	3	0	< 1	2	0
April	3.4	11	0	0.5	3	0	< 1	2	0
May	0.5	2	0	< 1.0	2	0	< 1	2	0
June	0.0	0	0	0	0	0	0	0	0
July	0.0	0	0	0	0	0	0	0	0
August	0.0	0	0	0	0	0	0	0	0
September	0.3	0	0	0	0	0	0	0	0
October	1.1	6	0	< 1.0	1	0	< 1	1	0
November	4.2	10	0	< 1.0	3	0	< 1	3	0
December	7.5	16	1	2.7	6	0	< 1	2	0
SEASONAL	37.4	0	0	0	0	0	0	0	0

a. Based on CFA data from January 1950 through September 1983. Day is from midnight to midnight.

Table 2.3.16

MAXIMUM SNOW DEPTHS ON THE GROUND EXPECTED AT TMI-2 ISFSI SITE[a]

	Average Maximum[b] (in.)	Highest Maximum (in.)	Lowest Maximum (in.)
January	7.0	13	Trace
February	6.7	22	Trace
March	3.6	27	Trace
April	1.3	6	0
May	0.4	5	0
June	0.0	Trace	0
July	0.0	0	0
August	0.0	0	0
September	0.0	Trace	0
October	0.0	3	0
November	1.7	6	0
December	4.1	13	Trace

a. Based on data from 1950 through 1983.

b. Average for period from April 1954 through December 1981.

Table 2.3-17

DEQ-ESTIMATED PLANNING-LEVEL AMBIENT CONCENTRATIONS - INEEL AIRSHED

	1-hr	8-hr	24-hr	Annual	Quarterly
PM-10	NA	NA	86 ug/m^3	32.7 ug/m^3	NA
TSP	NA	NA	130 ug/m^3	36.7 ug/m^3	NA
Pb	NA	NA	NA	NA	0.17 ug/m^3
CO	10 ppm (11450 ug/m^3)	4.5 ppm (5153 ug/m^3)	NA	NA	NA
NO_2	NA	NA	NA	40 ug/m^3	NA
SO_2	NA	0.208 ppm (544 ug/m^3)	0.055 ppm (144 ug/m^3)	0.009 ppm (23.6 ug/m^3)	NA
0_3	40 ppb (78.5 ug/m^3)	NA	NA	NA	NA

Table 2.3.18

ATMOSPHERE PRESSURE CFA APPLICABLE TO TMI-2 ISFSI SITE

	Station Pressure (in. of mercury)					
	Average	Average Daily High	Average Daily Low	Highest	Lowest	Maximum Monthly Range
January	25.08	25.18	25.00	25.69	24.26	1.43
February	25.07	25.15	24.98	25.58	24.27	1.31
March	24.99	25.08	24.90	25.61	24.26	1.35
April	24.98	25.07	24.91	25.44	24.46	0.98
May	25.00	25.07	24.94	25.48	24.51	0.97
June	25.02	25.09	24.96	25.39	24.55	0.84
July	25.09	25.15	25.04	25.44	24.71	0.73
August	25.09	25.15	25.03	25.37	24.72	0.65
September	25.09	25.16	25.03	25.59	24.54	0.82
October	25.11	25.19	25.03	25.59	24.54	1.02
November	25.12	25.21	25.04	25.65	24.46	1.19
December	25.13	25.23	25.04	25.66	24.29	1.37
Period of Record	25.06	25.14	24.99	25.69	24.26	1.43[a]

a. Greatest monthly range over the period of record

Table 2.3.19

XOODOQ INPUT DATA AND PROGRAM OPTIONS USED IN TMI-2 ISFSI DISPERSION ANALYSES

Parameter	Option	TMI-2 ISFSI Site
Stability	Various	NRC (UT) Grid 3
Wind	Various	PBF (1982)
Plume Spread parameters	Reference 2 and 15	Reference 2
Release height	Elevated or ground level or mixed mod	Ground level
Stack effluent momentum, temperature	Momentum and/or buoyancy	N/A (surface release)
Building wake effects	Dimensions, relation to release point	Not used (design not available)
Transport level wind height	May be extrapolated through planetary boundary layer	Not adjusted (e.g., 15.2m used)
Topography	Input for modified effective plume height	Not used (assume flat terrain)
Radioactive decay	Incorporate varied half lives	Not used (no inventory available)
Dry deposition	Incorporate depletion factors	Not used
Recalculation or stagnation	Tune X/Q, D/Q values	Not considered
Receptor grid	Standard or custom	Standard

Table 2.3.20

MESODIF INPUT DATA AND PROGRAM OPTIONS USED IN TMI-2 ISFSI DISPERSION ANALYSES

Parameter	Option	TMI-2 ISFSI Site
Stability	Various	NRC (UT) Grid 3
Wind	Various telemetered stations	All stations
Plume spread parameters	As input	Reference 2
Release height	As input	Surface
Stack effluent momentum, temperature	As input	Ambient
Building wake effects	Option not available	Not considered
Topography	Option not available	Not considered directly (Effects in windfield)
Radioactive decay	Option not available	Not considered
Deposition decay	Option not available	Not considered
Recirculation or stagnation	Considered directly	Yes--in windfield

Table 2.3.21

Example Grid 3 Data Output

Date (YYMMDD),Time (hhmm),GRI BVlt (Volts),GRI CRTmp (Degrees F.),GRI DPts,GRI HVol,GRI NRad (microR/hr),GRI 15S (MPH),GRI 15D (Degrees),GRI 15SD (Degrees),GRI 15G (MPH),GRI 2Tmp (Degrees F.),GRI 15Tmp (Degrees F.),GRI 2MaxT (Degrees F.),GRI 2MinT (Degrees F.),GRI 2RH (Percent),GRI SRad (Watts/m2),GRI Rain (Inches),GRI TopS (MPH),GRI TopD (Degrees),GRI TopSD (Degrees),GRI TopG (MPH),GRI TopT (Degrees F.),GRI BP (Inches Hg)

971124,555,12.94,18.09,300,0,16.51,3.5,208,4.5,4.1,11.75,15.46,11.86,11.62,98.6,0.7,0,4.2,348,3.4,4.6,27.02,25.09
971124,600,12.94,18.05,300,0,15.97,3.2,219,4,3.9,11.66,15.08,11.79,11.52,98.6,0.7,0,5.2,352,8.3,5.8,26.72,25.089
971124,605,12.92,18.05,300,0,16.4,3.4,212,8.6,3.7,11.39,14.16,11.57,11.25,98.3,0.8,0,5.2,356,7.7,6,26.5,25.092
971124,610,12.93,18.01,300,0,16.68,3.2,208,3.9,3.7,11.28,13.62,11.35,11.19,98.4,0.7,0,4.8,354,3.5,5.8,25.73,25.094
971124,615,12.92,17.97,300,0,17.76,3.6,213,5.1,4.2,11.32,13.21,11.39,11.23,98.5,0.9,0,4.3,358,4.5,5,25.63,25.095
971124,620,12.94,17.93,300,0,16.12,3.8,215,5.1,4.5,11.28,13.86,11.41,11.16,98.4,0.7,0,3.9,357,8.1,4.9,25.39,25.096
971124,625,12.94,17.93,300,0,17.01,3.8,215,3,4.2,11.12,12.81,11.26,11.01,98.2,0.8,0,3.4,9,7.4,4.2,25.05,25.098
971124,630,12.94,17.9,300,0,16.61,3.7,215,5.5,4.1,10.94,12.47,11.08,10.81,98.1,0.7,0,3.4,1,11.3,4.5,25.35,25.098
971124,635,12.94,17.82,300,0,17.28,3.4,224,4,3.9,10.83,12.24,10.98,10.67,98.1,0.9,0,4.2,352,12.6,4.8,26.03,25.097
971124,640,12.94,17.74,300,0,17.17,3.2,211,6.3,3.5,10.62,12.04,10.72,10.47,97.9,0.8,0,3.9,9,11.3,4.9,25.68,25.098
971124,645,12.94,17.7,300,0,16.44,3.3,205,2.1,3.5,10.4,12.04,10.53,10.26,97.8,0.7,0,3.5,16,5.9,3.8,25.68,25.1
971124,650,12.93,17.62,300,0,16.71,3.3,197,5.8,3.5,10.36,12.07,10.47,10.26,98,0.8,0,3.5,38,9.7,3.9,25.4,25.099
971124,655,12.93,17.55,300,0,17.14,3.3,206,4.2,3.6,10.53,12.15,10.8,10.31,98.3,0.9,0,2.9,37,6,3.5,24.53,25.102
971124,700,12.93,17.47,300,0,16.76,3.5,205,3.5,3.7,10.87,12.18,10.99,10.74,98.4,1,0,3.6,36,4.6,3.9,24.81,25.102
971124,705,12.93,17.38,300,0,16.14,3.1,205,3.4,3.4,10.9,12.15,10.98,10.81,98.2,0.9,0,4,31,4,5,24.7,25.103
971124,710,12.93,17.31,300,0,16.97,3.1,210,4.2,3.5,10.72,11.97,10.85,10.53,98,0.9,0,3.6,33,7.5,4.7,24.32,25.105
971124,715,12.93,17.28,300,0,17.48,3.2,208,6.3,3.8,10.35,11.71,10.56,10.15,97.6,1,0,3.7,39,7.7,5,24.05,25.105
971124,720,12.93,17.15,300,0,16.33,3.2,211,6.5,3.4,10.08,11.71,10.22,9.9,97.6,1.2,0,3.6,43,9.9,4.9,24,25.105
971124,725,12.93,17.11,300,0,16.15,3.4,202,3.9,3.7,9.73,11.95,10,9.5,97.3,2,0,2.8,59,8.1,3.6,23.81,25.106
971124,730,12.92,17.01,300,0,16.66,3.8,199,5.3,4.2,9.68,12.38,9.86,9.59,97.7,4.6,0,2.9,50,9.5,3.6,23.72,25.107
971124,735,12.92,16.92,300,0,14.6,4.2,198,3.9,5,10.06,12.49,10.49,9.77,98.2,7.8,0,2.2,63,17.5,3.1,24.06,25.105
971124,740,12.92,16.84,300,0,16,4.5,196,2.9,5,10.94,12.56,11.37,10.44,99,11.4,0,1,101,19.1,1.9,24.26,25.104
971124,745,12.92,16.81,300,0,17.14,4,193,4.4,4.5,11.75,12.51,12.13,11.35,99.3,14.2,0,1.8,105,16.5,2.5,24.3,25.103
971124,750,12.92,16.77,300,0,17.18,3.3,202,8.2,3.9,12.31,12.54,12.45,12.07,99.3,17,0,1.9,80,24.3,2.3,24.46,25.103
971124,755,12.92,16.77,300,0,15.87,3.4,217,6,4.4,12.43,12.43,12.52,12.36,99.1,27.5,0,1.4,62,63.1,3.1,24.79,25.103
971124,800,12.92,16.81,300,0,16.02,2.9,208,7,3.4,12.54,12.47,12.65,12.42,99.1,35.2,0,1.2,39,19.7,3.2,25.32,25.103
971124,805,12.92,16.84,300,0,17.61,3.6,211,7.4,4.6,12.72,12.69,12.81,12.6,99.2,44.9,0,1.6,54,91.1,3.2,25.35,25.103
971124,810,12.92,16.93,300,0,16.3,3.7,216,9.4,4.3,12.92,12.97,13.14,12.76,99.5,58.6,0,0.8,334,86.8,2,26.11,25.102
971124,815,12.92,17.01,300,0,16.9,3.2,211,7.1,3.9,13.32,13.21,13.6,13.08,99.7,73.1,0,0.6,345,17.1,1.6,26.72,25.104
971124,820,12.92,17.17,300,0,16.2,3.4,218,8.6,4.1,14.02,13.87,14.43,13.57,100.3,85.9,0,0.6,275,70.7,0.6,26.4,25.109
971124,825,12.92,17.35,300,0,15.89,3.3,222,6.7,4,14.79,14.61,15.13,14.38,100.7,100.3,0,0.6,283,35,0.6,26.62,25.111
971124,830,12.92,17.63,300,0,16.04,3.2,220,8,3.9,15.48,15.21,15.91,15.08,101,120,0,1.5,245,29.5,2.7,26.19,25.113
971124,835,12.92,17.97,300,0,16.22,3.1,220,6.5,3.7,16.34,16.11,16.88,15.87,101.6,116.1,0,0.9,257,12.1,1.8,26.73,25.111
971124,840,12.92,18.36,300,0,16.84,3.2,206,11,4.1,17.53,17.37,18.21,16.84,102.3,133.7,0,1.7,227,12.3,2.7,27.56,25.111
971124,845,12.93,18.86,300,0,16.29,3.1,206,10.3,4.2,18.97,18.78,20.06,18.16,103.3,191.9,0,3.4,214,4.6,4.1,27.64,25.11
971124,850,12.93,19.4,300,0,16.76,3.5,191,6.9,4.3,20.65,20.25,21.29,19.97,103.9,201.2,0,4.5,198,7.2,5,27.29,25.11
971124,855,12.93,20.05,300,0,16.45,2.9,186,7.6,4,22.04,21.44,22.76,21.2,104.5,222,0,4.5,182,3.9,6.2,27.14,25.109
971124,900,12.92,20.81,300,0,14.27,3.3,186,8,4.7,23.22,22.46,23.65,22.65,104.7,226.5,0,5,181,2.3,6.7,27.02,25.108
971124,905,12.92,21.64,300,0,15.36,3.4,178,7.3,4.5,24.17,23.42,24.71,23.49,105.1,205.1,0,6,179,3.2,7.2,26.34,25.109
971124,910,12.93,22.5,300,0,16.59,2.7,172,10.2,4.1,24.98,24.3,25.25,24.64,105.2,174.2,0,6.6,183,4.6,8,25.92,25.111
971124,915,12.93,23.44,300,0,16.51,2.5,170,11.7,3.7,25.02,24.29,25.17,24.83,104.7,171.4,0,7.2,193,4.1,7.6,25.45,25.112
971124,920,12.93,24.34,300,0,15.97,2.6,170,14.1,4.2,25.09,24.31,25.54,24.79,105,251.4,0,7.1,196,7.6,7.7,25.52,25.109
971124,925,12.92,25.23,300,0,16,3,190,11.2,3.9,25.71,25.02,26.25,25.35,105.4,268.8,0,6.8,209,3.3,7.6,25.77,25.11
971124,930,12.93,26.13,300,0,14.76,3.2,197,8.4,3.9,26.59,26.04,26.98,26.17,105.9,302.7,0,6.3,205,7.1,7.3,25.68,25.112
971124,935,12.94,27.02,300,0,14.69,3.2,183,8.7,4.3,27.3,26.64,27.59,26.86,106.1,325.3,0,5.4,202,8.6,6.9,25.98,25.112
971124,940,12.93,27.91,300,0,15.22,3.2,188,7.4,3.9,27.58,26.71,27.78,27.35,106,300.3,0,4.7,203,13.2,6.2,26.02,25.114
971124,945,12.93,28.79,300,0,16.16,2.9,189,12.5,4.2,27.61,26.79,27.87,27.46,105.9,266.2,0,4.9,206,10.5,5.9,26.07,25.118
971124,950,12.93,29.68,300,0,15.58,2.2,190,15.7,3.7,27.73,27.06,27.9,27.56,106,346.4,0,4.6,208,7.1,7,26.67,25.12
971124,955,12.93,30.57,300,0,15.48,2.1,190,13.6,3.1,28.12,27.65,28.39,27.82,106.3,298.7,0,3.6,223,12.5,4.7,27.05,25.121
971124,1000,12.93,31.45,300,0,17.16,2.5,180,15,3.8,28.65,28.05,29.01,28.02,106.6,371.5,0,3.6,198,14.5,4.6,27.44,25.12
971124,1005,12.93,32.37,300,0,16.75,3,182,20.3,5,29.18,28.57,29.45,28.79,106.7,371.5,0,3.3,206,20,4.9,27.94,25.121
971124,1010,12.93,33.34,300,0,16.04,3.2,188,20.7,5.6,29.56,29.05,29.97,29.32,106.8,371.6,0,4,207,11.6,5.7,28.3,25.122
971124,1015,12.94,34.3,300,0,14.41,3.5,176,10.2,4.7,30,29.39,30.1,29.92,106.9,367,0,3.2,191,13.9,4.2,28.95,25.123
971124,1020,12.94,35.41,300,0,15.06,2.5,164,15.9,4.8,30.26,29.54,30.53,30.05,106.9,380.1,0,3.2,160,15,4.3,29.46,25.122

Table 2.4-1. Monthly Discharge of the Big Lost River at Lincoln Boulevard near the INTEC (cubic feet)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1965	0	0	2,380	10,300	15,400	29,600	31,100	16,900	10,900	0	0	0	116,580
1966	0	0	0	3,660	981	0	0	0	0	0	0	0	4,641
1967	0	0	0	0	2,030	20,180	18,376	4,400	9,050	8,740	0	0	62,776
1968	0	0	2,280	3,390	16	524	0	1,053	1,130	3,290	4,500	0	16,183
1969	0	0	0	3,960	33,000	33,500	21,800	4,780	9,840	6,710	3,290	0	116,880
1970	0	0	501	1,650	793	13,800	17,700	1,510	6,080	5,280	4,750	8	52,072
1971	0	0	0	10,600	12,300	17,200	20,800	7,760	13,400	14,400	13,100	0	109,560
1972	0	0	1,540	4,920	504	1,710	861	84	2,990	3,520	3,099	0	19,228
1973	0	0	0	2,830	405	0	0	0	0	0	0	0	3,235
1974	0	0	3,240	5,520	6,940	16,200	9,390	1,170	1,160	3,760	4,200	0	51,580
1975	0	0	0	3,180	12,000	12,100	18,700	3,560	6,520	8,210	7,990	0	72,260
1976	0	0	333	1,450	1,660	1,120	0	0	300	620	1,100	76	6,659
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	0	0	0	0	0	0	0	0	0
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	0	0	0	1,140	0	0	0	0	0	1,140
1981	0	0	0	1,300	5,092	7,560	0	0	0	0	0	0	13,952
1982	0	0	0	5,930	17,200	13,400	15,100	4,820	8,190	10,500	5,740	600	81,480
1983	600	600	900	12,800	15,800	18,900	18,200	9,780	7,320	6,200	5,660	1,200	97,960
1984	1,200	1,200	1,200	2,200	2,230	4,550	3,950	5,790	5,140	5,980	8,710	2,120	44,360
1985	3	0	0	7,170	6,430	0	0	0	9,950	10,707	1,275	0	35,535
1986	0	96	537	8,370	14,825	20,315	2,900	1,016	14,753	8,220	1,190	2	72,224
1987	0	0	531	491	0	0	0	0	0	0	0	0	1,022
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	6	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	5,116	0	0	0	0	0	0	5,116
1994	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: Monthly discharge (cubic feet) value for 1965-88 from Bennett, Streamflow Losses and Groundwater Level Changes Along the Big Lost River at the Idaho National Engineering Laboratory, Idaho. USGS Water-Resources Investigations Report 90-4067. Data from 1989-94 from USGS printout.

Table 2.4-2 Mackay Dam and INEEL Diversion Dam and reservoir characteristics Koslow and Van Haaften, 1986).

	Mackay Dam	INEEL Diversion Dam
Dam crest elevation (ft msl)	6,076.0	5,064.7
Dam crest length (ft)	1,430	500
Dam height (ft)	79	22
Spillway	Ungated overflow crest, 75 ft long	none
Spillway crest elevation (ft msl)	6,066.5.	NA
Gate centerline elevation (ft msl)	6,036.6 (upper) 6,007.8 (lower)	5,045.6
Dam base elevation (ft msl)	5,997.0	5,042.6
Spillway maximum capacity (cfs)	6,588	NA
Gate maximum capacity (cfs)	2,960	1,121
Reservoir capacity[a] (ac-ft)	55,091 @ 6,076.0 44,500 @ 6,066.5 8,750 @ 6,030.0 500 @ 6,010.0	18,200 @ 5,040.0 58,000 @ 5,050.0

a. It has been estimated that Mackay Reservoir has lost 22% of its mid and late-season irrigation capacity due to sedimentation of the reservoir (Butte Soil Conservation District, 1982). Reservoir capacity given for INEEL diversion dam is for the spreading areas; no water is held immediately behind the diversion dam.

Table 2.4-3. Average, highest, and lowest total monthly and annual precipitation at CFA from January 1950 to December 1988.[a]

Month	Average (in.)	Highest (in.)	Lowest (in.)
January	0.69	2.56	0.00
February	0.64	2.40	0.00
March	0.60	1.44	0.07
April	0.73	2.50	0.00
May	1.20	4.42	0.07
June	1.18	3.89	0.02
July	0.53	2.29	0.00
August	0.57	3.27	0.00
September	0.63	3.52	0.00
October	0.52	1.67	0.00
November	0.68	1.74	0.00
December	0.75	3.43	0.02
Annual	8.71	14.40	4.50

a. Clawson et al. (1989).

Table 2.4-4. Results of PMF-induced overtopping failure of Mackay Dam (Koslow and Van Haaften, 1986).

Location (approximate elevation, ft msl)	Streambed elevation (ft msl)	Peak water surface elevation (ft msl)	Peak flood flow (cfs)	Peak water velocity (ft/s)	Time of wave arrival (hr)
Mackay Dam (6076)	5997	6078	306,700	8.5	0.0
Arco (5310-5410)	5309	5319	147,720	5.6	6.7
INEEL Diversion (5065)	5043	5073	71,850	1.0	10.0
CFA (4928-4940)	4935	4942	67,830	3.4	12.8
TRA (4920-4925)	4919	4924	67,170	2.8	13.2
INTEC (4914-4930)	4911	**4917**	66,830	2.7	13.5
NRF (4845-4850)	4846	4851	61,620	1.9	16.4
TAN (4780-4795)	4778	4786	34,810	1.1	34.5

Total flow to INEEL diversion spreading areas: 27,460 ac-ft
Total Mackay Reservoir release: 142,330 ac-ft.

Table 2.4-5. Results of seismic-induced failure of Mackay Dam during 25-yr flood (Koslow and Van Haaften, 1986).

Location (approximate elevation, ft msl)	Streambed elevation (ft msl)	Peak water surface elevation (ft msl)	Peak flood flow (cfs)	Peak water velocity (ft/s)	Time of wave arrival (hr)
Mackay Dam (6076)	5997	6067	107,480	5.8	0.0
Arco (5310-5410)	5309	5317	74,240	4.8	8.3
INEEL Diversion (5065)	5043	5070	45,410	1.4	11.8
CFA (4928-4940)	4935	4942	40,520	3.0	14.8
TRA (4920-4925)	4919	4923	39,580	2.5	15.3
INTEC (4914-4930)	4911	**4916**	39,080	2.4	15.8
NRF (4845-4850)	4846	4850	31,690	1.5	18.9
TAN (4780-4795)	4778	4782	4,440	0.7	42.5

Total flow to INEEL diversion spreading areas: 8,480 ac-ft
Total Mackay Reservoir release: 44,830 ac-ft.

Table 2.4-6. Dam Failure Characteristics of four hypothetical failure scenarios (Koslow and Van Haaften, 1986).

	Seismic	100-yr Piping	500-yr piping	Overtopping PMF
Mackay Dam:				
Breach Type	Trapezoid	Triangle	Trapezoid	Trapezoid
Breach bottom width, ft	31.6	0.0	31.6	140.0
Breach side slope, x/y	0.6	0.6	0.6	0.6
Failure mode	Internal (seismic)	Internal (piping)	Internal (piping)	Hydrologic (overtopping)
Failure time, hr	1.0	1.0	1.0	1.0
Reservoir inflow hydrograph	25-yr flood	100-yr flood	500-yr flood	PMF
Peak reservoir inflow, cfs	4,030	4,870	5,760	82,100
Reservoir level at failure, ft msl	6,066.5	6,066.5	6,066.5	6,077.0
INEEL Diversion Dam:				
Breach type	Trapezoid	Trapezoid	Trapezoid	Trapezoid
Breach bottom width, ft	60.0	60.0	60.0	60.0
Breach side slope, x/y	0.6	0.6	0.6	0.6
Failure mode	Overtopping	Overtopping	Overtopping	Overtopping
Failure time, hr	0.1	0.1	0.1	0.1
Initial water level, ft msl	5,059.6	5,059.6	5,059.6	5,059.6
Flow losses, percent of total flow	40	40	40	40

Table 2.5-1: INEEL Production Wells and Annual Volume Pumped

Well Name	Depth of well (ft bls)[a]	Depth to Water (ft bls)	Annual Volume (gal)
ANP-01	360	208	2.561E+06
ANP-02	340	211	1.433E+06
ANP-08	309	218	3.908E+05
Badging Facility well	644	489	5.760E+04
CFA-1	639	468	1.473E+07
CFA-2	681	471	1.448E+05
CPP-01	586	460	1.834E+08[b]
3. CPP-02	605	460	1.834E+08[b]
CPP-04	700	462	1.834E+08[b]
CPP-05	695	447	1.834E+08[b]
EBR-1	1075	596	4.491E+04
EBR II-1	745	632	2.767E+06[c]
EBR II-2	753	630	2.767E+06[c]
FET-1	330	199	1.427E+06
FET-2	455	200	5.067E+05
Fire Station well	516	420	1.057E+04
NRF-1	535	363	2.594E+06
NRF-2	529	362	9.368E+06
NRF-3	546	363	9.802E+04
NRF-4	597	363	1.649E+07
Rifle Range well	620	508	9.115E+04
RWMC Production	685	568	4.824E+05
SPERT-1	653	456	3.871E+05
SPERT-2	1217	463	3.450E+05
TRA-01	600	453	3.595E+07
TRA-03	602	456	2.074E+06
TRA-04	965	463	9.006E+07

a. Feet below land surface (ft bls)
b. Annual volume data is the total for wells CPP-1, CPP-2, CPP-4, and CPP-5.
c. Annual volume data is the total for both wells EBR II-1 and EBR II-2.
Note: All wells are withdrawing water from the main body of the Snake River Plain Aquifer and are used as drinking water wells with the exception of wells ANP-08, Fire station well, and NRF-4 which are production wells for facility operations.

Table 2.6-1. Summary of geologic units in the INEEL area.

Age	Unit, thickness, distribution	Physical character	Origin	Reference
Holocene to Late Pleistocene	Eolian deposits, <30m; covers much of INEEL, sand dunes in NE part and loess blankets elsewhere	Fine sand and silt, dune forms and blankets	Sand from Lake Terreton beaches; loess from glacial and alluvial fan deposits	Scott 1982, Nace et al. 1975
	Playa deposits, <10m, in sinks areas of northern INEEL and scattered small playas across INEEL	Poorly sorted clayey, sandy silt, some with high carbonate content	Deposited in closed depressions during wet periods	Scott 1982; Nace et al 1975; Kuntz et al. 1994
	Alluvium and alluvial fans, up to 30m, along streams and at base of mountains	Gravels with varying content of sand, silt, clay	Mainstream deposits along rivers, debris flows and intermittent stream deposits in fans	Scott 1982; Nace et al. 1975; Kuntz et al. 1994
	Holocene Lava fields, up to 30m, in Great Rift and along Axial Volcanic Zone	Olivine tholeiite basalt to rhyodacite and ferroliatite	Erupted from VRZs and AVZ	Kuntz et al 1986, 1994
Pleistocene	Lake Terreton deposits, <50m, northeastern INEEL and Mud Lake area	Sandy and clayey light colored silt with lenses of pure sand, silt, and clay	Deposited in beaches, bars, and floor of Pleistocene Lake Terreton	Nace et al. 1975; Scott 1982
	Rhyolite Domes, along axis of ESRP	Porphyritic to aphric rhyolite flows and minor pyroclastics	Dome building eruptions at Big Southern, East, Middle, Cedar, and unnamed butte.	Armstrong, Leeman, and Malde 1975; Hackett and Smith 1992; Hayden 1992

Table 2.6-1. (continued)

Age	Unit, thickness, distribution	Physical character	Origin	Reference
Late Tertiary to Quaternary	Snake River Group basalts and interbedded sediments ~1km, ESRP	Porphyritic to aphyric olivine tholeiites, fractured and vesicular, flows ~20 ft thick, interbedded with alluvial, eolian, and lacustrine sediments	Erupted from numerous vents and fissures in VRZs and AVZ of ESRP	Armstrong, Leeman, and Malde 1975; Malde 1991; Hacket and Smith 1992
Late Tertiary	Heise Volcanics, Several thousand meters, buried beneath ~1km of ESRP basalt and outcrops along margins of ESRP	Ash flow tuffs and rhyolitic lavas	Erupted from calderas buried beneath the basalts of the ESRP	Morgan 1988; Hackett and Morgan 1988; Hackett and Smith 1992
Late Precambrian to Paleozonic	Carbonate and clastic sedimentary rocks, >5,000m, mountains north and south ESRP	Quartzites overlain by middle to upper Palezoic carbonates	Marine deposition followed by Mesozoic thrusting	Link et al. 1988; Skipp and Hait 1977.

Table 2.6-2. Chemical analyses and ion exchange capacities of Eastern Snake River Plain basalts.

Chemical analysis		Ion exchange capacity[a]	
SiO_2	47.04%	4 mm	0.98
$Ti0_2$	2.70%	2 mm	0.89
Al_20_3	15.11%	1 mm	0.73
Fe0	13.51%	0.5 mm	0.61
Mn0	0.20%	0.25 mm	0.86
Mg0	7.65%	0.125 mm	1.32
Ca0	10.06%	0.062	2.80
Na_20	2.54%	<230 mesh	2.30
K_20	0.61%		
P_20_5	0.58%		

a. Meg per 100 g of rock

TABLE 2.6-3. TIME PERIODS OF EARTHQUAKE DATA COMPLETENESS

Magnitude Interval	Completeness Period
2.0-4.0	1975-1995
4.0-5.0	1963-1995
5.0-5.5	1950-1995
5.5-6.0	1925-1995
6.0-6.5	1900-1995
6.5-7.0	1875-1995
7.0 +	1850-1995

Modified from Woodward-Clyde Consultants [2.52].

TABLE 2.6-4. EARTHQUAKES WITH MAGNITUDES GREATER THAN 5.5 WITHIN 200 MILES OF INEEL

EARTHQUAKE DATE & TIME (HR:MN - UTC)[A]	MAGNITUDE[B]	MODIFIED MERCALLI INTENSITY[C]		GEOGRAPHICAL LOCATION[D]	RADIAL DISTANCE (KM)[E]	REFERENCES
		EPICENTE	ISFSI SITE			
1884 November 10 08:50						
1905 November 11 21:26	5.5 M_L	VII	IV	Shoshone, Idaho	164	2
1909 October 6 02:50	6.3 M_I	VIII		Hansel Valley, Utah	216	1
1914 May 13 17:15	5.7 M_I	VII		Ogden, Utah	283	1
1925 June 28 01:21	6.8 M 6.6 M_w	VI		Clarkston, Montana	275	3,4,5
1925 June 29 01:12	6.3 M			Clarkston, Montana	292	20
1930 June 12 09:15	5.8 M_L	VI		E of Soda Springs, Idaho	190	5
1934 March 12 15:05	6.6 M_L 6.6 M_w	IX		Hansel Valley, Utah	222	1,3,6
1934 March 12 18:20	6.2 M_L 5.9 M_w	VII		Hansel Valley, Utah[f]	222	1,3,6
1934 April 14 21:26	5.6 M_L	VII		Hansel Valley, Utah[f]	245	1
1934 May 06 08:09	5.6 M_L	VI		Hansel Valley, Utah[f]	222	1
1944 July 12 19:30	6.1 M_b	VII		N of Stanley, Idaho	235	7
1945 February 14 03:01	6.0 M_L	VI		N of Stanley, Idaho	235	7

TABLE 2.6-4. EARTHQUAKES WITH MAGNITUDES GREATER THAN 5.5 WITHIN 200 MILES OF INEEL

EARTHQUAKE DATE & TIME (HR:MN - UTC)[A]	MAGNITUDE[B]	MODIFIED MERCALLI INTENSITY[C]		GEOGRAPHICAL LOCATION[D]	RADIAL DISTANCE (KM)[E]	REFERENCES
		EPICENTE	ISFSI SITE			
1947 November 23 00:46	6.3 M 6.1 M_w			Virginia City, Montana	138	3,4
1959 August 18[g] 06:37	7.5 M_s 6.3, 7.3 M_w	X	VI	Hebgen Lake, Montana	187	3,8,9,10
1959 August 18 07:56	6.5 M			Hebgen Lake, Montana	208	3
1959 August 18 08:41	6.0 M			Hebgen Lake, Montana	208	3
1959 August 18 11:03	5.6 M			Hebgen Lake, Montana	182	3
1959 August 18 15:26	6.5 M_b 6.3 M_w			Hebgen Lake, Montana	209	10
1959 August 19 04:04	5.9 M_s 6.0 M_w			Hebgen Lake, Montana	209	4,10
1962 August 30 13:35	5.7 M_s 5.9 M_w	VII		Cache Valley, Utah	208	1,3,11
1964 October 21 07:38	5.8 M_b 5.6 M_w			Hebgen Lake, Montana[h]	154	3,4
1975 March 28 02:31	6.1 M_b 6.2 M_w	VIII	III	Pocatello Valley, Utah	183	3,12
1975 June 30 18:54	6.1 M_L	VII	NF	Yellowstone Park, Wyoming	209	3,13

TABLE 2.6-4. EARTHQUAKES WITH MAGNITUDES GREATER THAN 5.5 WITHIN 200 MILES OF INEEL

EARTHQUAKE DATE & TIME (HR:MN - UTC)[A]	MAGNITUDE[B]	MODIFIED MERCALLI INTENSITY[C]		GEOGRAPHICAL LOCATION[D]	RADIAL DISTANCE (KM)[E]	REFERENCES
		EPICENTE	ISFSI SITE			
1976 December 8 14:40	5.5 M_b			Yellowstone Park, Wyoming	198	5
1983 October 28 14:06	7.3 M_s 6.8 M_w	IX	VI	N W of Mackay, Idaho[i]	93	3,8,9,14
1983 October 28 19:51	5.8 M_L 5.4 M_w			N W of Mackay, Idaho[i]	98	3,15
1983 October 29 23:29	5.8 M_L 5.5 M_w			N W of Mackay, Idaho[i]	121	3,15
1984 August 22 09:46	5.8 M_L 5.6 M_w			Challis, Idaho[i]	127	3,15
1994 February 309:05	5.9M_w 5.7M_w	V	NF	W of Afton, Wyoming	172	16,17,18

Table 2.6-4

NOTES:

a - UTC - Universal Time Coordinated (Greenwich Mean Time).

b - Highest magnitude value is reported in this Table. Moment magnitudes are included, if calculated. Magnitude Scales: M_I - Conversion from Intensity; M_L - Local or Richter; M - magnitude type not specified; M_w - Moment; M_b - Body-wave; M_s - Surface-wave.

c - Modified Mercalli intensity for epicenter is based on Wood and Neumann, 1931. Modified Mercalli intensity at ISFSI site was obtained from available intensity maps. "NF" indicates "Not Felt" where documented. Blanks indicate no information available.

d - Latitude and Longitude coordinates are listed in Table 3.7-4.

e - Radial distances based on coordinates 43° 42.0', 112° 48.0'.

f - Aftershock following the $M_L = 6.6$, 1934 Hansel Valley, Utah earthquake.

g - Hebgen Lake usually referred to as M_s 7.5, but is actually a two events having magnitudes of M_w 6.3 and 7.3 per Doser, 1985.

h - Aftershock following the $M_s = 7.5$, 1959 Hebgen Lake, Montana earthquake.

i - Aftershock following the $M_s = 7.3$, 1983 Borah Peak, Idaho earthquake.

References: (1) Richins, 1979; (2) Oaks, 1992; (3) Doser and Smith, 1989; (4) Doser, 1989a; (5) National Earthquake Information Center, unpublished data; (6) Doser, 1989b; (7) Stover et al., 1986; (8) Doser, 1985a; (9) Stover, 1985; (10) Doser, 1985b; (11) Westaway and Smith, 1989; (12) Arabasz et al., 1979; (13) Pitt et al., 1979; (14) Doser and Smith, 1985; (15) Richins et al., 1987; (16) Dewey, 1994; (17) Nava et al, 1994; (18) Pechmann et al., 1997; (19) Cook and Nye, 1979; (20) Stover et al., 1977.

Table 2.6-5. Ground motions recorded during the Borah Peak earthquake at CPP-601 (~1000 feet north of the TMI-2 ISFSI site).

Location		Acceleration (g)	Velocity (cm/sec)	Displacement (cm)
CPP-601 1st Floor	L	0.043	1.38	0.25
	T	0.065	2.76	0.13
	V	0.033	1.28	0.16
CPP-601 2nd Basement	L	0.038	1.32	0.12
	T	0.044	2.19	0.16
	V	0.038	1.46	0.11
CPP-601 Free Field	L	0.078	2.03	0.23
	T	0.058	2.80	0.34
	V	0.035	1.39	0.25

TABLE 2.6-6. BASIN AND RANGE FAULTS AROUND THE ESRP

For each segment or fault, the information under IMPORTANT POINTS is presented as follows: Most recent event (MRE) in thousands of years (Ka), type of study, displacement per last event (D), length (L), slip rate (SR), and recurrence interval (RI). ND = no data available.

FAULT	REFERENCE	IMPORTANT POINTS
Sawtooth, White Cloud Peaks area	Dewey (1987), Jackson and Zollweg (1988), Smith et al (1985).	Contemporary earthquake swarms, maximum magnitude = 6.1, several mapped normal faults.
Lost River Fault	Pierce (1985, 1988), Scott et al. (1985), Crone et al. (1987), Schwartz (1988), Malde (1987), Piety et al. (1986)	**Arco Segment** - MRE~30 Ka, trenching, D~2-3 m, L~10 km, SR~0.12 mm/y, RI~30-40 Ka. **Pass Creek Segment** -MRE~30-50 Ka, scarp morphology, ND, L~30 km, RI~30-50 Ka? **Mackay Segment** -MRE~4.3-6.8 Ka, trenching, ND, L~22 km, SR~0.3 mm/yr, RI~4-7 Ka. **Thousand Springs Segment** - MRE=1983, trenching/earthquake, D=2.7 m, L=36 km, SR=0.3 mm/yr, RI=6-7Ka. **Warm Spring Segment** - MRE~5.5-6.2 Ka, trenching, ND, L~15 km, SR=0.3 mm/yr, RI<15 Ka. **North Segment** - MRE>Late Quaternary, scarp morphology, ND, L~20 km., ND, ND, low structural relief.

Lemhi Fault	Woodward-Clyde Consultants (1992a, 1992b), Knuepfer (1989), Turko (1988), Baltzer et al. (1989), Malde (1987), Haller (1988), Scott et al. (1985), Bruhn et al. (1992)	**Southern Segments (Howe and Fallert Springs segments) -** MRE~15-24Ka, trenching/scarp morphology, D~2-3 m, L~25km, SR~0.1mm/yr, RI=3.3Ka(ave.) **Sawmill Gulch Segment** - MRE<10Ka, trenching, D=1.7 m, L=43 km, ND, ND. **Goldburg Segment** - MRE~10-15 Ka, scarp morphology, ND, L=12 km, ND, ND. **Patterson Segment** - MRE<10 Ka?, scarp morphology, ND, L~23 km, ND, ND. **May Segment** - MRE~15-30 Ka?, scarp morphology, ND, L~23 km, ND, ND.
Beaverhead Fault	Haller (1988), Stickney and Bartholomew (1987).	**Blue Dome Segment** - MRE>30 Ka, scarp morphology, ND, L~25 km, ND, ND. **Nicholia Segment** - MRE~10-15 Ka, scarp morphology, ND, L~42 km, ND, ND. **Baldy Mountain Segment** - MRE>30 Ka, scarp morphology, ND, L~21 km, ND, ND. **Leadore Segment** - MRE<10 Ka, scarp morphology, ND, L~23 km, ND, ND. **Mollie Gulch Segment** - MRE~10-15 Ka?, scarp morphology, ND, L~20 km, ND, ND. **Lemhi Segment** - MRE>30 Ka, scarp morphology, ND, L~20 km, ND, ND.
Red Rock Fault	Haller (1988), Stickney and Bartholomew (1987).	**Sheep Creek Segment** - MRE<10 Ka, scarp morphology, ND, L~16 km, ND, ND. **Timber Butte Segment** - MRE~10-15 Ka, scarp morphology, ND, L~11 km, ND, ND.
Centennial Fault	Stickney and Bartholomew (1987), Johnson (1981).	**Western Centennial Valley Segment** - MRE<10 Ka, scarp morphology, ND, L~23 km, ND, ND. **Red Rocks Lake Segment** - MRE>20 Ka?, scarp morphology, ND, L~24 km, ND, ND. **Henrys Lake Segment** - MRE<10 Ka, scarp morphology, ND, L~1 km, ND, ND.

