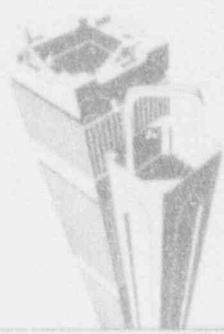
SIEMENS

EMF-14
Revision 3

SUPPLEMENT TO APPLICANT'S ENVIRONMENTAL REPORT

AUGUST 1992



Siemens Power Corporation

Nuclear Division

SIEMENS

EMF-14, Rev. 3
Issue Date: 8/26/92

SUPPLEMENT TO APPLICANT'S ENVIRONMENTAL REPORT

Prepared by

S. R. Lockhaven

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SUPPLEMENT TO APPLICANT'S ENVIRONMENTAL REPORT

Prepared by: ____________________ 8/20/92
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Date

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Regulatory Compliance
Date

SUPPLEMENT TO APPLICANT'S ENVIRONMENTAL REPORT

TABLE OF CONTENTS

List of Tables

List of Figures

INTRODUCTION

The purpose of this report is to present summary information and data that characterizes Siemens site environmental management performance and demonstrate the status of compliance with applicable federal, state and local environmental laws and regulations.

This report consists of summary data covering the years 1987 through 1991.

SUPPLEMENT TO APPLICANT'S ENVIRONMENTAL REPORT

1.0 FACILITY DESCRIPTION AND EFFLUENT CONTROL

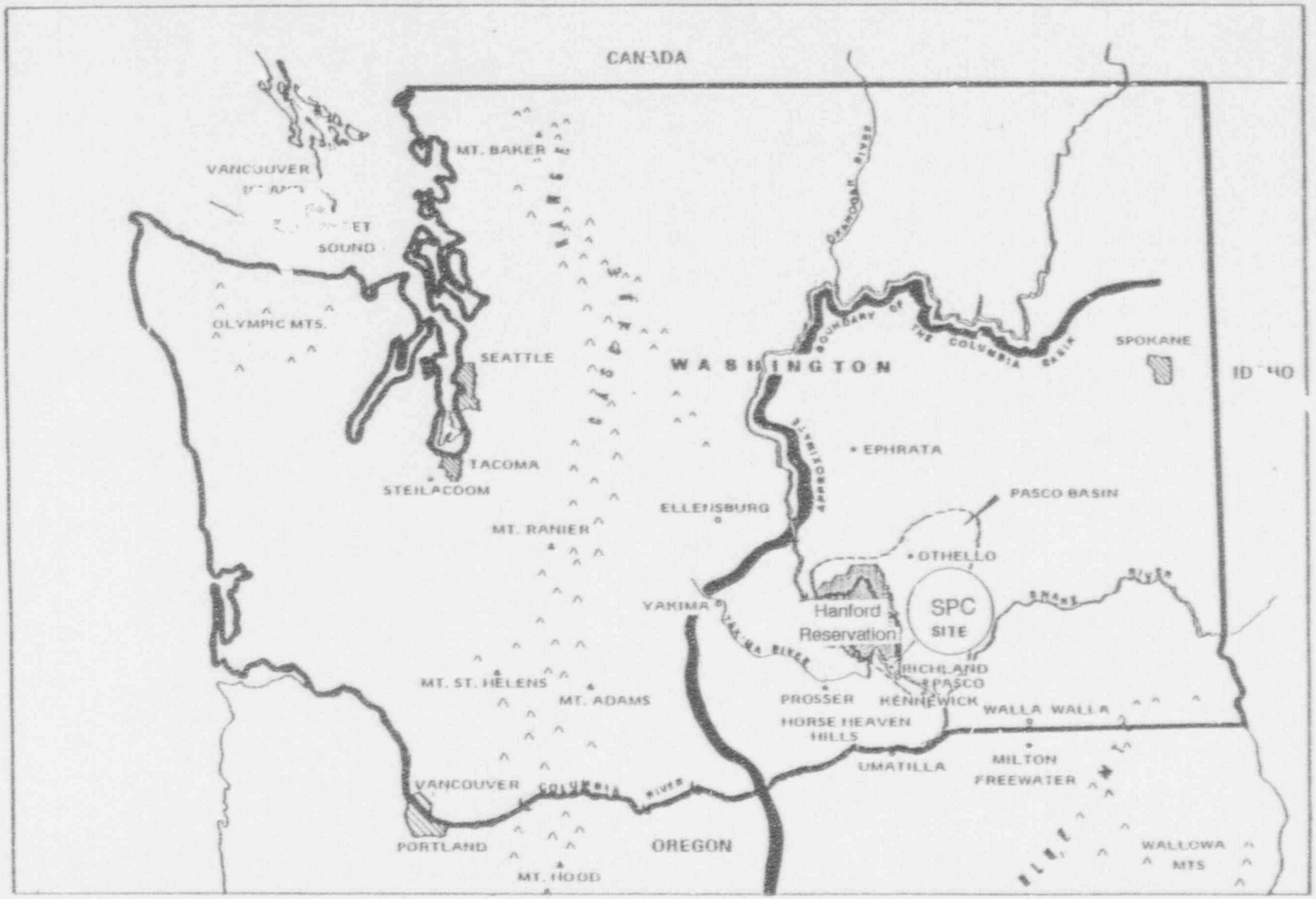
The facility description is provided by Part II, Chapter 10 of the License Application EMF-2. The methods used to control and monitor the effluents are described by Part I, Chapter 5 of that same application.

2.0 SITE DESCRIPTION

2.1 Location

The SPC site lies just inside the northern boundary of the City of Richland in the southeastern portion of the State of Washington, and is approximately 110 miles west of the Idaho-Washington border, 180 miles south of the Canadian border, and 225 miles east of the Pacific Ocean. As shown in Figure 2.1-1, it is bordered on the north by the Hanford Reservation. The site coordinates are 46° 22' north latitude and 119° 16' west longitude.

The site buildings lie just inside the north central plant boundary, and the center of the plant lies approximately 930 feet south of Horn Rapids Road which forms the northern boundary of the site. The Columbia River flows southward at a point approximately 1-3/4 miles east, and the Yakima River flows toward the southeast roughly 2-1/2 miles southwest of the plant. Table 2.1-1 gives the distance from a number of off-site developments.



PLANT LOCATION IN STATE
FIGURE 2.1-1

Table 2.1-1 Distances from the Facility to Off-Site Developments

Developments	Distance	Direction
Horn Rapids Road	930 feet	North
Industrial Plant (Allied Technology)	3,500 feet	Southeast
Closest Farm (Potatoes)	3,500 feet	South & Southwest
Stevens Drive	4,600 feet	East
Industrial Plant (Battelle Northwest)	1 mile	East
State Route 240	2 miles	Southwest
Closest School (Hanford High)	2-1/10 miles	Southeast
Closest Residence (Sprout Road and Harris Avenue)	2-1/10 miles	Southeast
Closest Airport (Port of Benton)	3 miles	South
Closest Hospital (Kadlec Medical Center)	4-3/4 miles	South

2.2 Land Use and Regional Demography

The City of Richland in which the SPC is located, along with Pasco and Kennewick, comprise a metropolitan area known as the Tri-Cities. In 1970, the Tri-Cities population was approximately 56,000. During the following 10 years, due mainly to the increased activities on the Hanford Reservation, the population of the Tri-Cities area had increased to 84,750; i.e., a 51% increase. Table 2.2-1 shows the 1990 population distribution within a 50-mile radius of the SPC by compass direction and radii interval. Projected population within 50 miles of SPC for 1995 is presented in Table 2.2-2.

The SPC site is on a 6,100 acre parcel of land known as the Horn Rapids Triangle. This land was acquired by the USAEC in 1942 as part of the Hanford Reservation and was subsequently annexed to the City of Richland in 1967. The triangular tract is bounded on the north by Horn Rapids Road, on the south by the Horn Rapids Irrigation Ditch, on the east by a strip of AEC Department of Energy (DOE) land, and on the southeast by the Port of Benton airport. State Route 240, Hanford Highway, runs diagonally through the Triangle.

The City of Richland owns two-thirds of the land in the Triangle; the remaining third, arranged in a checkerboard pattern, is owned by the Bureau of Land Management and private industry. At present, a portion of the Triangle is zoned for light industry and the remainder is zoned agricultural. The 320 acre SPC site lies in the northeastern portion of the 800 acre rectangle which is zoned industrial.

The City initiated a comprehensive planning study for the entire area. A 1970 development study of the Horn Rapids Triangle is being used as a guideline for this section of the City within the present plan. The year 2000 plan for the Horn Rapids Triangle is shown in Figure 2.2-1. It is estimated that 2,000 to 3,000 acres of the Triangle will be required by the year 2000, assuming a population growth rate in the range of 2% to 2.5%. The residential development, which is planned adjacent to Hanford Road, is not expected to be required until 1995 or later (if development in the area annexed in 1970 south of the Yakima River proceeds rapidly). It is planned that roughly 10-20% of the Triangle will be developed for industry, and that the industrial development will take place to the south and west of the existing SPC site.

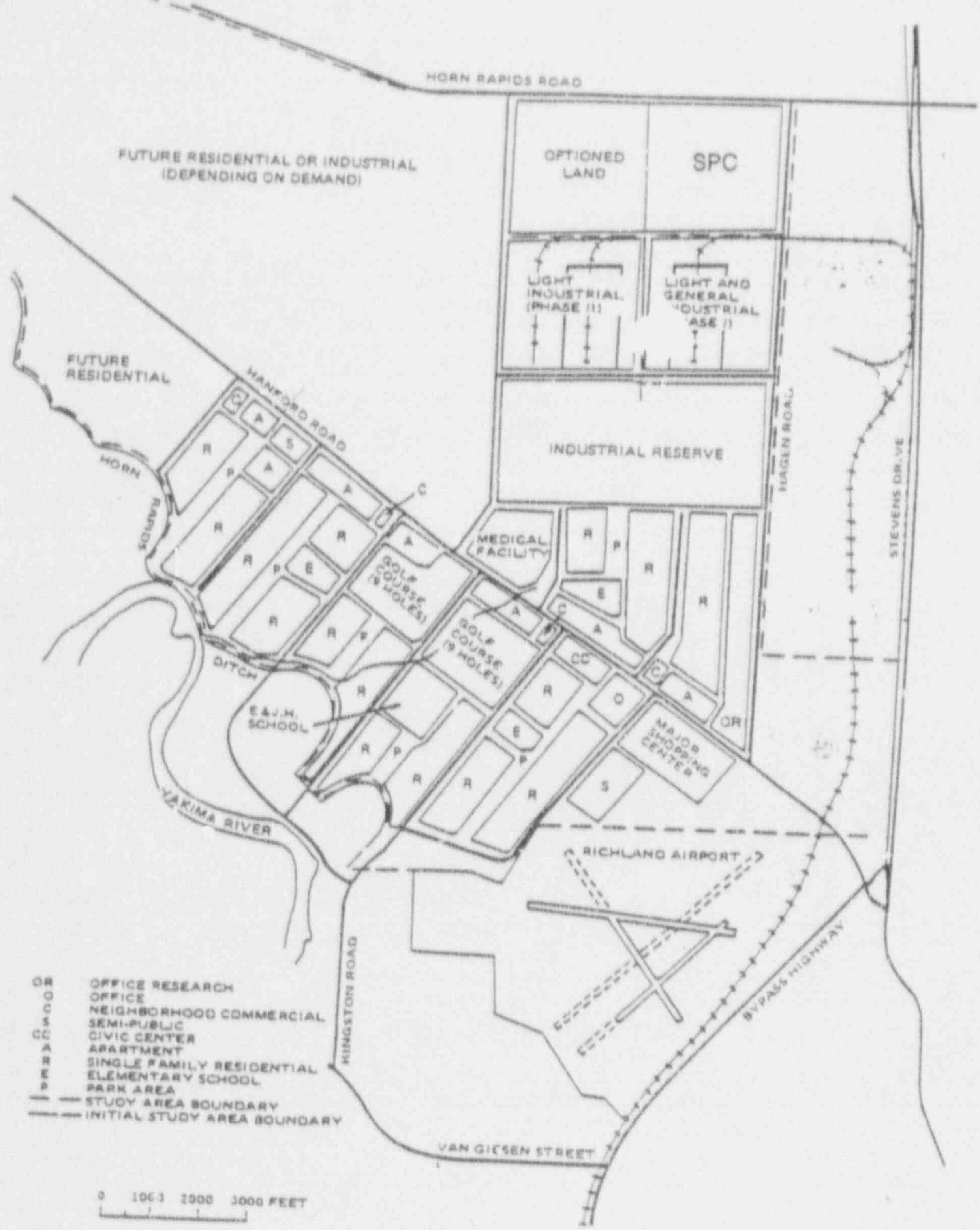
The land use in Benton County within a five-mile radius of the facility is comprised mostly of agricultural with rural residential southwest of the plant, high density residential southeast of the plant, unoccupied desert northeast and northwest of the plant and agricultural west of the plant. Approximately 90 acres of land are being farmed for alfalfa east-southeast of the plant, and an additional alfalfa field of about 65 acres lies southeast of the plant. Directly west, south and southwest of the plant is irrigated land that is used to grow crops such as potatoes. It is estimated that there are a few hundred head of cattle within five miles of the plant in Benton County. The closest herd of about 50 beef cattle are located about three miles southwest of the plant.

The portion of Franklin County which lies within a five-mile radius of the facility is primarily an agricultural area. The principal crops are alfalfa, hay and potatoes. There are two commercial dairy herds in this area totaling roughly 150 cows. There are, perhaps, an equal number of beef cattle.

Richland officials encourage the continued development of nuclear energy in the area. In particular, the development of commercial endeavors and the diversification of existing government research are intermediate term goals. The SPC development was considered a major step forward in the attainment of these goals.

Table 2.2-1							
Estimated Population Distribution (1990) within 50 Miles of the SPC Site (By Compass Sector and Distance)							
Compass Sector	0-5	5-10	10-20	20-30	30-40	40-50	Total
N	0	0	140	520	1,350	1,050	3,060
NNE	0	20	250	530	4,450	1,420	6,670
NE	0	130	700	1,500	1,220	550	4,100
ENE	50	150	500	180	270	250	1,400
E	100	200	250	250	150	550	1,500
ESE	120	2,700	4,260	420	650	900	9,050
SE	2,730	3,780	48,880	2,600	1,160	690	59,840
SSE	13,750	13,030	15,160	410	1,920	1,900	46,170
S	13,710	5,680	4.550	4,670	11,680	3,030	43,320
SSW	960	320	450	260	2,600	1,200	5,790
SW	1,120	240	880	510	320	410	3,480
WSW	170	1,750	1,360	6,200	10,240	810	20,530
W	250	430	1,020	1,650	15,450	17,510	36,310
WNW	0	0	0	1,280	1,300	2,670	5,250
NW	0	0	0	110	590	1,160	1,860
NNW	0	0	0	10	300	1,580	1,890
Total	32,960	28,430	78,400	21,100	53,650	35,680	250,220

Table 2.2-2							
Estimated Population Distribution (1995) within 50 Miles of the SPC Site (By Compass Sector and Distance)							
Compass Sector	0-5	5-10	10-20	20-30	30-40	40-50	Total
N	0	0	180	560	1,500	1,110	3,350
NNE	0	30	320	570	4,750	1,530	7,200
NE	0	150	840	1,560	1,350	610	4,510
ENE	70	170	510	180	280	270	1,480
E	150	300	390	300	150	570	1,860
ESE	280	2,950	4,400	430	670	930	9,660
SE	4,250	5,300	58,600	3,100	1,450	720	73,420
SSE	16,000	15,500	18,200	500	2,020	2,000	54,220
S	16,500	6,600	5,300	5,850	13,300	3,400	50,950
SSW	1,750	340	540	350	2,750	1,280	7,010
SW	1,200	250	950	600	330	430	3,760
WSW	170	2,000	1,500	7,600	10,550	830	22,650
W	260	450	1,080	1,750	16,800	18,800	39,140
WNW	0	0	0	1,650	1,330	2,800	5,780
NW	0	0	0	110	620	1,200	1,930
NNW	0	0	0	10	320	1,660	1,990
Total	40,630	34,040	92,810	25,120	58,170	38,140	288,910



HORN RAPIDS TRIANGLE YEAR 2000 DEVELOPMENT PLAN
FIGURE 2.2-1

2.3 Meteorology and Climatology

The prevailing wind at the SPC site is from the southwest along the Yakima River corridor, which enters the Columbia Basin near the site. Secondary direction frequency maxima are from the northwest and the southeast along the axis of the Columbia River Valley, and the lowest frequencies are from the east and northeast. This pattern holds most of the year, with the exception of a few months in the fall and early winter, when the winds from the southwest and southeast occur less frequently and the wind direction is predominantly from the north and northwest. Measurements of the wind characteristics in the vicinity of the SPC site are summarized by Figure 2.3-1 and Table 2.3-1. The annual average X/Q values for the SPC site are tabulated in Table 2.3-2.

Periods of relative stagnation occur frequently because of the interaction between Pacific high pressure systems and the basin terrain, although stagnation is seldom reduced to totally calm conditions. There are extended periods of light variable winds. On a statistical basis periods of 10-day stagnation (i.e., 0.5 mph) can be expected every other year, and periods of 8-day stagnation can be expected two out of three years.

Unusually large temperature variations in the Richland area are caused by the mountain ranges to the west, which prevent moderating Pacific Ocean breezes from reaching the area, and the orientation of the Rocky Mountains, which permits cold Canadian air to spill into the basin in the winter. The normal maximum temperatures of 95°F occur in July, and the normal minimum temperatures of 20°F occur in January. The record high temperature was 115°F and the record low temperature of 27°F below zero. The temperature falls to below freezing an average of approximately 100 days per year. Minimum temperatures of zero or below have occurred on as many as 14 days per month during both January and February. Maximum temperatures of 100°F or more have been recorded on 16 days each during July and August.

The total annual amount of precipitation in the Richland area is 6.4 inches on the average which is typical of a desert biome. It is distributed unevenly, with nearly an inch per month occurring during November, December, and January, while July and August average only about 0.2 inches. The extreme annual amounts of precipitation on record are a maximum of 12.43 inches and a minimum of 3.26 inches. Snowfalls of one inch or more occur on the average of twice each month in December and January. Periods of snow accumulations of three inches or more average about five days in January. The largest snowfall on record resulted in an accumulation of 43.6 inches.

Severe weather in the Columbia Basin consists of wind, thunderstorms, and occasionally a tornado. No tornadoes have been recorded within 20 miles of the facility. Wind speeds of approximately 60 mph are expected one year out of two, and speeds in excess of 50 mph are expected every year. The average annual frequency of thunderstorms in the Richland area is only eleven. Hail occurs during only about one thunderstorm in ten, or about once a year on the average. Hurricanes do not occur in Washington State.

Fourteen tornadoes have been recorded in the Columbia Basin during the past 56 years. All were of short duration, reaching ground level only for brief periods and causing only slight damage. Based on a review of tornado occurrences in the northwestern states during the period 1950-1969, individual storms and their occurrence along preferred paths or channels in the mountainous terrain, several conservative conclusions have been drawn:

1. Within a 100-mile circular area centered at the SPC Site, the expected number of tornadoes is 0.4 per year.

2. The mean (or expected) probability that a tornado will strike the specific SPC Site during any given year is 6.1×10^{-6}.

3. The probability is 0.95 that the wind speed will not exceed 168 mph in any given tornado, and over a forty-year period, the best estimate of the maximum wind speed is 174 miles per hour.

Table 2.3-1

Joint Frequency Distribution of Wind Speed, Wind Direction and Atmospheric Stability Applicable to the SPC Site

Wind Speed	Pasquill Stability	Wind Direction								
		NE	E	SE	S	SW	W	NW	N	Total
Calm (presumed 0-0.5 mph)	G	0.10	0.11	0.26	0.14	0.12	0.058	0.097	0.20	
	F	0.10	0.11	0.26	0.14	0.12	0.58	0.097	0.20	
	D	0.033	0.035	0.087	0.046	0.042	0.019	0.032	0.065	
	C	0.10	0.11	0.26	0.14	0.12	0.058	0.097	0.20	
	ALL	0.33	0.35	0.87	0.46	0.42	0.19	0.32	0.65	3.59%
0.5-3 mph	G	0.66	0.69	1.71	0.90	0.81	0.38	0.63	1.28	
	F	0.66	0.69	1.71	0.90	0.81	0.38	0.63	1.28	
	D	0.22	0.23	0.57	0.30	0.27	0.13	0.21	0.43	
	C	0.56	0.69	1.71	0.90	0.81	0.38	0.63	1.28	
	ALL	2.19	2.30	5.71	2.99	2.72	1.26	2.11	4.28	23.56%
4-7 mph	F	1.08	1.17	3.49	2.36	3.26	2.12	2.84	2.64	
	D	0.18	0.19	0.58	0.39	0.54	0.35	0.47	0.44	
	C	0.54	0.58	1.75	1.18	1.63	1.06	1.42	1.32	
	ADD	1.80	1.95	5.82	3.94	5.43	3.53	4.73	4.40	31.60%
8-12 mph	F	0.38	0.24	0.97	0.95	2.76	2.18	2.96	0.94	
	D	0.063	0.04	0.16	0.16	0.46	0.36	0.49	0.16	
	C	0.19	0.12	0.49	0.47	1.38	1.09	1.48	0.47	
	ALL	0.63	0.40	1.61	1.58	4.60	3.63	4.93	1.57	18.95%
13-19 mph	F	0.16		0.19	0.52	2.09	0.93	1.47	0.29	
	D	0.027		0.032	0.087	0.35	0.16	0.25	0.048	
	C	0.082		0.097	0.26	1.04	0.46	0.74	0.14	
	ALL	0.27		0.32	0.87	3.48	1.55	2.45	0.48	9.42%
19-24 mph	F				0.24	1.00	0.26	0.60		
	D				0.039	0.17	0.043	0.10		
	C				0.12	0.50	0.13	0.30		
	ALL				0.39	1.67	0.43	1.00		3.49%

Table 2.3-1 (Continued)

Wind Speed	Pasquill Stability	Wind Direction								
		NE	E	SE	S	SW	W	NW	N	Total
25-31 mph	F				0.095	0.42	0.043	0.34		
	D				0.016	0.070	0.007	0.057		
	C				0.047	0.21	0.021	0.17		
	ALL				0.16	0.70	0.072	0.57		1.50%
32-38 mph	F					0.18				
	D					0.031				
	C					0.092				
	ALL					0.31				0.31%
Variable* 0-3 mph	G	0.13	0.14	0.35	0.18	0.16	0.076	0.13	0.26	
	F	0.13	0.14	0.35	0.18	0.16	0.076	0.13	0.26	
	D	0.044	0.046	0.12	0.060	0.055	0.025	0.043	0.086	
	C	0.13	0.14	0.35	0.18	0.16	0.076	0.13	0.26	
	ALL	0.44	0.46	1.15	0.60	0.55	0.25	0.43	0.86	4.74%
Variable** 4-7 mph	F	0.067	0.072	0.22	0.15	0.20	0.13	0.18	0.16	
	D	0.011	0.012	0.035	0.024	0.034	0.022	0.029	0.027	
	C	0.033	0.036	0.11	0.073	0.10	0.065	0.088	0.082	
	ALL	0.11	0.12	0.35	0.24	0.34	0.22	0.29	0.27	1.94%

* Direction frequency distributed proportional to distribution within 0-3 mph class.

** Direction frequency distributed proportional to distribution within 4-7 mph class.

Table 2.3-2 Annual Average Atmospheric Dilution Factors

Annual Average CHI/Q (sec/meter cubed)