Madison Fault	Stickney and Bartholomew (1987), Schneider (1985)	**Madison Canyon Segment** - MRE~Late Holocene (1947?, 1959?), scarp morphology, ND, L~34 km (total fault length = 117 km). Additional scarps exist but no segments have been delineated (a short segment of this fault ruptured in 1959).
Hebgen Fault and Red Canyon Fault	Stickney and Bartholomew (1987), Doser (1985b).	**Hebgen Fault** - MRE=1959, scarp morphology, D=6.7m, L~13 km (+ 14 km on R.C.Fault), ND, ND. **Red Canyon Fault** - MRE=1959, scarp morphology, D=6.7m, L~45 km, SR~1.2-1.5 mm/yr (pre-1959), RI=4.3 Ka.
Yellowston e area	Pitt et al (1979), U.S. Geological Survey (1972), Doser (1984).	Numerous north-trending normal faults around Yellowstone Caldera with Quaternary movement. Contemporary seismicity, maximum magnitude = 6.1. RI = 700-750 years for M7 earthquakes based on seismic moment rates.
Teton Fault	Piety et al. (1986), Smith et al. (1990), Byrd et al. (1988), Susong et al. (1987), Gilbert et al. (1983)	**South Segment** - MRE~7Ka, trenching and scarp morphology, D=4.1m, L~24 km, SR~1.7-2.2 mm/yr, RI~1.4-2.3Ka. **Middle Segment** - MRE<11-14Ka, scarp morph., D~3m, L~20 km, SR~1.7-2.2 mm/yr, RI~1.4-2.3Ka. **North Segment** - MRE<11-14Ka, scarp morph., D~3m, L~20 km, SR~1.7-2.2 mm/yr, RI~1.4-2.3Ka.
Grand Valley Fault	Anders et al. (1989), Piety et al. (1986).	**Grand Valley Fault** - MRE>15-30 Ka, scarp morphology, ND, L~72 km, SR~0.02-0.04 mm/yr, ND.

Snake River Fault	Anders et al. (1989), Piety et al. (1986).	**Snake River Fault** - MRE>15-30 Ka, scarp morphology, ND, L~50 km, SR~0.001 mm/yr, ND
Star Valley Fault	Anders et al. (1989), Piety et al. (1986), McCalpin et al. (1990).	**Northern Segment** - MRE<9Ka, scarp morphology, D~3.6-6.3, L~30 km, SR~0.8-1.2mm/yr, RI~5-7Ka. **Southern Segment** - MRE<9Ka, trenching and scarp morphology, D~5.0-6.3 m, L~28 km, SR~0.6-1.1 mm/yr, RI~5-7 Ka.
Northern Wasatch Fault Segments	Schwartz (1988), Machette et al. (1992), Swan et al. (1980), Piety et al. (1986).	**Collinston Segment** - MRE>13 Ka, scarp morphology, ND, L~25 km, ND, ND. **Brigham City Segment** - MRE=3400 yrs, trenching, ND, L~40 km, ND, ND. **Weber Segment** - MRE~500 years, 1.7-3.7 m, trenching, D~1.7-3.7m, L~50 km, SR~1.2-2.8 mm/yr, RI~1Ka?

TABLE 2.6-7. EARTHQUAKES WITHIN 200 MILES THAT HAVE OCCURRED ON TECTONIC STRUCTURES

Earthquake Date & Time (Hr:Mn - UTC)[a]	Seismic Moment[b] ($x10^{25}$ dyne-cm)	Focal Mechanism Strike/Dip/Rake[c] (Degrees)	Tectonic Structure, Source Parameters and Dimensions, and References[d]
1925 June 28 01:21	10 ± 2 B	30 80 -175 FM 250 56 - 38 BW	Associated with a fault oriented in an oblique manner north of the Clarkston Valley Fault north of Bozeman, Montana. Z=9±5 km (LP); RL=25±5 km (BW), 59±5 km (SF); SD=2.0±1.0 m (v). (1,2)
1934 March 12 15:05	0.95 G 8.6 ± 2 B	7 80 - 70 FM 40 87 - 11 BW 0 73 -110 SF	Caused a fault scarp along an unnamed fault in Hansel Valley, Utah. Z= 8±2 km (LP); RL=11±3 km (BW), 6±2 km (SF); BWD= -2.1±0.1 m (h), 0.2±0.05 m (v); SD= -0.2 (h), 2.0±1.0 m (v); GD= 0.4±0.1 m (v). (1,3)
1934 March 12 18:20	0.77 ± 0.3 B	25 85 - 20 BW	Aftershock to March 12, 1934 earthquake. Z= 8±7 km (LP); RL=7±3 km (BW); BWD= -0.5±0.1 m (h). (1,4)
1947 November 23 09:46	1.8 ± 0.5 B	120 60 -120 FM 104 48 -170 BW	Possibly associated with the Madison Fault northwest of Hebgen Lake, Montana. Z= 8±2 km (LP); RL=9±2 km (BW); BWD= -0.7±0.2 m (h). (1,2,5)
1959 August 18 06:37 (M_s 7.5)	41 G 150 L 120 S	102 60 - 90 SW 120 70 - 90 SF 132 45 - 90 GE	Caused a fault scarp along the Hebgen and Red Canyon faults near Hebgen Lake, Montana. No distinction between subevents: Z= 11±2 km (LP); RL=24±4 km (SF), 40±4 km (GE); SD= 4.4 m (v); GD= 7.4±0.4 m (v). (1,6)
1959 August 18 06:37 (M_w 6.3)	2.8 B	102 60 - 90 FM 95 42 - 90 BW	Subevent 1: Z= 10±2 km (LP); RL=7±1 km (BW); BWD= 0.95 m (v). (1,6)
1959 August 18 06:37 (M_w 7.3)	92 B	100 54 - 90 FM 95 42 - 90 BW	Subevent 2: Z= 15±3 km (LP); RL=21±5 km (BW); BWD= 6.8 m (v). (1,6)

TABLE 2.6-7 Continued. EARTHQUAKES WITHIN 200 MILES THAT HAVE OCCURRED ON TECTONIC STRUCTURES

Earthquake Date & Time (Hr:Mn - UTC)[a]	Seismic Moment[b] ($x10^{25}$ dyne-cm)	Focal Mechanism Strike/Dip/Rake[c] (Degrees)	Tectonic Structure, Source Parameters and Dimensions, and References[d]
1959 August 18 07:56	nd	70 55 - 45 FM	Aftershock to August 18, 1959 earthquake. nd. (1)
1959 August 18 08:41	nd	70 65 - 15 FM	Aftershock to August 18, 1959 earthquake. nd. (1)
1959 August 18 11:03	nd	50 64 31 FM	Aftershock to August 18, 1959 earthquake. nd. (1)
1959 August 18 15:26	3.10 B 5.5 S	90 60 - 70 FM 83 50 - 90 BW	Aftershock to August 18, 1959 earthquake. Z= 10±2 km (LP); RL=9±1 km (BW). (1)
1959 August 19 04:04	1.1 ± 0.3 B 4.8 S	60 75 -155 FM 57 80 -161 BW	Aftershock to August 18, 1959 earthquake. Z= 8±2 km (LP); RL=11±2 km (BW). (1)
1962 August 30 13:35	0.52 ± 0.2 B	185 58 - 85 FM 201 49 -108 BW	Associated with the Temple Ridge fault, Cache Valley, Utah. Z= 12±2 km (LP); RL=3±1 km (BW); BWD= 0.55 ± 0.2 m (h). (1,7)
1964 October 21 07:38	1.10 ± 0.3 B	310 60 18 FM 307 56 14 BW	Aftershock to August 18, 1959 earthquake. RL=3±1 km (BW). (1)
1975 March 28 02:31	1.23 ± 0.6 B 2.4 L 1.2 S	225 39 - 53 FM 200 38 - 70 BW 210 60 - 90 GE	Associated with an unnamed fault in Pocatello Valley, Utah. Z= 9±2 km (LP), 5±2 km (SP), 12 km (GE); RL=12±2 km (BW), 18±2 km (GE); BWD= 0.75 ± 0.25 m (v); GD= 0.50 m (v). (1,8,9)
1975 June 30 18:54	0.75 S	302 71 -129 FM	Associated with an unnamed fault near the north-central boundary of the Yellowstone Caldera, Wyoming. Z= 6±1 km (SP); GD= 0.12 m (v). (1,9,10)

TABLE 2.6-7 Continued. EARTHQUAKES WITHIN 200 MILES THAT HAVE OCCURRED ON TECTONIC STRUCTURES

Earthquake Date & Time (Hr:Mn - UTC)[a]	Seismic Moment[b] ($x10^{25}$ dyne-cm)	Focal Mechanism Strike/Dip/Rake[c] (Degrees)	Tectonic Structure, Source Parameters and Dimensions, and References[d]
1983 October 28 14:06	28 G 21 B 29 L	138 45 - 60 FM 155 50 - 65 BW 160 70 - 70 SF 152 49 nd GE	Caused a fault scarp along the Thousand Springs segment of the Lost River Fault in central Idaho. Z= 16±4 km (LP), 12±2 km (SP), 14 km (GE); RL= 21±2 km (BW), 19±2 km (SF), 20±2 km (GE); BWD= -0.20 m (h), 1.30 m (v); SD= -0.30 m (h), 1.50 m (v); GD= 2.10 m (v). (1,11)
1983 October 28 19:51	0.13 B 0.24 S	287 58 -165 FM 282 48 -159 BW 286 70 -155 SF	Aftershock to October 28, 1983 earthquake. Z= 10 km (LP), 10 km (SP), 10 km (GE); RL= 6±2 km (BW). (1)
1983 October 29 23:29	0.20 B	309 51 - 65 FM 317 45 - 90 BW	Aftershock to October 28, 1983 earthquake. Z= 19±9 km (LP), 10 km (SP); RL= 8±1 km (BW). (1)
1984 August 22 09:46	0.24 B	170 70 - 5 FM 348 85 -160 BW	Aftershock to October 28, 1983 earthquake. Associated with the Challis segment of the Lost River fault and possibly caused slip (M 5.0) on an antithetic fault, the Lone Pine fault, central Idaho. Z= 10 km (LP), 10 km (SP); RL= 7±1 km (BW). (1,12)
1994 February 3 09:05	0.51 W	355 41 - 91 WI	Mainshock and aftershocks concentrated in a N-S trending zone 18 km west of the Star Valley fault. Interpreted to have been associated with buried subsidiary structures in hanging wall of the west-dipping Star Valley normal fault. Z= 8 km (13,14, 15,16)
1999 August 20 13:50	0.02 W	108 55 –85 WI, FM	The earthquake and aftershocks are interpreted to be associated with a cross-over structural zone between the east-dipping Red Rock normal fault and the west-dipping Monument Hill fault, range-bounding faults with late Quaternary displacements. (17,18)

a - UTC - Universal Time Coordinated (Greenwich Mean Time).

b - Seismic moments based on: G - geology; B - body-wave analysis; L - Geodetic observations; S surface-wave analysis from Doser and Smith, 1989 and W - Waveform inversion.

c - Focal mechanisms based on: FM - first motions; BW - body-wave analysis; SF - surface-wave analysis; SF - surface faulting; GE - geodetic observations from Doser and Smith, 1989 and WI - Waveform Inversion.

d - Earthquake source parameters and dimensions: Z - focal depth from long-period waves (LP), short period waves (SP), and geodetic observations (GE); RL - rupture length from body waves (BW), surface faulting (SF), and geodetic observations (GE); BWD - body-wave displacement, SD - surface displacement, and GD - geodetic displacement for horizontal (h) and vertical (v) orientations. Numbers in parentheses corresponds to references listed below. For obtaining original references see Doser and Smith, 1989.

References: (1) Doser and Smith, 1989; (2) Doser, 1989a; (3) Shenon, 1936; (4) Doser, 1989b; (5) Dewey et al., 1973; (6) Doser, 1985b; (7) Westaway and Smith, 1989; (8) Cook and Nye, 1979; (9) Bache et al., 1980; (10) Pitt et al., 1979; (11) Crone et al., 1987; (12) Jackson et al., 1991a; (13) Jeroen Pitsema, personnal communications, 1994; (14) Nava et al., 1994, (15) U.S. Geological Survey, 1994; (16) Pechmann et al., 1997; (17) Stickney and Lageson, 1999; (18) Mike Stickney, personal communications, 2000.

TABLE 2.6-8. HISTORICAL EARTHQUAKES POSSIBLY LOCATED WITHIN THE ESRP[a]

Date	Origin Time (UTC)[b]	Intensity[c]	Magnitude	Location Error (km)[d]
11 November 1905	22:29[e]	MM VII	M_L 5.5[f]	± 100-200
20 February 1909	01:nd	MM II	nd	± 50-100
6 December 1925	16:16	Felt	nd	± 50-100
7 August 1927	nd	Felt	nd	± 50-100
5 September 1928	05:36	Felt	M_L 5.2[g]	≥ ± 100
6 June 1932	11:00	MM II	nd	± 50-100
21 December 1932	08:00	MM II	nd	± 50-100
28 April 1934	09:30	MM IV	nd	± 100-200
28 April 1934	10:00	MM III	nd	± 100-200
29 April 1934	06:10	MM III	nd	± 100-200
18 November 1937	23:50	nd	M_L 5.4[h]	nd
1 February 1954	03:33:19.[i]	nd	nd	± 50-100
20 January 1964	10:09:39.7[i]	nd	nd	± 22-56
28 February 1969	15:30:24.4[i]	nd	nd	± 22-56

a - Modified from Woodward-Clyde Consultants (1992a).
b - Origin time shown as hour:minute:second for Universal Time Coordinated (UTC), as reported in Stover et al. (1986).
c - MM = Modified Mercalli Intensity (Wood and Neumann, 1931). Felt = Earthquake felt but no intensity assigned.
d - Estimated from Stover et al. (1986).
e - According to Oaks (1992) Shoshone earthquake occurred at 22:29 and not 21:29 as reported by Stover et al. (1986).
f - Richter magnitude (M_L) calculated by Oaks (1992).
g - Magnitude obtained from Slemmons et al. (1965).
h - Information obtained from Engdahl and Rinehart (1988).
i - Instrumentally computed location.
nd - No data.

TABLE 2.6-9. MAXIMUM MAGNITUDES AND FOCAL DEPTHS OF EARTHQUAKES ASSOCIATED WITH DIKE INJECTION[a]

LOCATION	VOLCANIC EVENT[c]	MAXIMUM MAGNITUDE[d]	FOCAL DEPTH(S)[e]	REFERENCES
Iceland				
Krafla	1975-76	5.0[f]	0 - 4	1,2
Krafla	1977	3.8[f]	0 - 6	3
Krafla	1978	4.1[f]	1 - 4	4
Hawaii, USA				
Kilauea Rift Zones				
East	1965	4.4 ((M_L))	0 - 8	5
East	1968, Aug.	3.3	< 5	6
East	1968, Oct.	3.1	< 6	6
East	1969	4.7	< 7	7
Southwest	1975	3.0	nd	8
East	1976-77	4.0	< 10	8
East	1980, Aug.	3.0(	0.5 - 3	9
East	1980, Nov.	3.1(Mc)g	0.7 - 4	9
Southwest	1981	3.4(M_c)[g]	1 - 2	9
East	1982		0.5 - 3	9
Japan				
Izu Pennisula [h]	1989	5.5(M_{JMA})	< 8	10,11,12
Africa				
Asal, Afar	1978	5.3(m_b)	0 - 6	13,14
New Zealand				
Taupo Volcanic	1964-65	4.6	4 - 8	15
Taupo Volcanic	1983	4.3	6 - 10	15
California, USA				
Mono Craters [k]	1325 + 20 AD	>	nd	16
Italy				
Mt. Etna	1989	3.3(M_L)	< 4	17,18
Mt. Etna	1991	3.3(M_L)	< 6	19
Mean $\pm$1 sigma; n=19[l]		3.9 $\pm$ 0.8		

a - Modified from Hackett et al. (1995).

b - Worldwide dike-injection events associated with mafic magma except Mono craters which is associated with silicic magma and for Mt. Etna which is associated with intermediate magma. Composition of magma for New Zealand episodes are unknown.

c - An episode of dike-injection and associated seismicity having a known beginning and end.

d - Maximum magnitude reported for the dike-injection event. Magnitudes: M_L - Local or Richter; M_c - Coda; M_{JMA} - Japan Meteorological Agency; m_b - Body-wave; M_s - Surface-wave. No definition of magnitude scale was reported for values without magnitude designation.

e - Depth range of volcanic seismicity and maximum magnitude earthquake associated with the dike-injection event.

f - Einarsson (1991) reports earthquakes of magnitude ≥ 5.0 are usually associated with caldera deflation events and magnitude ≤ 4.0 with dike injection at Krafla.

g - Coda magnitudes greater than amplitude magnitudes for these events (Nakata et al., 1982; Tanigawa et al., 1981, 1983).

h - This earthquake is interpreted to have triggered magma movement, but was part of an earthquake swarm that began about 10 days prior to a dike-fed submarine eruption (10, 11, 12).

j - Associated with or triggered by dike intrusion, or possibly associated with tectonic subsidence of the basin (15).

k - Minimum estimate of the largest of five historic earthquakes based on liquefaction deposits produced by earthquakes equivocally associated with dike intrusion or tectonic faults (16).

l - Mean and one standard deviation computed based on magnitudes as presented without Mono Craters because its a minimum estimate.

nd - No data obtained.

References: (1) Einarsson & Bjornsson, 1979; (2) Bjornsson et al., 1977; (3) Brandsdottir and Einarsson, 1979; (4) Einarsson and Brandsdottir, 1980; (5) Bosher and Duennebier, 1985; (6) Jackson et al., 1975; (7) Swanson et al., 1976; (8) Dzurisin et al., 1980; (9) Karpin and Thurber, 1987; (10) Okada and Yamamato, 1991; (11) Takeo, 1992; (12) Oura et al., 1992; (13) Abdallah et al., 1979; (14) Lepine and Hirn, 1992; (15) Grindley and Hull, 1986; (16) Sieh and Bursik, 1986; (17) Bonaccorso and Davis, 1993; (18) Barberi et al., 1990; (19) Ferrucci and Patane, 1993.

TABLE 2.6-10. MAXIMUM MAGNITUDES BASED ON RUPTURE AREAS OF NORMAL FAULTS AND FISSURES IN ESRP VOLCANIC RIFT ZONES

Normal Faults or Fissures	Surface Length - SL (km)	Fault Widths: Depth to Dike Top[a] - DDT (km)	Fault Widths: Level of Neutral Buoyancy[b] - LNB (km)	Rupture Areas: SL x DDT (km^2)	Rupture Areas: SL x LNB (km^2)	Moment Magnitudes[c] M	Moment Magnitudes[c] M
Kings Bowl, Fissures[d]	11.5 E	0.6	4.0	6.9	46.0	4.9	5.7
	14.0 M			8.4	56.0	5.0	5.8
South of New Butte, Fissures[d]	19.0 E	1.0	4.0	19.0	76.0	5.3	5.9
	22.0 M			22.0	88.0	5.4	6.0
Southeast of New Butte, Fissures[d]	11.0	1.0	4.0	11.0	44.0	5.1	5.7
Railroad Monocline, Fault[e]	5.0	0.2	4.0	1.0	20.0	4.1	5.3
Jaylin Monocline Fault[e]	3.2	nc	4.0	nc	12.8	nc	6.4
Box Canyon, Fault[e]	3.0	0.2	4.0	6.0	12.0	4.8	5.6
East-West, Fault[e]	0.7	nc	4.0	nc	2.8	nc	5.6
Southeast Butte City, Fissure[e]	0.7	nc	4.0	nc	2.8	nc	5.6
Northwest of Tea Kettle Butte, Fissure[e]	2.3	nc	4.0	nc	9.2	nc	6.2
Northeast of Sixmile Butte, Fissure[e]	1.2	nc	4.0	nc	4.8	nc	5.9
Northeast of Tea Kettle Butte, Fissure[e]	0.3	nc	4.0	nc	1.2	nc	5.2
East of Tea Kettle Butte, Fissure[e]	0.5	nc	4.0	nc	2.0	nc	5.4
Northwest of Sixmile Butte, Fissure[e]	1.1	nc	4.0	nc	4.4	nc	5.8
Kath Fissure[e]	0.6	nc	4.0	nc	2.4	nc	5.5
NRF Fissure[e]	1.5	nc	4.0	nc	6.0	nc	6.0
Hells Half Acre, Fissures[e]	4.0 E	0.8	4.0	3.2	16.0	4.5	5.3
	15.0 M		4.0	12.0	60.0	5.1	5.8
Lapoint Monocline, Fissure[e]	1.4	nc	4.0	nc	5.6	nc	5.9

TABLE 2.6-10. Continued

Normal Faults or Fissures	Surface Length - SL (km)	Fault Widths: Depth to Dike Top[a] - DDT (km)	Fault Widths: Level of Neutral Buoyancy[b] - LNB (km)	Rupture Areas: SL x DDT (km^2)	Rupture Areas: SL x LNB (km^2)	Moment Magnitudes[c] **M**	Moment Magnitudes[c] **M**
East of Morgan Crater, Fault[f]	11.7	0.5	4.0	5.9	46.8	4.8	5.7
North of Morgan Crater, Fault[f]	9.2	1.3	4.0	12.0	36.8	5.1	5.6
West of High Point Butte, Fault[f]	10.0	1.0	4.0	10.0	40.0	5.1	5.6
Antelope Flat, Fault[f]	11.0	1.7	4.0	18.7	44.0	5.3	5.7
South of Antelope Flat, Fault[f]	3.7	0.3	4.0	1.1	14.8	4.1	5.2
Mean ±1 sigma; n= 11; n=22						4.9 ± 0.4	5.7 ± 0.3

E - Exposed surface length; corresponding magnitude not used to estimate the mean value.
M - Maximum surface length estimated from extrapolation of fissures beneath younger lava flows.
nc - Not calculated because only one fissure or fault exposed, and therefore the depth to the dike top could not be estimated.
a - Maximum depth calculated using: d=1/2W; where d=depth to dike top; W=width of graben (Pollard et al., 1983; Mastin and Pollard, 1988).
b - Depth extent based on Ryan (1987) and Rubin (1992).
c - Magnitudes calculated using **M**=4.07+0.98*Log(RA); where **M**=moment magnitude; RA=rupture area. Magnitudes are extrapolated if less the constant in the equation (Wells and Coppersmith, 1994).
d - Surface lengths obtained from Kuntz et al. (1988).
e - Surface lengths obtained from Golder Associates (1992a).
f - Surface lengths obtained from aerial photographs and topographic maps.

TABLE 2.6-11 DETERMINISTIC SEISMIC HAZARD STUDIES APPLICABLE TO THE ISFSI SITE

Seismic Hazard Study	Methodology	Input Parameters	Peak Horizontal Acceleration (g) Bedrock	Soil
Woodward-Lungren and Associates, 1971 [2.175] & Allied Chemical Corporation, 1975 [2.177]	Based on empirical attenuation relationship — maximum acceleration of rock as functions of magnitude and distance (Seed et al., 1969). Soil based on amplification factor of 1.4 derived from lumped-mass method incorporating representative dynamic soil properties.	M_L 7.75 earthquake at the southern end of the Lost River fault at a distance of 24 km to the ICPP. Representative soil profile 50 ft of gravel and sand. This evaluation was for the NWCF site at the ICPP located 320 m from the ISFSI site.	0.33	0.46
Agbabian Associates, 1977 [2.178]	Reviewed the deterministic study conducted by Allied Chemical Corporation [2.177] with respect to NRC regulations. Suggested an alternative deterministic evaluation that considered use of: 1) fault surface length versus earthquake magnitude; and 2) an empirical attenuation relationship developed from earthquakes worldwide (Woodward-Clyde Consultants, 1975 [2.176]). No soil values calculated.	M_L 6.75 earthquake at the southern end of the Lost River fault at a distance of 24 km to the ICPP. This evaluation was for the NWCF site at the ICPP located 320 m from the ISFSI site.	0.30	
Woodward-Clyde Consultants, 1990 [2.51]	Site-specific evaluation using the a stochastic numerical modeling technique known as the band-limited-white-noise ground motion model combined with random vibration theory. The ground motions are modeled as a point source described by M_w, stress drop $\Delta\sigma$, and source region V_s, and ρ_s; crustal attenuation described by Q_o and η; and the local site response based on V_s, intrinsic damping Q_s, and ρ_s. Ground motions were modeled to the ground surface for both rock and soil. Results are in the form of horizontal peak acclerations and response spectra for the 16th, 50th, and 84th percentiles. An evaluation of the vertical to horizontal ratio resulted in an average value of 0.72.	M_w 6.9 on the Lemhi fault at a distance of 21 km, the closest point of the rupture plane to ICPP. $\Delta\sigma$= 50 bars; V_s= 3.55 km/sec; ρ_s = 2.7 gm/cm3; Q_o = 450; and η = 0.2. Local site response based on V_s and V_p measurements in boreholes and empirical earthquake recordings. Sites selected for evaluation at the ICPP were called FPR for rock and SIS for soil, located approximately 500 m from each other and 200 m and 600 m from the ISFSI site, respectively.	0.20 (84th)	0.30 (84th)

TABLE 2.6-11 Continued. DETERMINISTIC SEISMIC HAZARD STUDIES APPLICABLE TO THE ISFSI SITE

Seismic Hazard Study	Methodology	Input Parameters	Peak Horizontal Acceleration (g) Bedrock	Soil
URS Griener Woodward-Clyde Federal Services, 1999 [2.179]	Incorporated results of detailed paleoseismic investigations at the southern end of the Lemhi fault [2.94]. Combined four empirical attenuation relationships [2.53] with an attenuation relationship based on the same stochastic modeling approach as in Woodward-Clyde Consultants [2.51] to calculate a weighted mean peak horizontal acceleration for a maximum credible earthquake. Soil value was estimated by using an amplification factor of 2 [2.53]. Results are in the form of peak horizontal accelerations at the 50th and 84th percentiles.	M_w 7.1 on the Lemhi fault at a distance of 22 km, the closest point of the rupture plane to ISFSI site. $\Delta\sigma$ = 75 bars; V_s= 3.55 km/sec; ρ_s = 2.7 gm/cm3; Q_o = 150; and η = 0.6. Local site response based on V_s and V_p measurements in boreholes drilled at the ISFSI site.	0.28 (84th)	0.56 (84th)

TABLE 2.6-12 PROBABILISTIC SEISMIC HAZARD STUDIES APPLICABLE TO THE ISFSI SITE

Seismic Hazard Study	Methodology	Input Parameters	Peak Horizontal Acceleration (g) Bedrock	Soil
Agbabian Associates, 1977 [2.178]	Calculated the probability of experiencing the design earthquake during the service life of the facility. Calculation procedure uses the mathematical model by Der-Kiureghian and Ang (1977). Evaluation performed for the NWCF site at the ICPP located 320 m from the ISFSI site.	Three source areas located around the ESRP having maximum magnitudes (6.75-7.5) corresponding to Modified Mercalli Intensities (MMI) IX-X, recurrence intervals based on the historical earthquake record, and intensity attenuation relationships developed from five regional earthquakes.	0.4 /MMI VIII-IX (0.01% chance of exceedance in 100 years)	None
Tera Corporation, 1984	Calculated probabilities of peak horizontal accelerations with return periods of 100, 1,000, and 10,000 yrs. Procedure uses the Tera (1978) model based on the work of Mortgat et al. (1977) and Mortgat and Shah (1979). Analysis done for Argonne National Laboratory site, but hazard maps include the ICPP.	Nine source regions, three are the major range-bounding faults northwest of the ESRP. Magnitudes range 6.5-7.75 and recurrence based on 17 years of earthquake data. Attenuation based on Campbell (1982) and Tera (1984) with Q_o=450, η=0.2 outside the ESRP; Q_o=150, η=0.55 inside the ESRP.	0.18 (1,000 yrs) 0.30 (10,000 yrs)	None
Woodward-Clyde Federal Services, 1996 [2.53]	Calculated annual exceedance probabilities (500, 1,000, 2,000, and 10,000) for peak horizontal accelerations. Procedure is based on Cornell (1968) and Youngs and Coppersmith (1990). Results are in the form of mean peak horizontal accelerations and uniform hazard spectra for rock. Evaluation performed for the ICPP.	Source zones: basin and range faults, M6.5-7.75; volcanic rift zones, M4.5-5.5; ESRP background seismicity, M5-6; northern basin and range background seismicity, M6.25-6.75. Recurrence based on earthquake catalog 1884-1992. Attenuation includes four empirical relationships unmodified for style of faulting factors and stochastic numerical modeling ($\Delta\sigma$ = 75 bars; V_s= 3.55 km/sec; ρ_s = 2.7 gm/cm3; Q_o = 150; and η = 0.6. Site response V_s and V_p measured in boreholes drilled at ICPP and INEEL).	0.10 (1,000 yrs) 0.13 (2,000 yrs) 0.22 (10,000 yrs)	None

TABLE 2.6-12 Continued. PROBABILISTIC SEISMIC HAZARD STUDIES APPLICABLE TO THE ISFSI SITE

Seismic Hazard Study	Methodology	Input Parameters	Peak Horizontal Acceleration (g) Bedrock	Peak Horizontal Acceleration (g) Soil
URS Griener Woodward-Clyde Federal Services, 1996b [2.179]	Developed seismic design parameters for the ISFSI site. Procedures include: deaggregation of mean uniform hazard spectra and adjustment of the normalized spectral shapes to produce bedrock response spectra; soil response analysis using a frequency-domain equivalent-linear formulation (Silva et al. [2.180]); and development of acceleration time histories by combining a Fourier amplitude spectrum with a phase spectrum from an observed strong ground motion record based on (Silva and Lee, 1987). Results in the form of peak horizontal and vertical accelerations for rock, preliminary peak horizontal and vertical accelerations for soil, smoothed response spectra, and time histories.	Recomputed the seismic hazard using extensional empirical attenuation relationships and stochastic numerical modeling ($\Delta\sigma$ = 50 bars; V_s= 3.55 km/sec; ρ_s = 2.7 gm/cm3; Q_o = 150; and η = 0.6. Site response V_s and V_p measured in boreholes drilled at ISFSI and INTEC. Soil analysis includes: depths ranging 6 - 20 m and shear wave consistent with Tanle 2.6-15 obtained from boreholes drilled at the ISFSI site.	0.10 (1,000 yrs) 0.13 (2,000 yrs) 0.22 (10,000 yrs)	0.23[a] (1,000 yrs) 0.30[a] (2,000 yrs) 0.47[a] (10,000 yrs)
Payne et al. [2.249]	Developed horizontal and vertical design basis earthquake (DBE) response spectra based on the URSG-WCFS [2.179] soil UHS. The soil UHS was adjusted for a 2,500-yr return period. The DBE response spectral shapes incorporate broadened regions of the peak accelerations, velocities, and displacements defined by the soil UHS.	Smoothed horizontal soil UHS and vertical to horizontal (V/H) ratio developed by URSG-WCFS [2.179].		0.25[b] (2,500 yrs) 0.36 (10,000 yrs)

a Peak vertical accelerations for soil are 0.14 g (1,000 yrs), 0.17 g (2,000 yrs), and 0.28 g (10,000 yrs).

b Peak vertical accelerations for soil are 0.19 g (2,500 yrs) and 0.28 g (10,000 yrs).

Table 2.6-13 Properties of Soils (Sediments) and Bedrock at ICPP

Unit and depth of occurrence	Classification (USCS)	Dry Density (lbs/ft^3)	Moisture Content (%)	Relative Density (%)	Porosity (%)	Strength Characteristics	Vp ft/s, (m/s)	Vs ft/s (m/s)	Damping
Upper Alluvial Soils (0-20 ft)	Sandy Gravel (GW)	110-123	1-8	36-98	29	C=0 F=43	2000 (610)	1000 (300)	0.5%@10^{-4}% strain 15%@10^{-1}% strain
		131.5 - 133	6		29	C=0 F=38-43	2000 (610)-2300 (700)	1000 (300)-1150 (350)	
		117-142	2-20	13-100		C=0 F=38°	3300 (1000)	1400(425)	1%@10^{-4}%Strain
		98-135					1600 (490)-1700 (520)	500 (150) 900 (275)	
							3665 (1120)-5600 (1700)	650 (200) 1700 (520)	
Lower Alluvial Soils (20-40 ft)	Sandy Gravel (GW) and Poorly Graded Sand (SP)	112-123	1-8	49-98	29	C=0 F=43(gravel) F=35(sand)	2300(700)	1150 (350)	10^{-4}%@0.5%strain 10^{-1}%@15% strain
		131.5 - 133	6		29	C=0 F=38-43	2000 (610)-2300 (700)	1000 (300)-1150 (350)	
		117-142				C=0, F=38° (compacted gravel)	3300 (1000)	1400 (425)	1%@10^{-4}% strain
							2500 (760)-3000 (910)	1400(425)-1600 (490)	
Clay Soils (0 -14 ft) (variable just above bedrock)	Sandy clay Silty clay (CL) Sandy silt to clayey sand (ML-SC)	92-110	17-23		39	C=650-5000 psf F=0-25°	2600 (790)	1150 (350)	Similar to lower aluvial soils
		109	17		39	C=0-1500 psf F=25-38°	2600 (790)	1150 (350)	
Basalt Bedrock (>40 ft)	Vesicular olivine basalt	136-163				6-17x10^5 psf Uniax.Comp.Strength	6800 (2070)	3500 (1070)	
		140-165				1.3-1.7x10^6psf Uniax.Comp.Strength	6800 (2070)	3500 (1070)	
							9000 (2740)-10000 (3050)	4000 (1200)-5500 (1670)	
							7500 (2300)	4000 (1200)	
						5-16 x 10^5 psf	9200 (2800)	3900 (1200)	1%

Table 2.6-13(cont) Properties of Soils (Sediments) and Bedrock at ICPP (continued)

Unit and depth of occurrence	Shear Modulus (G)	Poisson's Ratio (n)	Static Modulus of Elasticity (E)	Bulk Modulus (K)	Consolidation Characteristics	Location (Facility)	Reference
Upper Alluvial Soils (0-20 ft)	2.2×10^6 psf 5.5×10^5psf	0.32	1.8×10^6psf@5000 psf load 2.5×10^6psf@10000 psf load	1.7×10^6psf@5000psf 2.3×10^6psf@10000psf	Elastic - dependent on E	New Waste Calcining Facl.	Dames and Moore (1976)
	6.8×10^5psf@5000psf 9.5×10^5psf@10000psf	0.32	1.8×10^6psf@5000 psf load 2.5×10^6 psf@10000 psf load		C_v=0.012 C_c=0.015	7th Bin Set & FPR	EG&G (1984a, b)
	8.2×10^6 psf	0.39	2.2×10^7 psf		slightly compressible	SIS	Northern Engineering and Testing (1987)
	1.1×10^6 to 3.1×10^6psf dynamic max. (G_{max})	0.27 - 0.30 (dyamic)	2.9×10^6 to 8.1×10^6 psf (dynamic)			HLWTF replacement	Golder Associates (1992b)
		0.41 - 0.45				FFTF	Dames and Moore (1977)
Lower Alluvial Soils (20-40 ft)	?? ??	0.32	1.8×10^6psf@5000 psf load 2.5×10^6 psf@10000 psf load	1.7×10^6psf@5000psf 2.3×10^6psf@10000psf	Elastic - dependent on E	New Waste Calcining Facl.	Dames and Moore (1976)
	6.8×10^5psf@5000psf 9.5×10^5psf@10000psf	0.32	1.8×10^6psf@5000 psf load 2.5×10^6 psf@10000 psf load		C_v=0.012 C_c=0.015	7th Bin Set & FPR	EG&G (1984a, b)
	8.2×10^6 psf	0.39	1×10^6 to 3×10^6 psf		slightly compressible	SIS	Northern Engineering and Testing (1987)
	$7.6\times10^6$to 9.9×10^6 psf dynamic max. (G_{max})	0.27 - 0.30 (dyamic)	1.9×10^7 to 2.57×10^7 psf (dynamic)			HLWTF replacement	Golder Associates (1992b)
		0.41 - 0.45				FFTF	Dames and Moore (1977)
Clay Soils (0 -14 ft) (variable just above bedrock)	Similar to lower alluvial soils	0.38			C_v=0.037@ 0-5000psf load C_v=0.065 @ 5000-10000psf	New Waste Calcining Facl.	Dames and Moore (1976)
	4.3×10^5 psf @8000 psf		1.2×10^6psf @ 8000psf	1.6×10^6 psf @ 8000 psf	C_v=0.001 C_c=0.016	7th Bin Set & FPR	EG&G (1984a, b)
Basalt Bedrock (>40 ft)		0.18-0.25 (calc)	1.3-3.1 x 10^8 psf 1.9-4.5x10^8 psf	1.6-3.7x10^8psf	Relatively incompressible	New Waste Calcining Facl.	Dames and Moore (1976)
	0.99-2.2x10^8 psf 0.73-1.7x10^8psf	0.115-0.136	2.1-5.9 x 10^8 psf	1.6-3.7x10^8psf	Relatively incompressible	7th Bin Set & FPR	EG&G (1984a, b)
	7.4×10^7 to 1.41×10^8 psf	0.28-0.38 (dynamic)	2.1-3.6 x 10^8 psf (dynamic)			HLWTF replacement	Golder Associates (1992b)
		0.25-0.30				FFTF	Dames and Moore (1977)
	7.1×10^7 psf	0.39	2.0×10^8psf		Incompressible	SIS	Northern Engineering and Testing (1987)

Table 2.6-14. Standard Penetration Test Results for Boreholes in Surficial Sediments at the TMI-2 ISFSI Site

Standard Penetration Test Results for TMI-2 ISFSI Site Boreholes at INTEC
November, 1997

Hole Number	Blows/ft at 5.5-6.5 ft	Blows/ft at 20.5-21.5 ft
1	106	69
1A	32	167
2	32	69
4A	178	90
5	31	79
7	28	108
11	30	121
12	62	98
13	59	188
14	62	224
16	18	166
19	62	113
22	53	135

Table 2.6-15. Seismic Velocities of Surficial Sediments and Basalts at the TMI-2 ISFSI Site. Data from Downhole Logging of Agbabian Associates, 1997

Depth	BH-1		BH-3		BH-5		BH-11		BH-14		BH-19		BH-22	
(m)	Vs	Vp	Vs	Vp	Vs	Vp	Vs	Vp	Vs	Vp	Vs	Vp	Vs	Vp
1	375	549	322	545	234	410							367	595
2	375	549	322	545	234	410			353	514	296	565	367	595
3	375	549	322	545	234	410			353	514	296	565	367	595
4	469	827	322	545	234	410	498	1328	497	1009	296	565	367	595
5	469	827	322	545	604	1018	498	1328	497	1009	296	565	367	595
6	469	827	586	864	604	1018	498	1328	497	1009	430	844	421	1127
7	469	827	586	864	604	1018	498	1328	497	1009	430	844	421	1127
8	469	827	586	864	604	1018	498	1328	497	1009	430	844	421	1127
9	469	827	586	864	1005	2444	498	1328	497	1009	430	844	421	1127
10	469	827	586	864	1005	2444	498	1328	857	2497	430	844	421	1127
11	469	827	586	864	1005	2444	882	2719	857	2497	430	844	679	2443
12	387	669	1215	2700	1005	2444	882	2719	857	2497	430	844	679	2443
13	387	669	1215	2700	1005	2444	882	2719	857	2497	430	844	679	2443
14	387	669	1215	2700	1005	2444	882	2719			430	844	679	2443
15	387	669	1215	2700							430	844	679	2443
16	387	669	1215	2700							430	844		
17	387	669									733	2291		
18	939	1857									733	2291		
19	939	1857									733	2291		
20	939	1857									733	2291		
21	939	1857									733	2291		
22	939	1857												
23	939	1857												

Table 2.6-16. Characteristics of volcanism in the INEEL area.