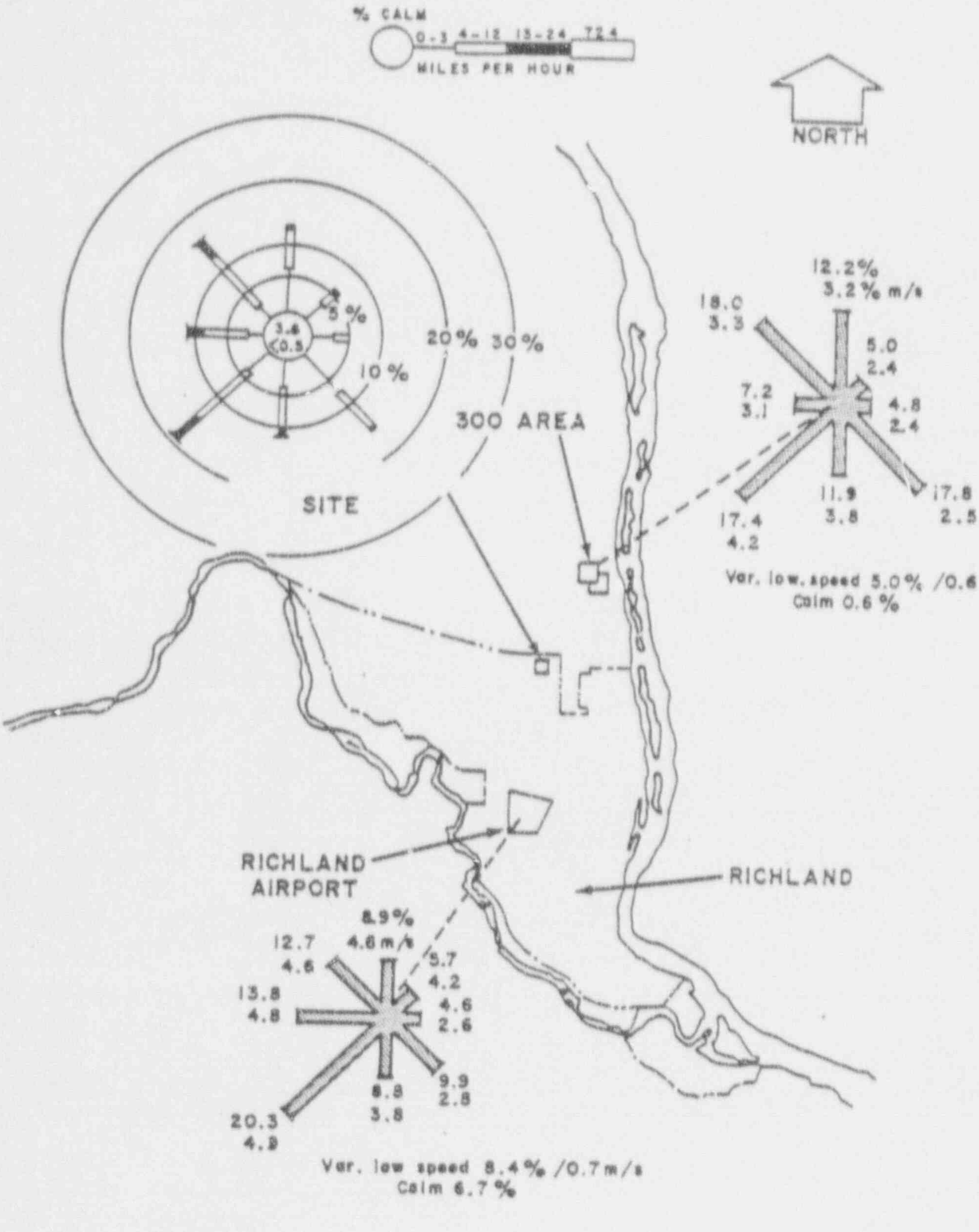
Distance in Miles

Direction From Site	0.500	1.000	2.000	3.000	4.000	5.000	10.000	20.000	30.000	40.000	50.000
N	0.635E-05	0.214E-05	[illegible]	0.474E-06	0.322E-06	0.239E-06	0.965E-07	0.408E-07	0.249E-07	0.176E-07	0.134E-07
NNE	0.656E-05	0.223E-05	0.852E-06	0.492E-06	0.334E-06	0.247E-06	0.998E-07	0.421E-07	0.256E-07	0.180E-07	0.137E-07
NE	0.678E-05	0.232E-05	0.884E-06	0.510E-06	0.345E-06	0.256E-06	0.103E-06	0.434E-07	0.263E-07	0.185E-07	0.141E-07
ENE	0.517E-05	0.177E-05	0.675E-06	0.389E-06	0.264E-06	0.195E-06	0.786E-07	0.330E-07	0.200E-07	0.141E-07	0.107E-07
E	0.353E-05	0.122E-05	0.463E-06	[illegible]	0.181E-06	0.134E-06	0.538E-07	0.225E-07	0.137E-07	0.957E-08	0.727E-08
ESE	0.453E-05	0.156E-05	0.593E-06	0.342E-06	0.231E-06	0.171E-06	0.689E-07	0.289E-07	0.175E-07	0.123E-07	0.935E-08
SE	0.553E-05	0.190E-05	0.722E-06	0.417E-06	0.282E-06	0.209E-06	0.841E-07	0.353E-07	0.214E-07	0.150E-07	0.114E-07
SSE	0.703E-05	0.238E-05	0.912E-06	0.528E-06	0.358E-06	0.265E-06	0.107E-06	0.453E-07	0.276E-07	0.195E-07	0.148E-07
S	0.861E-05	0.289E-05	0.111E-05	0.642E-06	0.436E-06	0.323E-06	0.131E-06	0.555E-07	0.339E-07	0.239E-07	0.182E-07
SSW	0.645E-05	0.217E-05	0.829E-06	0.481E-06	0.326E-06	0.242E-06	0.981E-07	0.416E-07	0.254E-07	0.179E-07	0.137E-07
SW	0.429E-05	0.144E-05	0.551E-06	0.320E-06	0.217E-06	0.161E-06	0.653E-07	0.277E-07	0.169E-07	0.120E-07	0.913E-08
WSW	0.436E-05	0.147E-05	0.562E-06	0.326E-06	0.221E-06	0.164E-06	0.666E-07	0.283E-07	0.173E-07	0.122E-07	0.932E-08
W	0.448E-05	0.150E-05	0.575E-06	0.333E-06	0.226E-06	0.168E-06	0.681E-07	0.289E-07	0.177E-07	0.125E-07	0.954E-08
WNW	0.795E-05	0.267E-05	0.102E-05	0.592E-06	0.402E-06	0.298E-06	0.121E-06	0.513E-07	0.313E-07	0.221E-07	0.169E-07
NW	0.114E-04	0.383E-05	0.147E-05	0.851E-06	0.578E-06	0.429E-06	0.174E-06	0.736E-07	0.450E-07	0.318E-07	0.242E-07
NNW	0.887E-05	0.298E-05	0.114E-05	0.662E-06	0.449E-06	0.333E-06	0.135E-06	0.572E-07	0.349E-07	0.246E-07	0.188E-07

CHI/Q (sec/meter cubed) for each segment

Segment Boundaries in Miles

Direction From Site	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
N	0.347E-05	0.124E-05	0.610E-06	0.387E-06	0.275E-06	0.142E-06	0.596E-07	0.312E-07	0.207E-07	0.152E-07
NNE	0.360E-05	0.129E-05	0.634E-06	0.401E-06	0.285E-06	0.147E-06	0.605E-07	0.321E-07	0.212E-07	0.156E-07
NE	0.373E-05	0.134E-05	0.658E-06	0.415E-06	0.295E-06	0.152E-06	0.624E-07	0.330E-07	0.218E-07	0.160E-07
ENE	0.284E-05	0.103E-05	0.502E-06	0.317E-06	0.225E-06	0.116E-06	0.476E-07	0.251E-07	0.166E-07	0.122E-07
E	0.195E-05	0.705E-06	0.344E-06	0.217E-06	0.154E-06	0.793E-07	0.325E-07	0.172E-07	0.113E-07	0.828E-08
ESE	0.250E-05	0.902E-06	0.441E-06	0.273E-06	0.198E-06	0.102E-06	0.417E-07	0.220E-07	0.145E-07	0.106E-07
SE	0.304E-05	0.110E-05	0.537E-06	0.339E-06	0.241E-06	0.124E-06	0.509E-07	0.269E-07	0.177E-07	0.130E-07
SSE	0.385E-05	0.138E-05	0.679E-06	0.430E-06	0.306E-06	0.158E-06	0.651E-07	0.346E-07	0.229E-07	0.169E-07
S	0.469E-05	0.168E-05	0.825E-06	0.523E-06	0.373E-06	0.192E-06	0.795E-07	0.424E-07	0.281E-07	0.207E-07
SSW	0.352E-05	0.126E-05	0.618E-06	0.392E-06	0.279E-06	0.144E-06	0.596E-07	0.318E-07	0.211E-07	0.156E-07
SW	0.234E-05	0.835E-06	0.411E-06	0.261E-06	0.186E-06	0.959E-07	0.397E-07	0.212E-07	0.141E-07	0.104E-07
WSW	0.239E-05	0.852E-06	0.419E-06	0.266E-06	0.190E-06	0.978E-07	0.405E-07	0.216E-07	0.144E-07	0.106E-07
W	0.244E-05	0.871E-06	0.429E-06	0.272E-06	0.194E-06	0.100E-06	0.414E-07	0.221E-07	0.147E-07	0.108E-07
WNW	0.433E-05	0.155E-05	0.761E-06	0.483E-06	0.344E-06	0.178E-06	0.734E-07	0.392E-07	0.260E-07	0.192E-07
NW	0.623E-05	0.223E-05	0.109E-05	0.694E-06	0.494E-06	0.255E-06	0.106E-06	0.563E-07	0.374E-07	0.276E-07
NNW	0.484E-05	0.173E-05	0.851E-06	0.539E-06	0.384E-06	0.198E-06	0.819E-07	0.437E-07	0.290E-07	0.214E-07



Wind Roses for SPC Site & Vicinity
Figure 2.3-1

2.4 Geology and Seismology

2.4.1 Geology

The Columbia Basin is underlain by very thick sequences of basaltic lava flows more than 10,000 feet thick. Within the area of the basaltic lava flows are a number of structural basins that contain layers of unconsolidated sands and gravels tens to hundreds of feet thick over the basaltic bedrock. Elsewhere, the basaltic is at or within a few feet of the surface. The SPC site, as shown in Figure 2.4-1, lies near the southwestern margin of the largest of such structural basins, which is known as the Pasco Basin.

Borings and excavations at the site show a shallow layer of loose sand overlying interbedded sands, gravels, and silts that are partly consolidated at depths. The depth to basaltic bedrock has been estimated at about 150 feet. Engineering studies have shown that the unconsolidated materials at the site provide good natural foundations for structures and have no potential for liquefaction under the proposed seismic design criteria. The materials are easily excavated with hand and power tools and are good sources of sand and gravel for construction purposes.

The lava beds and some of the overlying materials in the Pasco Basin are gently deformed into very broad folds that have overall dips toward the center of the basin. This structure is broken by several east-west trending linear zones of discontinuous folds and small faults that are marked by ridges and chains of hills and buttes that stand above the ɘral basin topography. The basin is bounded on the north and south by zones of sharper folding and faulting in which resistant lava beds have been uplifted to form hilly ridges. A schematic geological cross-section through the Pasco Basin is given in Figure 2.4-2.

2.4.2 Seismology

Considerable attention has been given to the seismicity of the area by many geologists and geophysicists, including those of the U.S. Geological Survey and private consultants to SPC. The SPC site, as shown in Figure 2.4-3, lies in a region classified as Zone 2, corresponding to Intensity VII on the Modified Mercalli Scale of 1931. No faults or other active tectonic features have been identified at the SPC site. The following three nearby structural zones have been considered as loci of potential earthquake activity:

1. Saddle Mountain lineament - a zone about 25 miles north of the site in which lava beds are sharply folded and faulted, and along which the epicenter of a damaging earthquake was located in 1918.

2. Gable Mountain lineament - a series of folds with minor faulting about 15 miles north of the site on which no movement younger than 40,000 years has been identified.

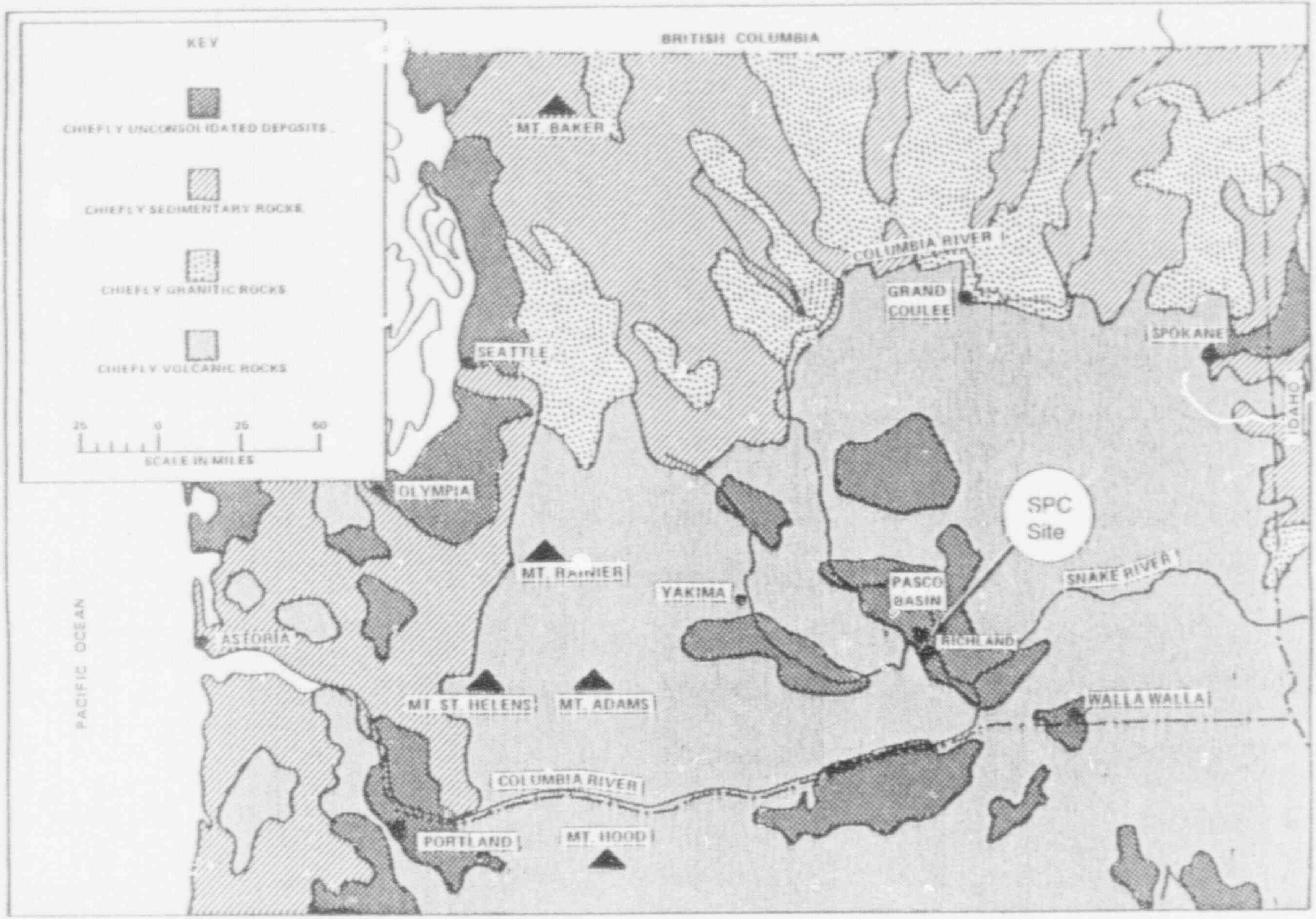
3. Rattlesnake Hills lineament - a zone approximately seven miles southwest of the site in which lava beds are folded and moderately faulted, and which has been interpreted by some geologists as a major, continuous feature extending northwest to the Pacific Ocean and by others as of more local significance. The characteristics of this lineament are not

> well enough known to fully assess its importance as a potential locus for earthquake activity. However, the existence of minor fault movements that may have occurred in historic times and the location of epicenters of two damaging earthquakes on or near the lineament suggest that parts of the feature may still be tectonically alive.