	CALDERA FORMATION	RIFT-ZONE VOLCANISM	AXIAL-ZONE VOLCANISM	AREAS BETWEEN VOLCANIC ZONES
MAGMA TYPES	rhyolite (viscous and gas-rich)	basalt (fluid and gas-poor)	basalt and subordinate rhyolite	basalt (and minor rhyolite?)
VOLCANIC STYLE AND PRODUCTS	highly explosive; voluminous pumice and fine ash blankets entire regions	mild & effusive; erupt mainly lava flows from fissures, low shield volcanoes and small tephra cones	as per rift zones, but also local rhyolite domes & intrusions (Big Southern, Middle, East Buttes) with local explosive phenomena	as per volcanic rift zones and axial volcanic zone
STRATIGRAPHY	calderas filled with up to several km of welded, silicic ash-flow tuffs, lava flows and volcaniclastic sediment [Heise Volcanics]	piles of 1- to 30-m-thick basalt lava flows & minor interbedded sediment; total lava thickness up to1 km in INEEL area [Snake River Group]	basaltic lava flows and dispersed small tephra cones; isolated rhyolite domes and intrusions [Snake River Group]	fine clastic sediment of fluvial, lacustrine and eolian origin; fewer lava flows than near VRZs [Snake River Group]
TECTONICS AND PHYSICAL CONFIGURATION	collapse: broad, oval depressions, 10s to 100 km wide and 1-2 km deep, ringed by inward-dipping fractures	extensional: NW-trending belts of open fissures, monoclines, small normal faults and basaltic vents	extensional, but magma-induced fissures or faults are rare; a diffuse, NE-trending, volcanic highland along the ESRP axis	subsidence(?): broad, low topographic basins between extensional and constructional volcanic highlands; seldom disturbed by magma intrusion
GEOLOGIC AGE IN INEEL AREA	6.5 Ma to 4.3 million yrs in INEEL area, now covered by younger basaltic lava. [2.1 to 0.6 million yrs on Yellowstone Plateau]	Surficial INEEL basalts: 1.2 to 0.05 million yrs; most are 0.7 to 0.1 million yrs. Inception of major basaltic volcanism was ca. 4 million yrs ago.	Basalt: >1 million yrs (Middle Butte), to 5,400 yrs (Hells Half Acre). Rhyolite: >1 million yrs (near East Butte) to 300,000 yrs (Big Southern Butte)	as per VRZs
QUATERNARY ERUPTION FREQUENCY	zero in INEEL area; Quaternary calderas closest to INEEL occur on Yellowstone Plateau	low; one eruption per 10,000 to 100,000 yrs (see Table 3)	low: one basaltic eruption per 8,000 yrs (see Table 3); one rhyolitic intrusion or dome every 200,000 yrs or more	very low; by definition less frequent than within rift zones (one eruption per 100,000 yrs or more)

Table 2.6-17. Hazards associated with basaltic volcanism on the Eastern Snake River Plain. Entries are listed from highest to lowest relative hazard.

PHENOMENON	RELATIVE FREQUENCY	SIZE OR AREA OF INFLUENCE	COMMENTS
lava flow	common	0.1 km^2 to 400 km^2 in area, up to 25 km length based on sizes of ESRP lava flows of the past 400,000 years	significant hazard; typical basaltic phenomenon; lava from fissures or shield volcanoes may inundate large areas downslope of vents
ground deformation: fissuring, faulting and uplift	common; associated with virtually all shallow magma intrusion and eruption	fissuring could affect areas to 2 x 10 km; minor tilting & broad uplift in areas to 5 x 20 km	significant hazard; due to shallow dike intrusion; "dry" intrusion may occur without lava flows; affects smaller areas than for lava inundation
volcanic earthquakes	common; associated with magma intrusion before and during eruption	maximum M = 5.5 and most events M < 4; ground vibration may affect facilities within 25 km	low to moderate hazard; swarms of shallow earthquakes (<4 km focal depth) occur as dikes propagate underground
gas release (toxic and corrosive vapors)	common; associated with fissuring and lava eruption	restricted to near-vent areas; may affect several-square-km area downwind	low hazard; local plume of corrosive vapor, downwind from eruptive vent or fissure; cooled vapors may collect in local topographic depressions
tephra fall (volcanic ash and bombs)	uncommon	as per gas release	low hazard; basaltic eruptions are inherently nonexplosive and may form small tephra cones but little fine ash to be carried downwind
base surge (ground-hugging blast of steam and tephra)	rare	effects limited to radius of several km from vent; < 10 km^2 area	low hazard; steam explosions due to interaction between ascending magma and shallow groundwater; water table too deep under most of INEEL
tephra flow (ground-hugging flow of hot, pyroclastic material)	extremely rare	near vent; may affect area < 1 km^2	very low hazard; as per tephra fall but affecting even smaller areas

Table 2.6-18. Estimated volcanic-recurrence intervals and corresponding annual eruption probabilities (in parentheses) for volcanic zones and boreholes of the INEEL area.

VOLCANIC ZONE OR BOREHOLE	DATA SOURCES	TIME INTERVAL OF VOLCANISM [yrs before present]	NUMBER OF VENTS, FISSURES OR FLOW GROUPS	COMMENTS	ESTIMATED RECURRENCE INTERVAL
Great Rift (25 km southwest of INEEL)	Kuntz et al., 1986, 1988	2,100 - 15,000 yrs (radiocarbon dating)	> 100 vents 8 Holocene eruptive periods (each lasting a few decades or centuries, and each including multiple flows and cones).	no impact on INEEL; most recently and frequently active of all ESRP rift zones; thus provides minimum-recurrence for entire ESRP; most probable area of future ESRP volcanism	2,000 yrs (5×10^{-4} / yr)
Axial Volcanic Zone (southern INEEL)	Kuntz et al., 1986, 1994	5,000 - 730,000 yrs (K-Ar dating; radiocarbon; paleomagnetic data)	73 vents & fissure sets; 4 Holocene lava fields, 3 of them shared by volcanic rift zones. 45 cogenetic vent/fiss gps	could affect much of southern INEEL; most recently and frequently active of all volcanic zones that could impact INEEL	16,000 yrs (6.2×10^{-5} / yr)
Arco Volcanic Rift Zone (southwestern INEEL)	Kuntz, 1978; Smith et al., 1989; Kuntz et al., 1994	10,000 - 600,000 yrs (radiocarbon, K-Ar and TL dating; paleomagnetic data)	83 vents & fissure sets; 2 Holocene lava fields. 35 cogenetic vent/fiss gps	volcanism could affect southwestern INEEL	17,000 yrs (5.9×10^{-5} / yr)
Lava Ridge-Hells Half Acre Volcanic Rift Zone (includes Circ Butte/Kettle Butte volc rift zone) (north & eastern INEEL)	Kuntz et al., 1986, 1994	5,000 - 1,200,000 yrs (K-Ar dating; radiocarbon; paleomagnetic data)	48 vents & fissure sets; 1 Holocene lava field: Hells Half Acre. 30 cogenetic vent/fiss gps	could affect northern & eastern INEEL; extremely long eruptive history; includes oldest and youngest basalts in the INEEL area	40,000 yrs (2.5×10^{-5} / yr)
Howe-East Butte Volcanic Rift Zone (central INEEL)	Kuntz, 1978, 1992; Golder Associates, 1992a	230,000 - 730,000 yrs (K-Ar dating; paleomagnetic data)	7 vents & fissure sets; no Holocene features. 5 cogenetic vent/fissure groups	old, poorly exposed and sediment-covered; identified in part by subsurface geophysical anomalies	100,000 yrs (1.0×10^{-5} / yr)
Borehole NPR SITE E (south-central INEEL)	Champion et al., 1988	230,000 - 640,000 yrs (K-Ar dating; paleomagnetic data)	9 lava-flow groups (each group contains multiple flows, erupted over a short time)	dates from 600-foot interval of subsurface lavas give recur-rence estimate consistent with surficial geology of the area	45,000 yrs (2.2×10^{-5} / yr)
Borehole RWMC 77-1 (southwestern INEEL)	Kuntz, 1978; Anderson & Lewis, 1989	100,000 - 565,000 yrs (K-Ar and TL dating; paleomagnetic data)	11 lava-flow groups (each group contains multiple flows, erupted over a short time)	dates from 600-foot interval of subsurface lavas give longer recurrence interval than nearby Arco & Axial zones, reflecting flow-group (sub-surface) vs. vent-counting (surface geology) approaches	45,000 yrs (2.2×10^{-5} / yr)

Table 2.6-19. Areas and Area Statistics for Lava Flows in the INEEL Area. Areas Measured from References [2.166] and [1.55].

	Area (km^2)	Lava flow name or location
Qba	5	North Robbers flow
	3	South Robbers flow
	175	Cerro Grande flow
	400	Hells-Half Acre flow
	325	Wapi Flow
	3.3	Kings Bowl flow
Qbb	50	Arco lava field
	100	Taber lava field
	150	Quaking Aspen Butte
	181	N. of Big Southern Butte
	77	Fingers Butte
	57	Near N. and S. Robbers
	55	SW of Big Southern Butte
Qbc	100	Table Legs Butte
	125	St. Marys Nipple
	41	Little Butte
	70	Little Butte South
	260	Kettle Butte
	65	Section 5, T3N, R34E
	311	ANL-W·
	142	Mid Butte
	130	Section 35, T4N, R33E
	80	Near 2-2A
	130	Section 33, T4N, R33E
	111	Section 20, T4N, R33E
	67	EastButte Crater
	77	Section 14, T3N, R33E
	96	NW of Wildhorse Butte
	78	Just north of Twin Buttes
	1	Coyote Butte
Qbd	275	Crater Peak
	65	Sixmile Butte
	31	Lavatoo
	1	Small butte near Teakettle
	0.5	Small butte near Teakettle
	1	Small butte near Teakettle
	44	Butterfly Butte
	52	Butterfly Butte South
	93	Section 36, T5N, R34E
	34	Table Butte
	31	Cedar Butte (N. of Mud Lake)
	31	section 6, T4N, R.34E
	26	Crater Peak, SE

Descriptive Statistics	
Mean	96.51
Standard Error	14.37
Median	70
Mode	1
Standard Deviation	94.21
Sample Variance	8876
Kurtosis	2.298
Skewness	1.587
Range	399.5
Minimum	0.5
Maximum	400
Sum	4150
Count	43
95%Confidence Lev.	28.99

area	*Percentile*
400	100.00%
325	97.60%
311	95.20%
275	92.80%
260	90.40%
181	88.00%
175	85.70%
150	83.30%
142	80.90%
130	76.10%
130	76.10%
125	73.80%
111	71.40%
100	66.60%
100	66.60%
96	64.20%
93	61.90%
80	59.50%
78	57.10%
77	52.30%
77	52.30%
70	50.00%
67	47.60%
65	42.80%
65	42.80%
57	40.40%
55	38.00%
52	35.70%
50	33.30%
44	30.90%
41	28.50%
34	26.10%
31	19.00%
31	19.00%
31	19.00%
26	16.60%
5	14.20%
3.3	11.90%
3	9.50%
1	2.30%
1	2.30%
1	2.30%
0.5	.00%

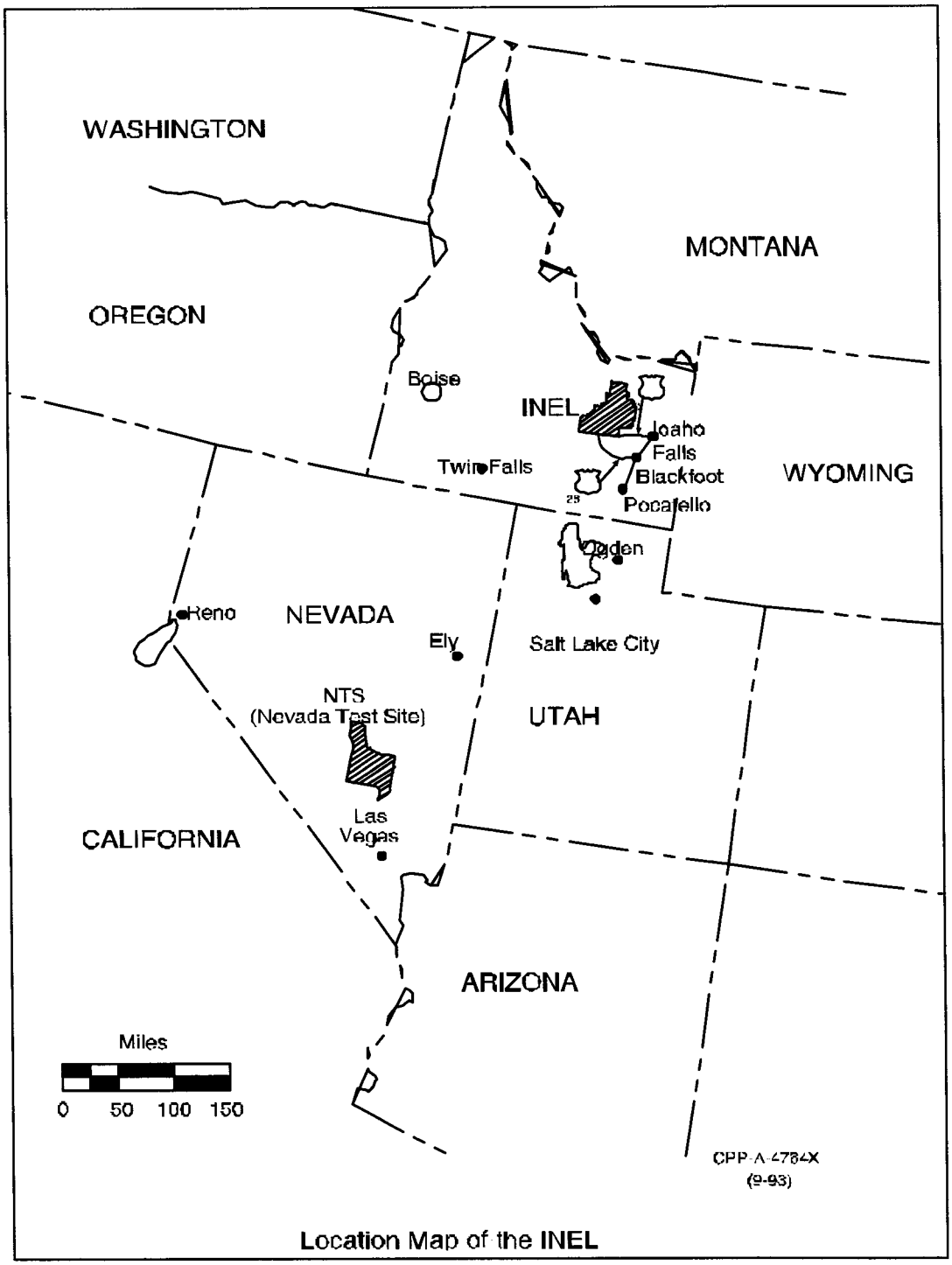
Table 2.6-20. Lengths and Length Statistics for Lava Flows in the INEEL area. Lengths Measured from References [2.166] and [2.55]

	Length	Lava flow name or location
QBa	5.4	North Robbers flow
	3.5	South Robbers flow
	21	Cerro Grande flow south
	15	Cerro Grande flow north
	31	Hells-Half Acre flow
	21	Wapi Flow
	3	Kings Bowl flow
QBb	8	Arco lava field
	9	Taber lava field
	27	Quaking Aspen Butte
	17	North of Big Southern Butte
	12	Fingers Butte
	13	Near N. and S. Robbers
	18	SW of Big Southern Butte
QBc	18	Table Legs Butte
	18	St. Marys Nipple
	10	Little Butte
	27	Little Butte South
	28	Kettle Butte
	10	Section 5, T3N, R34E
	25	ANL-W (north)
	15	ANL-W (south)
	16	Mid Butte
	18	Section 35, T4N, R33E
	8	Near 2-2A
	7	Section 33, T4N, R33E
	8	Section 20, T4N, R33E
	10	Near Unnamed Rhyolite Dome
	15	EastButte Crater
	10	Section 14, T3N, R33E
	11	NW of Wildhorse Butte
	10	Just north of Twin Buttes
	0.5	Coyote Butte
QBd	27	Crater Peak
	10	Sixmile Butte
	5	Lavatoo
	0.5	Small butte near Teakettle
	0.1	Small butte near Teakettle
	0.5	Small butte near Teakettle
	7	Butterfly Butte
	6	Butterfly Butte South
	13	Section 36, T5N, R34E
	6	Table Butte
	7.5	Cedar Butte (N. of Mud Lake)
	10	section 6, T4N, R.34E
	12	Crater Peak, SE

Descriptive Statistics	
Mean	12.457
Standard Error	1.1713
Median	10
Mode	10
Standard Deviation	7.944
Sample Variance	63.107
Kurtosis	-0.26
Skewness	0.5889
Range	30.9
Minimum	0.1
Maximum	31
Sum	573
Count	46
95%Confidence Lev.	2.3591

length	*Percentile*
31	100.00%
28	97.70%
27	91.10%
27	91.10%
27	91.10%
25	88.80%
21	84.40%
21	84.40%
18	75.50%
18	75.50%
18	75.50%
18	75.50%
17	73.30%
16	71.10%
15	64.40%
15	64.40%
15	64.40%
13	60.00%
13	60.00%
12	55.50%
12	55.50%
11	53.30%
10	37.70%
10	37.70%
10	37.70%
10	37.70%
10	37.70%
10	37.70%
10	37.70%
9	35.50%
8	28.80%
8	28.80%
8	28.80%
7.5	26.60%
7	22.20%
7	22.20%
6	17.70%
6	17.70%
5.4	15.50%
5	13.30%
3.5	11.10%
3	8.80%
0.5	2.20%
0.5	2.20%
0.5	2.20%
0.1	.00%

2.10 Figures



Location Map of the INEL

Figure 2.1-1

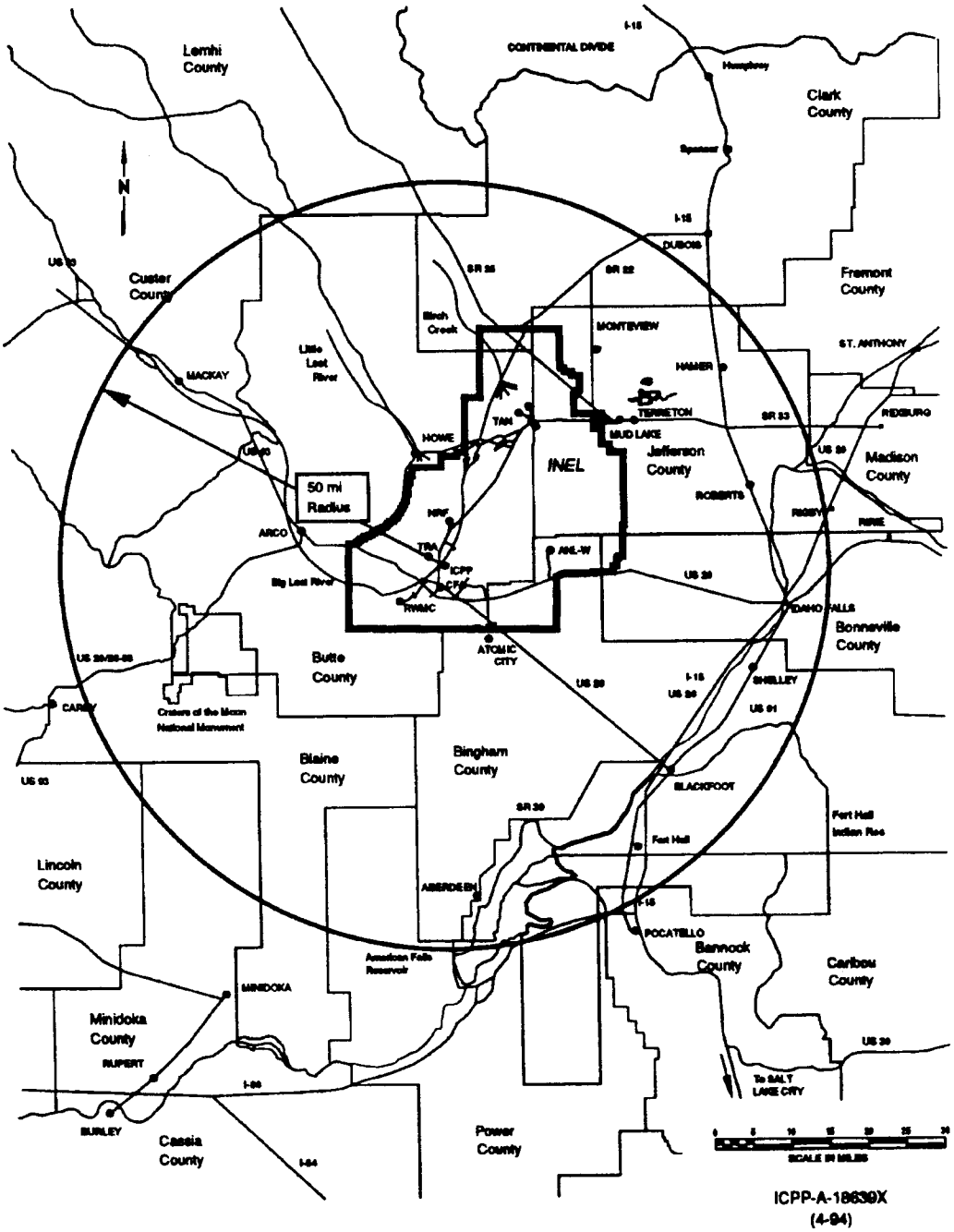


Figure 2.1-2. INEEL Vicinity Map (with 50-mile radius line).

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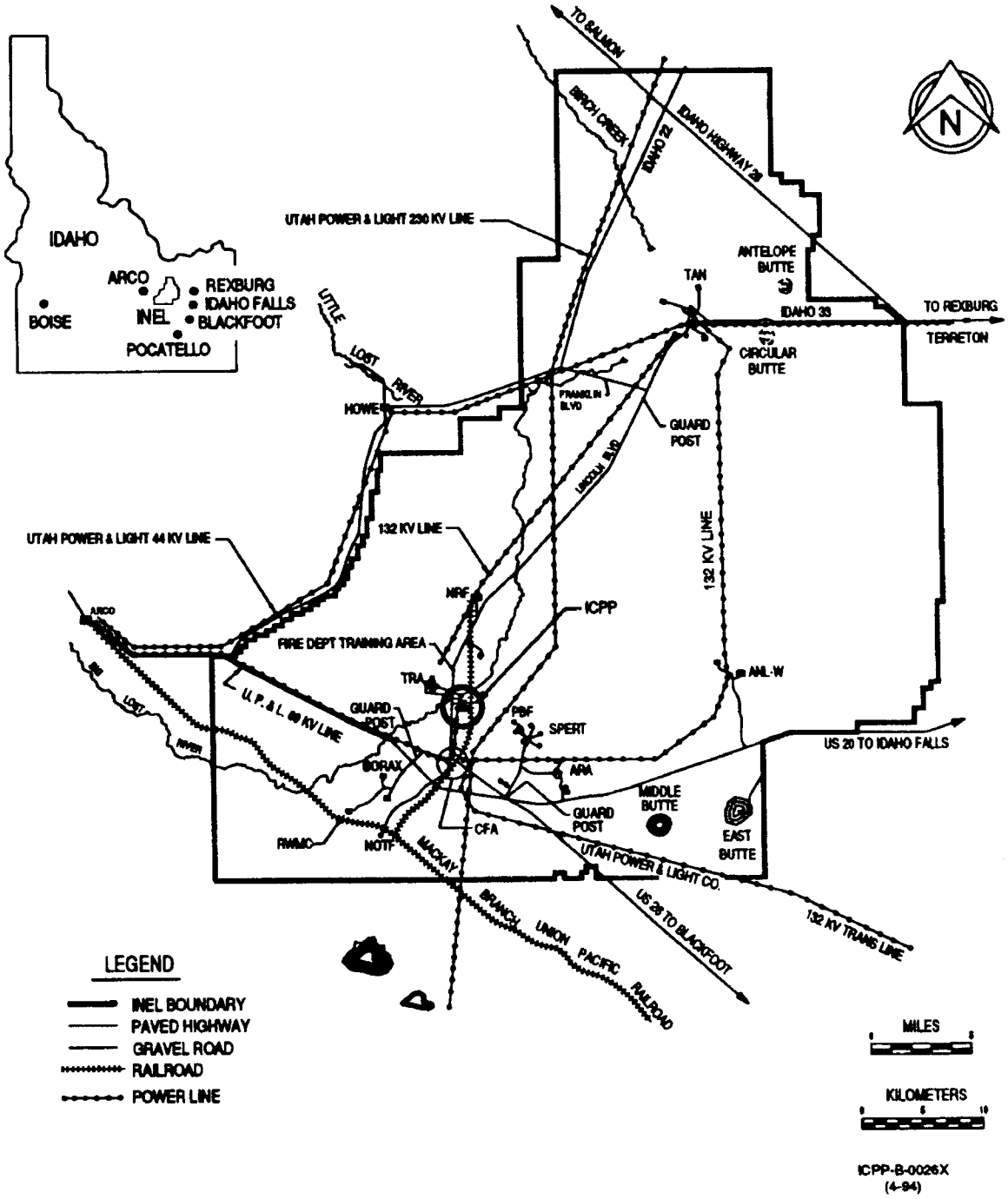


Figure 2.1-3. Map of INEEL.

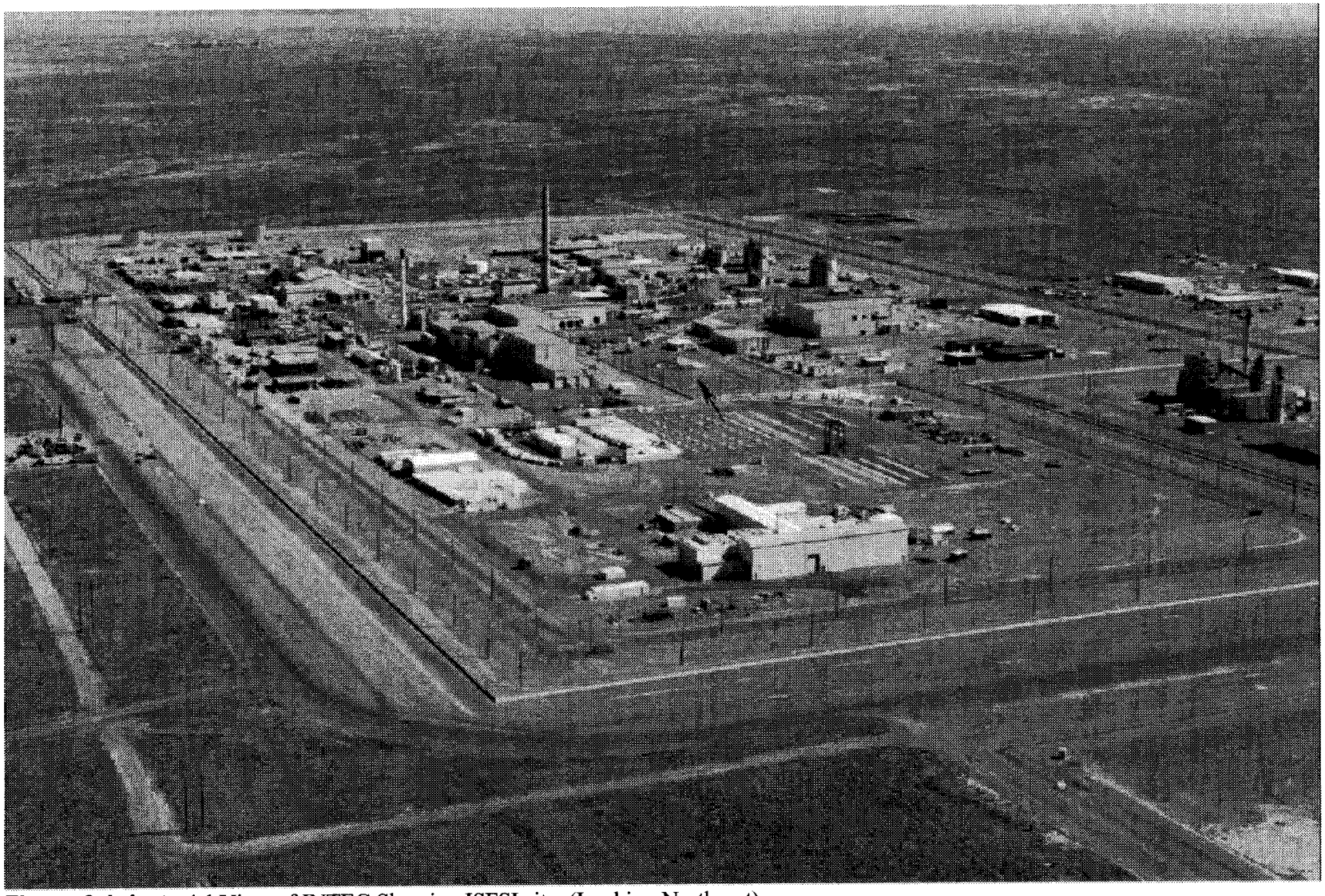


Figure 2.1-4. Aerial View of INTEC Showing ISFSI site. (Looking Northeast)

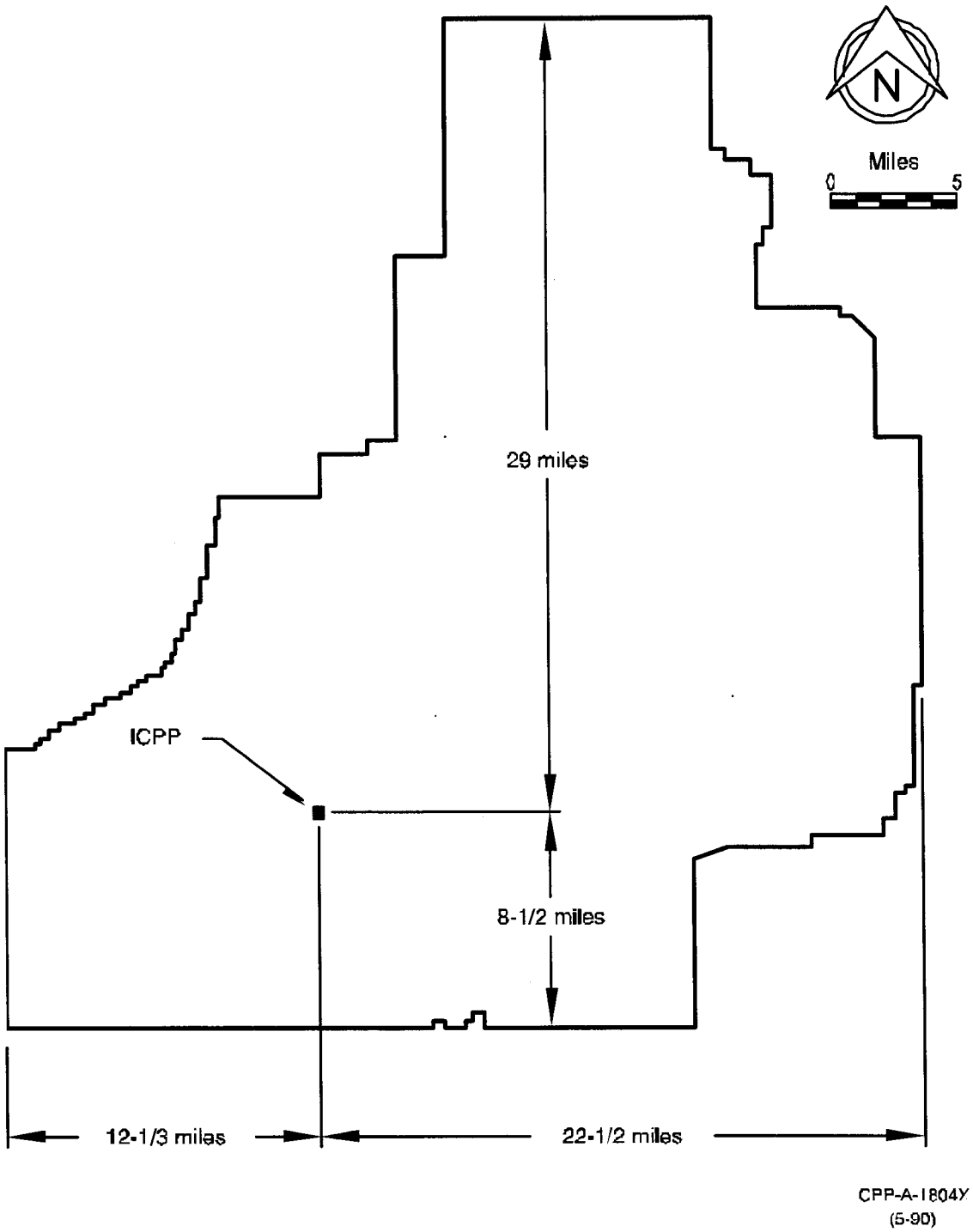


Figure 2.1-5 Distances from the TMI-2 ISFSI to the INEEL Boundary (Controlled Area).

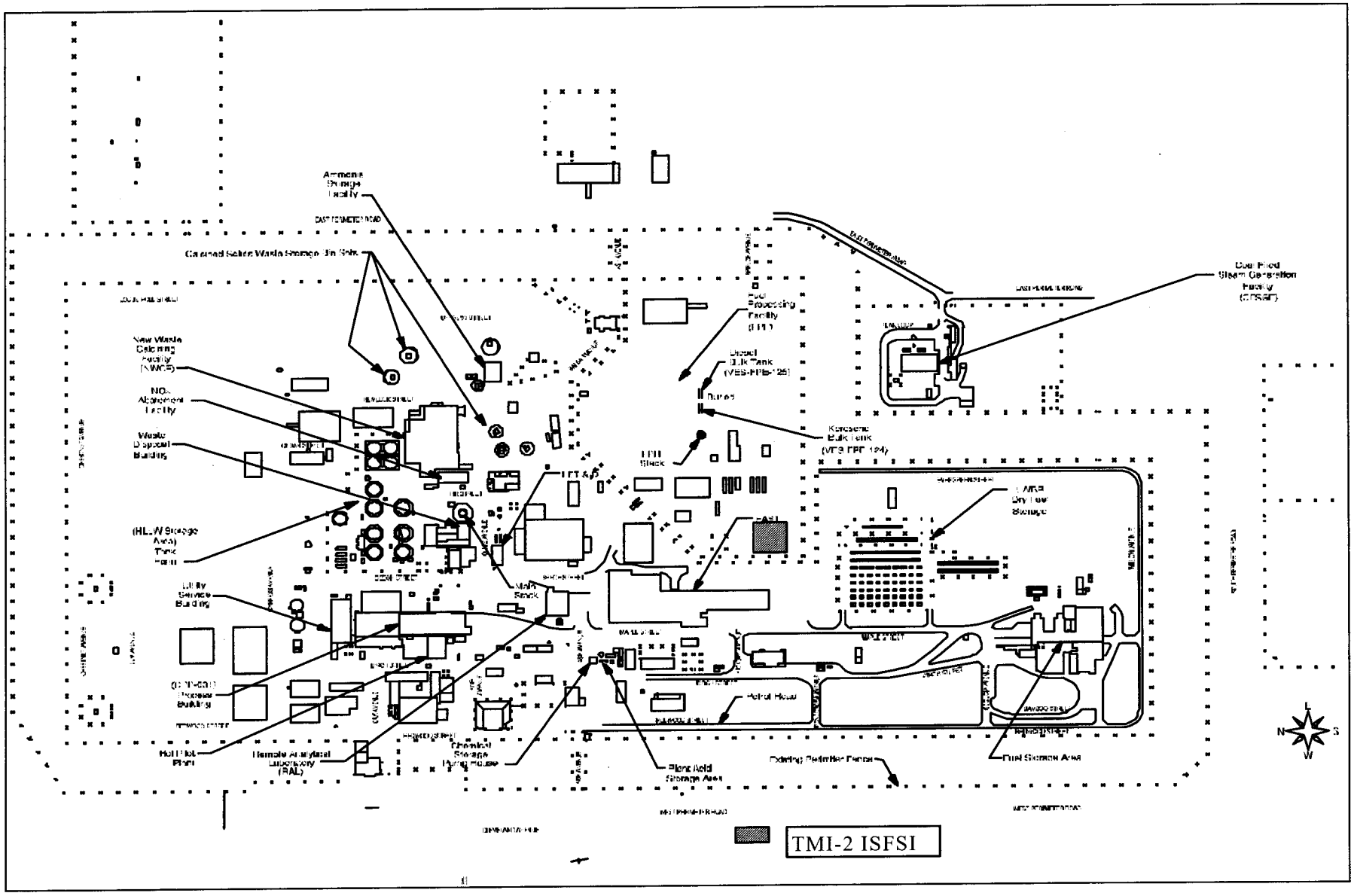


Figure 2.1-6 INTEC Area Plot Plan (not to scale).

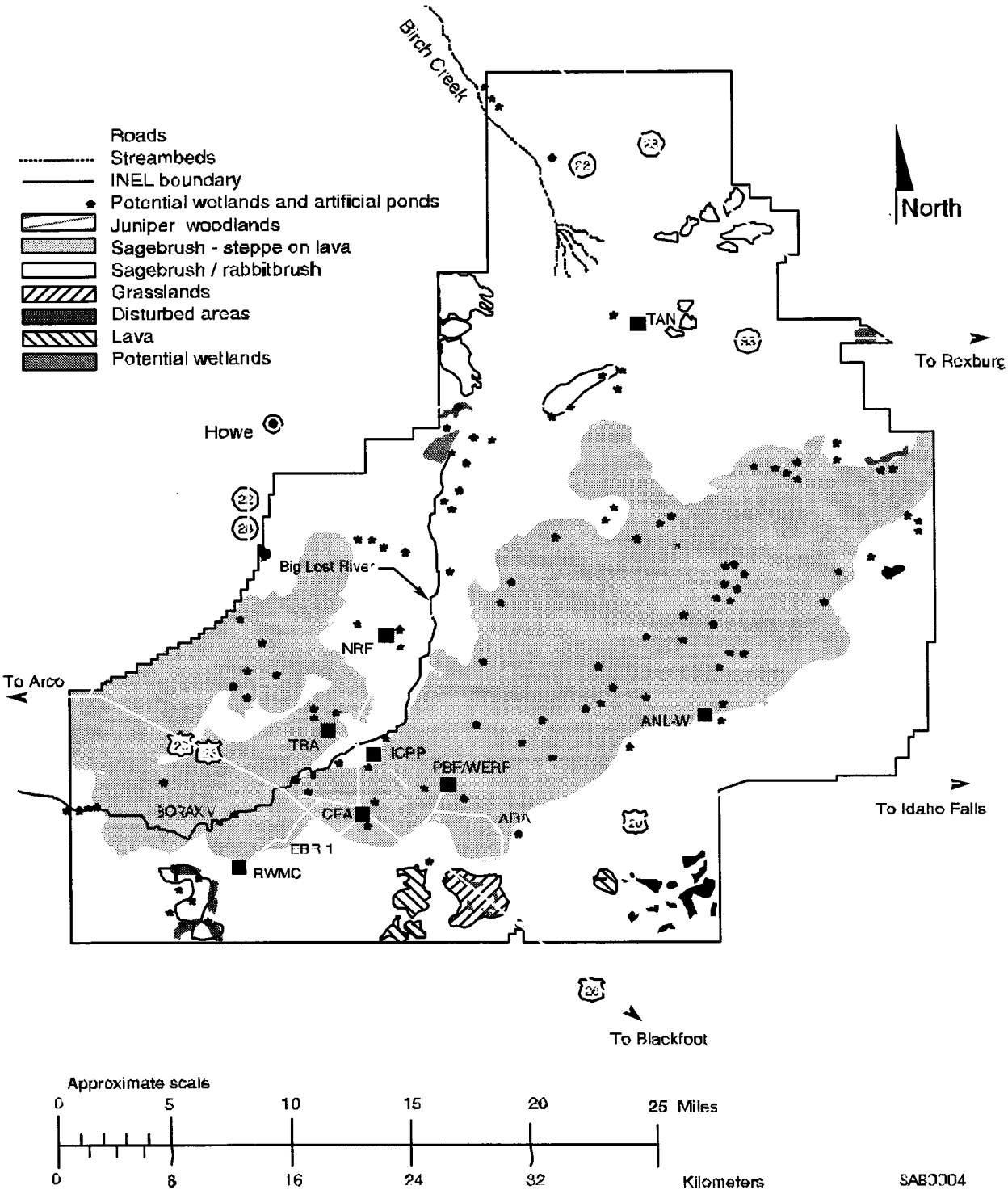


Figure 2.1-7 Approximate Distribution of Vegetation at the INEEL.