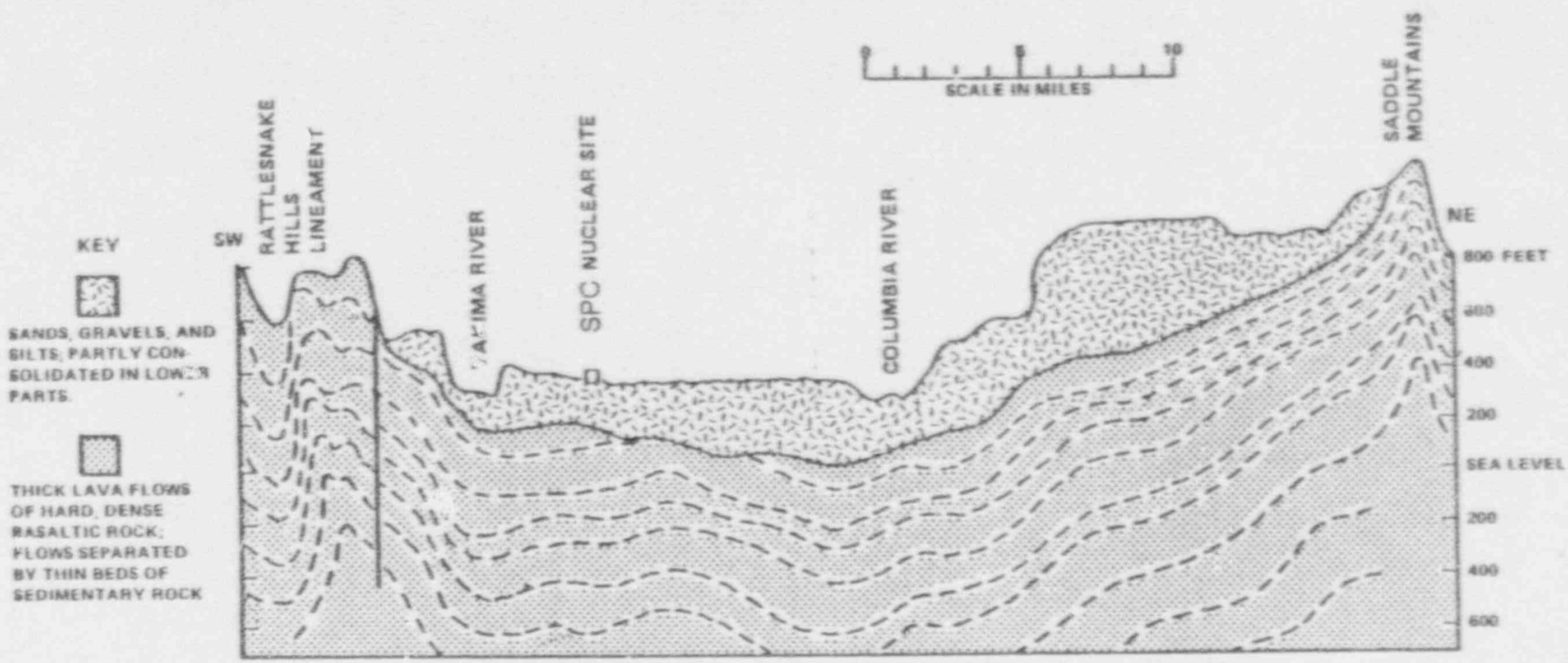
Although no damage from earthquakes has been reported at the site, there have been three earthquakes during the past 100 years of intensity large enough to cause moderate damage to structures within 30 to 60 miles of the site. The closest epicenters were in the vicinity of Umatilla in 1983 and near Walla Walla in 1936. The maximum intensities of these quakes were estimated to be VII (intensities are given in the Modified Mercalli Scale). The distribution of the epicenters of these and other less intense earthquakes in the vicinity is given in Figure 2.4-3.

It has been estimated that the maximum intensity experienced at the SPC site during historic earthquakes was approximately V on the Modified Mercalli Scale, producing a maximum horizontal ground acceleration of 0.02 g. Because the two largest nearby quakes had epicenters on or near the Rattlesnake Hills lineament, it is assumed that future earthquakes in the vicinity of the site are most likely to occur there. By assuming a geologic structure for the Rattlesnake Hills and by analogy with other regions where the geology is better known, the maximum seismic event likely to affect the plant is estimated to have an intensity of VIII at an epicenter seven miles from the site, and would induce a maximum ground acceleration of 0.25 g at the site. This is greater than ten times the estimated maximum intensity of any earthquake felt at the site during recorded history and is consistent with the basis for analyses of two nearby nuclear reactor sites. The Fast Flux Test Facility, located about 5 miles to the north, characterizes the design basis earthquake as 0.25 g. The safety evaluation of the Hanford No. 2 Nuclear Power Plant, which is located about 8 miles north of the SPC site, states that "....an acceleration of 0.25 g. is adequate for representing the ground motion from the maximum earthquake likely to affect the site."

The Cascade Range to the west of the plant contains a number of active or recently active volcanoes. The nearest volcano is nearly 80 miles away. Though there is not considered to be a potential hazard from lava flow during a volcanic eruption, the May 18, 1980 eruption of Mt. St. Helens showed that ash fallout can be a problem. To cover such potential problems in the future, SPC has developed an Emergency Ash Fallout Plan.



MAJOR GEOLOGICAL FEATURES OF WASHINGTON STATE
FIGURE 2.4-1



SCHEMATIC GEOLOGICAL CROSS–SECTION THROUGH PASCO BASIN
FIGURE 2.4-2

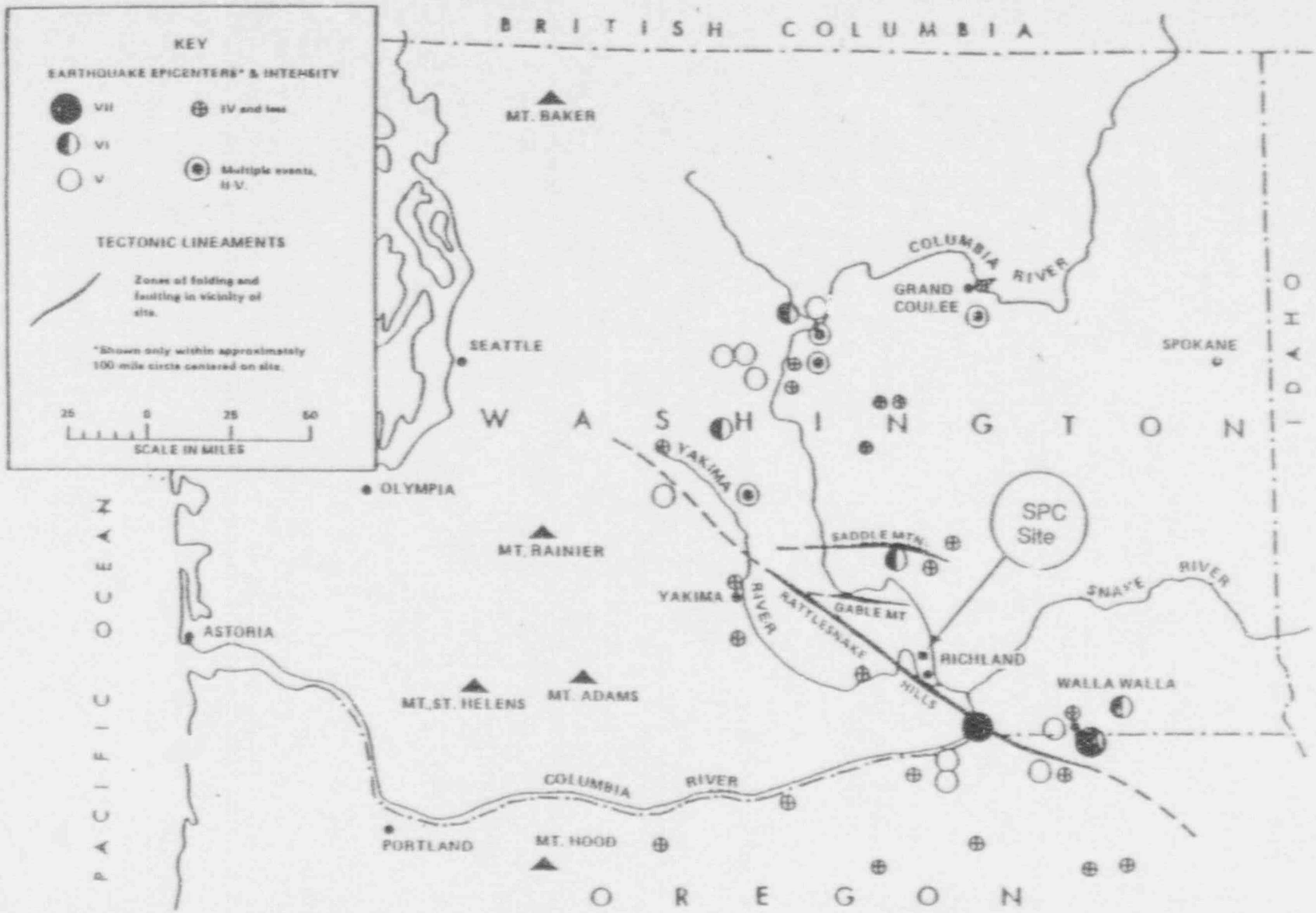


Figure 2.4-3 - Seismicity and Tectonics, Vicinity of SPC Site

2.5 Hydrology

2.5.1 Surface Water Hydrology

The SPC site lies between the Yakima and Columbia Rivers. The Columbia, one of the three largest rivers in North America, is fed by snowmelt in mountains far to the north and by ground water along its path. It is subject to flooding, chiefly during the spring melt season. Four large floods have occurred during the past 100 years. The flow of the Columbia is presently highly regulated by the many dams upstream of Richland in Washington State and British Columbia. The average daily discharge ranges from a controlled minimum of 76,000 cfs to 239,000 cfs. At the closest point, the site lies about 25 feet above the river level at a Columbia River flow rate of 260,000 cfs. The Columbia's water is of good chemical and bacteriological quality and the river is used for irrigation, power generation, municipal water supplies, transportation, fishing and water sports.

The Columbia River has been the subject of extensive flood frequency studies. Estimates have been made of maximum probable floods based on combinations of extreme natural hydrologic conditions and taking into consideration the flood-control storage afforded by existing and planned dams. The maximum probable flood assumes a flow of 1,440,000 cfs on the main stem of the Columbia River in the vicinity of the City of Richland. On the basis of such estimates, the site is considered subject to maximum flooding, to a depth of about 7 feet. The general extent of such flooding, which exceeds any historical documentation, is shown on Figure 2.5-1. Normal monitoring of hydrologic conditions within the basin could be expected to provide an early warning for such floods. The applicant estimates that a 30 day period is provided by early warning, which is sufficient to afford time for diking and movement of radioactive material inventory to in plant elevations above flood levels.

The 500 year flood is estimated to have a flow of 775,000 cfs in the Hanford reach of the Columbia. The facility, which is 371.5 feet above mean sea level is about six feet above the level expected from the 500 year flood.

Flooding on the Yakima River would not affect the SPC site. The only other surface drainage in the area consists of two abandoned irrigation ditches one-half mile east and west of the site that contain water during, and for short periods following, rains.

2.5.2 Groundwater Hydrology

Groundwater occurs in unconfined sand and gravel aquifers with the water table at between 11 and 30 feet below the surface at the site. Groundwater under artesian conditions also occurs at great depths within the basaltic bedrock. Recharge of shallow aquifers is chiefly from the Yakima River to the west. Water movement is mainly to the east with the water table discharging to the Columbia River. Deep aquifers have recharge areas in hills to the west and southwest.

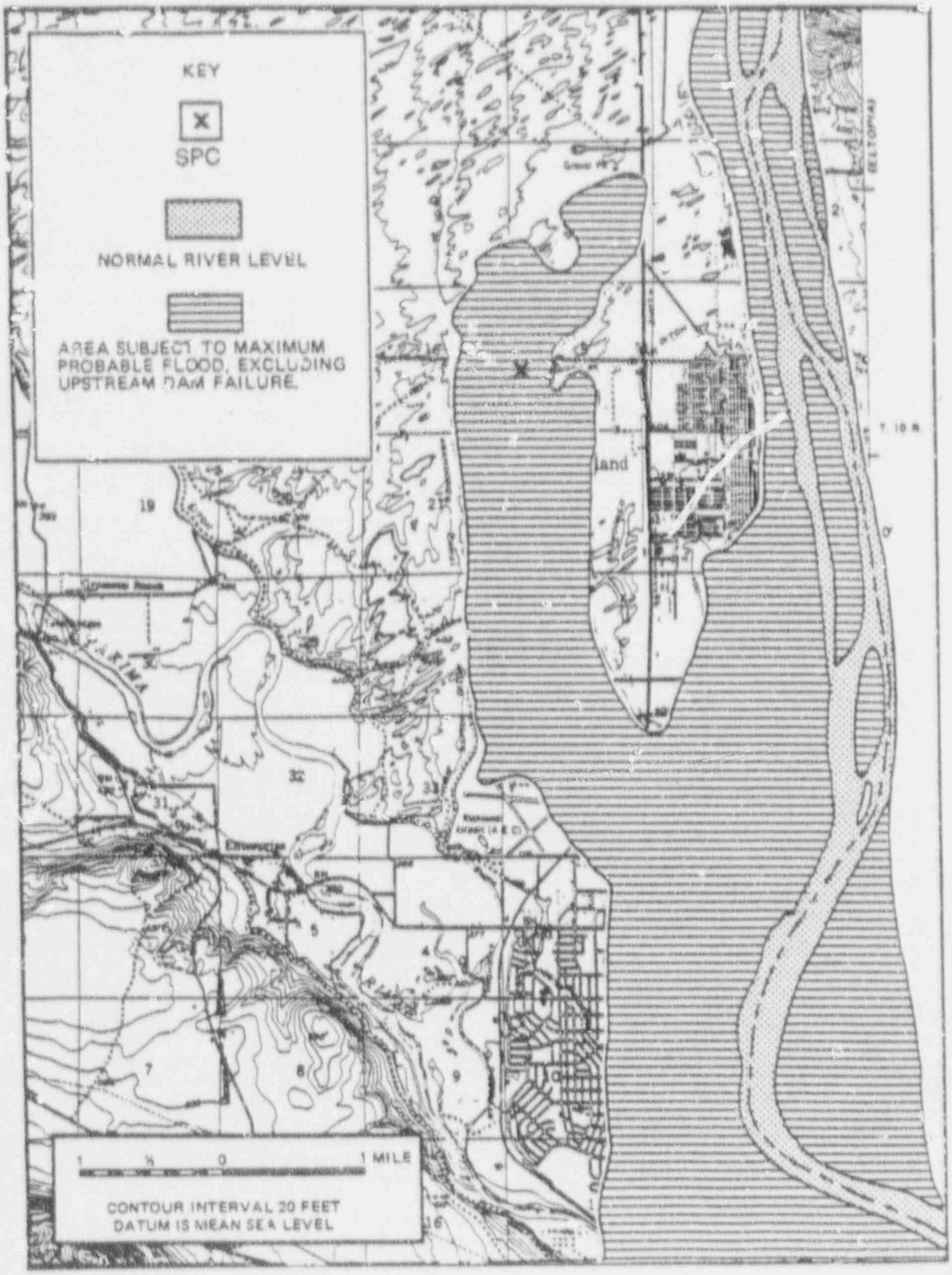
The site is not considered susceptible to flooding by groundwater seepage. To bring the water table to or near the surface at the site would require flooding on the Columbia River to a level and for a duration that is not credible.

Previous hydrogeologic studies of the Hanford area have found the region to be largely dominated by the Pasco gravels and the Ringold Formation. Both of these strata were deposited as sediments of the ancestral Columbia River. The Ringold formation can consist of two subgroups, one composed of sand and gravel, while the second consists of sands and silts with some clay. The area is underlain by the Columbia River Basalt group.

Drilling logs of wells drilled on the SPC site indicate the presence of the Pasco gravels (along with eolian sand deposits) from the surface to a depth of about 18 feet. Sand and gravels of the Ringold formation occur below this to about 43 feet, at which point a layer of impervious silt and clay (also of the Ringold formation) extends for at least 17 feet. Drilling was stopped at 60 feet when it was determined that this impervious silt and clay layer was not simply an isolated lens. Data exists which implies that this silt layer is anywhere from 20-40 feet thick. Below this layer is about 100 feet of sand and gravel underlain by a second layer of impervious silt and clay, approximately 20-40 feet thick. Below this lies the Columbia River Basalt group.

Onsite monitoring wells indicate the water table is presently located in the Ringold formation. This unconfined aquifer has a lower boundary elevation of about 332' at this location, which is formed by the impervious silt and clay layer.

The local groundwater hydrology at the SPC site was investigated in late 1977 and early 1978 because of previous leakage from the lagoons. Additional investigation of the groundwater hydrology was performed in 1982 by JUB Engineering and reported in the document "Groundwater Quality and Flow Characteristics in The Vicinity of The Exxon Fuel Fabrication Facility, Richland, Washington", XN-JUB-82-86, October 1982. Geraghty & Miller, Inc. is presently doing an in depth ground water hydrology study in conjunction with contracted work being done at SPC.



Flooding Potential, SPC Site
Figure 2.5-1

2.6 Ecology of the Site and Environment

The SPC site is located in a relatively flat, desert steppe. Sagebrush and antelope bitterbrush predominate among the pristine plant communities in the area. Cheatgrass, brome, and Sandberg bluegrass prevail in the understory. The annual herbage production has been estimated to be roughly 100 gms of dry matter per square meter.

Throughout the years, the local vegetation has been disturbed by homesteading, fire, and grazing, leaving areas exposed to wind erosion and dune formation. As a result, alien vegetation such as Russian thistle, mustard, and rabbitbrush have encroached on the native flora. A few barely surviving locust trees testify to the homesteading history. A severe wildfire in 1970 encompassed an area of approximately 19,000 acres of the Hanford Reservation north of the SPC site, but it did not spread into the Horn Rapids Triangle. The fire destroyed a majority of the established shrubs, forbs, and grasses in its path. Initial revegetation of disturbed areas is dominated by annual grasses and forbs, such as cheatgrass, with little or no perennial plant recovery.

The most abundant mammals in the vicinity of the site are pocket mice and deermice. Jackrabbits and coyotes are also scattered throughout the area. By far, the most abundant mammal is the pocket mouse, which subsists largely on the seeds of grasses. Larger and more mobile mammals, such as mule deer, prefer the shores and islands of the Columbia River, with limited use of the more barren, inland steppe. In the fall and winter, however, the mule deer may wander inland to forage upon the shoots of cheatgrass and the leaves and smaller twigs of bitterbrush. In the summer, the deer are frequently found in the distant Rattlesnake Hills.

The most abundant reptile is the side-blotched lizard. Snakes, especially the gopher snake and the Pacific rattlesnake, are occasionally encountered.

Birds are not abundant in the sagebrush-bitterbrush type of vegetation. The most common resident birds are meadowlarks and horned larks. The loggerhead shrike, although not an abundant bird, is conspicuous. During periods when food and cover are adequate, game birds, such as the chukar partridge, quail, ringneck pheasant, and mourning dove may be found in the vicinity of the site. The region is used as a hunting ground for birds of prey, such as the marsh hawk and golden eagle in the winter and the burrowing owl and Swainson's hawk in the summer. The bald eagle is occasionally observed in the area, and is the only wildlife species in the vicinity that is on the list of endangered species. During the fall and winter, migrating flocks of Canadian geese forage upon the cheatgrass and alfalfa in the vicinity of the site.

Waterfowl are of major importance in the area. Approximately 200 pairs of Canadian geese reside on the river islands in the vicinity of the site, and produce an average of roughly 700 goslings annually. An estimated 100 pairs of ducks also rest on these islands. Two islands, one near Ringold and another near Coyote Rapids, are used as rookeries by colonies of California and ring-billed gulls. Approximately 6000 nesting pairs produce 10,000-20,000 young annually.

3.0 EFFLUENT SURVEILLANCE AND MONITORING PROGRAM

Compliance with the U.S. Nuclear Regulatory Commission License No. SNM-1227, Washingtc . State Department of Ecology Waste Discharge Permit No. ST3919, and Washington State air quality limits are assured by the implementation of SPC 's Environmental Safety Standards. The essence of this standard is inclu:led as Appendix A of this document.

The data resulting from the surveillance and monitoring program is summarized in Appendix B of this document.

4.0 EFFECT OF OPERATIONS ON THE ENVIRONMENT

4.1 Water Quality

The concentration of radioactivity discharged to the sewer system is limited by 10 CFR 20.2003. The uranium released to the sewer has consistently been less than 0.1 ppm (0.16 E-9 Ci/l) which is more than a factor of 100 less than the limiting concentration allowed to be averaged over one month per 10 CFR 20.2003(c). From the environmental monitoring performed at Hanford for 1985 by Battelle Northwest (PNL-5817) the average concentration of uranium in the Columbia River is approximately 0.4 E-12 Ci/l. By simple ratio of average sewer flow and concentration to average river flow and concentration the uranium concentration in the river would be increased by less than 0.01%. The total radioactive material discharged to the sewer is limited to one curie per year by 10 CFR 20.2003(c). The radioactive material released to the sewer during the past five years is listed in Table 2 of Appendix B and the uranium released has remained below 1/10th of the one curie per year limit.

Discharges to the sewer system are limited by the State Effluent Discharge Permit No. ST3919. The chemicals and solids discharged to the sewer have remained well below the State Permit limits listed in Table 2 of Appendix A except for approximately five events where one of the limit values were slightly exceeded. Values that exceed discharge limits are reported to the state Department of Ecology and the NRC.

A review of the chemical discharges shows an increase in suspended solids, NO3, ammonia and fluoride from 1987-1991. These increases are associated with the controlled release of low uranium liquids from the lagoon system. The release of these materials at below State Permit limits is expected to continue with no significant effect on the environment.

4.2 Air Quality

The radioactive gaseous effluent concentrations remained consistently below that required by 10 CFR 20.1301 & 2. Uranium discharges out of plant stacks have averaged less than 25 microcuries per year during the last five years. This amount of uranium (less than 16 grams) has had essentially no impact on the cumulative off-site dose due to uranium fuel cycle operations. Using a worst case chi/Q of 0.114-04 from Table 2.3-2 and 25 microcuries per year of uranium released, the average exposure to a person 0.5 miles from the site will be on the order of 21 microRem.

Chemical air quality is controlled by the State and is concerned with fluoride and nitrogen dioxide emissions from our gaseous effluents. Fluoride is monitored at the stacks periodically; however, limits are placed on ambient air and forage, and not on stack emissions. Forage is monitored for fluoride content during the growing season. NO_2 monitoring is used to verify that the NO_2 at the site boundary is less than 0.05 ppm. Monitoring for these chemicals has provided no indication that these limits have been exceeded.

4.3 Terrestrial Quality

The surface outside of the fenced exclusion area has essentially remained uncha... ...d during th... last five years except for the south plant fence which has been moved furtner south by approximately 500 feet and additional asphalt parking which has been added west of the plant fence. There has been no discernible increase in radiation levels, contamination levels nor chemical levels in the environs near the plant site as measured by our environmental monitoring program.

APPENDIX A

ENVIRONMENTAL SURVEILLANCE AND MONITORING PROGRAM

TABLE OF CONTENTS

List of Tables

List of Figures

ENVIRONMENTAL SURVEILLANCE AND MONITORING PROGRAM

1.1 Gaseous Effluents (Exhaust Air)

Continuous isokinetic sampling is provided on all exhaust air stacks servicing areas in which uncontained radioactive materials are used, processed, or otherwise handled. These samples are analyzed on a weekly basis for gross alpha activity. Certain stack samples are analyzed for fluoride and/or beta activity.

Each stack's air flow is recorded weekly and used with the stack sample data in determining the quantity of radionuclides released. The sampling analysis and record requirements for radioactivity are outlined in Table 1.

1.2 Liquid Effluents (Sewer)

Waste liquid effluents from the SPC plant are discharged to the municipal sewer system of the City of Richland. Continuous sampling of this effluent stream occurs prior to its discharge into the Richland municipal sewerage system per Table 2. Composited samples are collected daily for uranium and selected chemicals Monday through Friday. The Monday sample is representative of the weekend.

For each measurement or sample taken, the following information is recorded: (1) the date, exact place, and time of sampling; (2) the dates the analyses were performed; (3) who performed the analyses; (4) the analytical techniques or methods used; and (5) the results of all analyses.

All records of monitoring activities and results, including all reports of recordings from continuous monitoring instrumentation shall be retained for a minimum of five (5) years. This period of retention shall be extended during the course of any unresolved litigation regarding the discharge or when requested by the State Authority.

1.3 Groundwater

The liquid waste management lagoons are monitored by sampling the "between liners" leak detection systems monthly. If liquid is found, an investigation shall be initiated to determine the source and magnitude of the leak and appropriate corrective action.

Test wells around the periphery of the lagoon system are utilized to indicate whether leaks have penetrated both upper and lower lagoon liners and have released any of the stored liquid chemical waste to groundwater. These test wells also monitor the concentrations and movement of chemicals in the groundwater. The test wells would also detect groundwater contamination from other leak or spill sources.

Test well locations relative to the storage lagoons are shown in Figure 2. A ground water study is currently underway at the SPC site including placement of new wells of a more current and accepted design. A new monitoring well pattern is shown in Figure 2A.

The groundwater sampling program is outlined in Table 3.

The groundwater sampling program is outlined in Table 3.

For each measurement or sample taken, the following information is recorded: (1) the date, exact place, and time of sampling; (2) the dates the analyses were performed; (3) who performed the analyses; (4) the analytical techniques or methods used; and (5) the results of all analyses.

All records of monitoring activities and results, including all reports of recordings from continuous monitoring instrumentation shall be retained for a minimum of five (5) years. This period of retention shall be extended during the course of any unresolved litigation regarding the discharge or when requested by the State Authority.

1.4 Environmental

This part of the monitoring program supplements that previously described and consists of periodic collection and analysis of samples from the local environs, including ambient air, soil and vegetation.