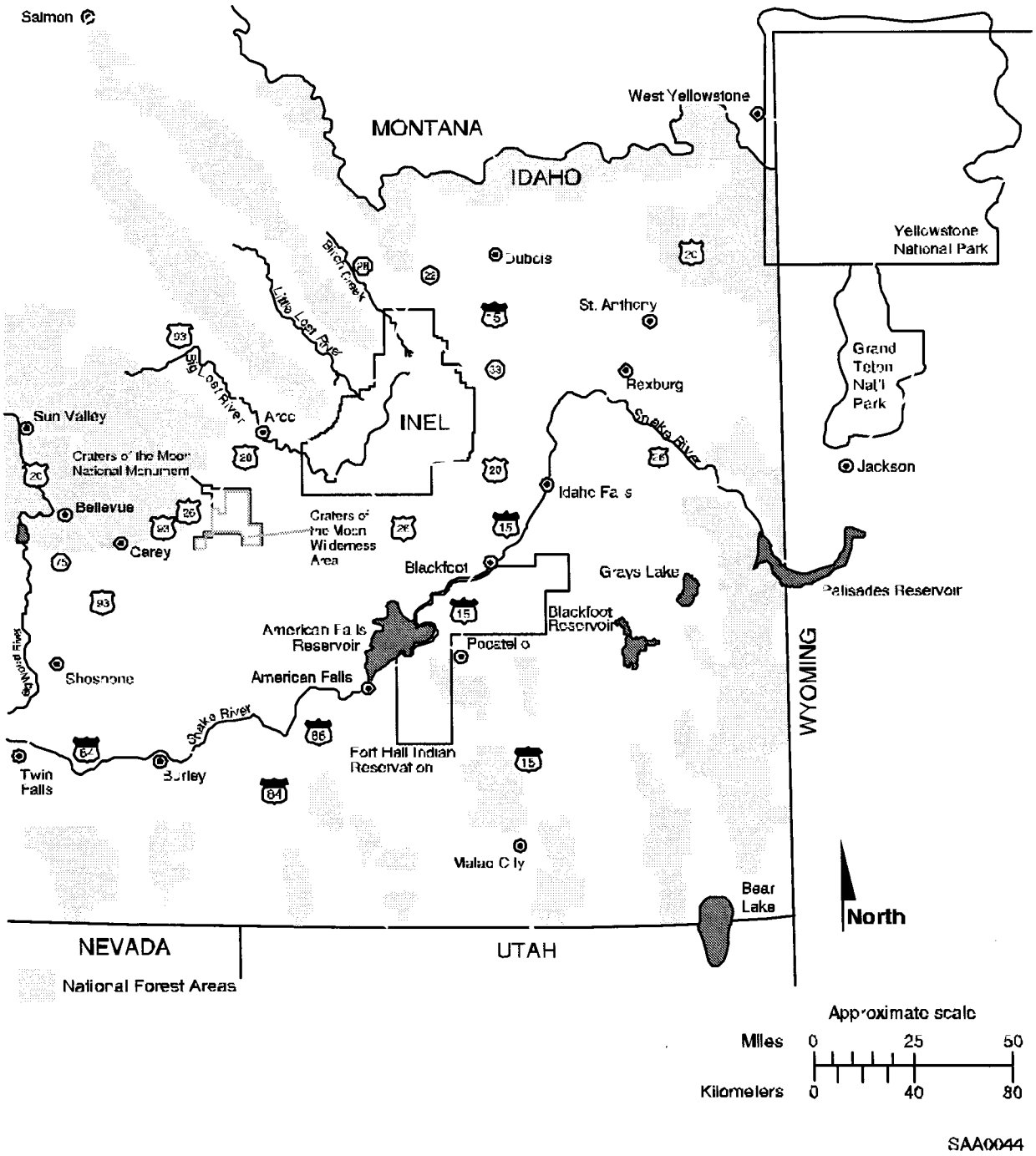
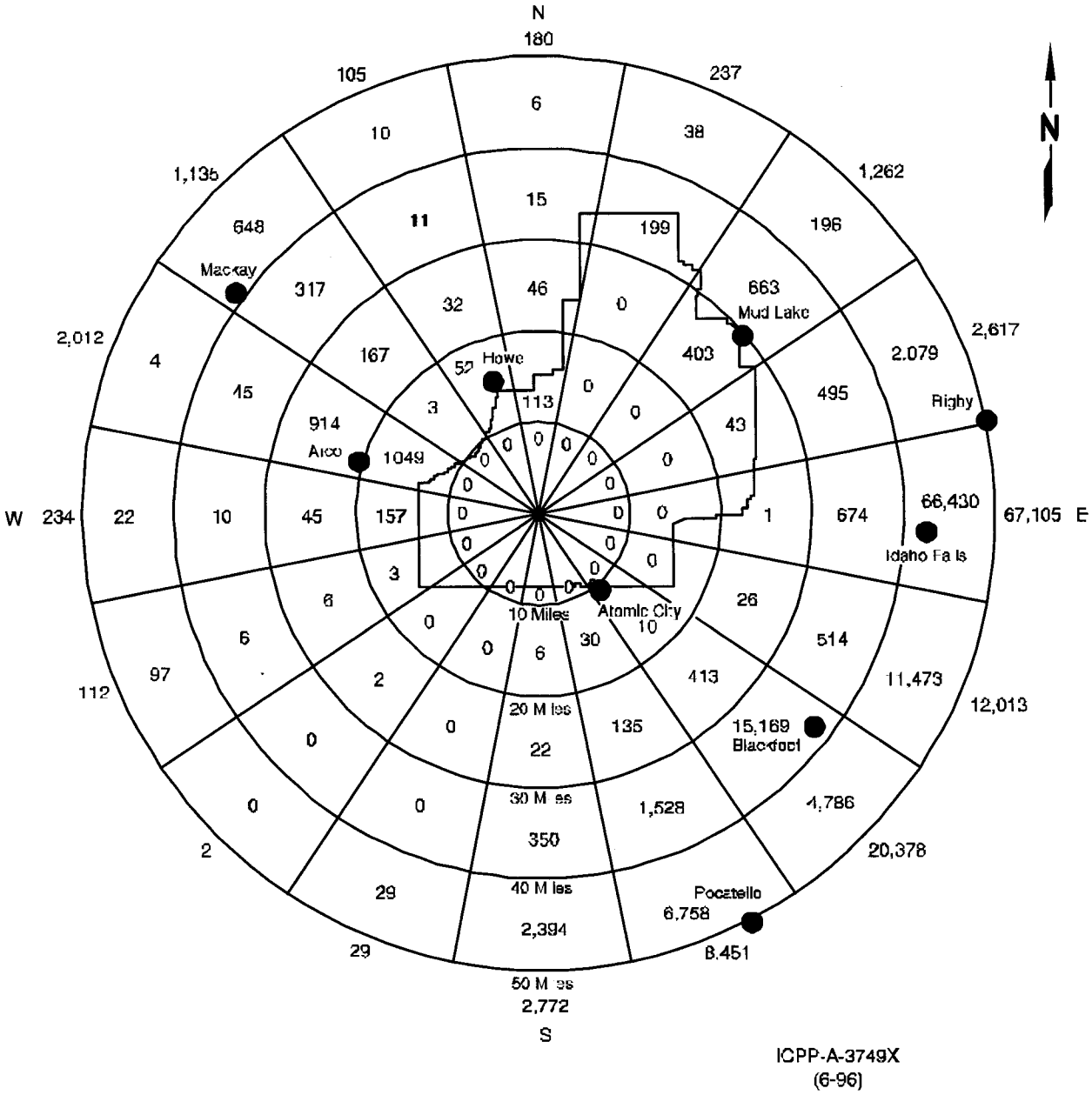
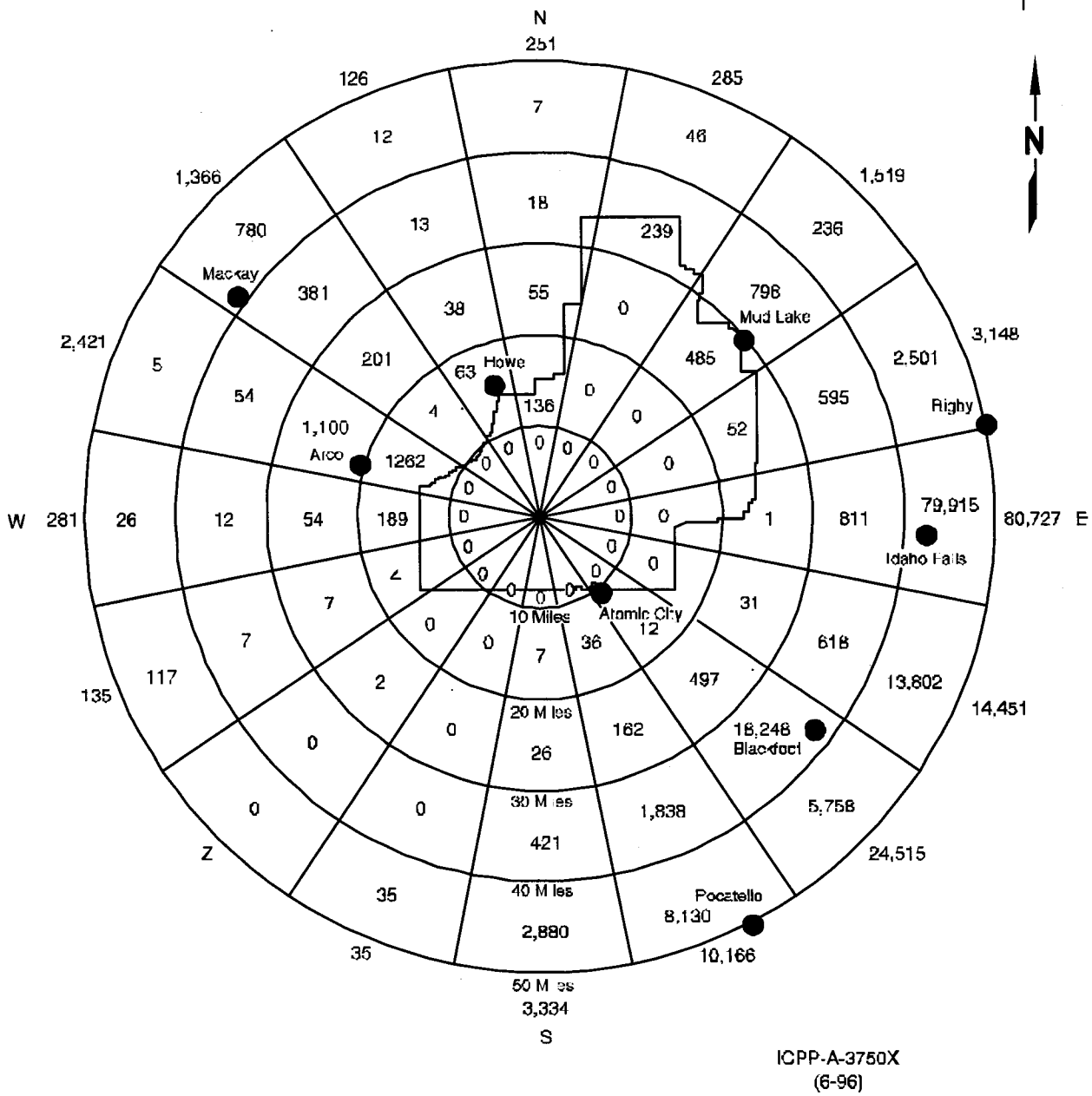


Figure 2.1-8 Location of the INEL in Southeastern Idaho.



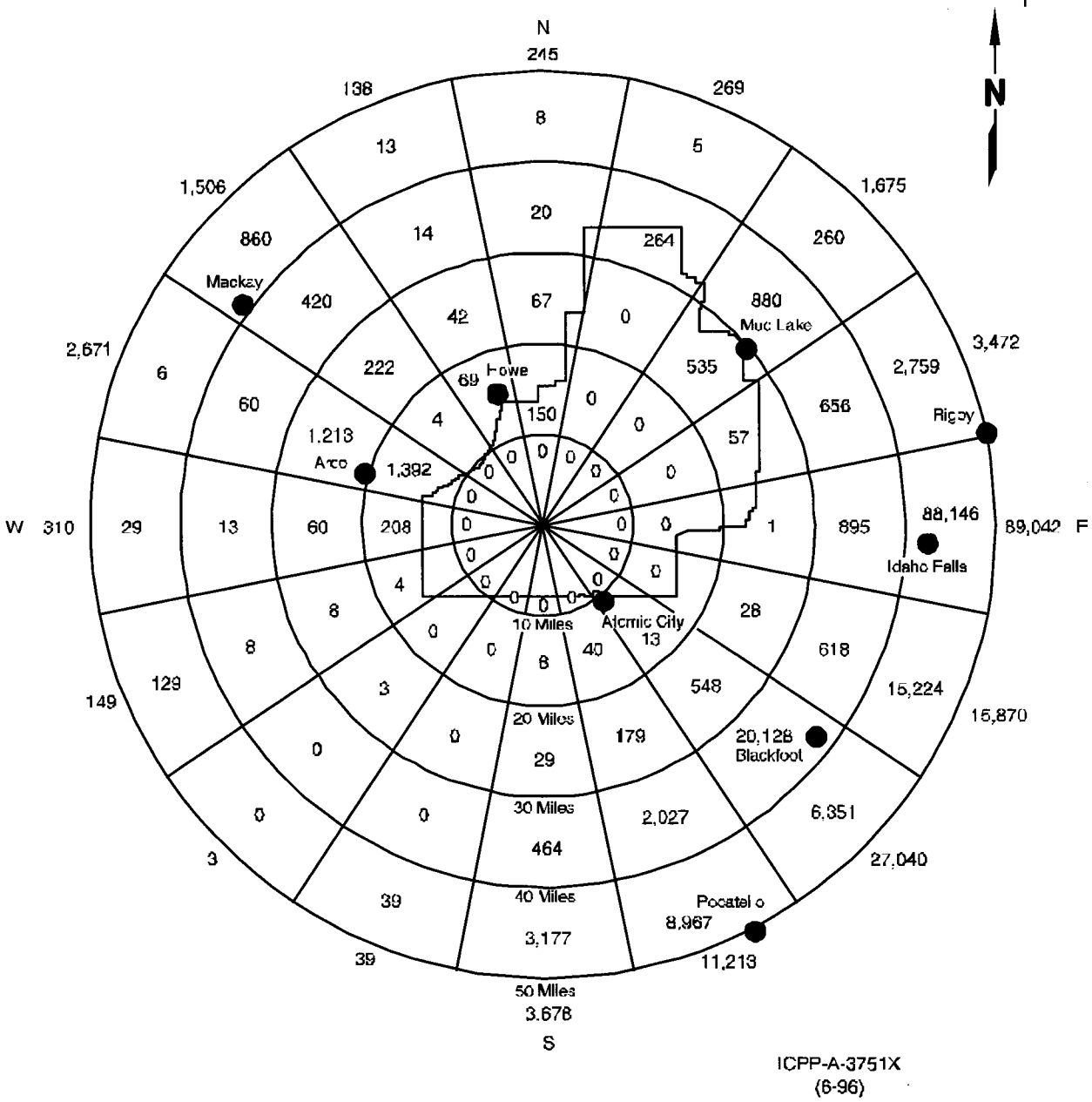
Total: **118,644**

Figure 2.1-9 Population Distribution for 1990



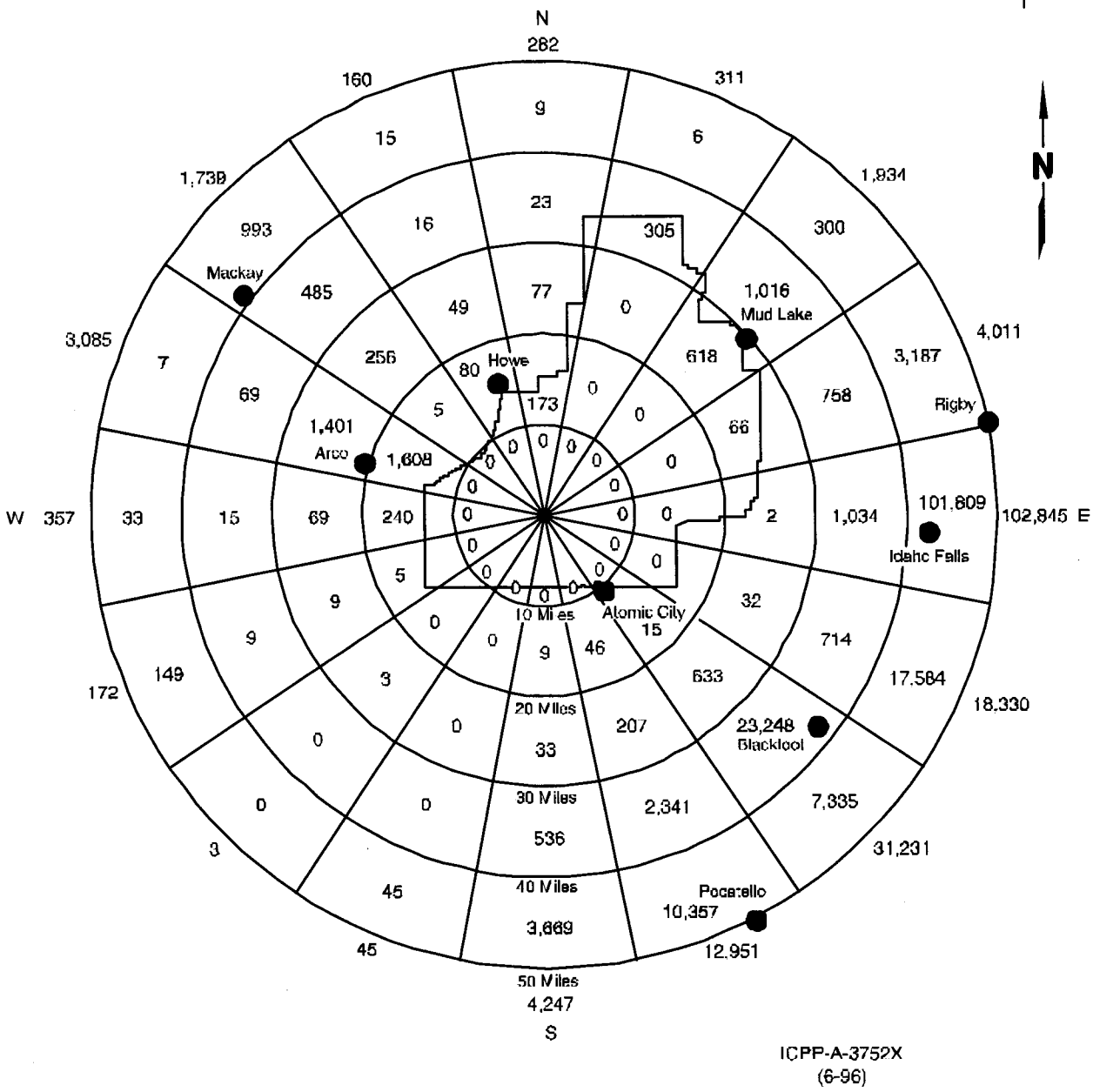
Total: **142,727**

Figure 2.1-10 Population Distribution for 2000.



Total: 157,320

Figure 2.1-11 Population Distribution for 2010.



Total: **181,703**

Figure 2.1-12 Population Distribution for 2020.

ANL-W Argonne National Laboratory-West
ARA Auxiliary Reactor Area
CFA Central Facilities Area
EBR- Experimental Breeder Reactor - I
ICPP Idaho Chemical Processing Plant
NRF Naval Reactors Facility
PBF Power Burst Facility
RWMC Radioactive Waste Management Complex
TAN Test Area North
TRA Test Reactor Area
WERF Waste Experimental Reduction Facility

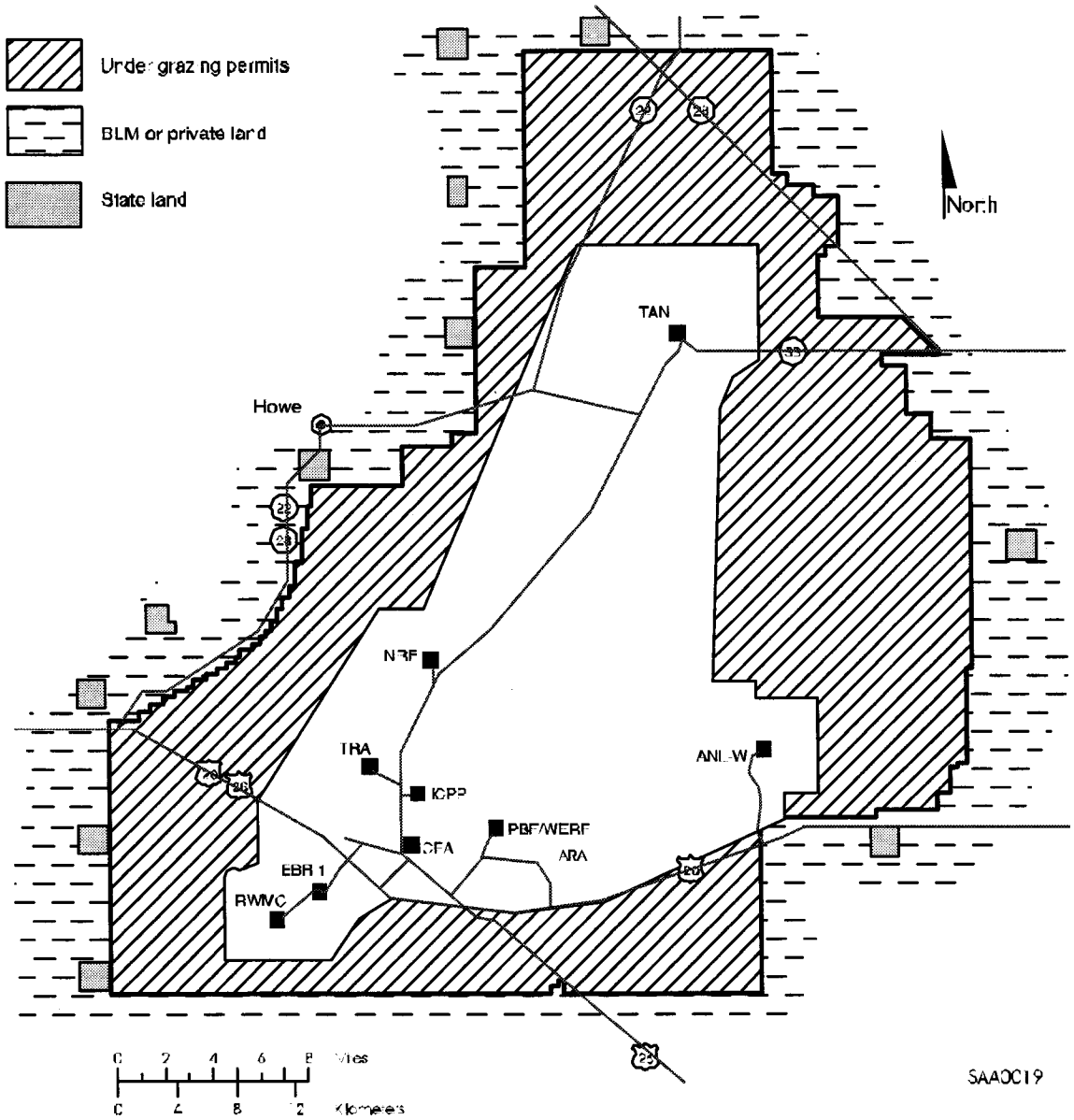
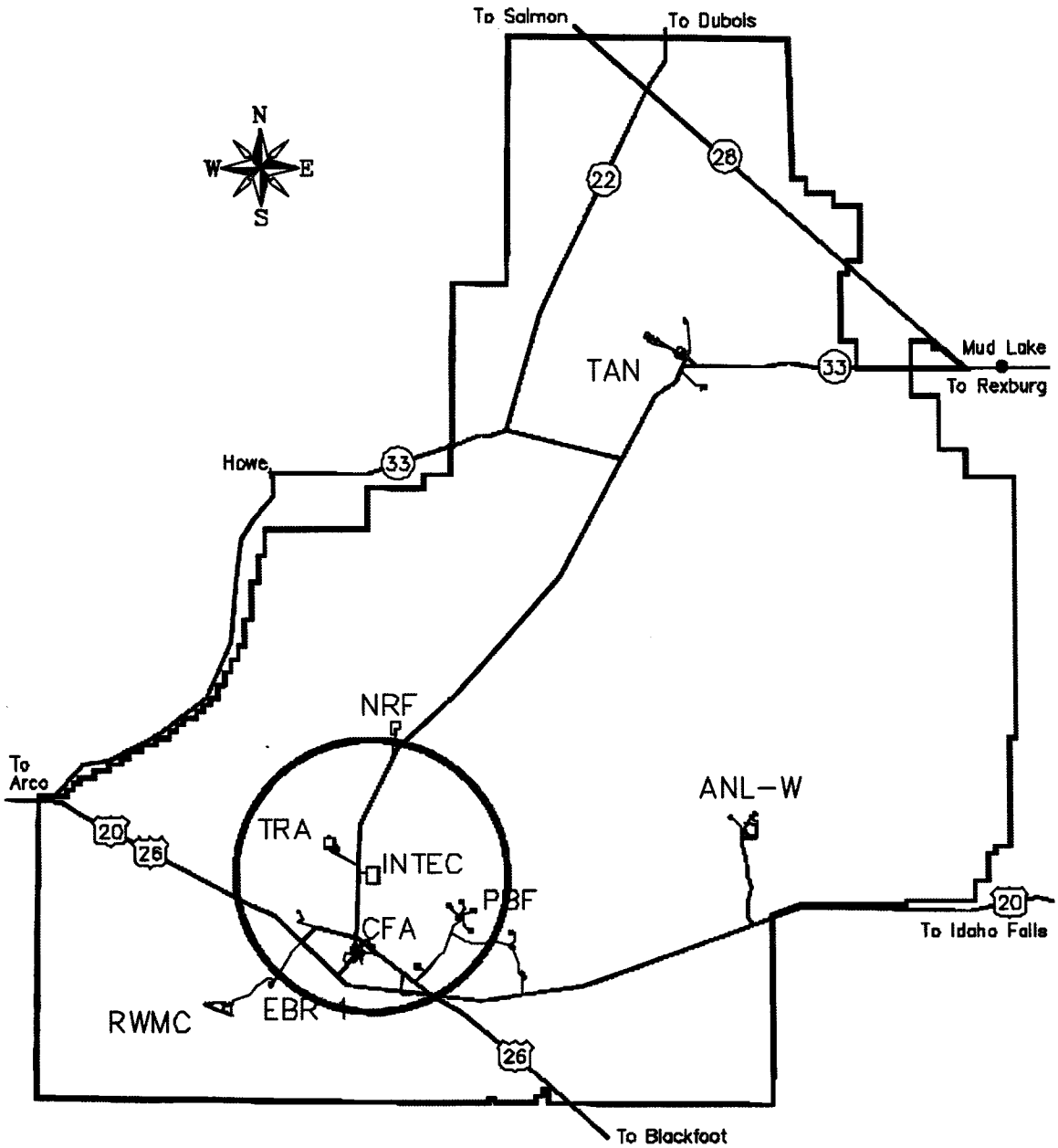


Figure 2.1-13 Selected Land Uses at the INEEL and Surrounding Region.



Central Facilities Area (CFA)
Argonne National Laboratory West (ANL-W)
Experimental Beeder Reactor-1 (EBR-1)
Idaho Nuclear Technology and Engineering Center (INTEC)
Naval Reactor Facility (NRF)
Power Burst Facility (PBF)
Radioactive Waste Management Complex (RWMC)
Test Area North (TAN)
Test Reactor Aea (TRA)

GT980173

Figure 2.2-1. **Idaho National Engineering and Environmental Laboratory's Primary Facility Areas (showing 5-mile radius from TMI-2 ISFSI).**

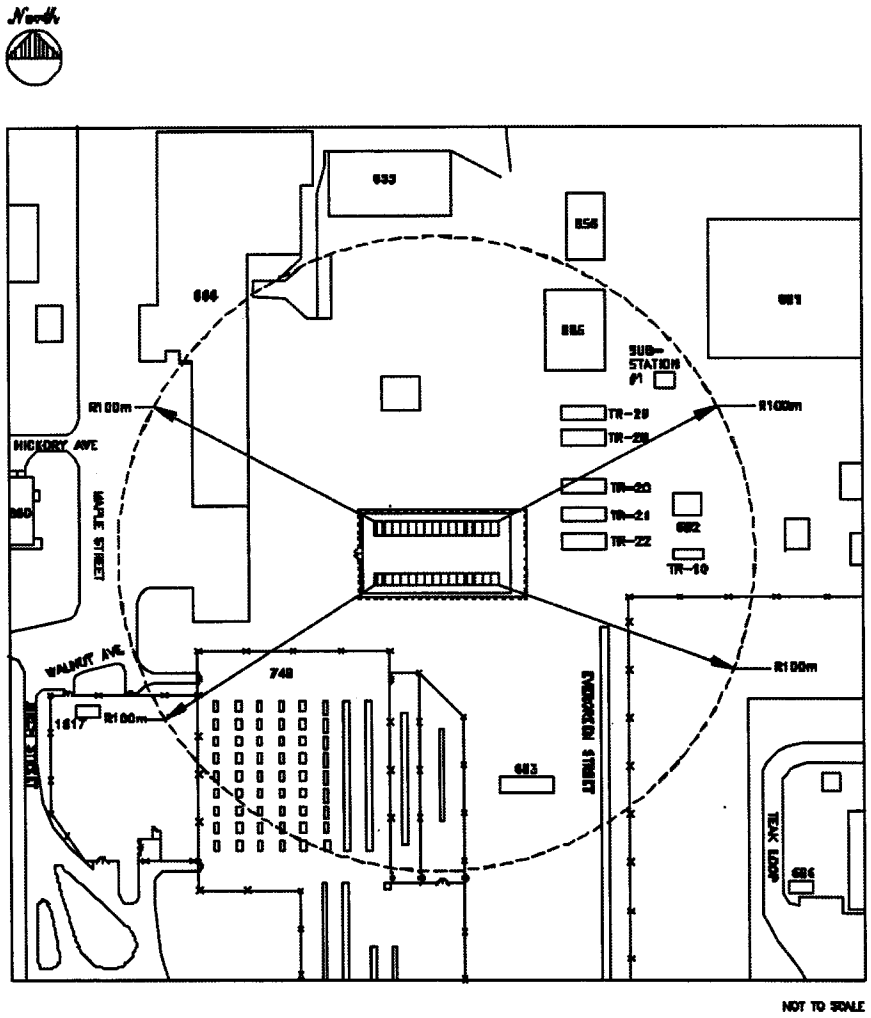
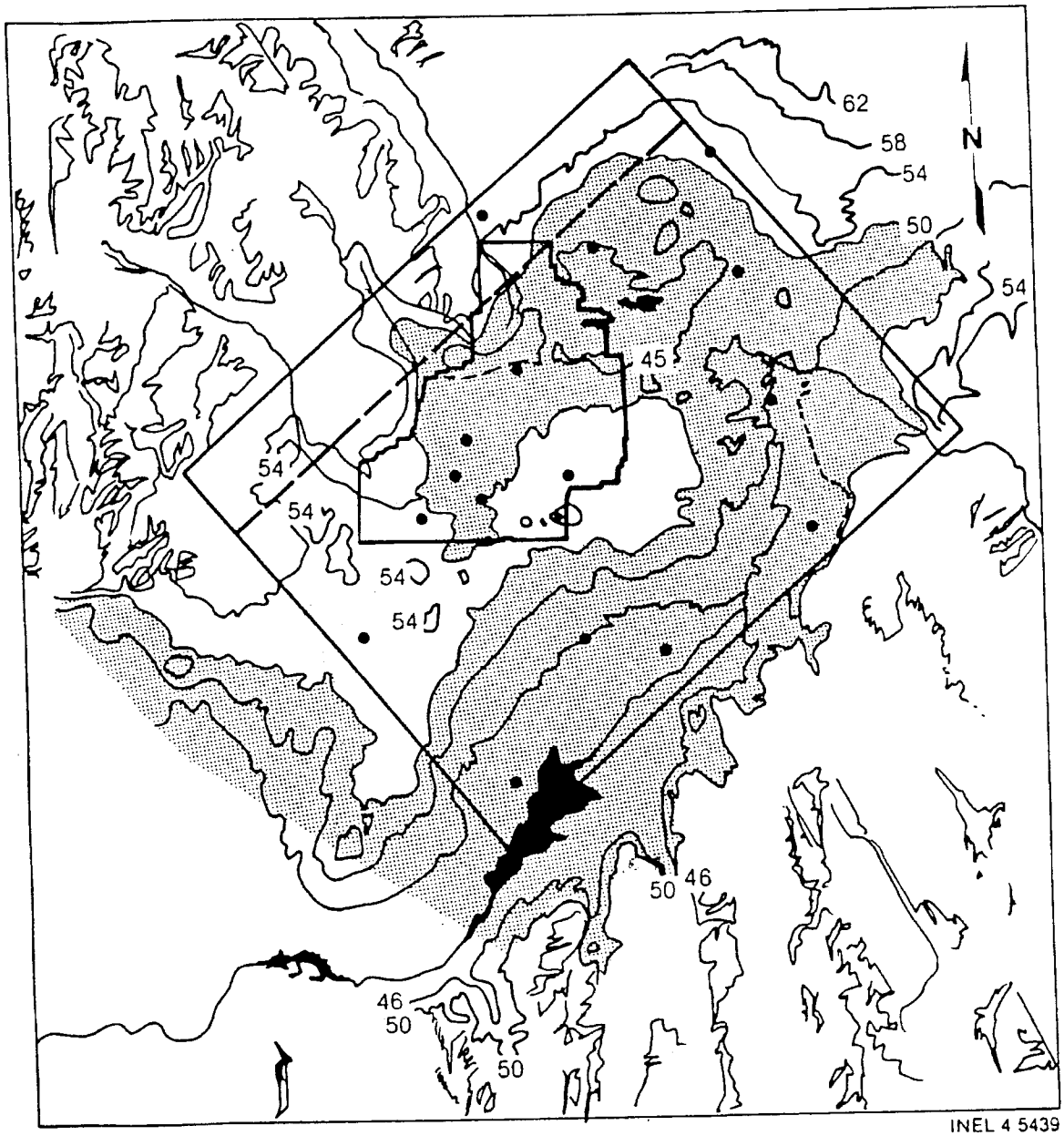


Figure 2.2-2 TMI-2 ISFSI Location with 100 meter Radius Line.



46-62 = Height values in hundreds of ft above mean sea level (msl)
= Below 5000 ft msl
Tick marks = 8.6 km (computational grid mesh size)
• = Tower-mounted wind sensors

Figure 2.3-1. Relief map of the ESRP.

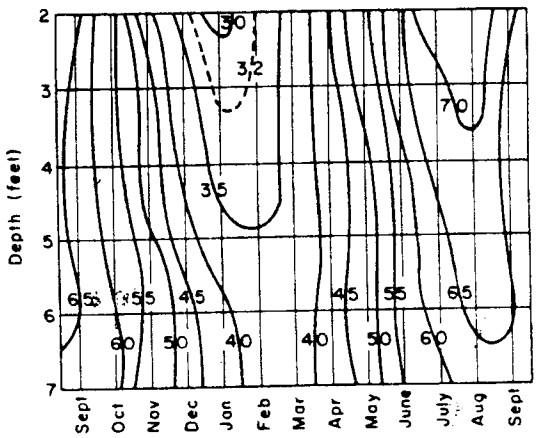


Figure 2.3-2. **Average monthly subsoil temperatures (°F), sandy soil surface.**

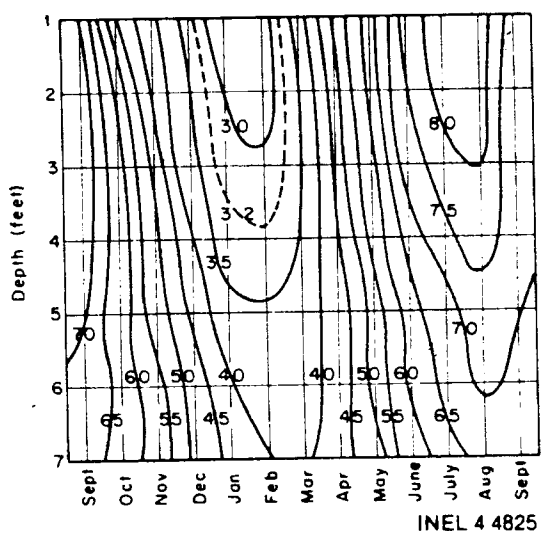


Figure 2.3-3. **Average monthly subsoil temperatures (°F), asphalt surface.**

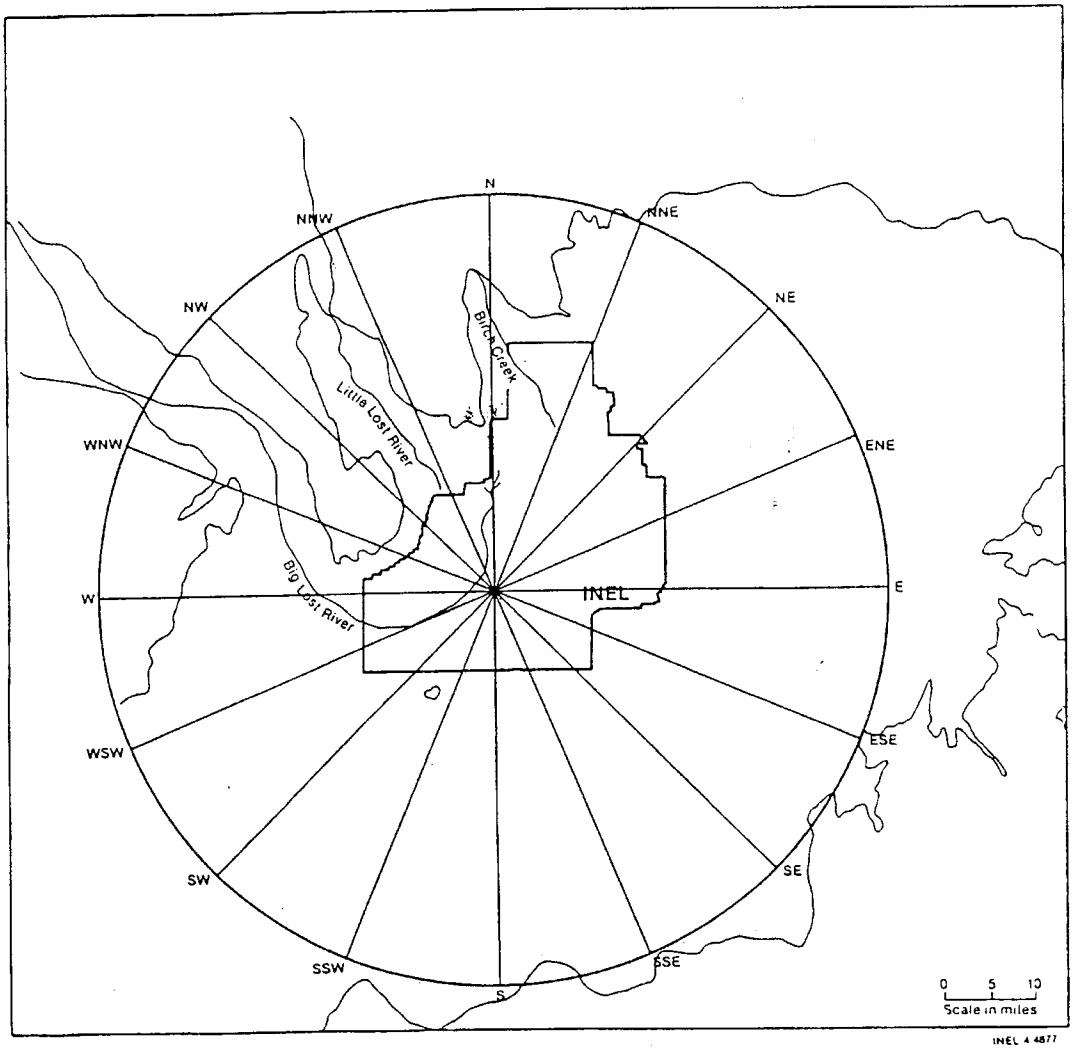


Figure 2.3-4. **TMI-2 ISFSI site 50-mi radius.**

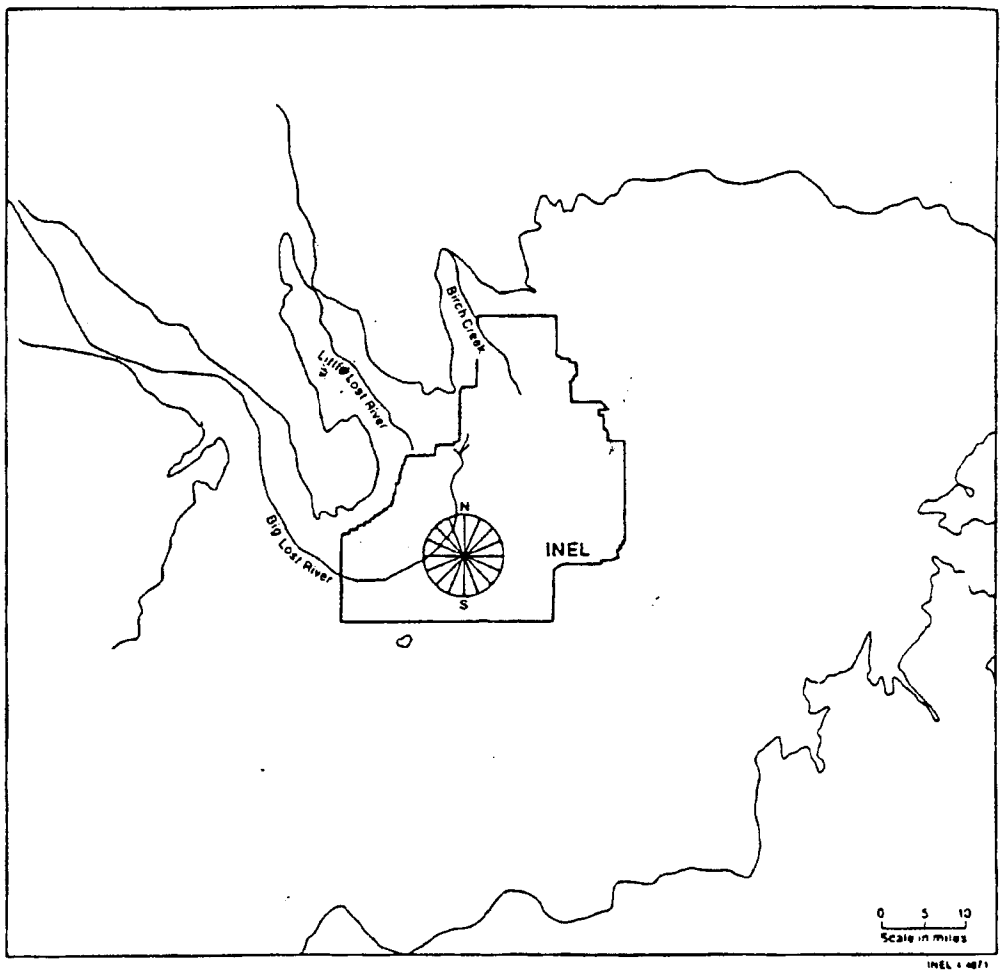


Figure 2.3-5. **TMI-2 ISFSI site 5-mi radius.**

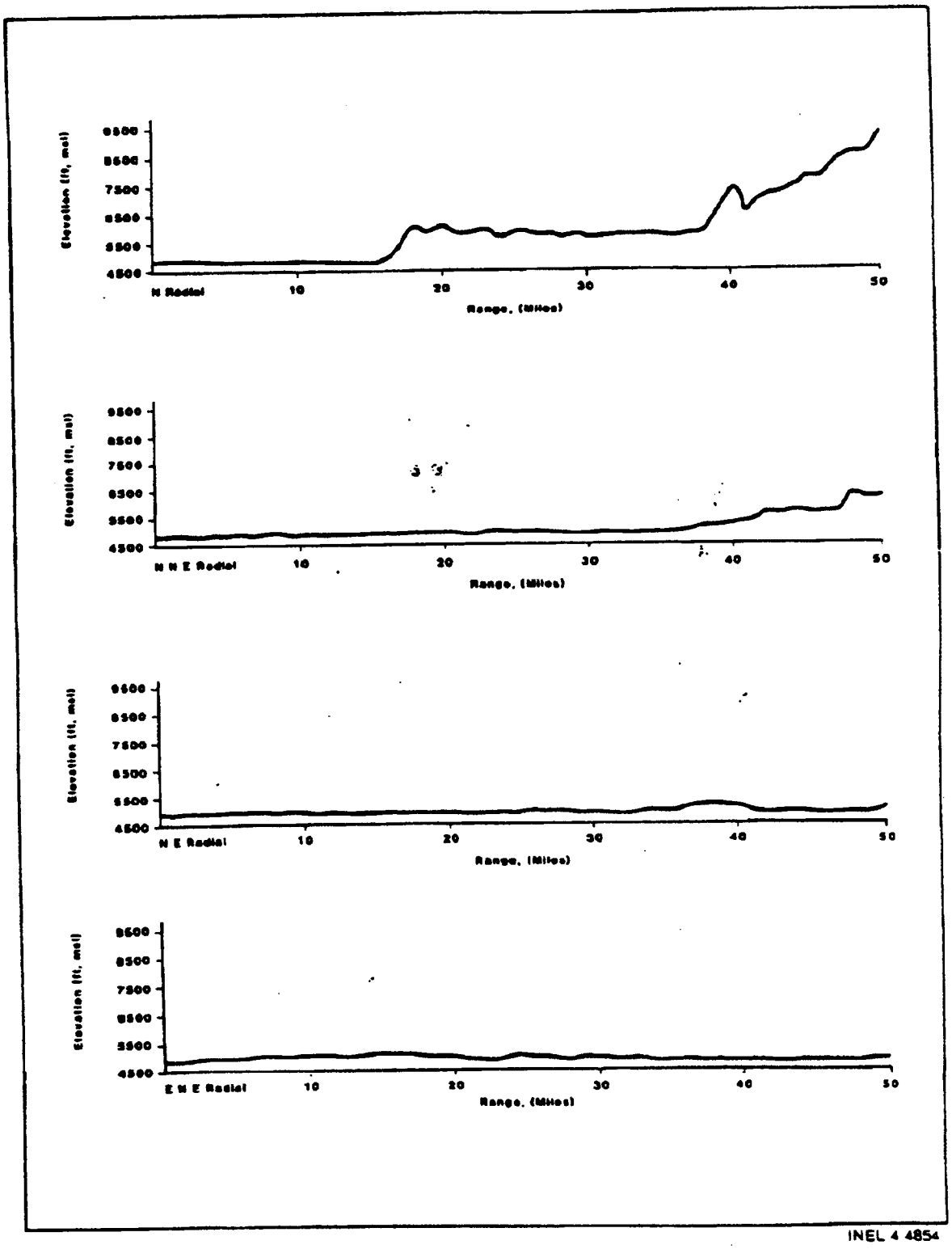


Figure 2.3-6. Topographic cross-sections for TMI-2 ISFSI site--50 mi radius, north and east radials.

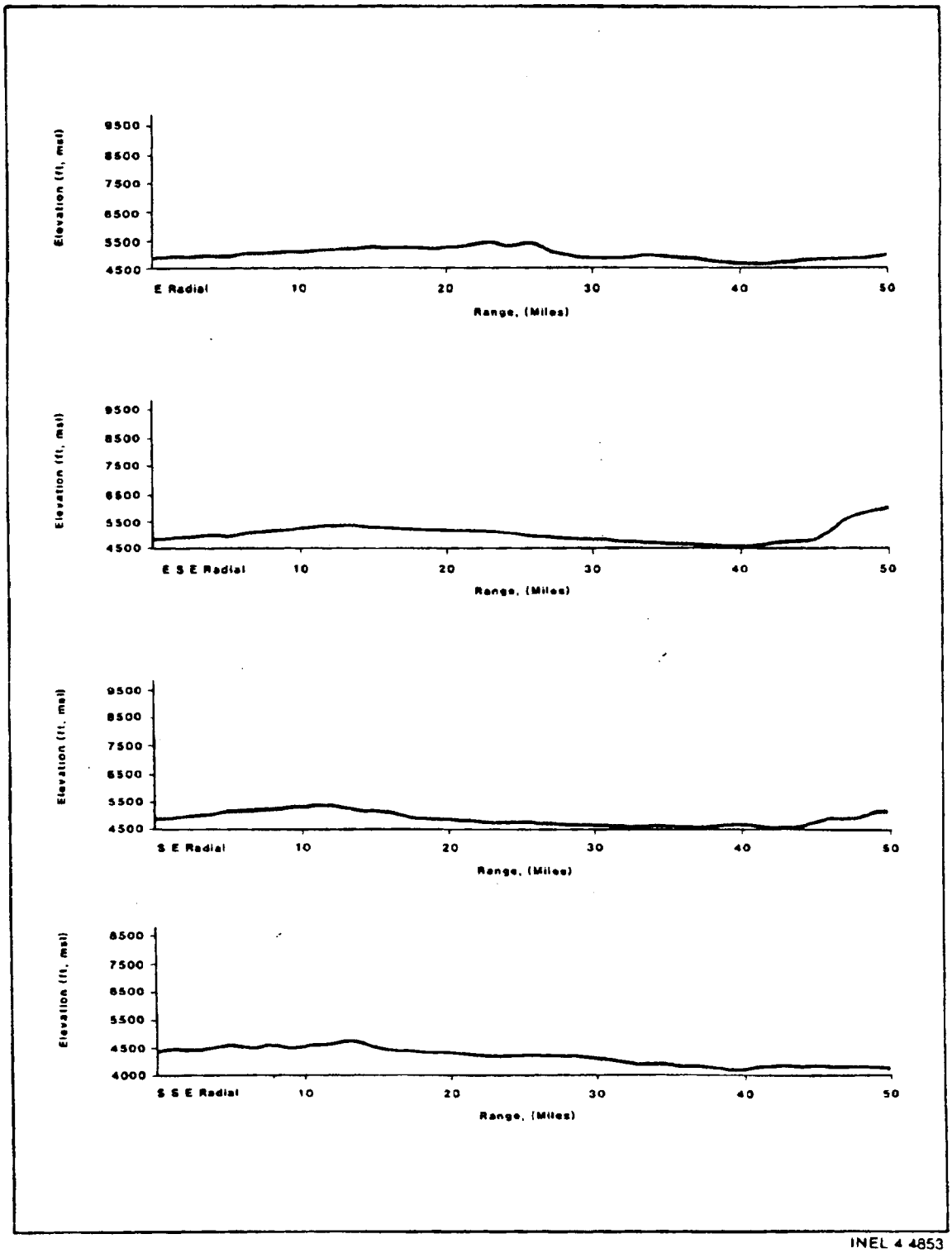
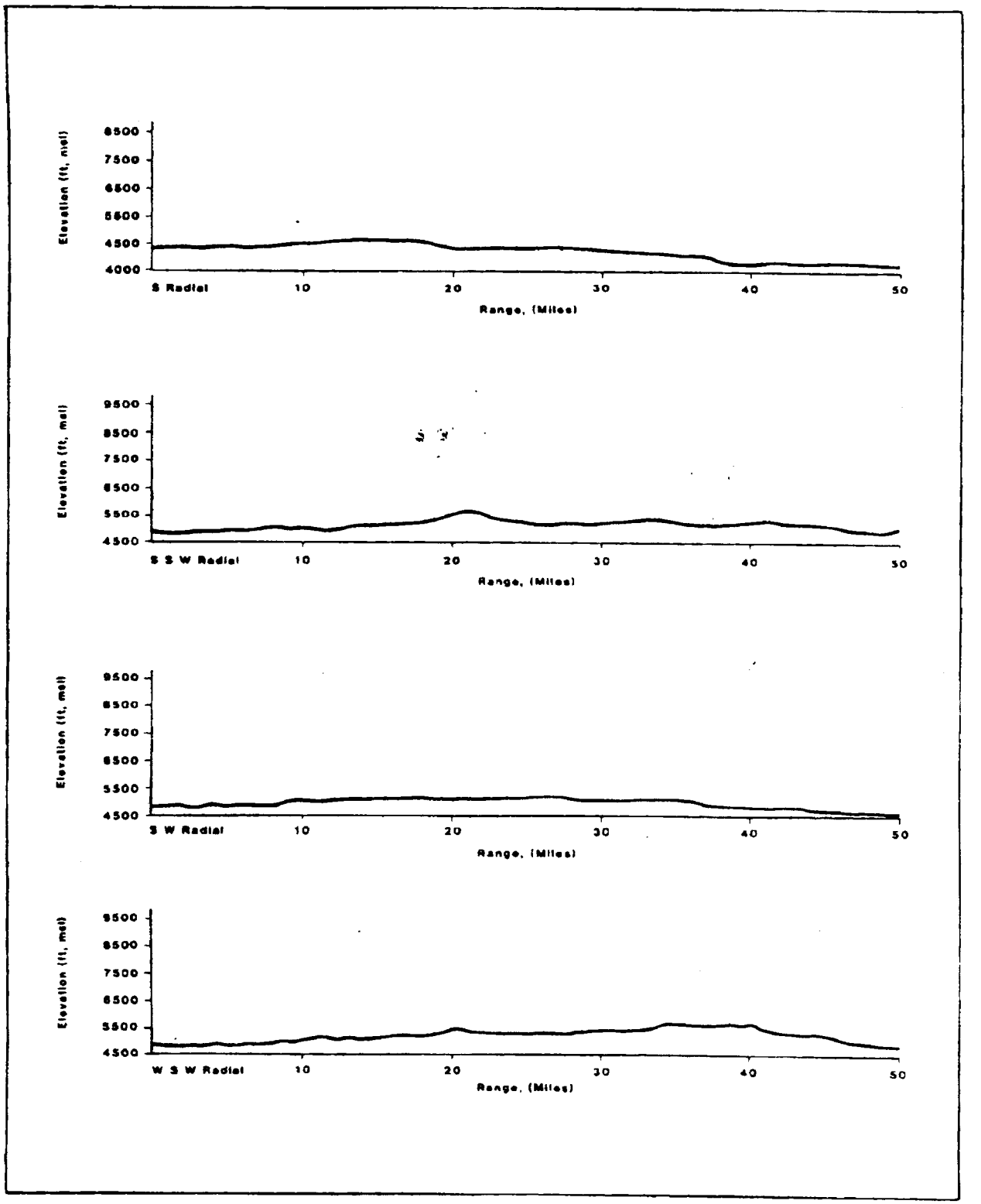
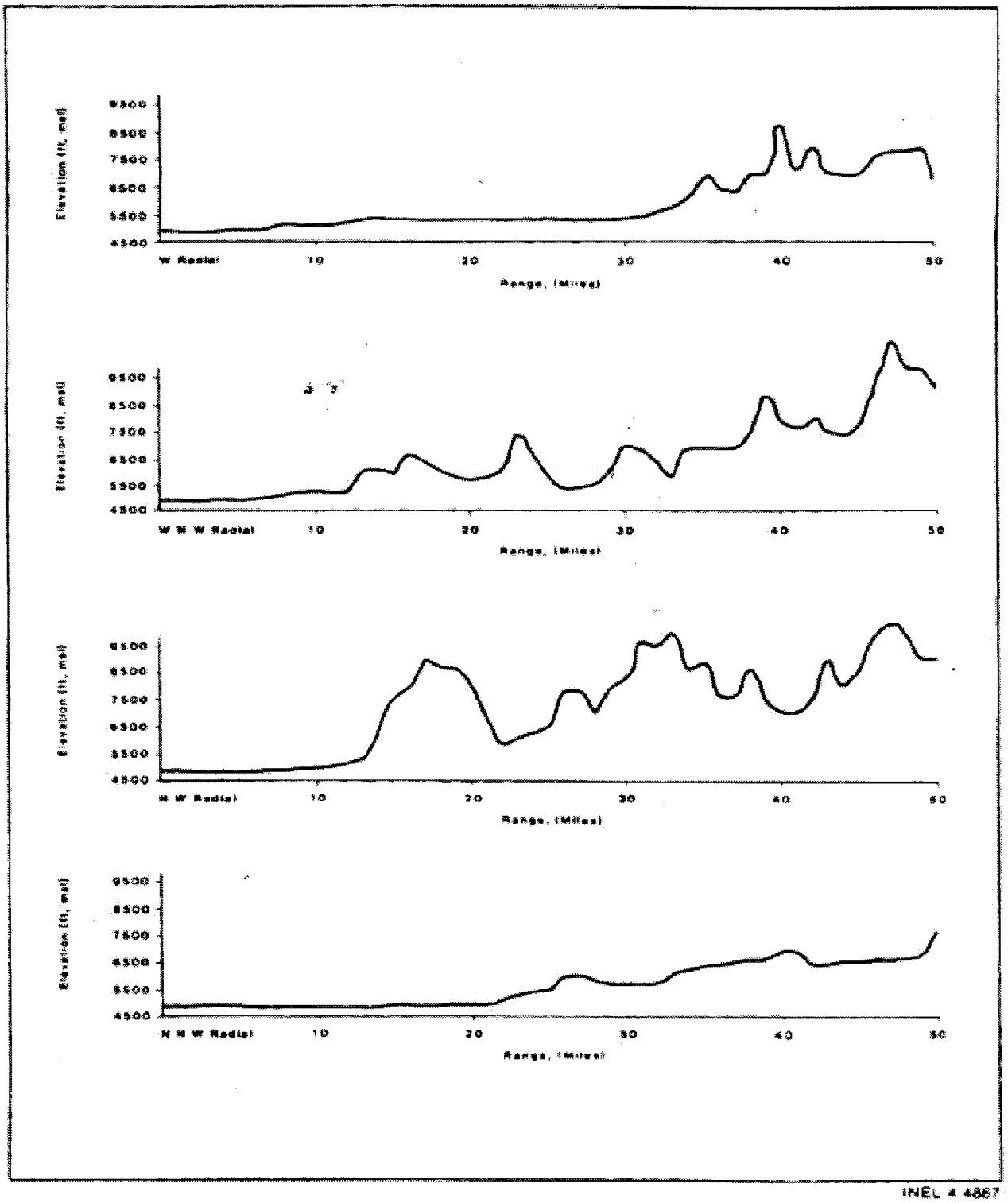


Figure 2.3-7. Topographic cross sections for the TMI-2 ISFSI site--50-mile south and east radials



INEL 4 4868

Figure 2.3-8. Topographic cross-sections for TMI-2 ISFSI site--50 mi radius, south and west radials.



INEL 4 4867

Figure 2.3-9. Topographic cross-sections for TMI-2 ISFSI site--50 mi radius, north and west radials.

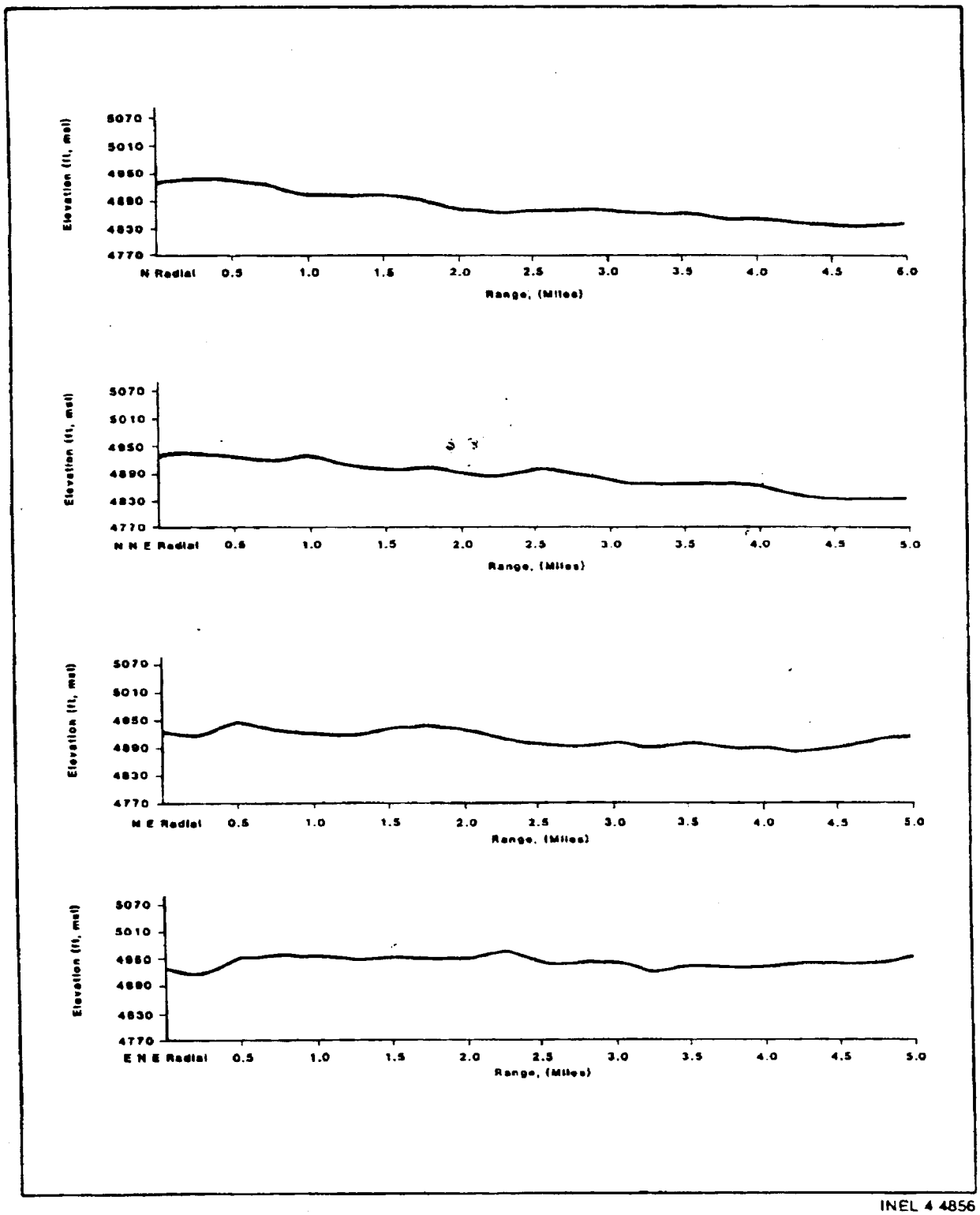


Figure 2.3-10. Topographic cross-sections for TMI-2 ISFSI site--5 mi radius, north and east radials.

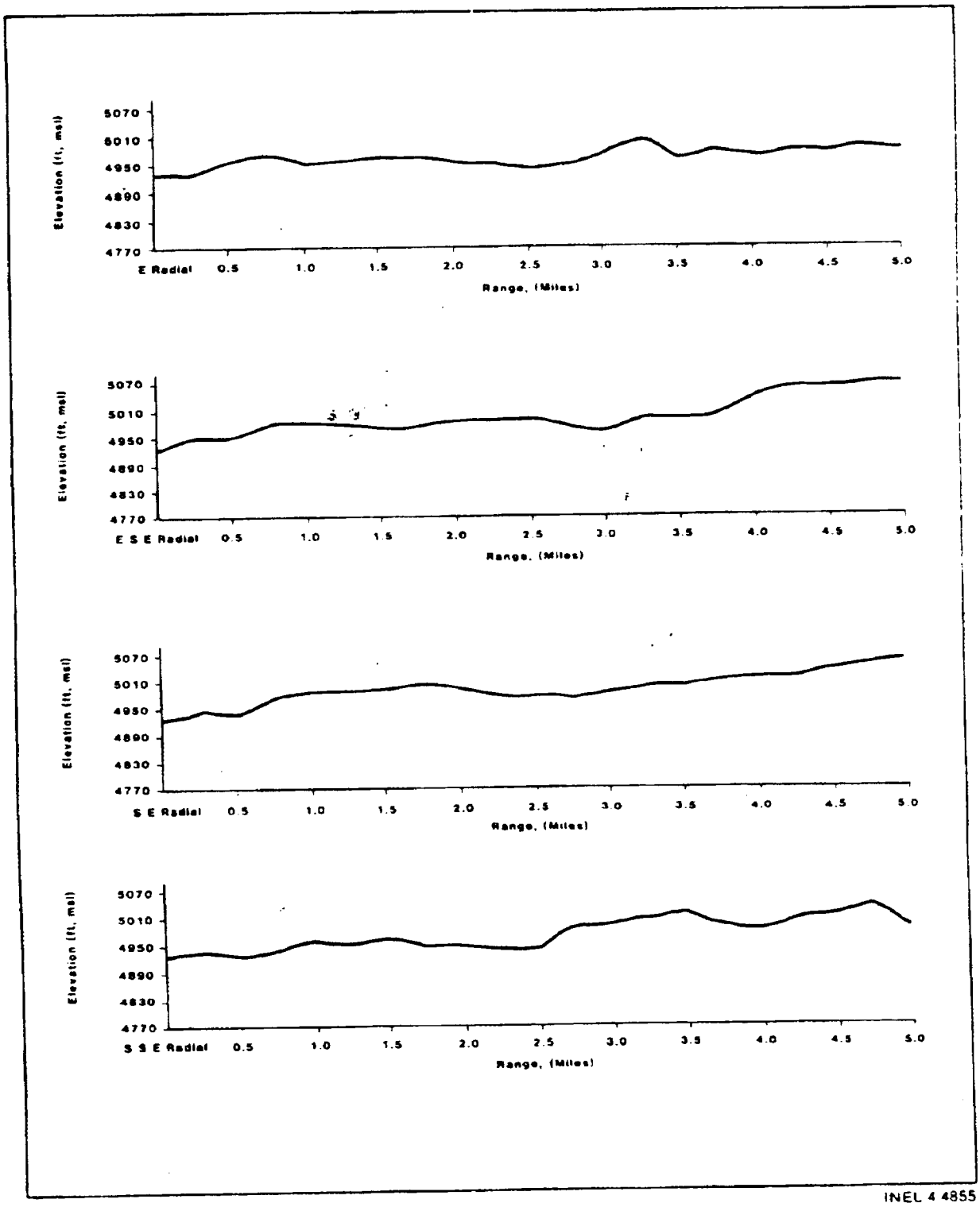


Figure 2.3-11. Topographic cross-sections for TMI-2 ISFSI site--5 mi radius, south and east radials.

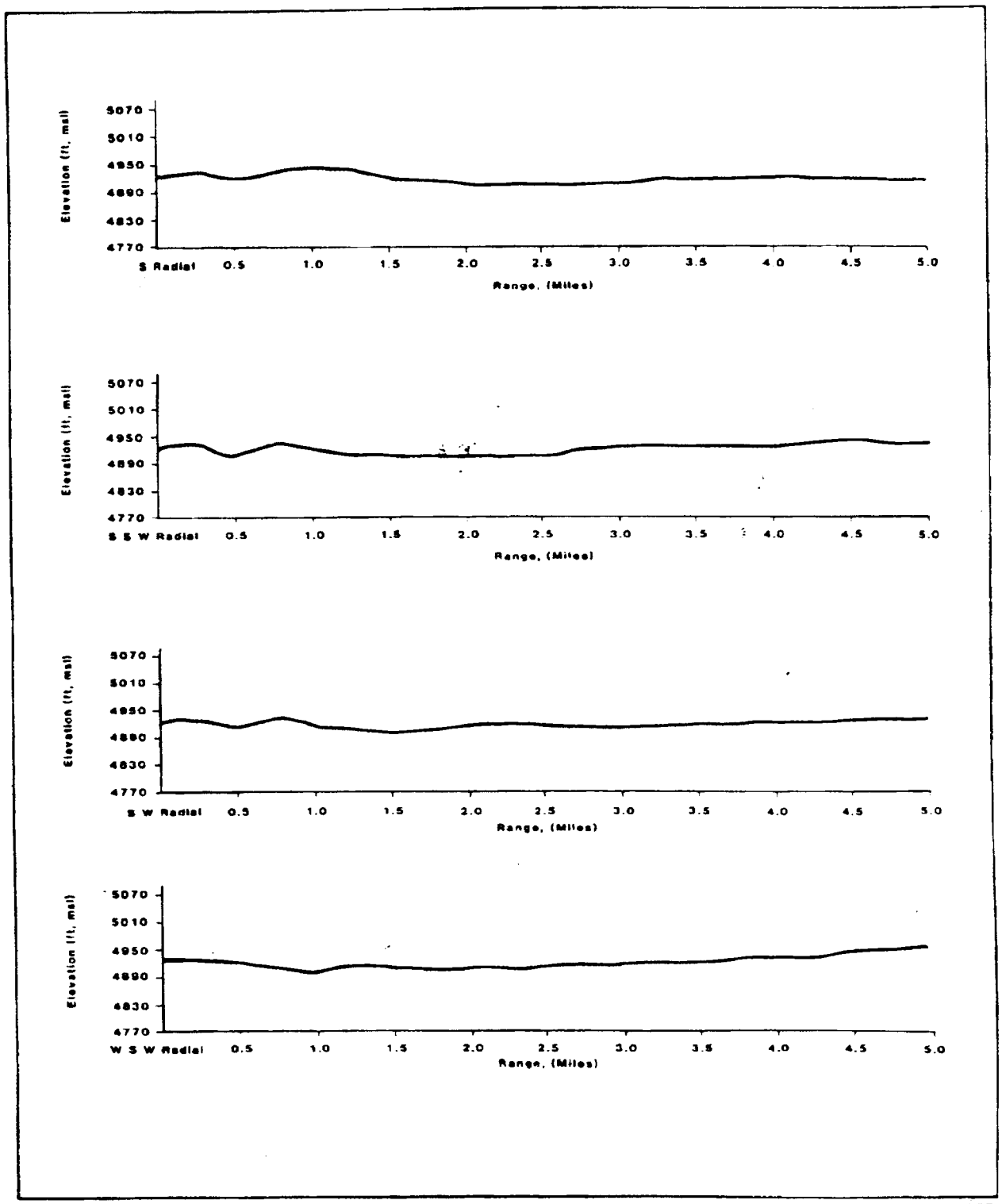
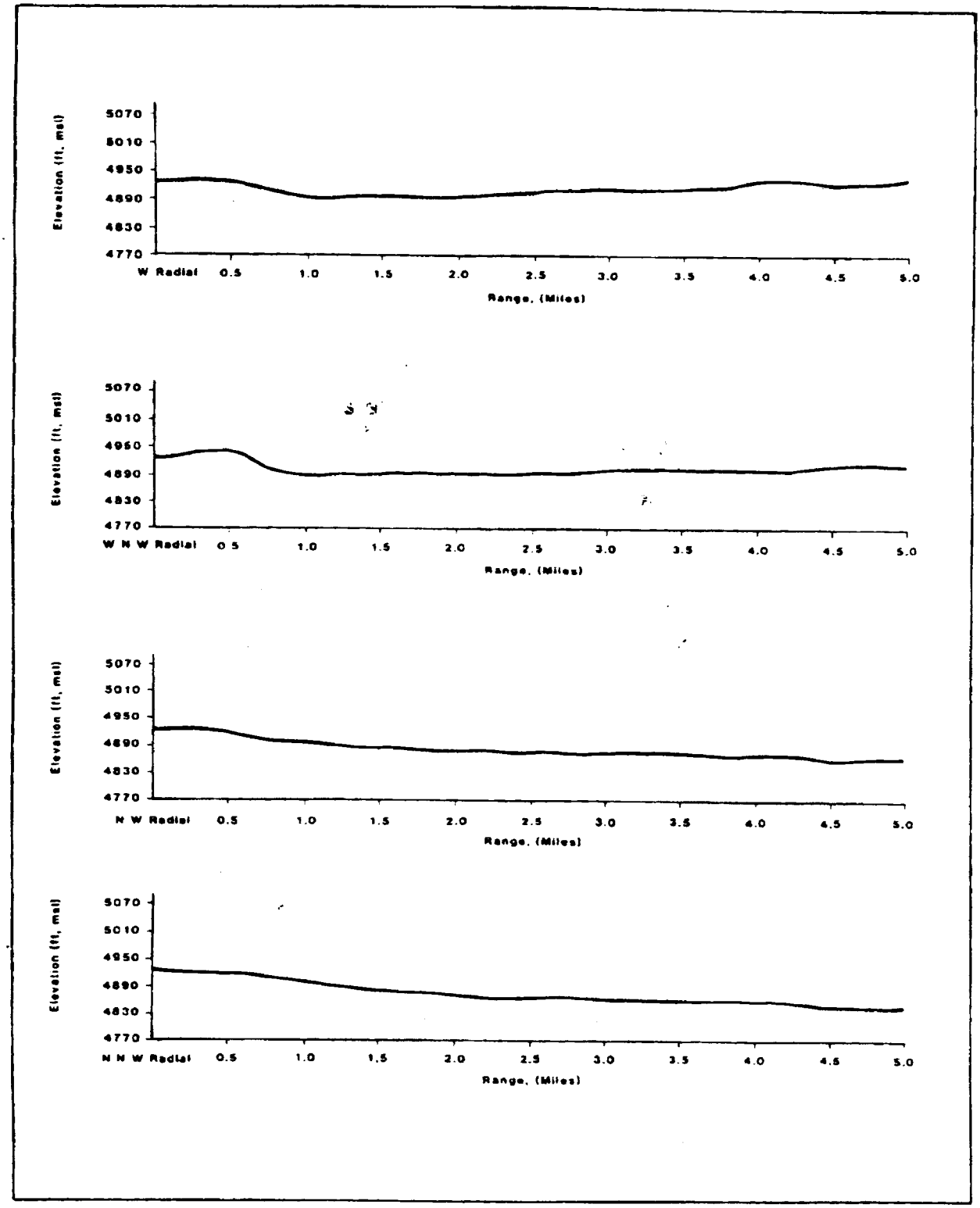


Figure 2.3-12. Topographic cross section for TMI-2 ISFSI site--5 mi radius, south and west radials.



INEL 4 4858

Figure 2.3-13. Topographic cross section for TMI-2 ISFSI site--5 mi radius, north and west radials.