The "field" sampling program is outlined in Table 4. Field sample station locations are diagrammed in Figure 1.

Soil samples shall be approximately 500 grams each collected from between 1 cm and 5 cm beneath the surface of the topsoil on a quarterly basis.

The records of the analysis shall be retained for the life of the plant.

Table 1 Exhaust Air Sampling/Monitoring Matrix

Exhaust Stack ID	Stack Location	Exhaust Flow	Radioactivity	Fluoride	Oxides of Nitrogen
K-3	Room 100	W	C	C,S	
K-6	NAF	W	C		
K-9	Etch	W	C	C,S	
K-10	Line 1 POG	W	C	C,S	M
K-21	Room 182	W	C		
K-25	ELO	W	C		
K-31	Line 2	W	C	C,S	
K-32	Line 2 POG	W	C	C,S	M
K-37	U_3O_8	W	C		
K-42	Laundry	W	C		
K-46	ELO Addition	W	C		M
K-49	SWUR POG	W	C		
K-50	SWUR Room	W	C		
K-52	Build #9	W	C Gross beta only		
K-55	SWUR Shroud	W	C		

C - Continuous isokinetic sampling.
M - Stack sampling at least monthly during operations.
S - Semiannually determine total (particulate + gaseous) fluoride.
W - Exhaust flow rates are recorded up to three times per day by Plant Engineering (Facility Technicians). Weekly these values are averaged by Safety, Security, and Licensing (HST).

Table 2

Liquid Effluent Sampling Matrix (Sewer)[1]

Parameter	Daily[2] Average	Daily[3] Maximum	Monitoring[4] Frequency	Location	Sample Type
Flow	400,000 gal	500,000 gal	Daily	Waste Effluent	Meter
NH_3 as N	80 lb/d	125 lb/d	Daily	Waste Effluent	Composite
NO_3 as N	750 lb/d	875 lb/d	Daily	Waste Effluent	Composite
Fluoride as F	2,500 lb/d	3,150 lb/d	Daily	Waste Effluent	Composite
pH	≥ 5.0		Daily	Waste Effluent	Composite
Total Suspended Solids	300 mg/l	600 mg/l	Weekly	Waste Effluent	Composite
Radioactivity					
	Daily Max[5]	$9x10^{-4}$ μCi/mL (562 ppm) or 0.1 μCi			
	Monthly Max[5]	$9x10^{-4}$ μCi/mL			
	Yearly Max	1.0 Ci total			
	Action Level[4]	>0.1 ppm >1.0 ppm	(1.6-7 μCi/mL) Investigate (1.6-6 μCi/mL) Shutdown		

(1) Entries here are limits set by State Waste Discharge Fermit ST3919 and 10 CFR 20.

(2) The daily average is defined as the average of the measured values obtained over a calendar month's time.

(3) The daily maximum is defined as the greatest allowable value for any calendar day.

(4) Samples pulled are taken on weekday mornings and represent the day before except for Monday morning which represents Friday, Saturday and Sunday.

(5) Based on 3 wt% enriched uranium 1.6 μCi/gm.

Table 3

Ground Water Sampling Matrix[1]

Parameter	Monitoring Frequency	Location	Sample Type
Fluoride as F	Quarterly	Well Group B	Grab
NO_3 as N	1 per 6 months	Well Group A	Grab
NH_3 as N	1 per 6 months	Well Group A	Grab
pH	1 per 6 months	Well Group A	Grab
Presence of liquid	Monthly	Lagoon interliner sampling system	Grab
Gross Alpha/Beta	Quarterly	Well Group B	Grab
Gross Alpha/Beta	Semiannually	Well Group C	Grab
Monitoring Well Group A is Wells 1, 2, 9, 13, 14, 15, and 16.			
Monitoring Well Group B is Wells 1-7, 11, 12, 13, and 19-21.			
Monitoring Well Group C is Wells 9, 14, 15, and 16.			

(1) The License Amendment application submitted for NRC approval in 1992 requests a change in the groundwater sampling matrix. The change is to incorporate wells put in by Geraghty & Miller, Inc. (see Figure 2A) that are more environmentally correct. The new matrix would be;

Parameter	Monitoring Frequency	Location	Sample Type
Presence of liquid	Monthly	Lagoon interliner	Grab
F,NO_3+NH_3 (as N), pH and Gross Alpha/Beta	Quarterly	GM wells 1,5,6,7 and 8	Grab

Table 4

Field Sampling Matrix

Sample Station	Sample Type	Sampling Frequency	Analysis
1	Soil	Quarterly	Uranium
2	Soil	Quarterly	Uranium
3	Air	Monthly	Fluoride
4	Air	Monthly	Fluoride
5	Forage	Monthly*	Fluoride
6	Forage	Monthly*	Fluoride

(*) During the growing season only (April-October).