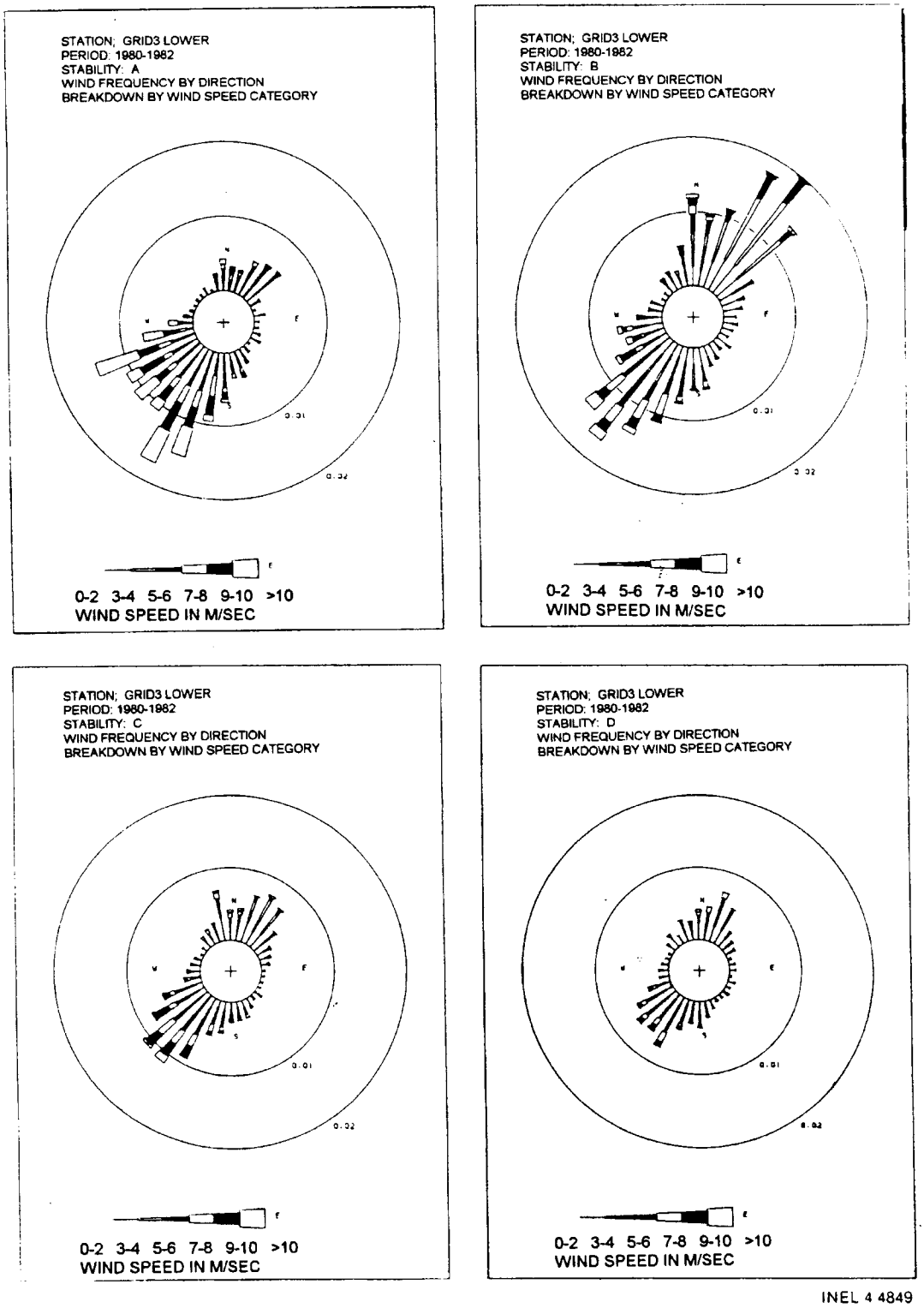
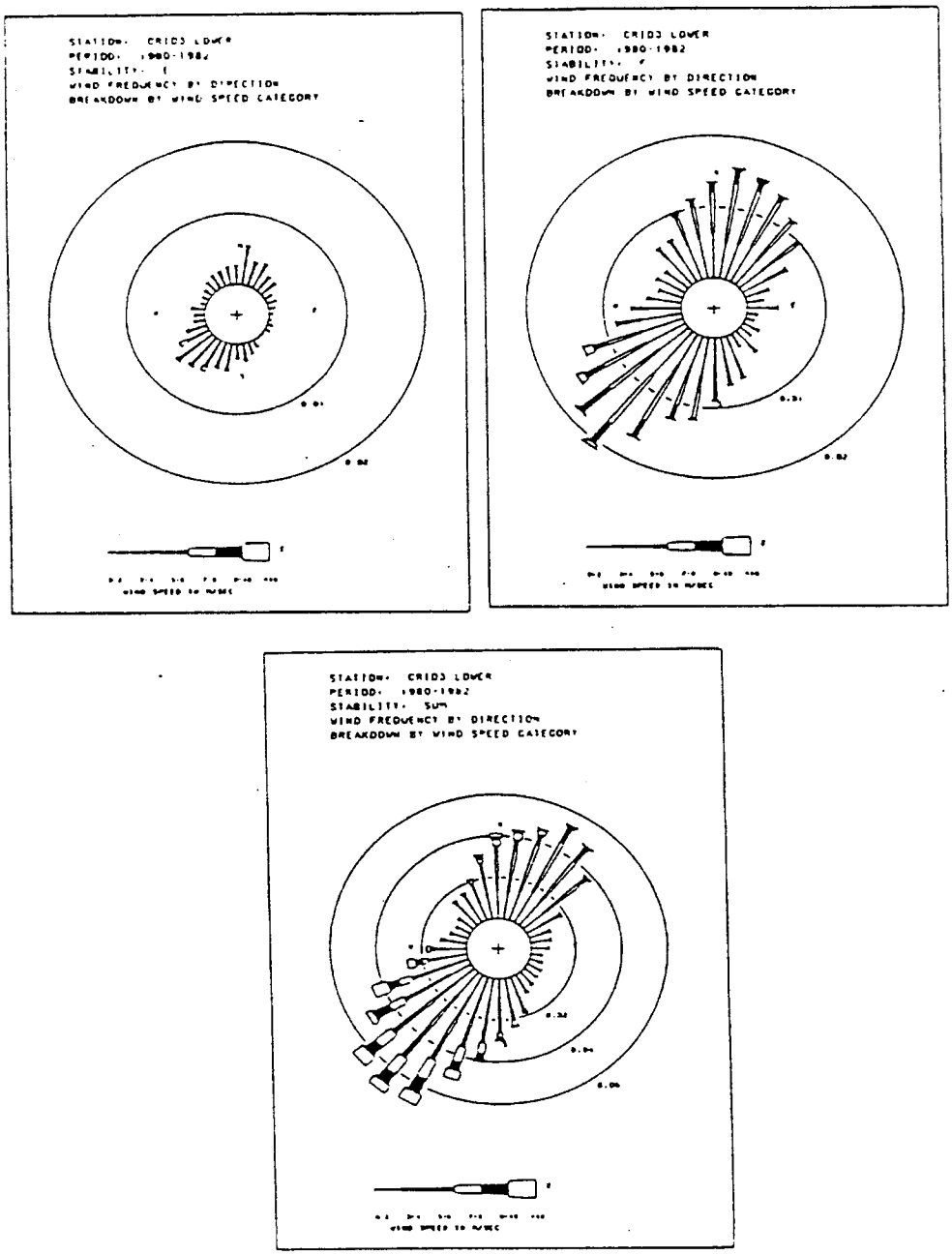


Figure 2.3-14. Grid 3 10-m level annual wind roses, (1981-1982).



INEL 4 4850

Figure 2.3-15. Grid 3 10-m level annual wind roses, (1981-1982).

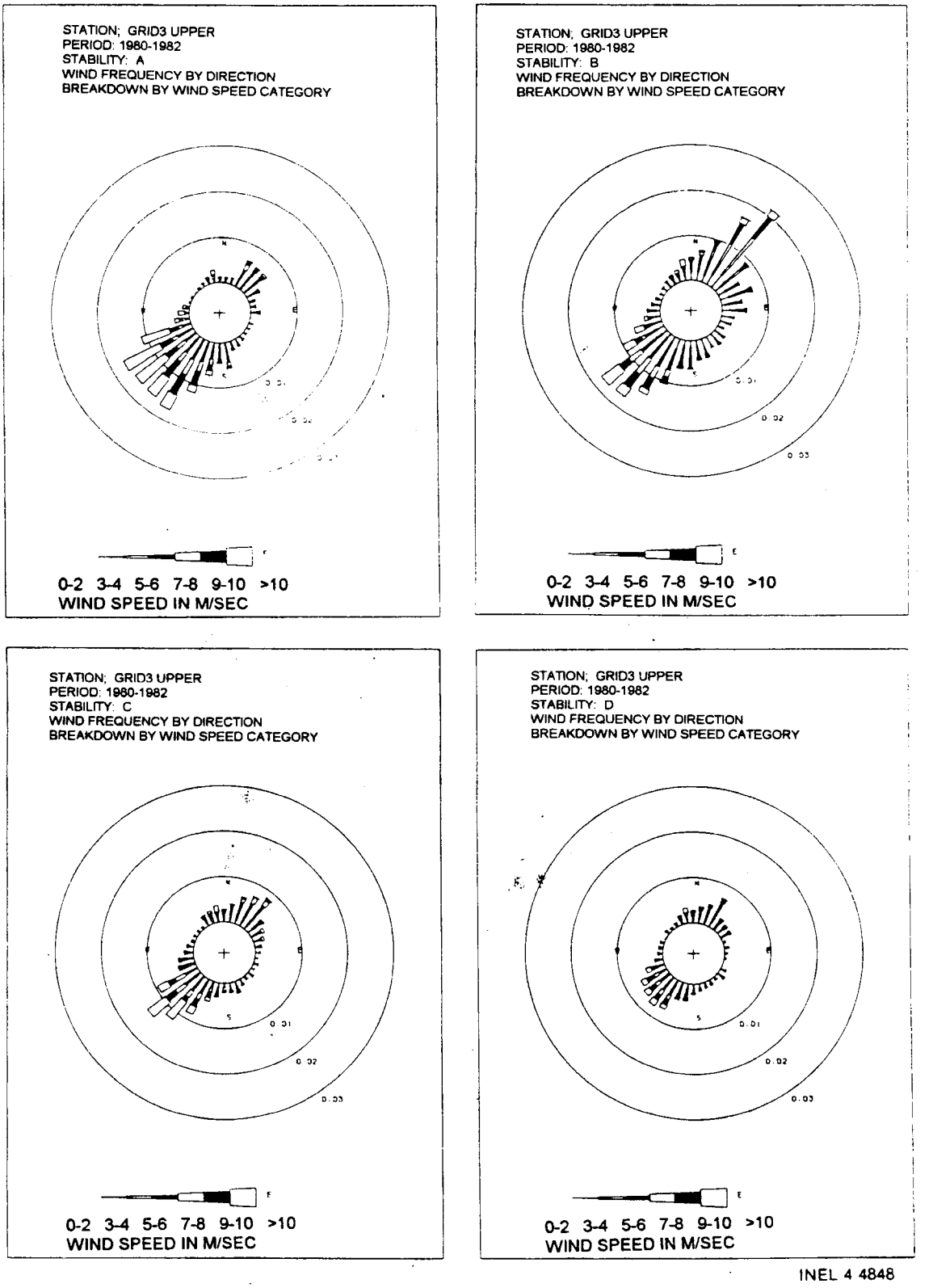


Figure 2.3-16. Grid 3 61-m. level annual wind roses, (1981-1982).

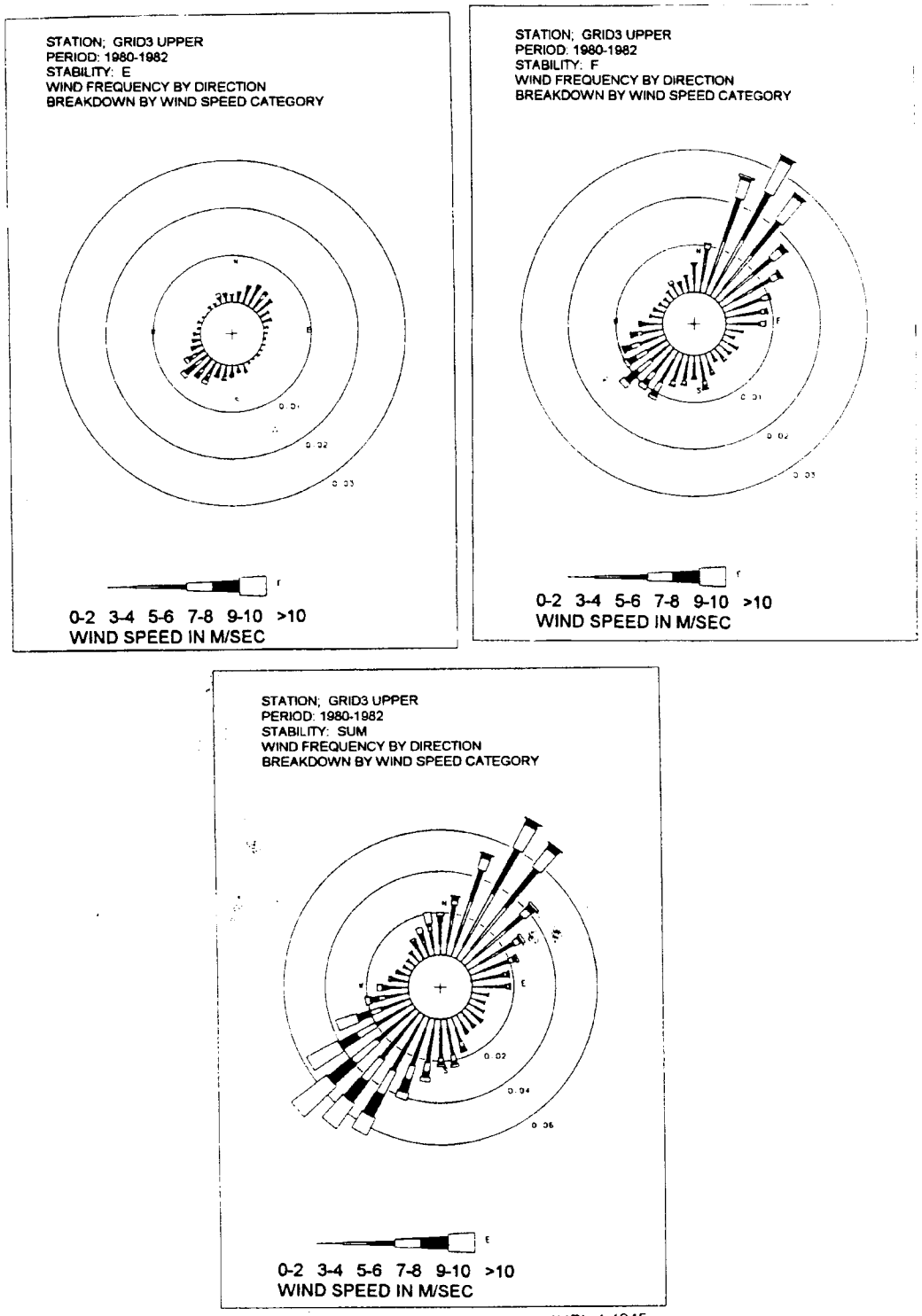


Figure 2.3-17. Grid 3 61-m. level annual wind roses, (1981-1982).

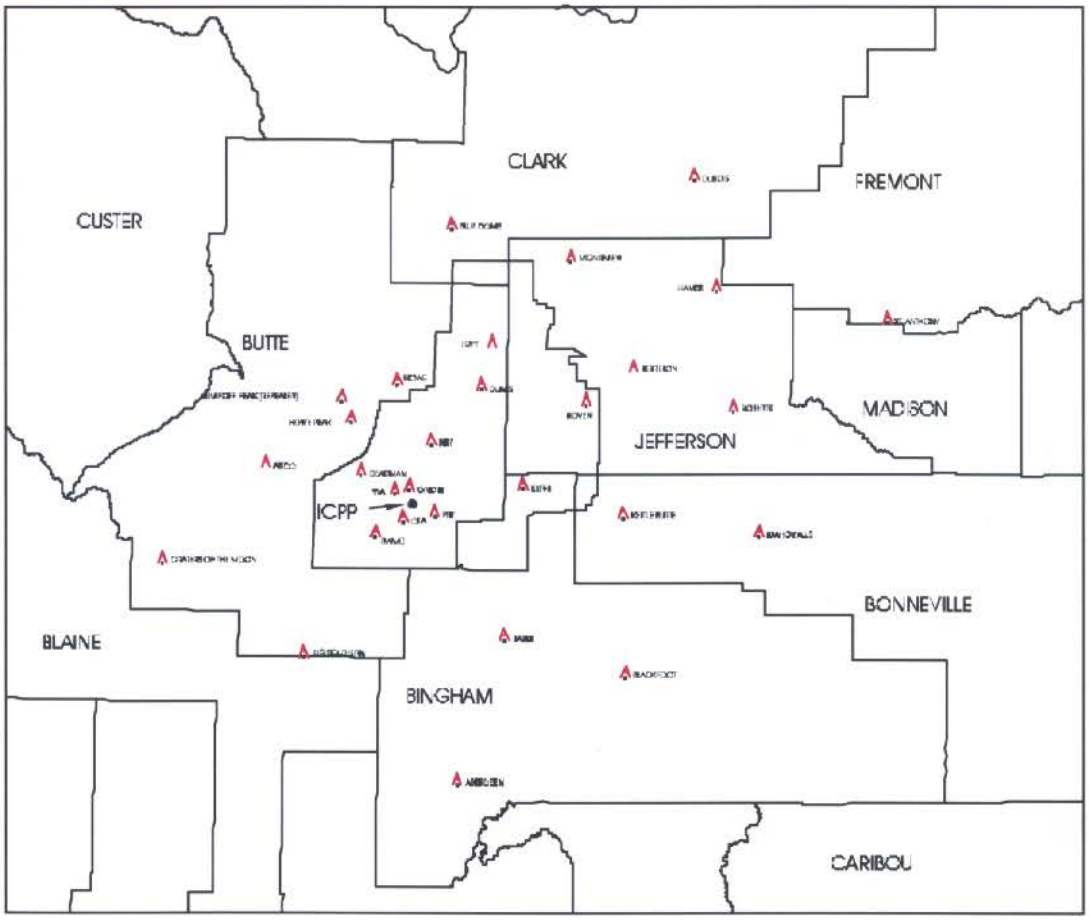


Figure 2.3-18. Wind observation locations within a 50-mi radius of the TMI-2 ISFSI site at INTEC.

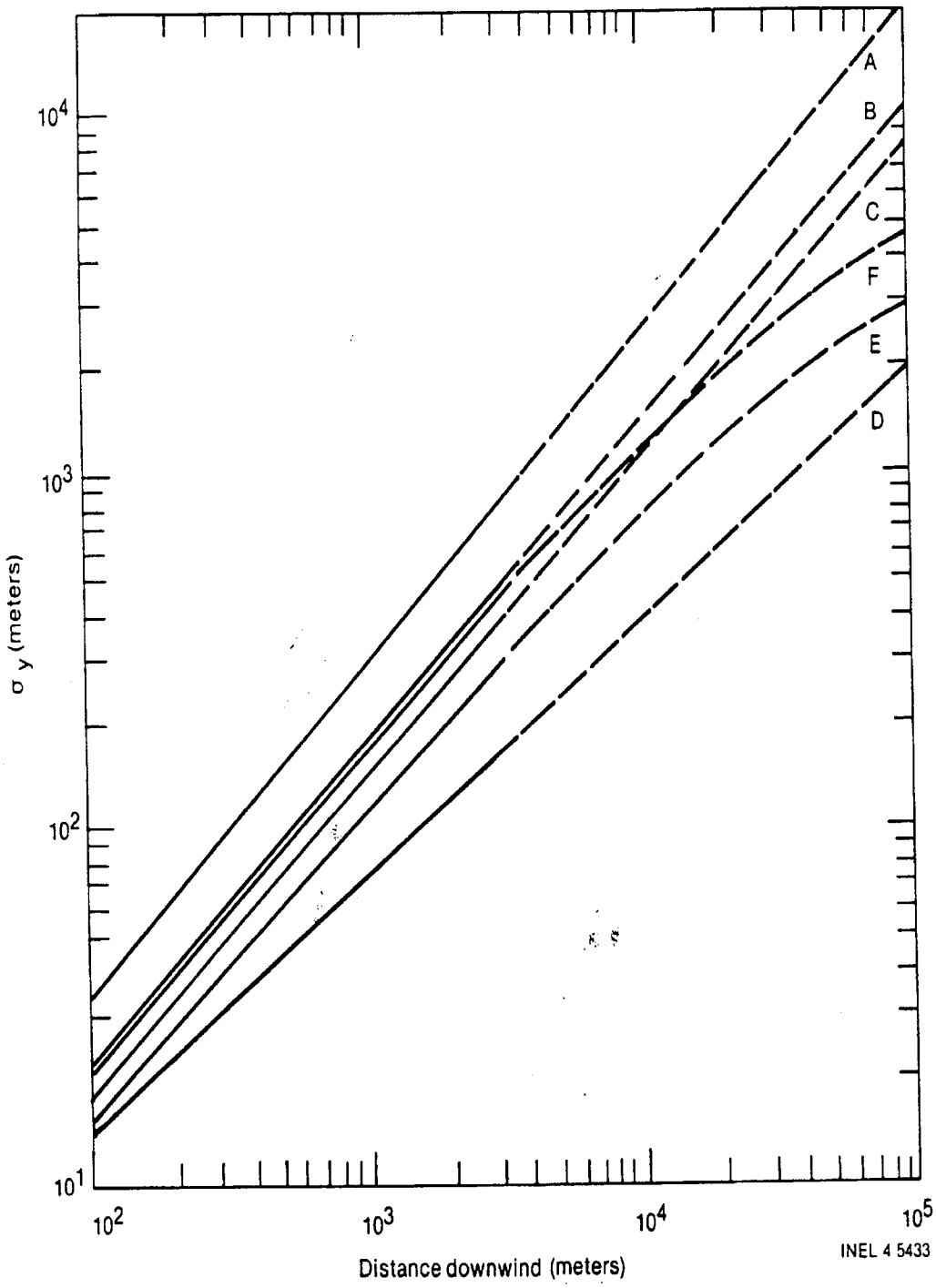


Figure 2.3-19. [redacted]$_y$ versus distance at INEEL

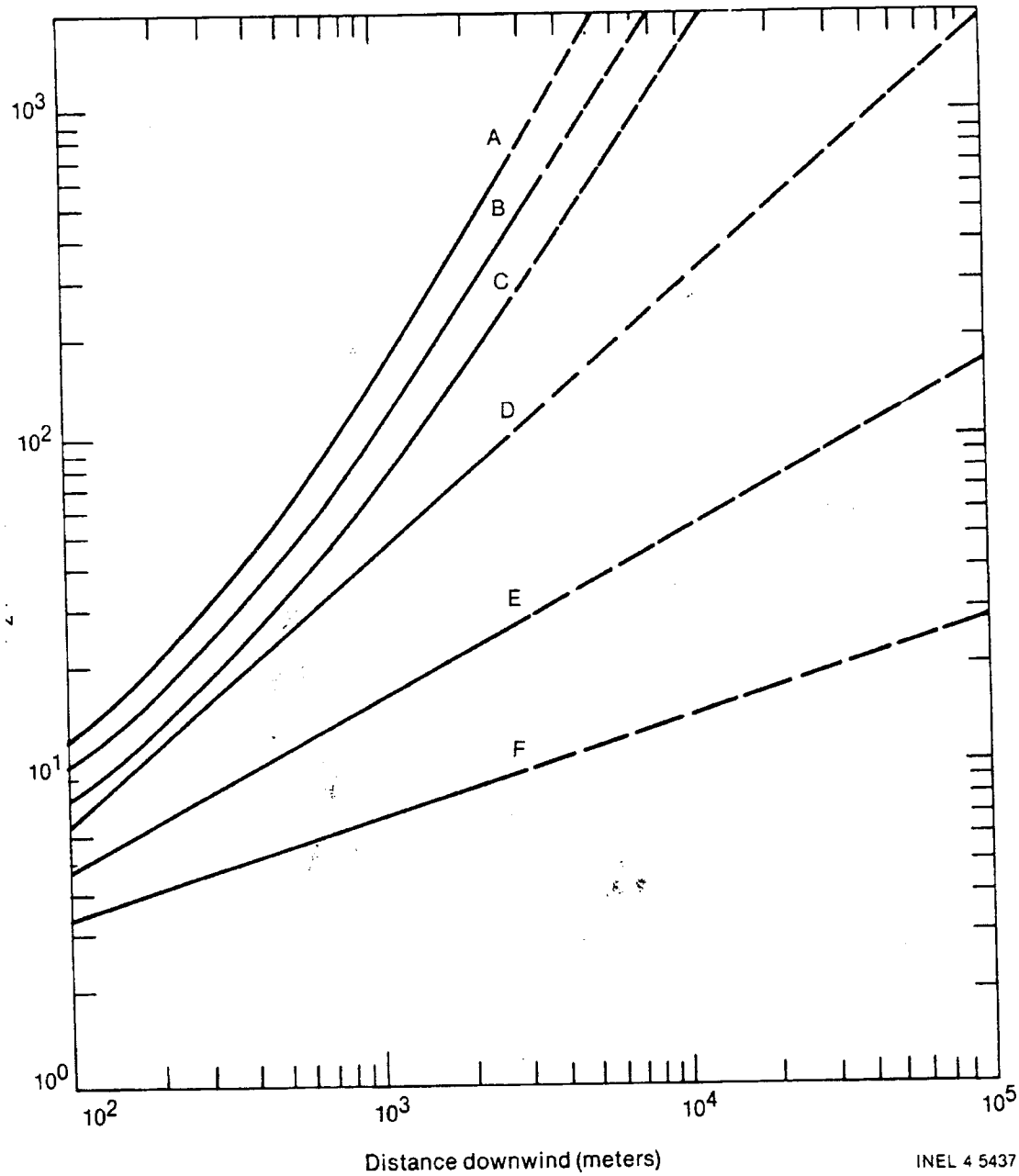


Figure 2.3-20. σ_z versus distance at INEEL.

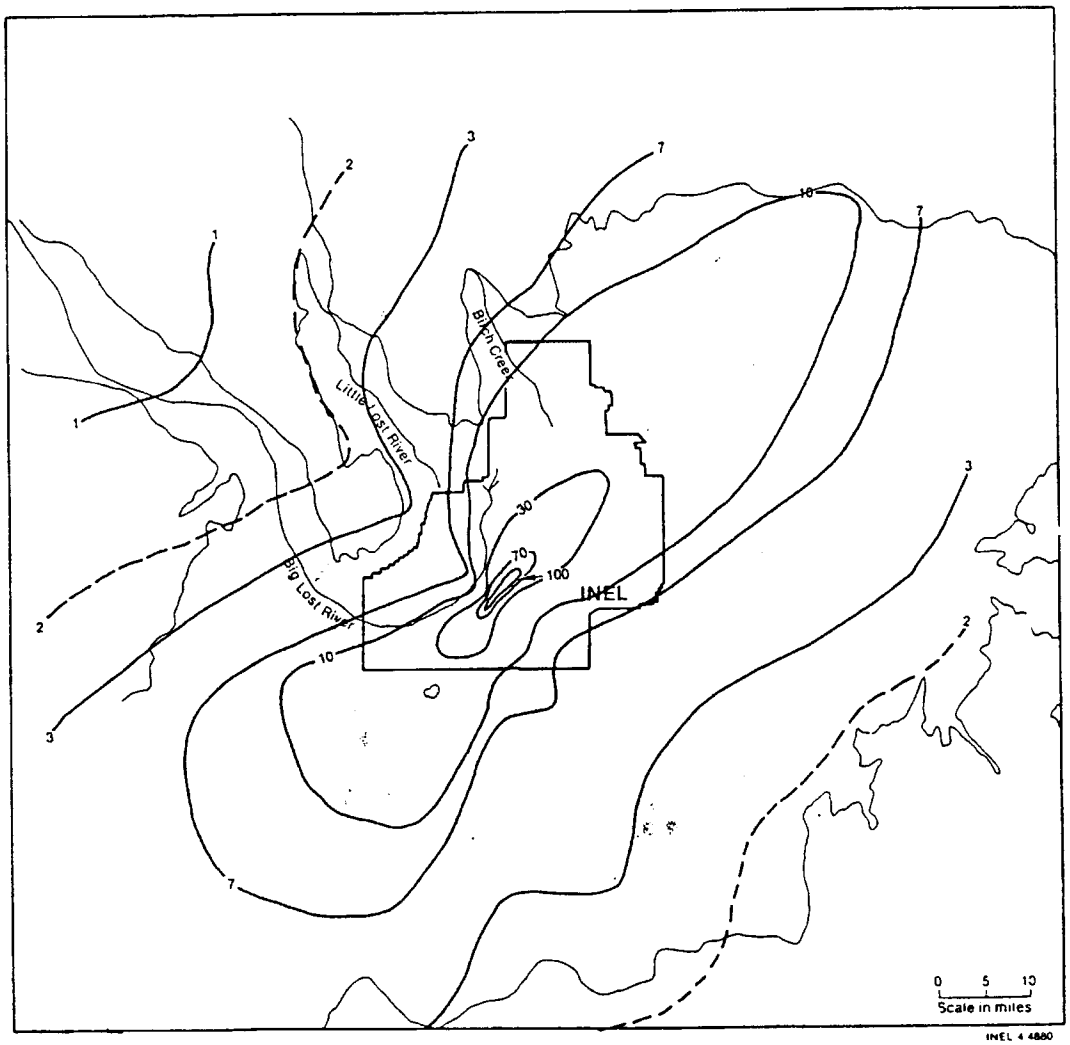


Figure 2.3-21. Annual normalized concentration [illegible]/Q ($s/m^3 \times 10^{-9}$)
Source location: TMI-2 ISFSI site--50-mi 1982.

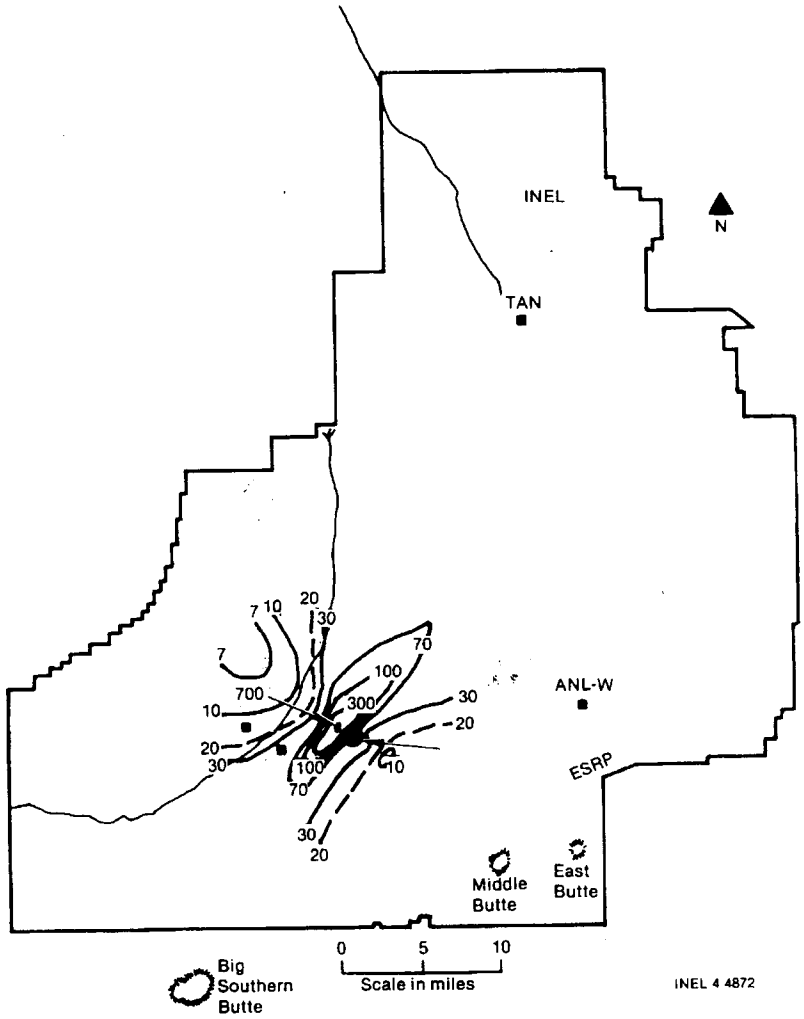


Figure 2.3-22. Annual normalized concentration χ/Q ($s/m^3 \times 10^{-9}$) Source location TMI-2 ISFSI site -- 5-mi 1982.

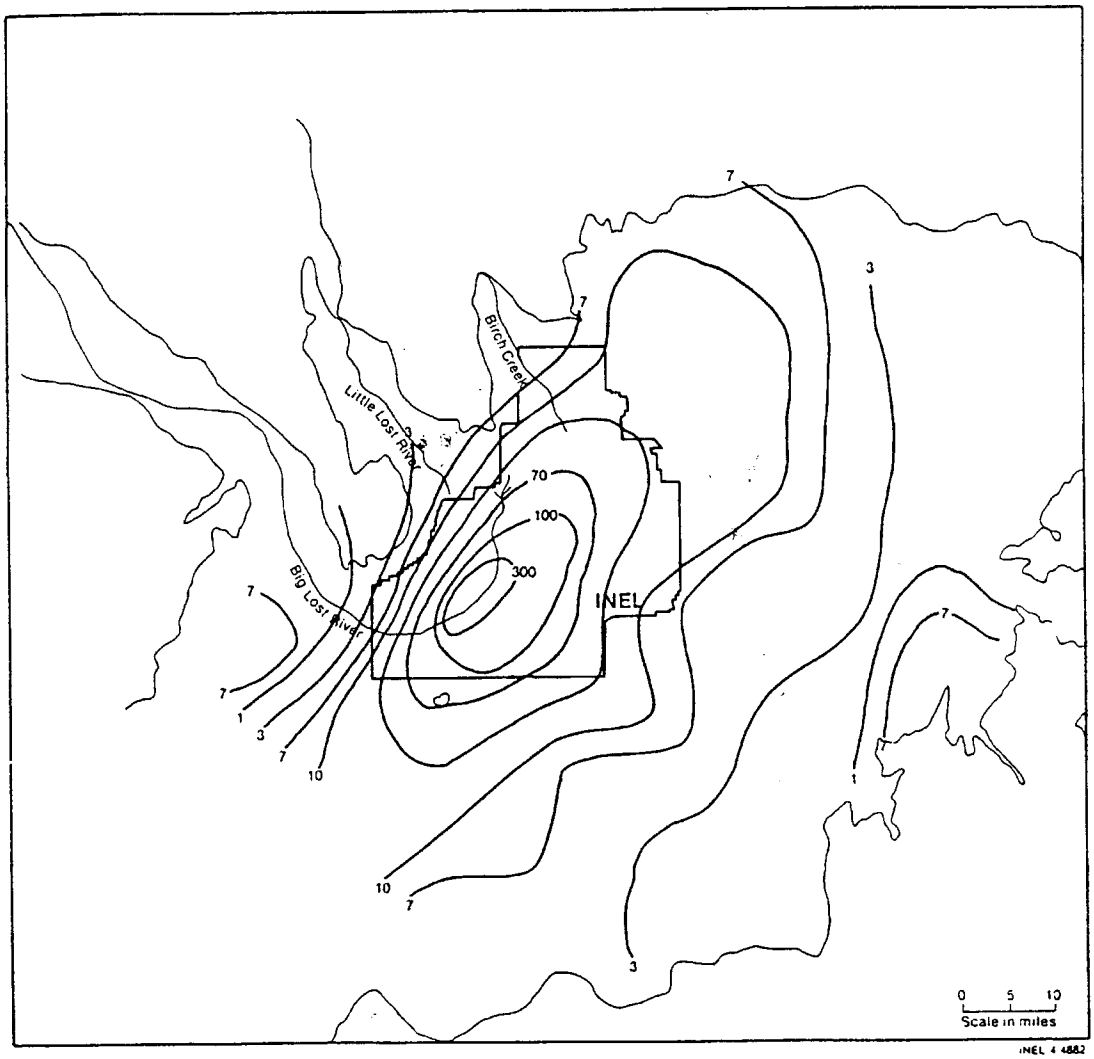


Figure 2.3-23. Annual normalized total integrated concentration ($h^2/m^3 \times 10^{-9}$)
Source location: INTEC 1980.

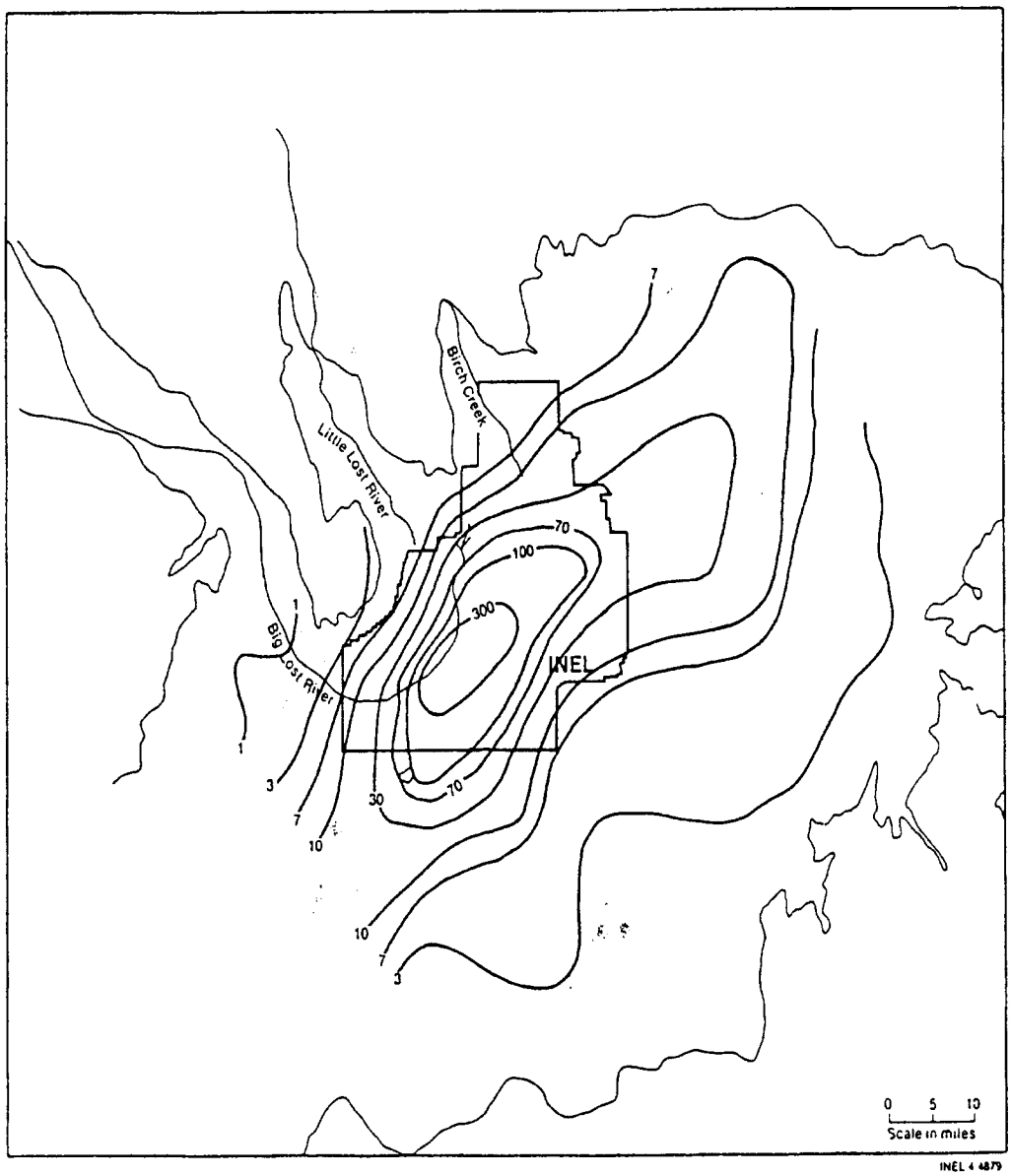


Figure 2.3-24. Annual normalized total integrated concentration ($h^2/m^3 \times 10^{-9}$)
Source location: INTEC 1981.

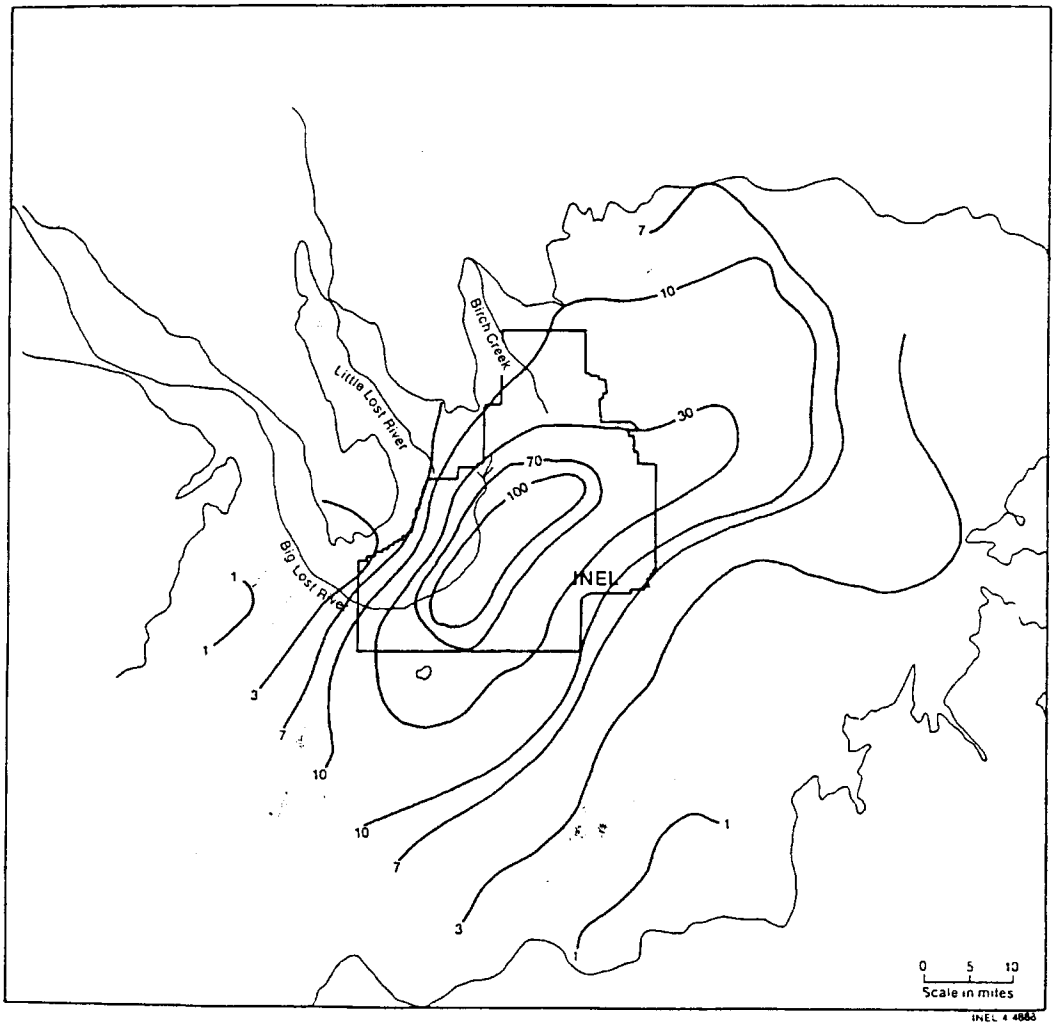


Figure 2.3-25. Annual normalized total integrated concentration ($h^2/m^3 \times 10^{-9}$)
Source location: INTEC 1982.

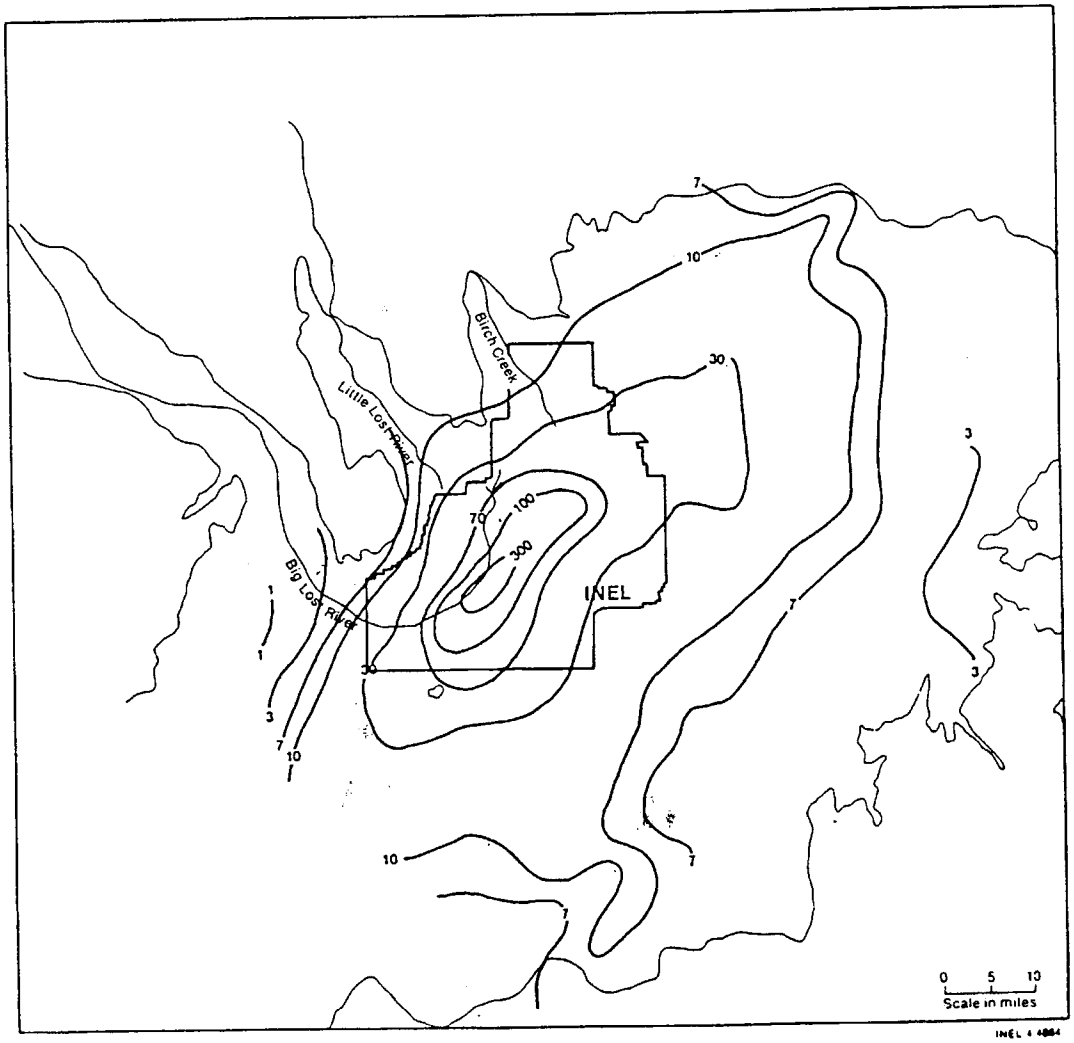


Figure 2.3-26. Normalized total integrated concentration ($h^2/m^3 \times 10^{-9}$)
Source location: INTEC 1974-1983.

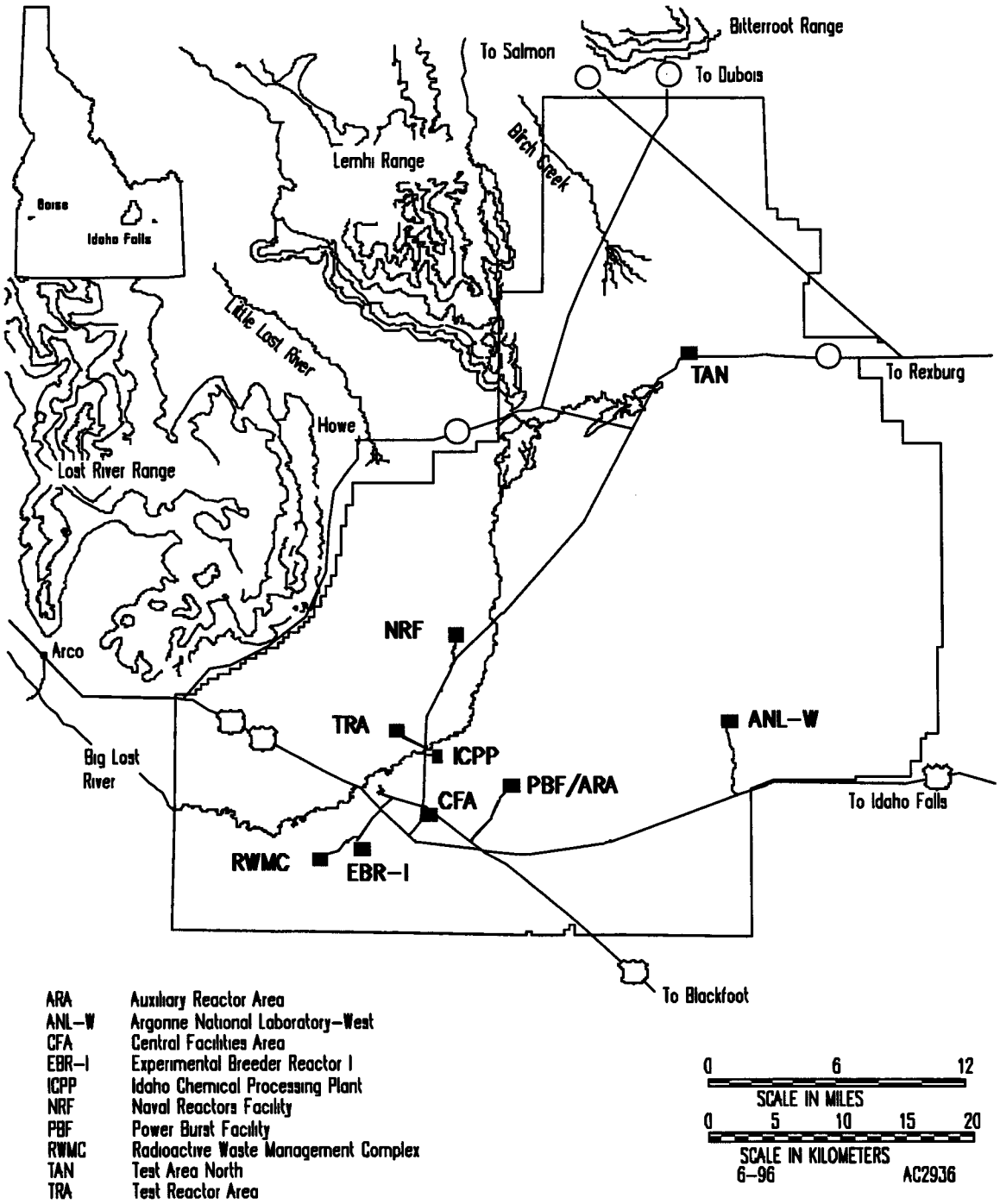


Figure 2.4-1 INEEL site map with major drainages

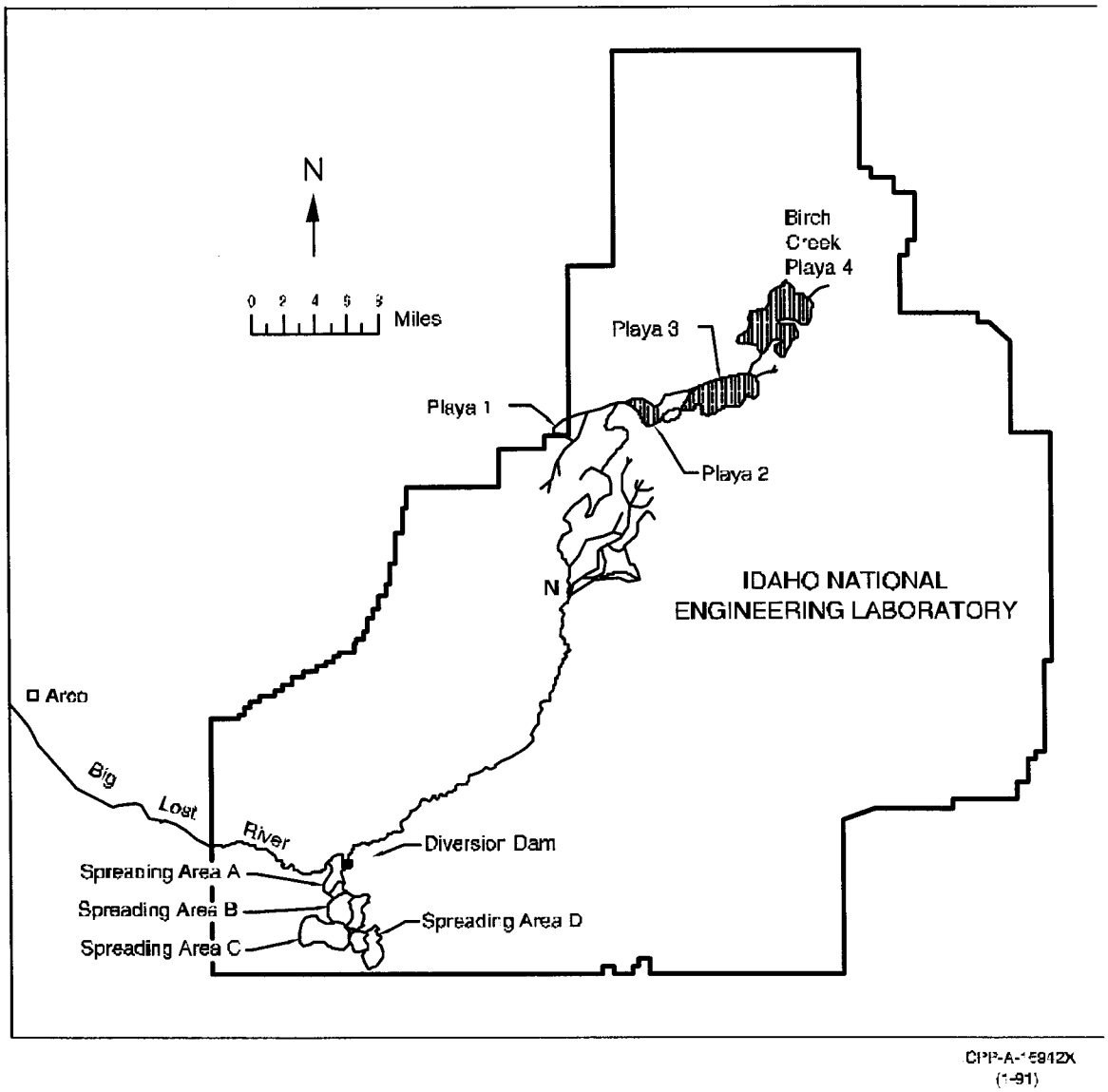


Figure 2.4-2 Big Lost River System on the INEEL (LITCO, 1995)

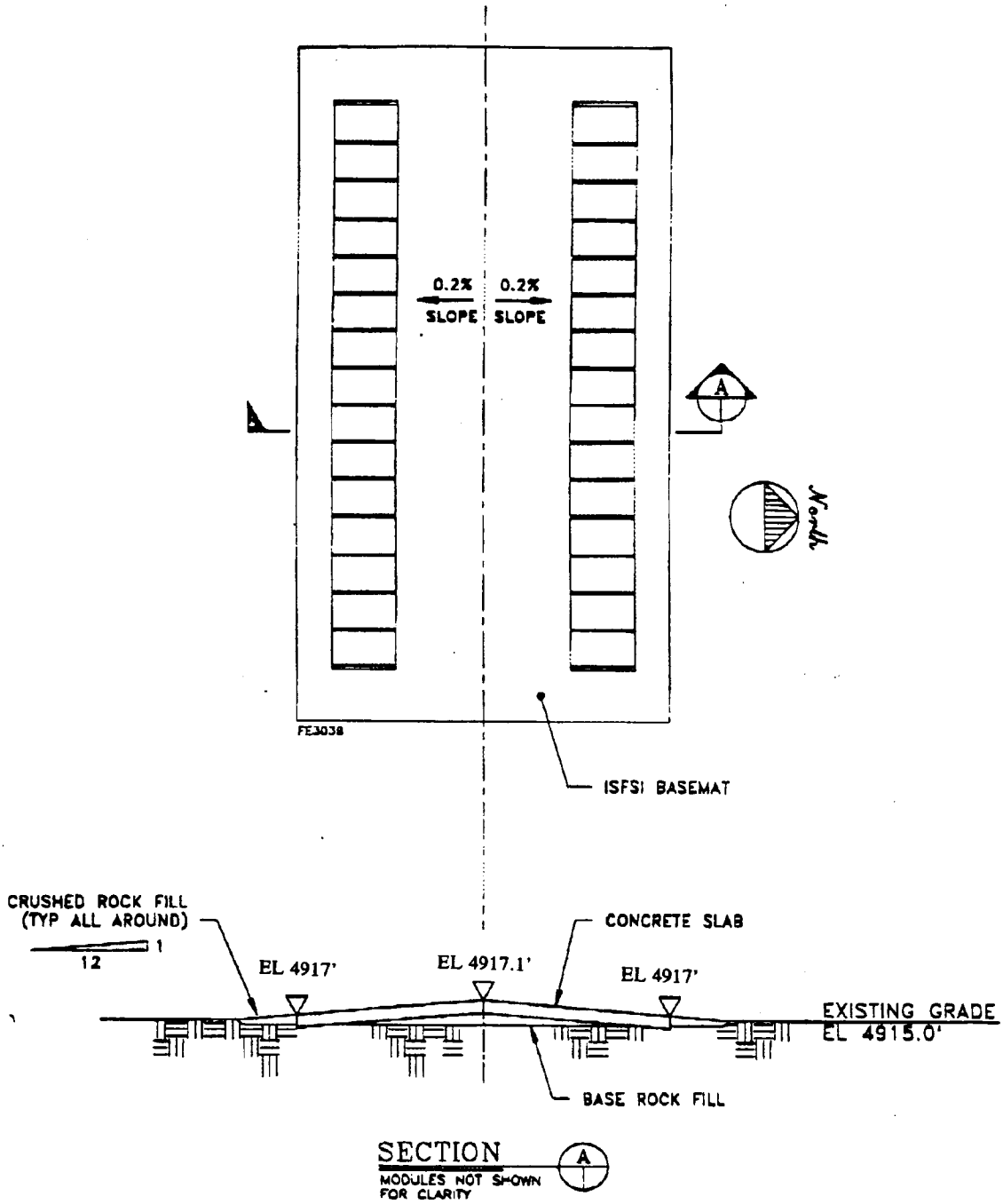


Figure 2.4-3. TMI-2 ISFSI Pad Cross Section.

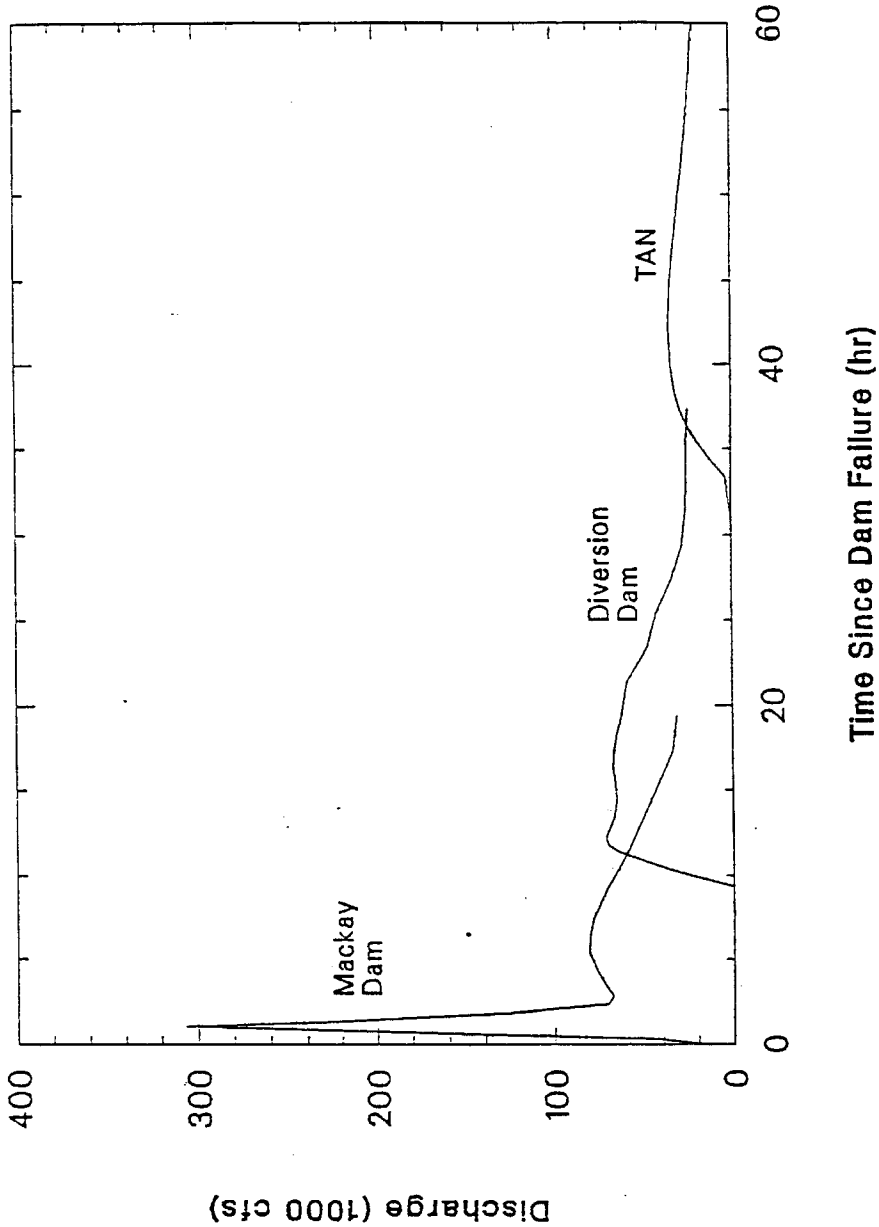


Figure 2.4-4 Hydrograph for the PMF-induced failure of the Mackay Dam (Koslow and Van Haaften, 1986)

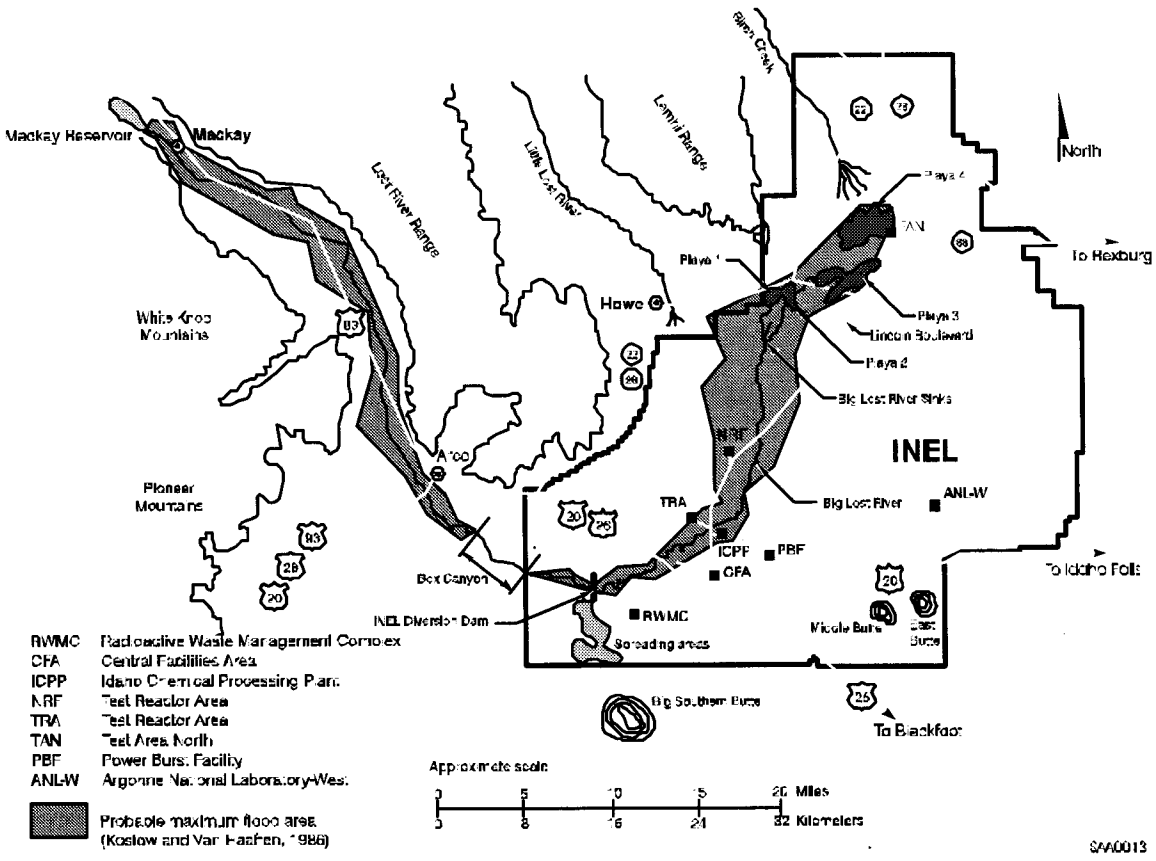
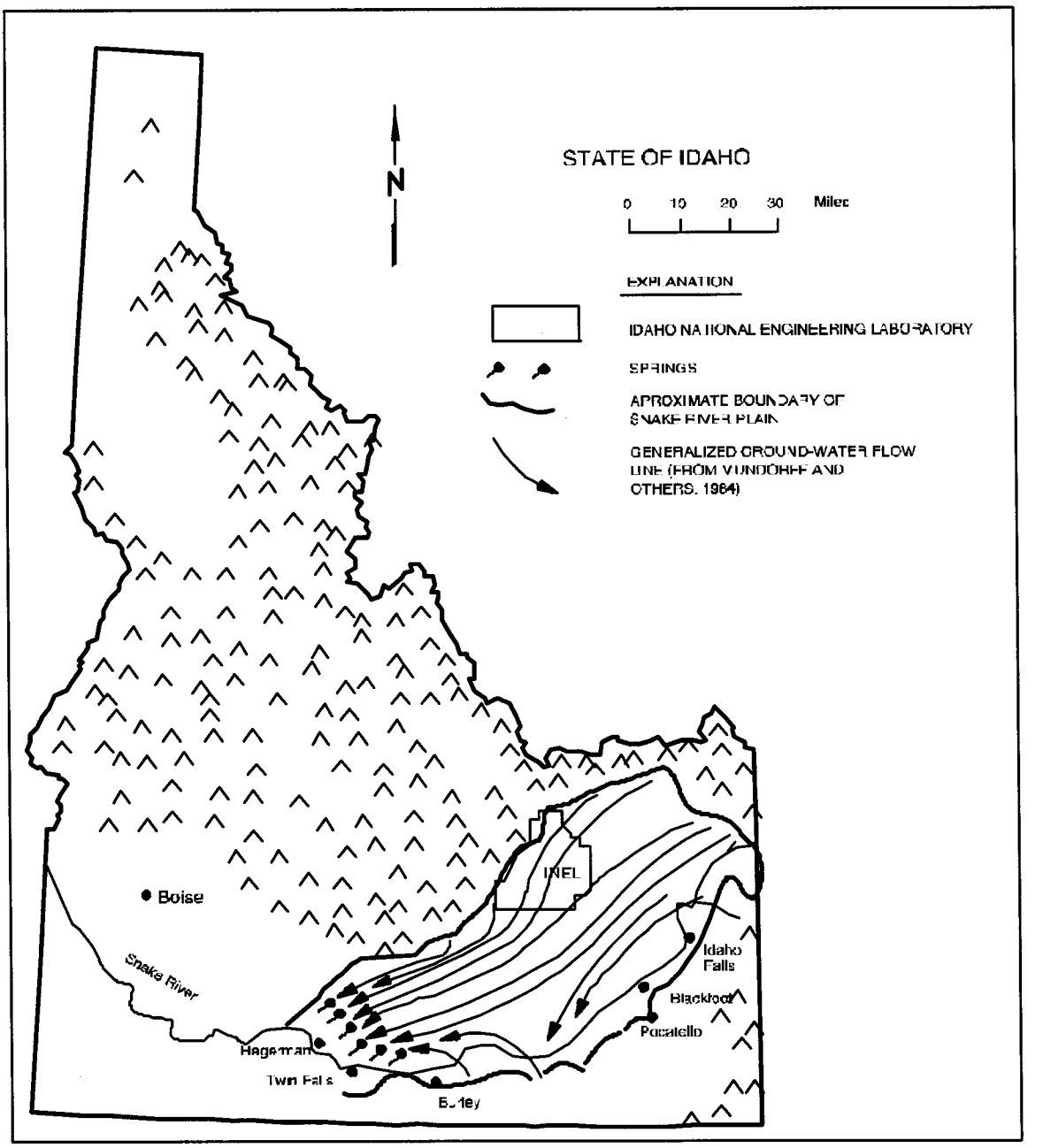


Figure 2.4-5 INEEL facilities with the predicted inundation area for the probable maximum flood-induced overtopping of the Mackay Dam (Bennett 1990).



ICPP-A-4584X
(10-94)

Figure 2.5-1 Relief Map of Idaho With Groundwater Flow Lines.

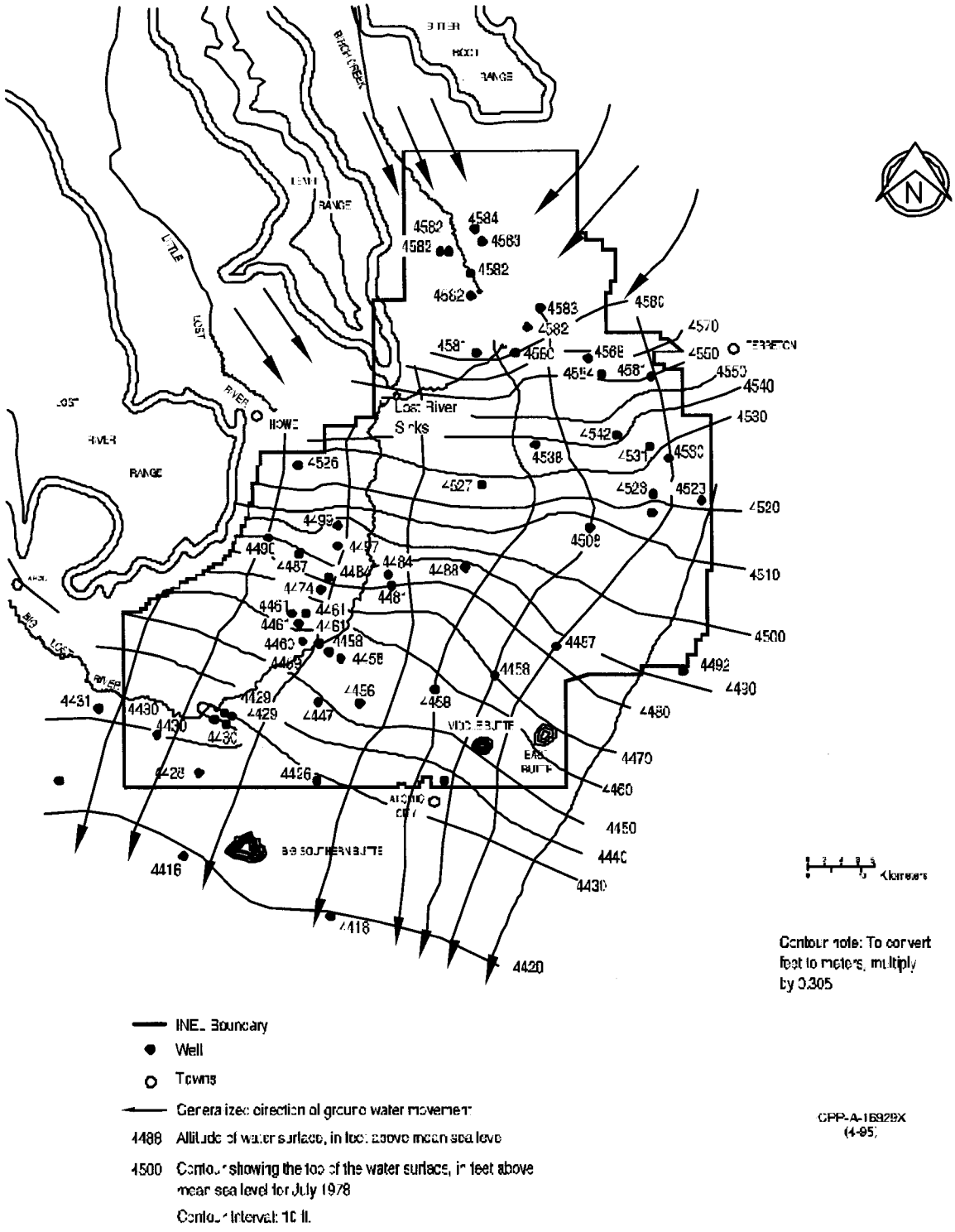


Figure 2.5-2 Groundwater Contours and Directions - INEEL.

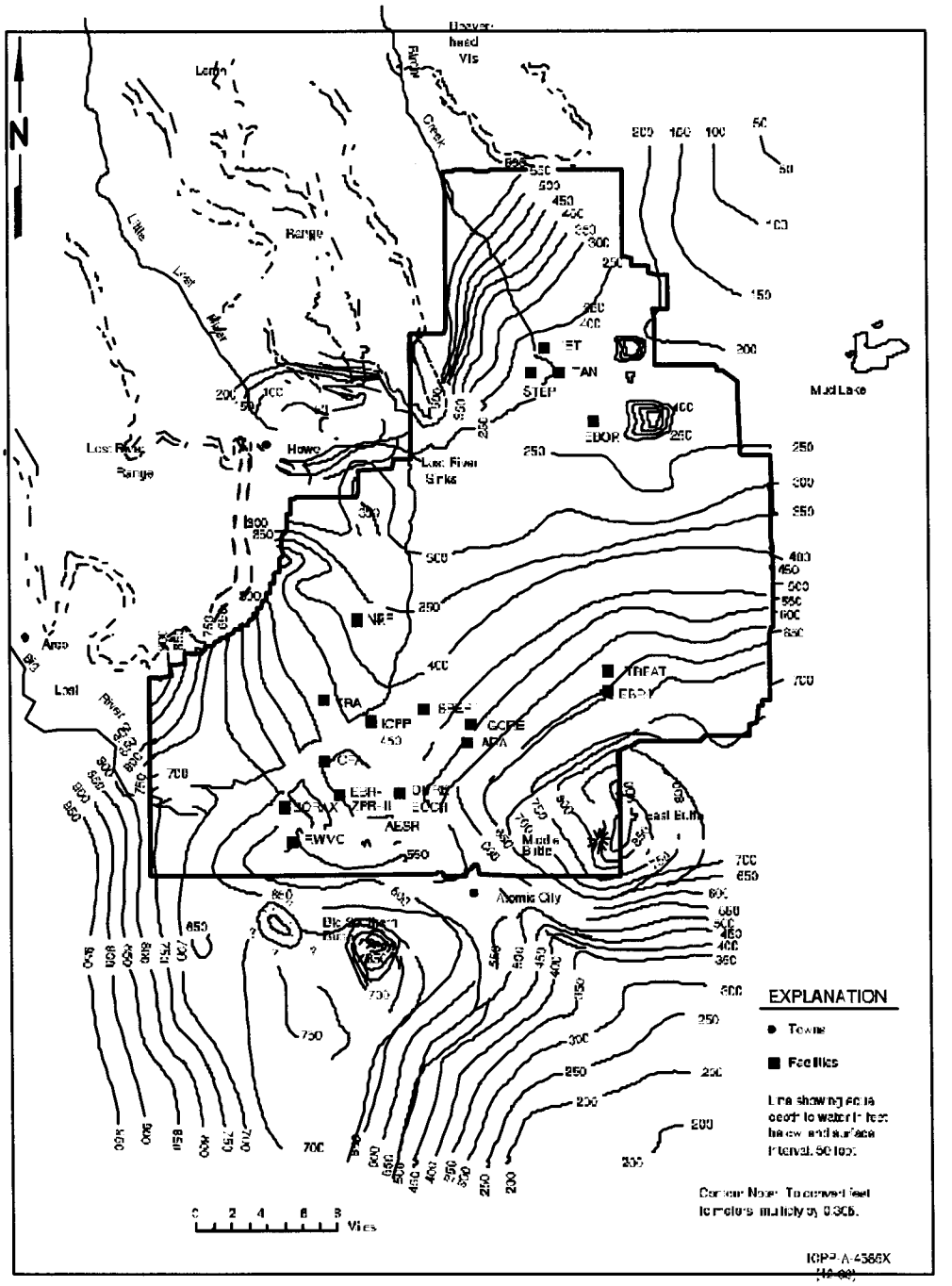


Figure 2.5-3 Depth to Water Table, INEEL.

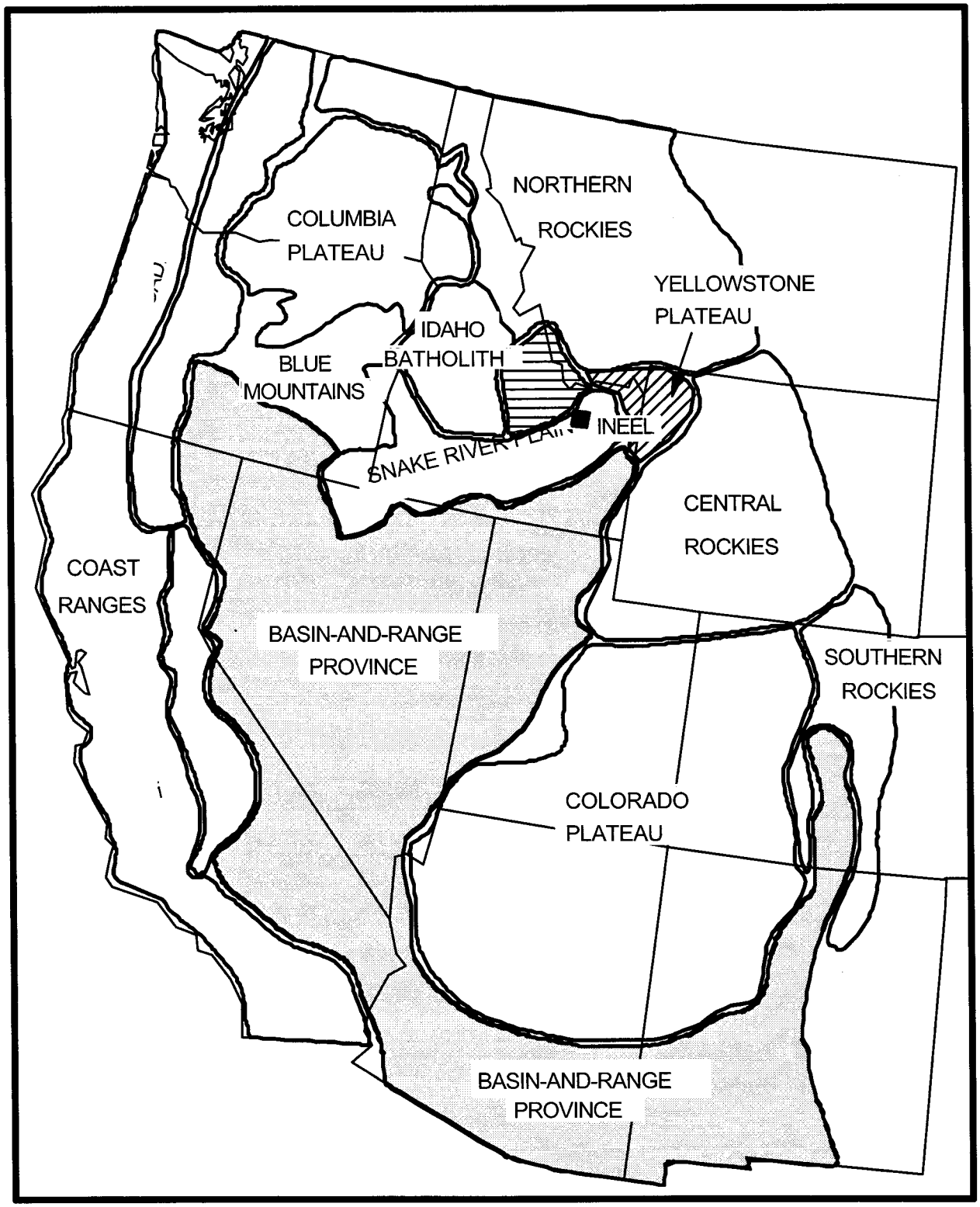


Figure 2.6-1 Physiographic Province Map of the Western United States Showing the Location of the ESRP and the INEEL.