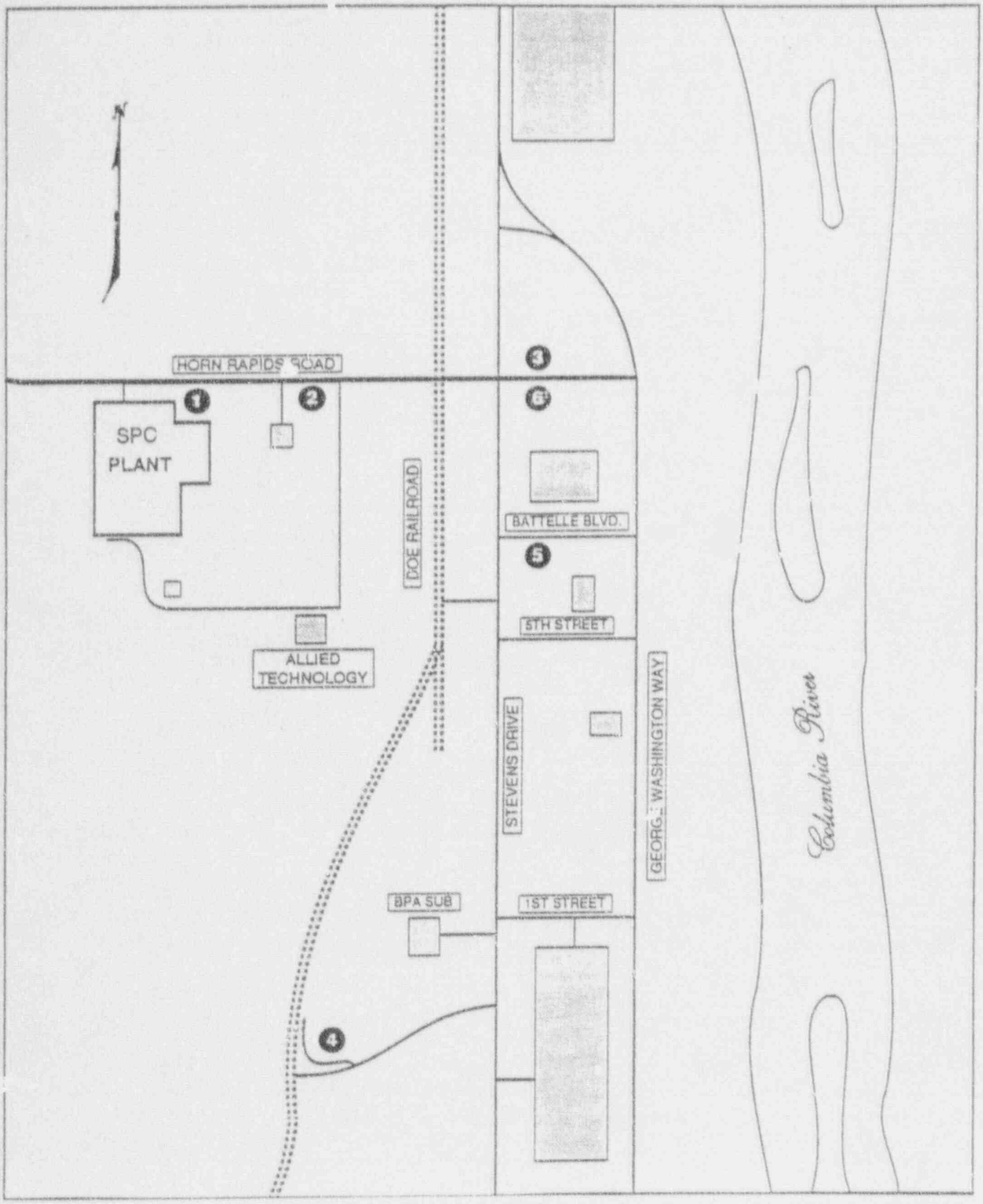


FIGURE 1

FIELD SAMPLE STATION LOCATIONS

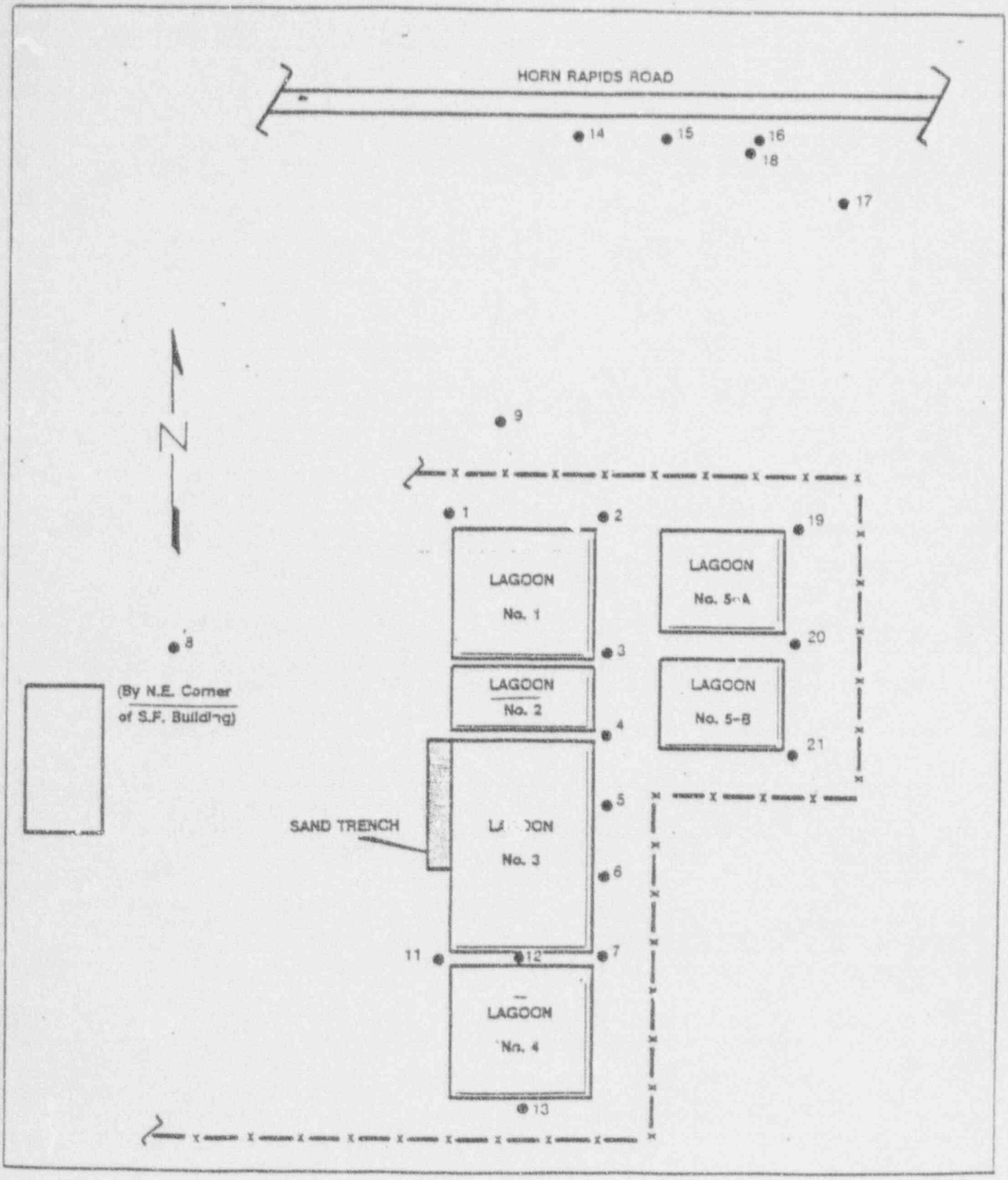


FIGURE 2

LAGOON TEST WELL LOCATIONS

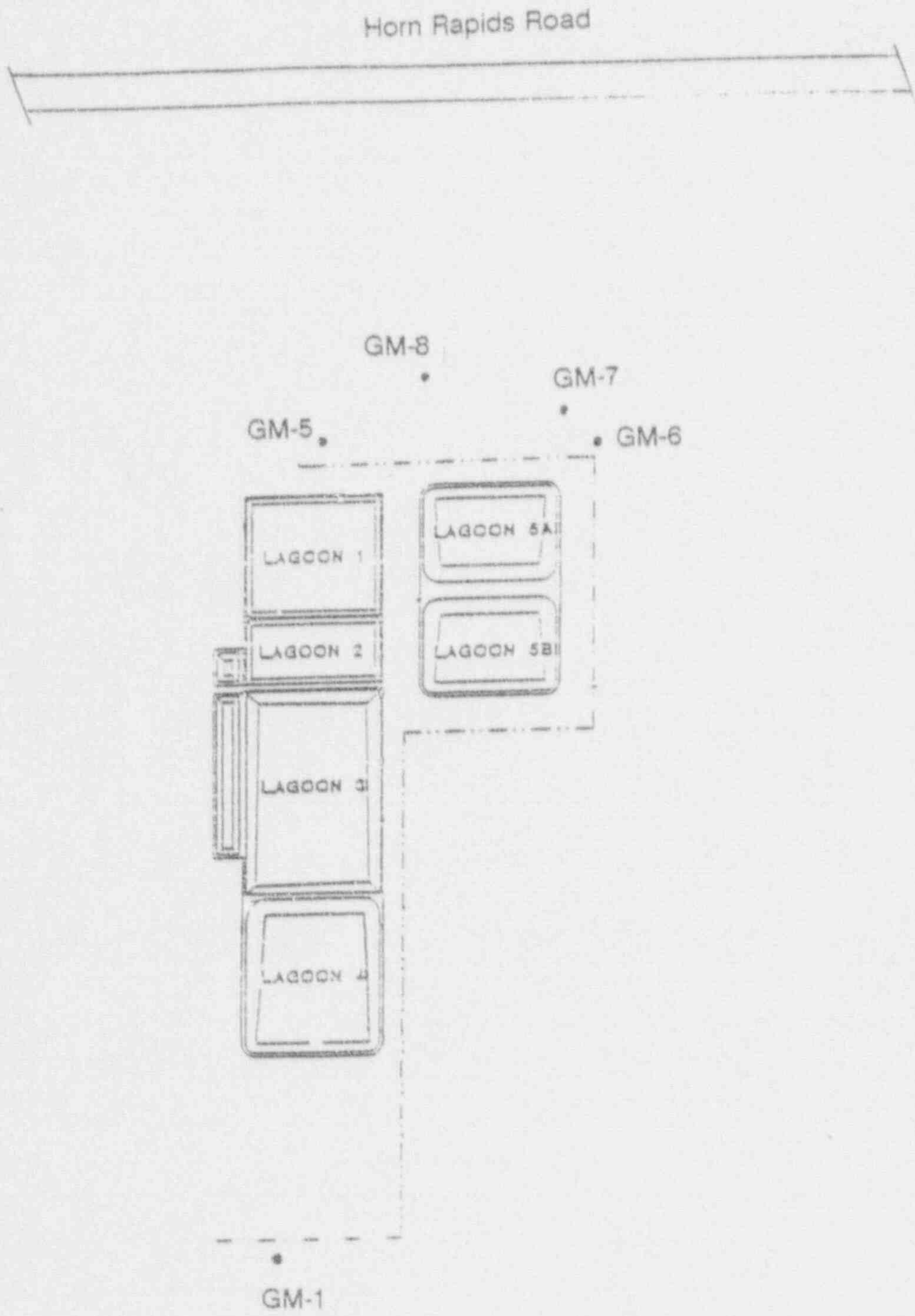


FIGURE 2A

LAGOON TEST WELL LOCATIONS

APPENDIX B

DATA TABLES

APPENDIX B

Table 1

Gaseous Effluent Data

Microcuries				Maximum Fluoride (ppm)				
Year	U	Pu	FP	K3	K9	K10	K31	K32
1981	<20	<0.1		0.06		0.03	0.02	0.10
1982	<22	<0.1		0.07	1.87	18.60	0.02	0.11
1983	<24	<0.1		0.03	1.31	3.70	7.68	2.38
1984[1]	<7	<0.1		0.07	0.45	1.60	0.01	0.12
1985	<15	<0.02[2]	<2.88	0.02	0.12	21.99	0.01	0.69
1986	<17	0.0	<2.8	0.04	0.28	0.53	0.02	0.25
1987	<17	-	<2.7	0.008	0.08	0.15	0.02	0.04
1988	<20	-	<2.5	0.06	0.07	0.18	0.01	0.08
1989	<15	-	<4.2	0.006	0.10	0.24	0.04	0.43
1990	<17	-	<0.9	0.01	0.10	0.47	0.009	0.51
1991	<17	-	<1.7	0.005	0.11	0.47	0.008	0.04

1 There was a reduction in total exhaust when some of the building exhaust systems were shutdown for maintenance during the July-August 1984 furlough.

2 Reported only for the first half of the year.

Table 2

Liquid Effluent (Sewer) Data

Parameter	Limit Daily Average	Limit Daily Max	Year	Daily Average	Daily Max
Flow (gal)	5E+5	5E+5	1987	2.5E+5	3.8E+5
			1988	2.9E+5	5.2E+5
			1989	2.9E+5	4.8E+5
	4E+5[1]	5E+5	1990	2.1E+5	4.0E+5
			1991	2.0E+5	4.0E+5
NH_3 as N (mg/ℓ)	25	30	1987	6.5	22.5
			1988	5.8	16.3
			1989	5.5	22.5
			1990(1-6)	[illegible].9	34.2
(lb/d)	80[1]	125[1]	1990(7-12)	12.5	67.9
			1991	26.6	104.5
NO_3 as N (lb/d)	600[1]	700	1987	232.4	537.9
			1988	221.8	592.7
			1989	226.4	723.8
			1990(1-6)	294.0	567.7
	750[1]	875[1]	1990(7-12)	288.1	632.0
			1991	385.4	913.5
Suspended Solids (mg/ℓ)	300	600	1987	53.8	284
			1988	41.4	143
			1989	43.4	150
			1990	53.0	127
			1991	77.5	203
Fluoride (lbs/d)[1]	2500	3500	1987	945.7	2513.7
			1988	959.8	2097.4
			1989	743.1	1850.7
			1990(1-6)	1208.4	3119.4
	2500	3150[1]	1990(7-12)	990.0	2583.9
			1991	1547.1	3603.4

1 Change in units or limit due to revision of state discharge permit.

Table 2 (cont)

Liquid Effluent (Sewer) Data

Parameter	Limit Daily Average	Limit Daily Max	Year	Daily Average	Daily Min
pH ≥ 5.0			1987	9.4	6.0
			1988	9.0	7.1
			1989	9.5	7.1
			1990	9.0	6.4
			1991	8.3	4.5
				Yearly Total	
Uranium (Ci)	1.0 Ci/Year		1987	<0.064	
			1988	<0.068	
			1989	<0.067	
			1990	0.052	
			1991	0.058	

Table 3

Environmental Sampling Data

		Station No. 1	Station No. 2	Station No. 3	Station No. 4	Station No. 5	Station No. 6
Type of Sample		Soil	Soil	Air	Air	Forage	Forage
Frequency		Qtr	Qtr	Mo. Qtr Avg	Mo. Qtr Avg	Mo. [a] Qtr Avg	Mo. [a] Qtr Avg
Units	Yr/Qtr	U (ppm)	U (ppm)	F (ppb)	F (ppb)	F (ppm)	F (ppm)
	87-1	0.4	0.4	0.10	0.07		
	87-2	0.7	0.6	0.13	0.13	3.4	3.2
	87-3	1.1	1.1	0.20	0.14	5.2	7.6
	87-4	0.1	0.1	0.19	0.18	9.3	10.3
	88-1	0.5	0.3	0.14	0.14		
	88-2	2.1	1.2	0.14	0.08	2.5	2.8
	88-3	0.3	0.5	0.12	0.14	2.5	2.5
	88-4	0.3	0.3	0.11	0.10	2.4	2.5
	89-1	0.1	0.1	0.48	0.09		
	89-2	0.5	0.2	0.15	0.09	3.0	2.7
	89-3	1.0	2.2	0.23	0.14	2.8	2.6
	89-4	1.3	0.3	0.12	0.07	0.9	0.9
	90-1	0.2	0.3	0.17	0.10		
	90-2	0.2	0.5	0.11	0.08	1.9	1.4
	90-3	0.3	0.8	0.10	0.09	2.3	2.7
	90-4	0.6	0.6	0.12	0.06	3.8	3.8
	91-1	0.3	0.4	0.11	0.07		
	91-2	0.2	0.3	0.11	0.06	3.8	4.1
	91-3	0.4	0.3	0.13	0.11	5.6	4.8
	91-4	0.3	0.2	0.11	0.12	8.2	4.7
	Limit	19 @ 3 w/o [b]		0.5 [c]		40 [d]	

(a) During growing season only (April-October).

(b) EPA acceptable level, 30 pico Ci/gm

(c) WAC 18-48-130.

(d) WAC 18-48-120

Yr/Qtr	Alpha pCi/ℓ	Beta pCi/ℓ	F ppm	NO_3 ppm as N	NH_3 ppm as N	pH
Well #1						
87-1	57.3	43.3	3	30.5	7.23	7.5
87-2	14.6	33.3	2	52.41	51.25	6.9
87-3	15.7	19.1	3	35.47	25.62	7.6
87-4	75.4	92.4	6		39.6	
88-1	49.4	39.0	5	64.16	52.03	7.2
88-2	15.4	30.0	3			
88-3	5.89	14.5	1.8	36.55	54.36	7.6
88-4	10.5	17.6	4.7			
89-1	12.9	14.1	3.4	62.54	46.59	6.6
89-2	5.06	9.85	6			
89-3	13.4	11.3	1.5	44.5	38.83	6.8
89-4	22.1	14.2	4.2			
90-1	29.1	14.3	4.3	44.05	63.67	7.6
90-2	18.8	12.7	3.9			
90-3	1.7	10.5	3.2	35.69	33.39	7.3
90-4	19.7	19.4	5.3			
91-1	46.4	23.2	6	46.99	43.48	7.4
91-2	18.5	16.7	4.2			
91-3	14.0	23.3	4.0	38.72	71.44	7.7
91-4	33.3	9.31	4.7	29.19	31.06	7.7

Yr/Qtr	Alpha pCi/ℓ	Beta pCi/ℓ	F ppm	NO_3 ppm as N	NH_3 ppm as N	pH
Well #2						
87-1	33.0	66.3	5.0	30.5	51.25	7.5
87-2	44.6	45.8	6.4	44.73	35.72	6.8
87-3	35.3	34.7	6.0	37.73	43.48	7.9
87-4	29.4	37.6	5.0		12.42	
88-1	31.3	65.0	7.0	25.75	24.07	6.9
88-2	19.6	47.2	5.0			
88-3	27.1	52.5	4.9	57.54	3.49	7.2
88-4	45.8	43.9	7.1			
89-1	22.2	17.4	12.9	37.5	17.08	7.1
89-2	11.5	10.1	5.8			
89-3	13.7	10.8	4.0	60.77	3.88	6.0
89-4	7.92	11.5	5.2			
90-1	13.6	16.9	6.0	22.36	31.06	7.0
90-2	10.0	11.5	6.5			
90-3	7.43	12.6	5.8	45.86	22.52	7.0
90-4	16.7	16.8	6.0			
91-1	12.6	16.3	7.0	22.36	21.74	7.0
91-2	11.5	13.6	5.6			
91-3	6.54	18.0	4.0	8.01	13.74	7.9
91-4	10.8	7.98	3.4	29.19	31.06	7.7

Yr/Qtr	Alpha pCi/ℓ	Beta pCi/ℓ	F ppm	NO_3 ppm as N	NH_3 ppm as N	pH
Well #3						
87-1	2.36	23.1	0.5			
87-2	2.8	27.2	0.5	28.69	4.66	7.8
87-3	2.34	19.1	0.4			
87-4	4.73	26.6	0.8		7.77	
88-1	1.01	23.0	2.0			
88-2	2.85	23.5	0.4			
88-3	3.28	24.1	1.0			
88-4	1.68	20.0	1.6			
89-1	3.75	8.58	0.4			
89-2	1.8	10.70	0.4			
89-3	2.53	9.92	0.4			
89-4	2.3	9.2	0.5			
90-1	0.88	8.77	0.5			
90-2	2.46	11.0	1.0			
90-3	1.77	8.01	0.6			
90-4	0.81	8.19	0.4			
91-1	0.48	9.57	1.0			
91-2	1.2	12.7	0.3			
91-3	0.49	7.72	<1.0			
91-4	3.77	8.82	0.4			

Yr/Qtr	Alpha pCi/ℓ	Beta pCi/ℓ	F ppm	NO_3 ppm as N	NH_3 ppm as N	pH
Well #4						
87-1	2.01	24.0	0.4			
87-2	1.93	19.0	0.6	25.07	4.66	7.5
87-3	2.39	22.0	0.3			
87-4	2.21	18.4	0.5		3.11	
88-1	2.6	12.9	0.4			
88-2	1.73	18.2	0.3			
88-3	2.67	[illegible]	1.7			
88-4	1.88	[illegible]	0.5			
89-1	2.81	6.01	0.4			
89-2	1.19	6.78	0.4			
89-3	2.34	10.3	0.4			
89-4	2.67	7.91	0.4			
90-1	0.71	8.04	0.5			
90-2	4.72	13.0	0.4			
90-3	3.43	11.0	0.5			
90-4	0.15	10.5	0.4			
91-1	2.59	8.87	<2.5			
91-2	1.83	14.1	0.4			
91-3	1.64	12.1	<1			
91-4	2.65	7.02	0.4			

Yr/Qtr	Alpha pCi/ℓ	Beta pCi/ℓ	F ppm	NO_3 ppm as N	NH_3 ppm as N	pH
Well #5						
87-1	1.13	20.7	0.3			
87-2	0.03	5.45	0.7			
87-3	0.38	6.38	0.3			
87-4	0.68	7.22	0.3		3.11	
88-1	1.05	23.2	0.3			
88-2	1.89	5.34	0.24			
88-3	0.472	6.02	0.3			
88-4	1.41	6.59	0.5			
89-1	2.13	8.51	0.4			
89-2	0.86	3.22	0.3			
89-3	2.53	9.92	0.4			
89-4	0.58	6.2	0.3			
90-1	0.82	5.27	0.4			
90-2	1.01	6.78	0.4			
90-3	1.64	7.47	0.4			
90-4	0.33	5.31	0.3			
91-1	1.54	6.16	<2.5			
91-2	1.15	10.4	0.3			
91-3	0.58	7.18	<1			
91-4	0.45	2.51	0.2			

Yr/Qtr	Alpha pCi/ℓ	Beta pCi/ℓ	F ppm	NO_3 ppm as N	NH_3 ppm as N	pH
Well #6						
87-1	.59	12.8	0.3			
87-2	.98	9.59	0.4			
87-3	.56	6.32	0.3			
87-4	1.98	20.3	0.3		3.11	
88-1	0.868	14.3	0.3			
88-2	1.62	10.0	0.27			
88-3	2.18	10.3	0.3			
88-4	1.15	9.59	0.5			
89-1	1.94	7.95	0.4			
89-2	2.72	3.72	0.3			
89-3	1.44	5.67	0.3			
89-4	1.2	5.[illegible]	0.4			
90-1	0.82	5.75	0.4			
90-2	1.3	6.47	0.4			
90-3	1.41	7.61	0.4			
90-4	0.95	7.26	0.3			
91-1	2.25	6.07	1.0			
91-2	0.245	5.6	0.3			
91-3	.25	9.74	<1			
91-4	3.42	6.94	0.3			

Yr/Qtr	Alpha pCi/ℓ	Beta pCi/ℓ	F ppm	NO_3 ppm as N	NH_3 ppm as N	pH
Well #7						
87-1	1.37	6.62	0.3			
87-2	0.96	2.69	0.3			
87-3	0.67	5.3	0.2			
87-4	0.96	4.7	0.4		3.11	
88-1	1.34	3.91	2.0			
88-2	1.04	3.71	0.24			
88-3	0.972	7.47	0.2			
88-4	1.27	4.25	0.4			
89-1	1.26	6.66	0.2			
89-2	0.73	1.3	1.1			
89-3	1.36	5.69	0.2			
89-4	0.95	4.97	0.3			
90-1	1.43	4.14	0.3			
90-2	0.59	5.31	0.2			
90-3	2.28	6.67	1.4			
90-4	1.0	4.53	0.4			
91-1	2.38	6.61	1.0			
91-2	0.771	6.67	0.3			
91-3	0.68	5.64	<1			
91-4	3.83	5.03	0.3			

Yr/Qtr	Alpha pCi/ℓ	Beta pCi/ℓ	F ppm	NO_3 ppm as N	NH_3 ppm as N	pH
Well #9						
87-1	87.6	76.2			74.54	
87-2						
87-3	84.1	56.2	8.0	77.94	104.83	8.0
87-4						
88-1	192.0	128.0		41.79	23.04	7.7
88-2						
88-3	54.3	44.3	9.3	61.83	45.04	7.3
88-4	101.0	50.8	5.93			
89-1	87.8	32.6	6.9	20.33	24.07	6.4
89-2						
89-3	45.4	18.9	7.5	83.13	38.83	6.8
89-4						
90-1	32.1	30.2	24.6	98.04	947.33	10.0
90-2						
90-3	23.9	10.2	41.7	66.19	590.14	9.7
90-4			48.0		869.68	
91-1			25.5		260.13	
91-2	20.0	4.53	22.0		180.92	
91-3	7.36	11.9	11.9	88.33	211.21	9.6
91-4						

Yr/Qtr	Alpha pCi/ℓ	Beta pCi/ℓ	F ppm	NO_3 ppm as N	NH_3 ppm as N	pH
Well #11						
87-1	1.84	6.05	0.2			
87-2	3.7	10.5	1.4			
87-3	0.75	10.1	0.4			
87-4	1.57	7.44	0.5		1.55	
88-1	2.[illegible]6	6.45	1.6			
88-2	0.65	12.1	0.27			
88-3	1.63	5.46	0.3			
88-4	1.11	11.3	0.6			
89-1	5.08	10.1	0.3			
89-2	0.95	5.51	0.4			
89-3	3.06	5.04	0.4			
89-4	1.7	5.54	0.4			
90-1	2.21	6.06	0.3			
90-2	3.15	9.22	0.5			
90-3	1.31	8.2	0.5			
90-4	0.23	5.87	0.6			
91-1	1.45	9.49	1.0			
91-2	20.0	4.53	0.4			
91-3	0.84	9.6	<1			
91-4	1.39	5.83	0.3			

Yr/Qtr	Alpha pCi/ℓ	Beta pCi/ℓ	ppm	NO_3 ppm as N	NH_3 ppm as N	pH
Well #12						
87-1	0.38	6.91	0.2			
87-2	2.17	8.74	0.2			
87-3	1.27	5.77	0.6			
87-4	1.21	6.31	0.4		2.33	
88-1	0.438	8.12	0.4			
88-2	0.31	6.41	0.3			
88-3	0.962	1.91	0.3			
88-4	1.25	4.9	0.7			
89-1	2.14	7.63	0.5			
89-2	0.15	3.91	0.3			
89-3	2.52	3.36	0.3			
89-4	2.48	7.83	0.3			
90-1	1.51	5.63	0.3			
90-2	3.08	7.88	0.5			
90-3	0.74	4.77	0.4			
90-4	1.0	11.0	0.3			
91-1	2.33	4.49	1.0			
91-2	1.6	6.28	0.5			
91-3	0.66	3.23	36.0			
91-4	3.5	2.87	0.4			

Yr/Qtr	Alpha pCi/ℓ	Beta pCi/ℓ	F ppm	NO_3 ppm as N	NH_3 ppm as N	pH
Well #13						
87-1	0.81	3.09	0.3	3.16	1.55	8.1
87-2	0.59	3.79	0.5			
87-3	1.21	5.14	0.2			
87-4	1.73	6.36	0.5		3.11	
88-1	0.437	6.75	0.3	7.0	1.55	7.9
88-2	0.0	3.24	0.3			
88-3	1.52	4.89	0.2	12.98	0.62	8.1
88-4	2.29	3.84	0.5			
89-1	1.57	6.56	0.4	5.44	0.78	8.2
89-2	2.68	6.41	0.4			
89-3	1.51	3.89	0.3	3.84	0.85	7.6
89-4	2.07	5.39	0.4			
90-1	2.76	3.34	0.4	6.1	0.62	7.5
90-2	1.4	3.54	0.4			
90-3	1.19	4.74	0.5	3.84	0.62	7.0
90-4	1.22	6.27	0.3			
91-1	0.9	2.48	1.0	38.18	0.78	8.1
91-2	1.45	7.77	0.4			
91-3	0.84	5.61	<1	9.71	1.86	8.2
91-4	1.96	3.0	0.3			

Yr/Qtr	Alpha pCi/ℓ	Beta pCi/ℓ	F ppm	NO_3 ppm as N	NH_3 ppm as N	pH
Well #14						
87-1	64.4	42.5		62.35	21.74	7.6
87-2						
87-3	2.49	35.7		64.16	43.48	7.8
87-4						
88-1	72.8	53.2		42.02	25.62	7.0
88-2						
88-3	33.0	27.4	2.7	46.92	17.08	6.9
88-4	23.2	28.5	4.3			
89-1	19.8	19.6	3.1	56.48	1.94	6.7
89-2						
89-3	17.8	11.8	3.7	63.93	9.32	6.6
89-4						
90-1	15.7	15.1	3.7	58.96	26.4	7.2
90-2				60.32		9.6
90-3	17.9	18.3	6.3	56.48	22.91	7.3
90-4	1.22	6.27	0.3			
91-1	0.9	2.48	1.0	38.18	0.78	8.1
91-2	22.9	22.5	9.0			
91-3	12.0	26.6		58.73	20.97	8.0
91-4						

Yr/Qtr	Alpha pCi/ℓ	Beta pCi/ℓ	F ppm	NO_3 ppm as N	NH_3 ppm as N	pH
Well #15						
87-1	65.3	74.8		63.93	62.12	7.7
87-2						
87-3				59.41	97.06	7.8
87-4						
88-1	94.7	123.0		58.96	93.18	7.4
88-2						
88-3	59.9	63.2	8.0	38.38	27.95	7.2
88-4	64.1	55.9	7.8			
89-1	64.7	26.1	7.6	64.16	65.23	6.2
89-2						
89-3	71.4	19.7	8.3	63.93	93.18	7.6
89-4						
90-1	35.4	27.4	7.5	48.34	62.12	7.3
90-2						
90-3	32.3	35.4	27.8	46.54	58.24	7.5
90-4	17.0	23.6	14.4			
91-1	26.6	18.0	15.0	41.11	43.48	7.6
91-2	39.6	[illegible].7	13.8			
91-3	13.5	[illegible]9.2		43.82	93.18	7.2
91-4						

Yr/Qtr	Alpha pCi/ℓ	Beta pCi/ℓ	F ppm	NO_3 ppm as N	NH_3 ppm as N	pH
Well #16						
87-1	0.62	14.8		1.36	51.25	8.1
87-2						
87-3	0.86	8.48		2.26	166.95	8.2
87-4						
88-1	0.261	7.07		1.13	24.07	7.6
88-2						
88-3	0.143	10.6	2.3	1.76	15.53	7.9
88-4	1.77	9.0	5.0			
89-1	0.53	9.08	4.4	5.65	20.19	7.1
89-2						
89-3	0.55	5.04	4.0	2.48	7.77	6.4
89-4						
90-1	3.45	9.67	2.1	7.45	31.06	7.9
90-2						
90-3	0.81	2.03	5.8	1.81	19.02	8.8
90-4	0.03	16.3	3.4			
91-1	0.23	3.8	4.0	0.45	17.08	8.6
91-2	1.4	3.21	4.0			
91-3	0.37	7.59		1.08	20.19	8.6
91-4						

Yr/Qtr	Alpha pCi/ℓ	Beta pCi/ℓ	F ppm	NO_3 ppm as N	NH_3 ppm as N	pH
Well #19						
87-1	0.7	7.59	0.2			
87-2	3.59	5.84	0.4			
87-3	1.18	10.7	0.3			
87-4	1.65	9.21	0.3		1.55	
88-1	1.87	11.6	0.3			
88-2	3.12	6.1	0.24			
88-3	2.51	9.7	0.3			
88-4	1.37	12.9	0.41			
89-1	2.94	5.51	0.2			
89-2	5.94	10.5	0.3			
89-3	1.91	6.32	0.3			
89-4	3.38	5.39	0.8			
90-1	2.8	10.1	0.3			
90-2	3.02	7.8[illegible]	0.4			
90-3	0.8	5.38	0.3			
90-4	0.54	10.4	0.3			
91-1	1.09	2.67	<2.5			
91-2	1.42	4.31	0.4			
91-3	0.66	7.14	<1			
91-4	3.86	3.61	0.2			

Yr/Qtr	Alpha pCi/ℓ	Beta pCi/ℓ	F ppm	NO_3 ppm as N	NH_3 ppm as N	pH
Well #20						
87-1	2.21	6.7	0.2			
87-2	1.14	7.98	0.4			
87-3	2.07	7.96	0.4			
87-4	1.92	8.05	0.3			
88-1	2.7	6.58	0.3			
88-2	2.04	5.23	0.3			
88-3	0.739	7.16	0.2			
88-4	0.85	6.8	0.6			
89-1	1.97	5.26	0.5			
89-2	1.02	2.11	0.3			
89-3	1.48	7.04	0.3			
89-4	1.63	4.78	0.4			
90-1	1.1	3.78	0.3			
90-2	2.89	6.25	0.4			
90-3	0.75	4.68	0.4			
90-4	1.24	16.2	0.4			
91-1	0.71	4.25	1.0			
91-2	0.959	4.98	0.3			
91-3	0.17	4.83	<1			
91-4	6.22	2.28	0.3			

Yr/Qtr	Alpha pCi/ℓ	Beta pCi/ℓ	F ppm	NO_3 ppm as N	NH_3 ppm as N	pH
Well #21						
87-1	1.8	4.45	0.2			
87-2	2.22	5.54	0.3			
87-3	2.44	5.27	0.4			
87-4	1.94	4.97	0.3		1.55	
88-1	1.45	6.5	0.3			
88-2	2.74	7.52	0.24			
88-3	1.63	2.24	0.3			
88-4	1.74	5.31	0.9			
89-1	6.56	12.4	0.5			
89-2	2.69	2.71	0.4			
89-3	3.71	6.44	0.3			
89-4	3.1	5.2	0.4			
90-1	2.52	8.82	0.3			
90-2	0.62	3.86	0.4			
90-3	0.63	8.04	0.5			
90-4	1.84	12.9	0.3			
91-1	1.66	2.63	<2.5			
91-2	0.7	5.74	0.4			
91-3	.74	6.01	<1.0			
91-4						

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SUPPLEMENT TO APPLICANT'S ENVIRONMENTAL REPORT

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