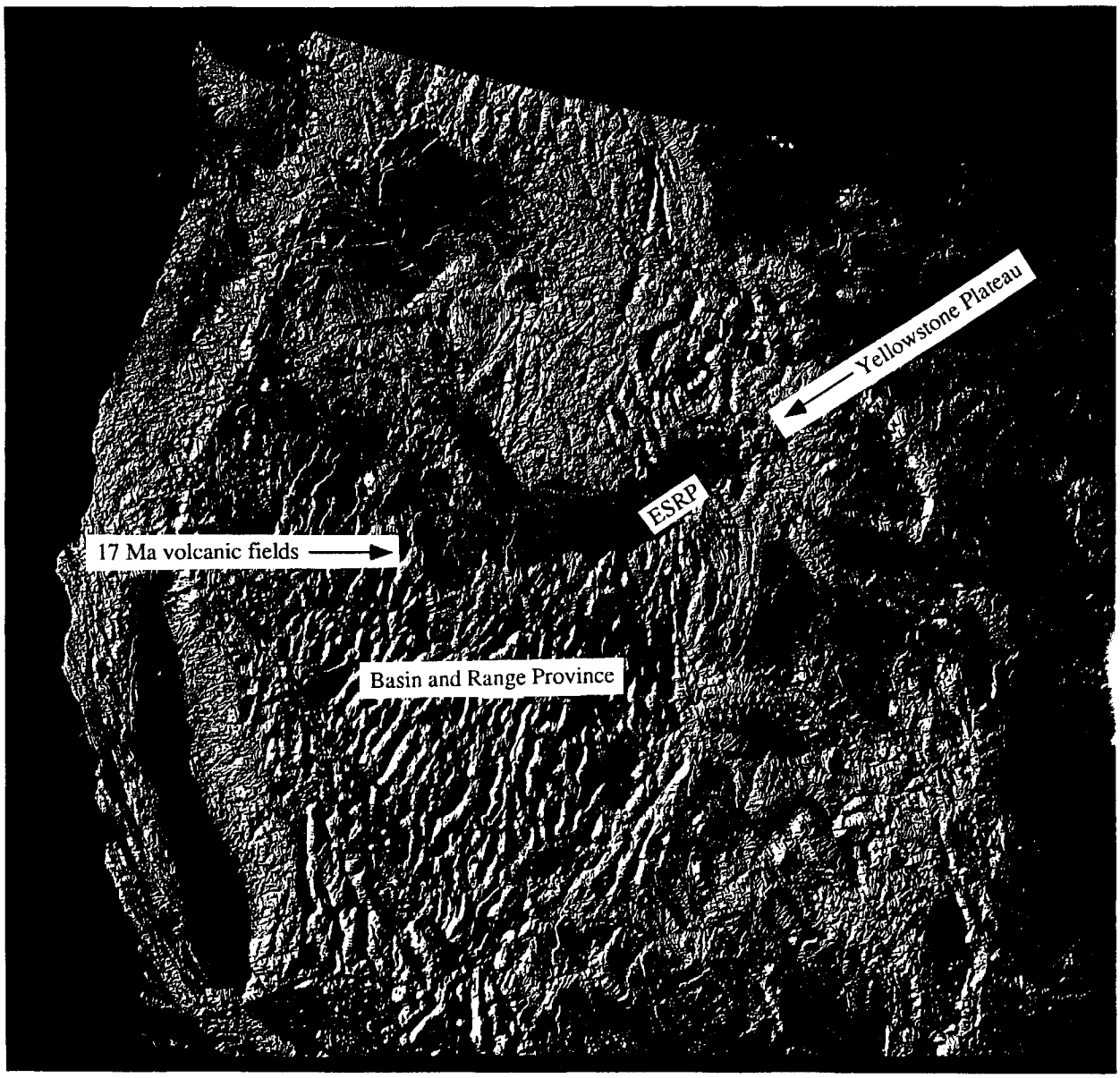


Figure 2.6-2. Shade relief topographical map of the Western United States showing the Eastern Snake River Plain (ESRP), the basin and range providence and the track of the Yellowstone hot spot from the 17MA volcanic fields of north central Nevada to the Yellowstone Plateau.

Geologic Age	Formation and Brief Description	Thickness (m)
Quaternary	Surficial deposits of playas (silty sand to clayey silt), floodplains (sandy gravel to silty sand), alluvial fans (sandy gravels to silty sands), and thin eolian blankets (loess and fine sand).	Playas: <30m Floodplains: ~20m on INEEL Eolian: 1-10m
	Rhyolitic lavas, breccias, and obsidians of Big Southern, East, and Cedar Buttes, and an unnamed butte along the axis of the ESRP. 0.3-1.2 Myr.	2500 at Big Southern Butte
Quaternary and Tertiary	**Snake River Group.** Interbedded clastic sediments and basaltic lava flows of the Snake River Plain. Sediments are unlithified to poorly lithified alluvial (gravels, sands, minor silt), lacustrine (silty clays to sandy silts), and eolian (silts and sands) deposits. Basaltic lavas are black to dark gray pahoehoe and minor a'a flows with near-vent scoria, cinder, and ash deposits. Age range - 2 kyr to ~4.5 Myr. Rocks and sediment older than about 1.2 Myr are present only in the subsurface. Comprises almost all of the rocks within the ESRP.	700-1500
Tertiary	Various basaltic lava flows of late-Tertiary age, rhyolitic ash flow tuffs of the **Heise volcanic field** (4.3-7 Myr), older rhyolitic ash flow tuffs (7-12 Myr), and Eocene **Challis volcanics**. All outcrop outside the ESRP in the mountains northwest of the INEEL. Heise and older tuffs occur in deep drill holes within the ESRP.	Total thickness unknown
Triassic	**Dinwoody Fm.** Siltstone and micaceous shale.	>55
Permian	**Phosphoria Fm.** Limestone, chert, phosphatic siltstone, phosphorite, and dolostone.	60
Permian to Mississippian	**Snaky Canyon Fm.** Interbedded limestone, dolostone, and minor sandstone.	1200
Pennsylvanian-Mississippian	**Bluebird Mt. Fm.** Sandstone w/interbedded limestone and minor dolostone. Straddles period boundary.	100
Mississippian	From younger to older, consists of **Bluebird Mtn., Arco Hills, Railroad Canyon, Surrett Canyon, South Creek, Scott Peak, and Middle Canyon Fms.** Mostly fossiliferous limestones w/interbedded sandstones, siltstones, and shales.	1000-1500
Mississippian - Devonian	**McGowan Creek and Three Forks Fms.** Gray argillites, siltstones, and limestones.	64-163
Devonian	**Jefferson Fm.** Sandy to silty gray dolostone and limestone.	60-300
Ordovician	**Fish Haven Dolostone.** Gray, massive dolostone.	18-300
	Kinnikinic Quartzite. Vitreous orthoquartzite.	100-230
	Summerhouse Fm. Quartzite w/calcareous sandstone and siltstone.	0-60
Cambrian	**Tyler Peak Fm.** Sandstone, shale, and quartzite.	265
Precambrian	**Swager Fm, Lemhi Group, and Wilbert Fm.** Arkosic, conglomeratic sandstones and quartzites.	320-400

Notes: ESRP = eastern Snake River Plain. Double lines = unconformities. Precambrian to Triassic units outcrop only in the mountains north and south of the ESRP.

Figure 2.6-3 Stratigraphic Section of the Precambrian, Paleozoic, and Mesozoic Rocks Exposed in the Ranges North and South of the ESRP.

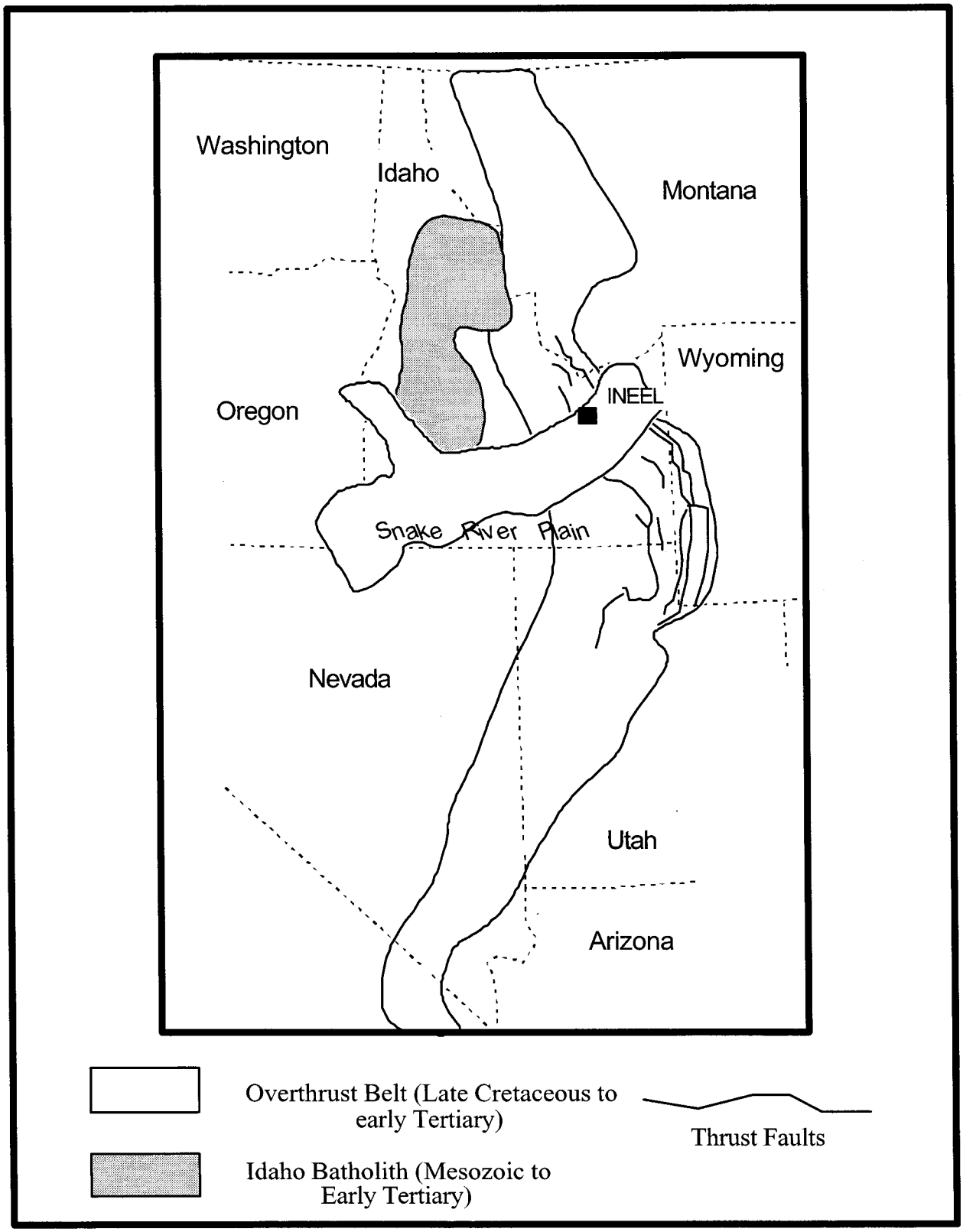


Figure 2.6-4 Map of the Overthrust Belt.

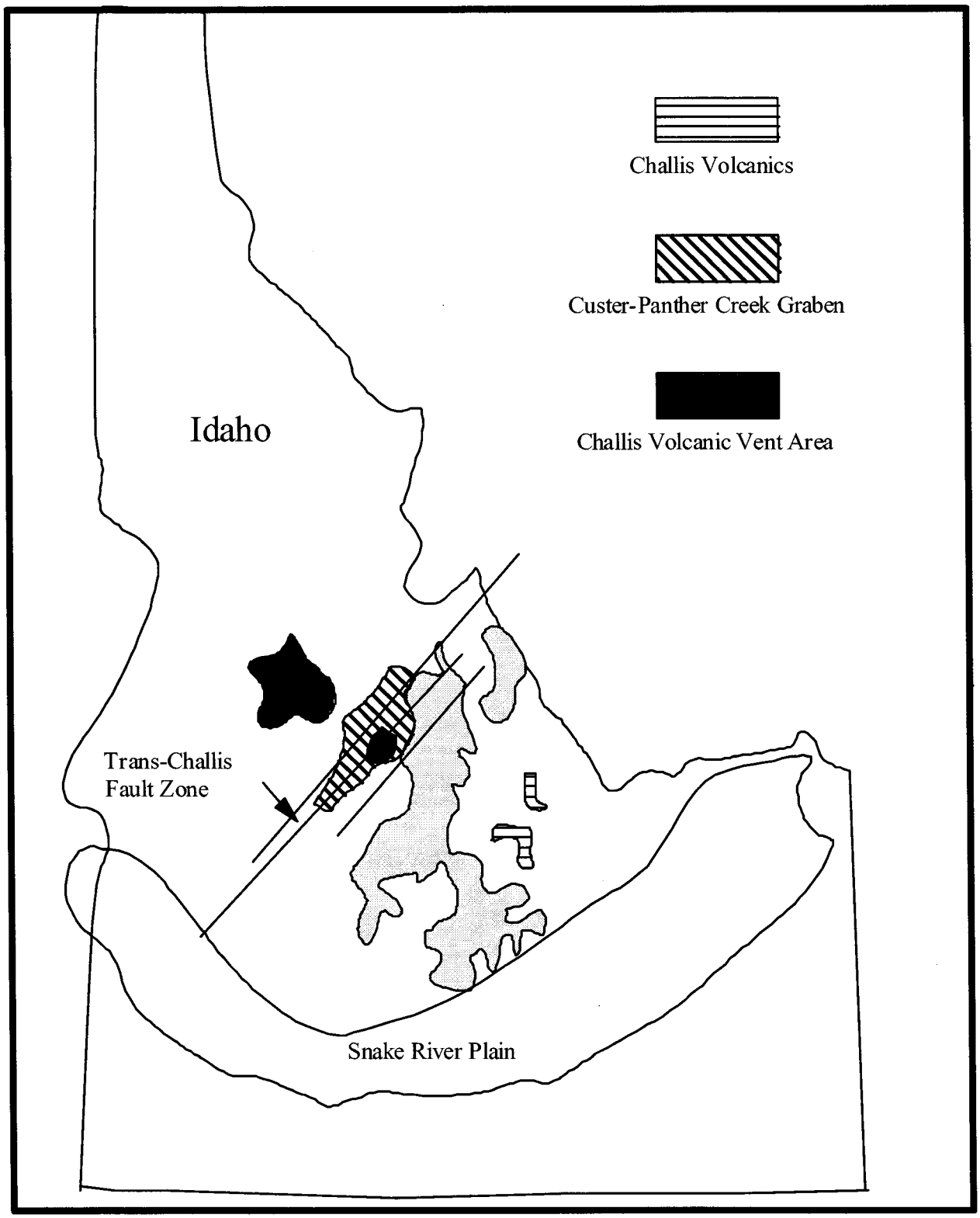


Figure 2.6-5 Map Showing Trans-Challis Fault Zone and Challis Volcanic Field

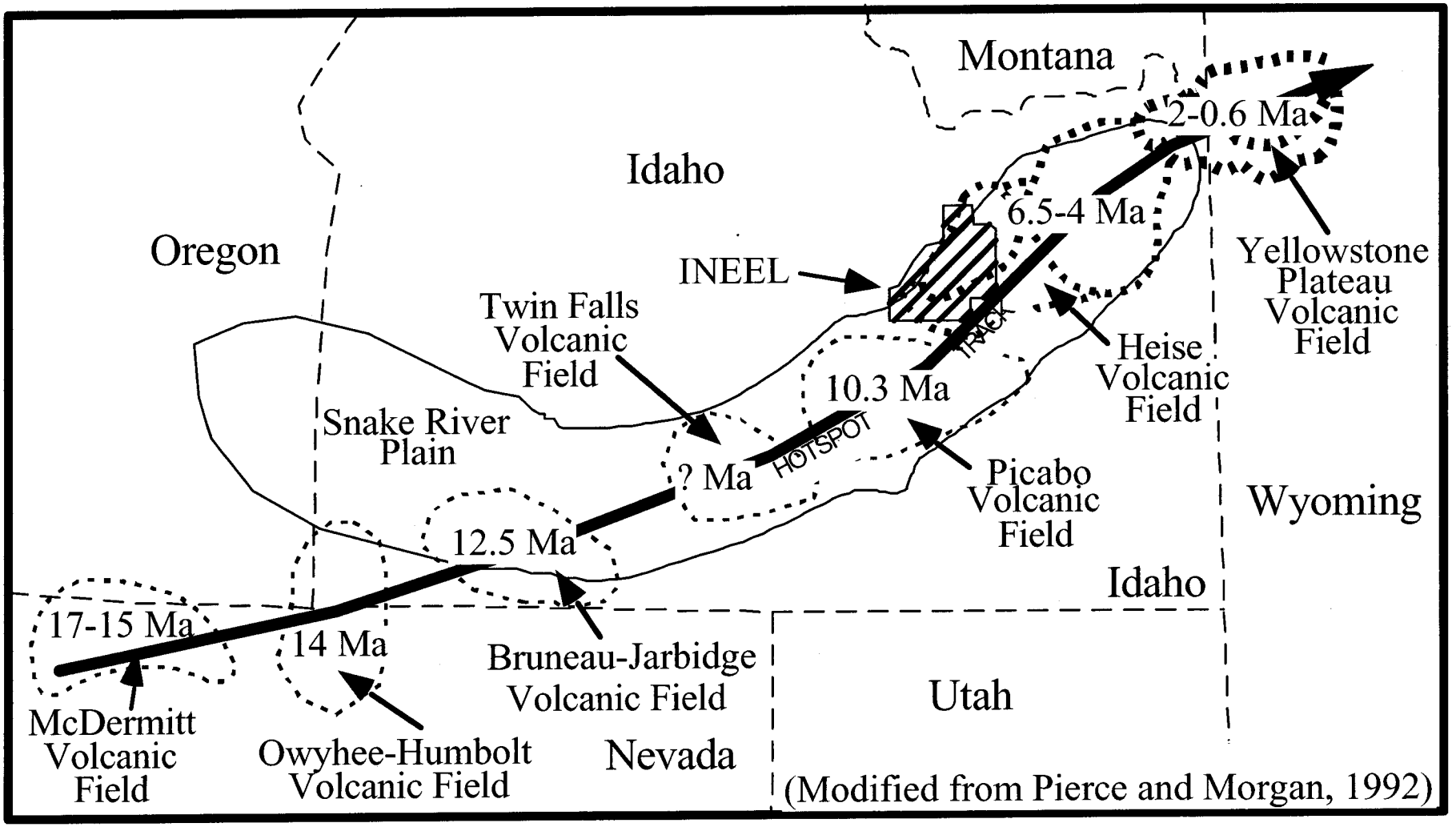


Figure 2.6-6 Calderas in the Track of the Yellowstone Hotspot (modified from Pierce and Morgan, 1992).

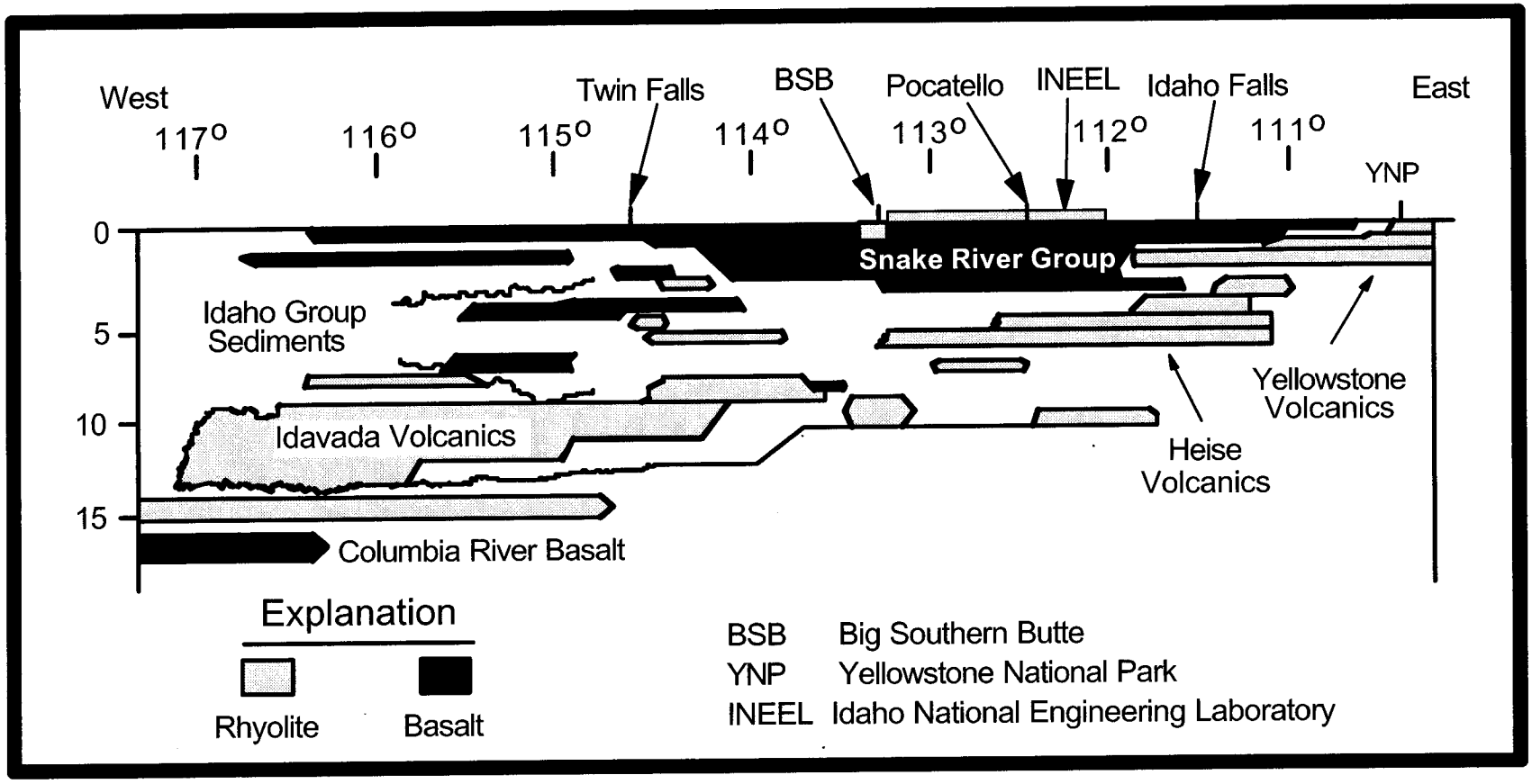


Figure 2.6-7 Armstrong Diagram

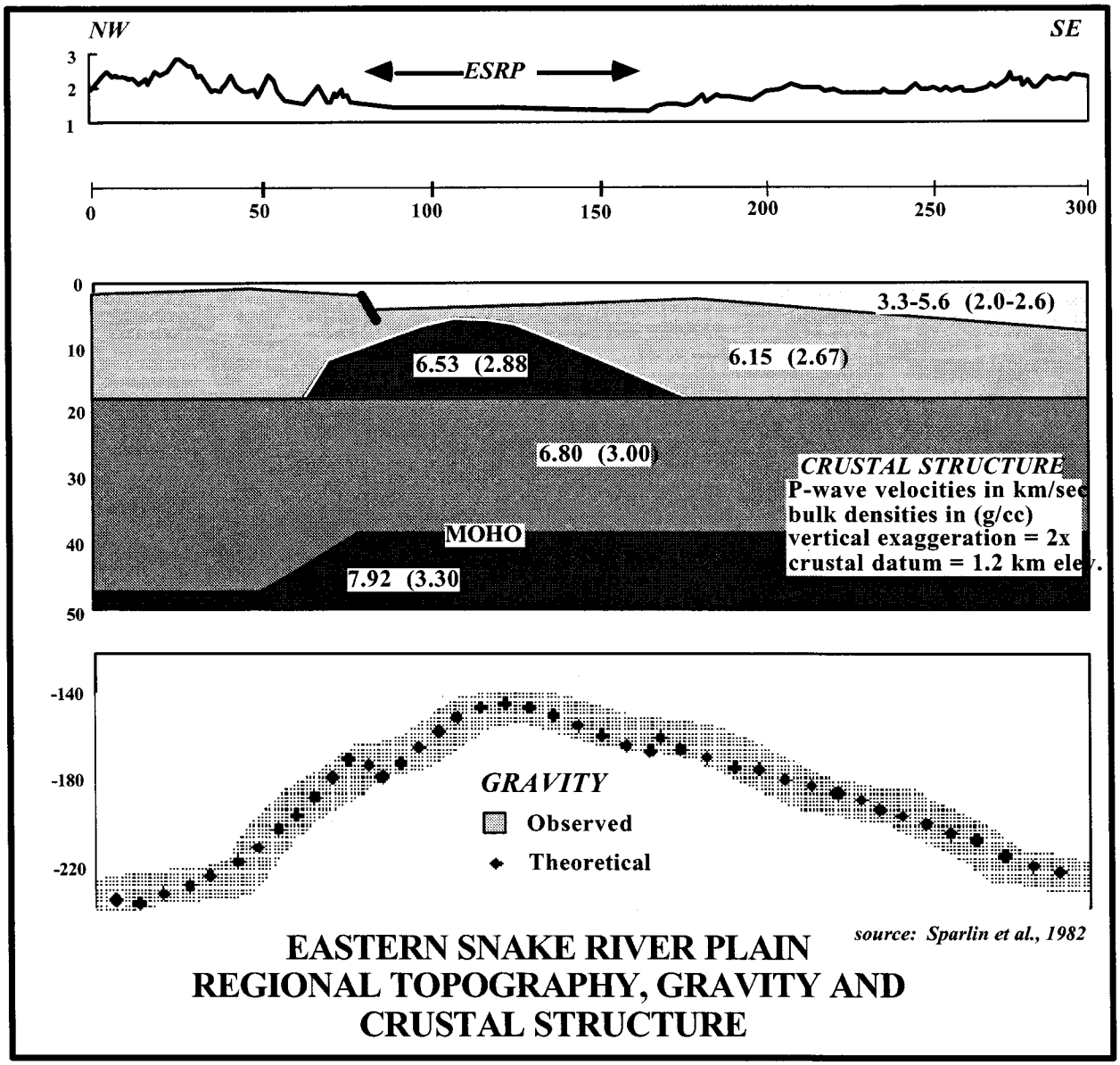


Figure 2.6-8 Topographic Profile, Crustal Structure, and Gravity Profile of the ESRP (modified from Sparlin et al., 1982)

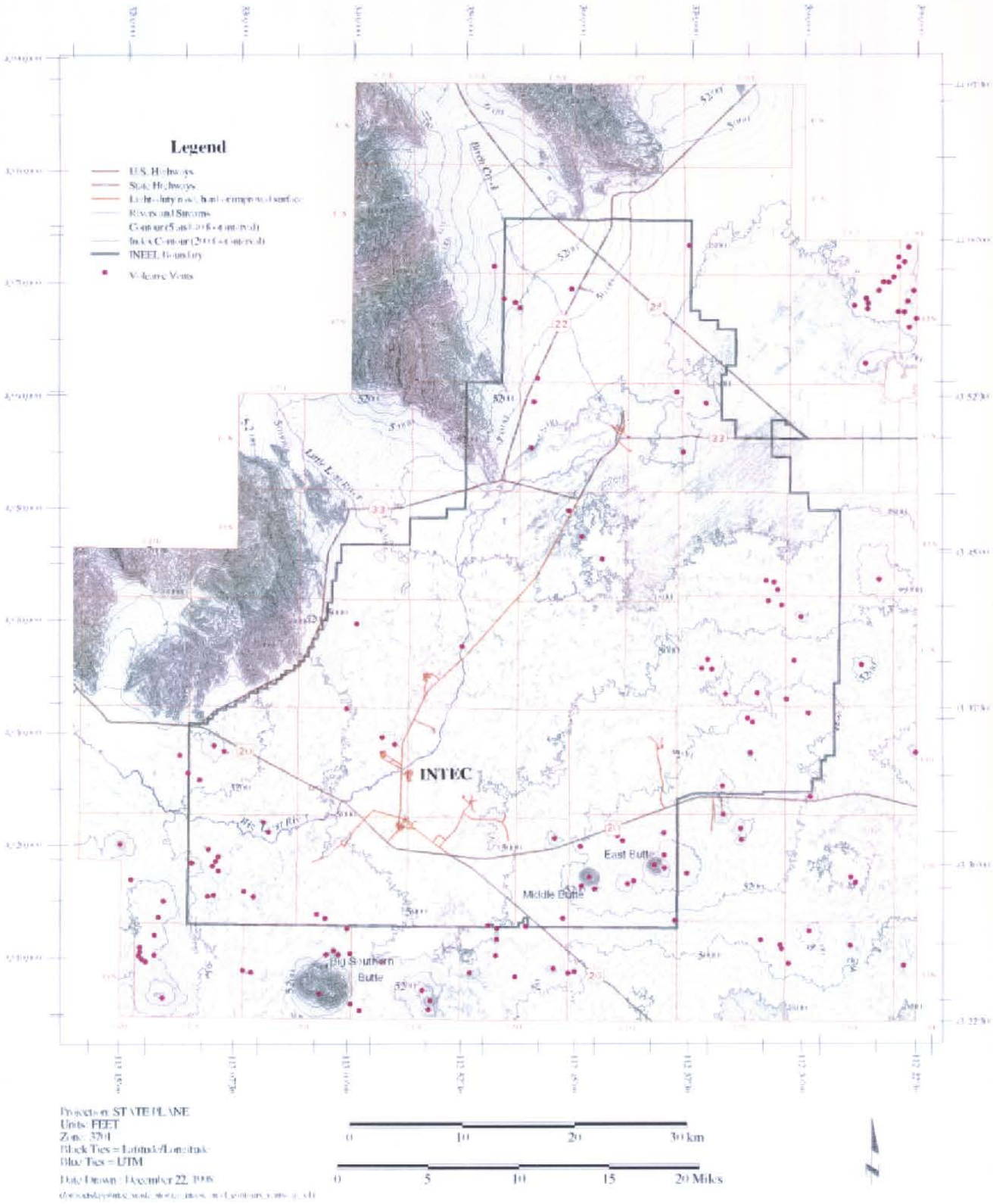


Figure 2.6-9. Topographic Map of the INEEL Area With Volcanic Vents.

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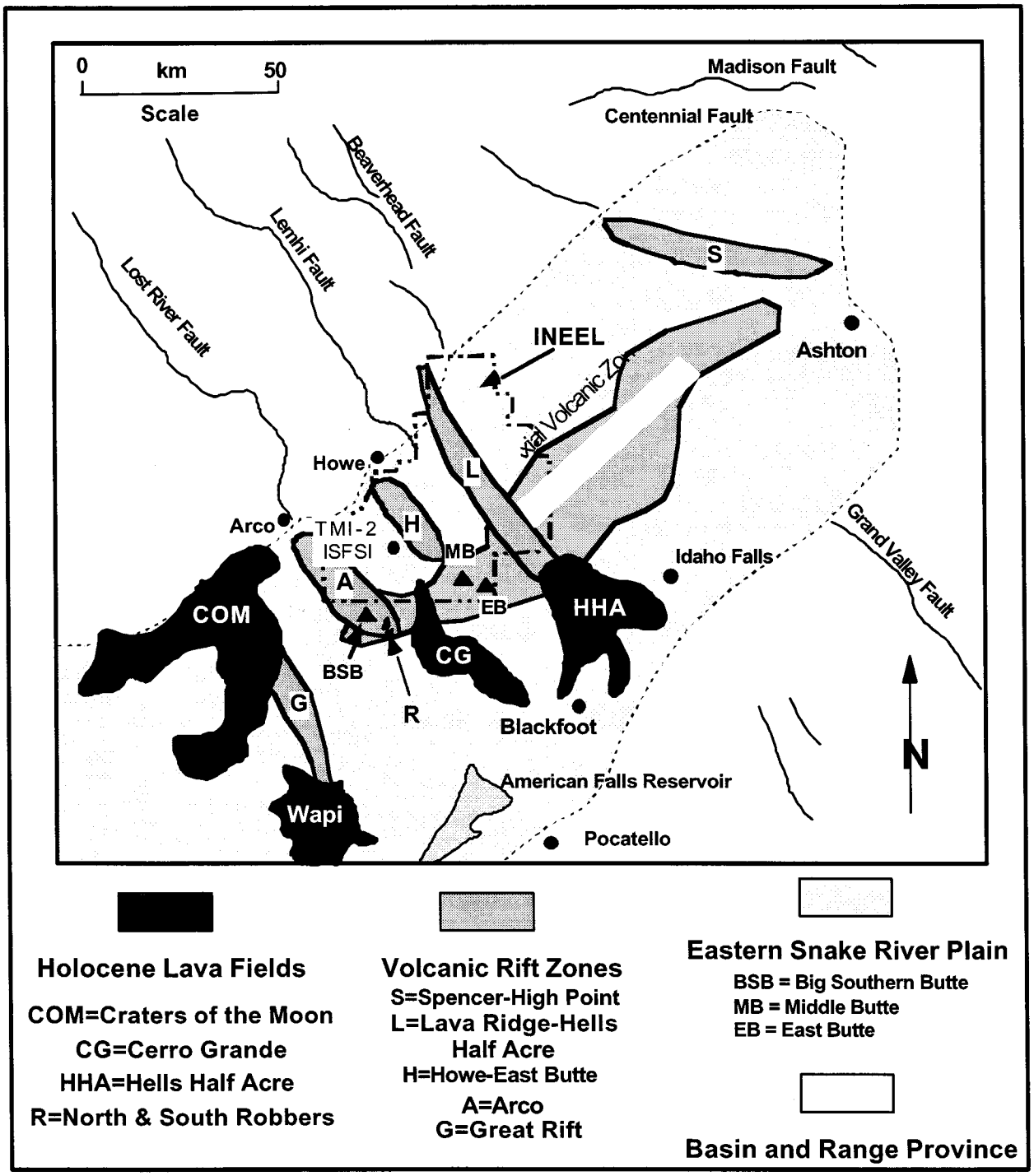

Figure 2.6-10 Map of the ESRP Showing Locations of Volcanic Zones, Holocene Volcanic Fields, the INEEL, and the Location of the ISFSI Site.

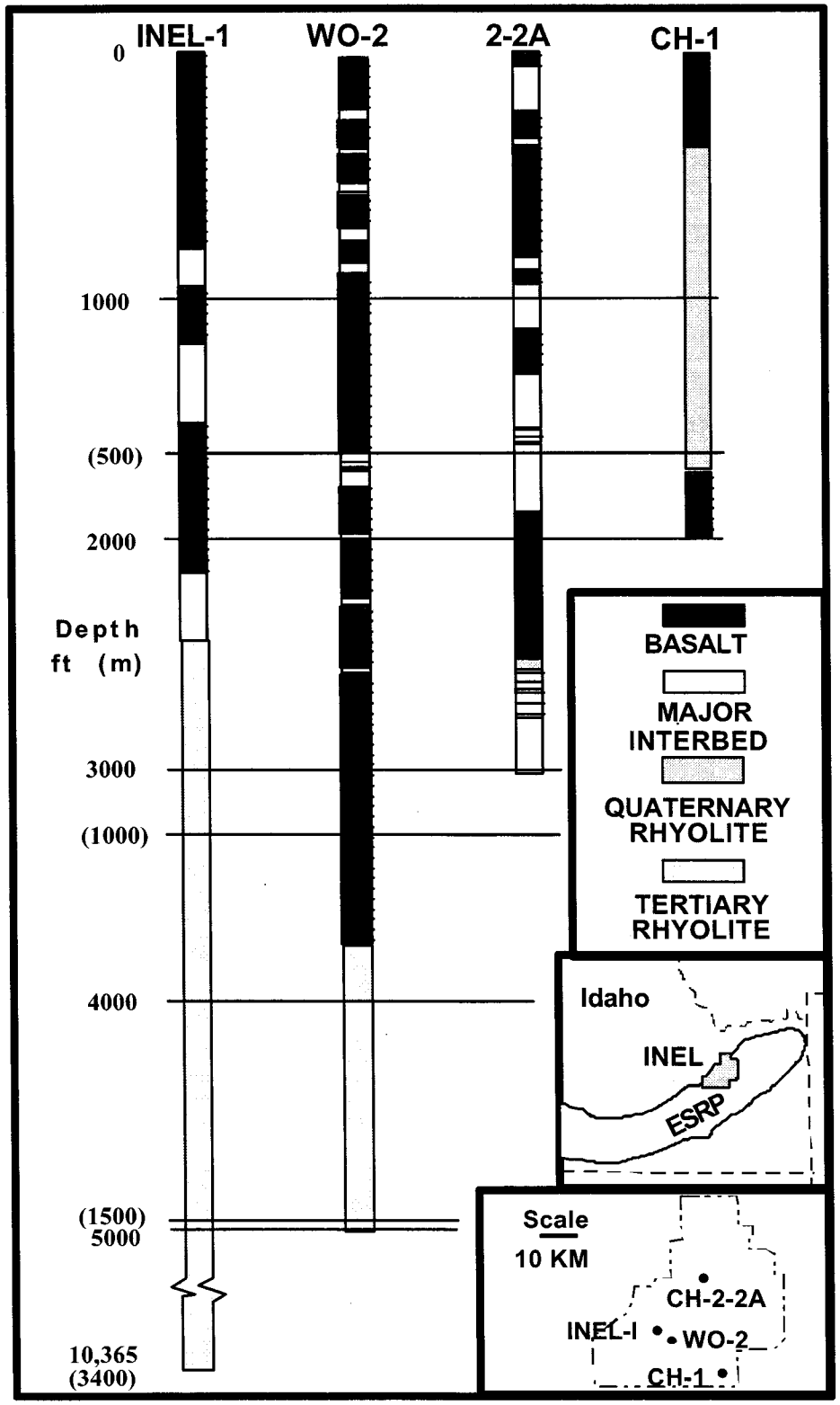

Figure 2.6-11 Lithographic Logs of the Four INEEL Deep Drill Holes

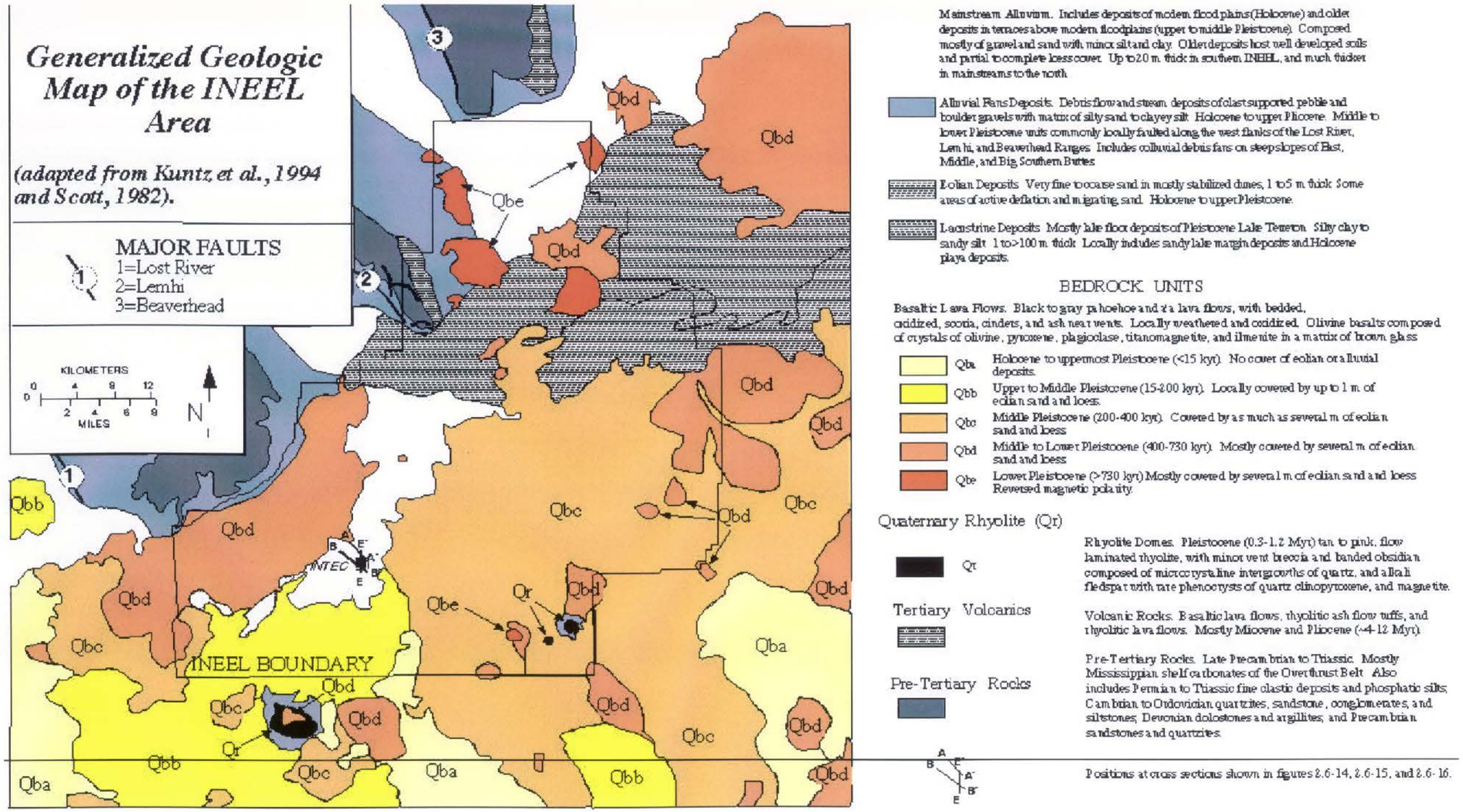

Figure 2.6-12 Geologic Map of the INEEL with INTEC Located

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