INSTRUCTIONS

The following is furnished as a guide for insertion of Amendment 2 sheets into the WNP-3 Environmental Report - Operating License Stage. After inserting Amendment 2, place the transmittal letter and instruction sheets in the front of the Environmental Report to maintain a record of the changes.

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THE SITE AND ENVIRONMENTAL INTERFACES

2.1 GEOGRAPHY AND DEMOGRAPHY

2.1.1 Site Location and Description

2.1.1.1 Specification of Location

The Satsop site is located in southeastern Grays Harbor County, Washington, approximately one mile south of the Chehalis River near its confluence with the Satsop River. The site is about 26 miles west of Olympia and 16 miles east of Aberdeen (Figure 2.1-3). The central site area lies in Section 17 of Township 17 North, Range 6 West. The Reactor Building is located at latitude 46° 57' 33" N and longitude 123° 27' 58" W. The Universal Transverse Mercator coodinates are N^{52} 00, 525m and E^{4} 64, 517m.

2.1.1.2 Site Area Map

Figure 2.1-1 is a map showing the plant property lines and the principal plant features. Figure 2.1-2 is a map showing topography and local transportation routes. The land owned by the Supply System in the site proper totals about 1,360 acres. The Supply System also has ownership of miscellaneous properties in the site area such as the right-of-ways of the access roads from the east and west. |2

2.1.1.3 Boundaries for Establishing Effluent Release Limits

Boundaries for establishing effluent release limits conform to the plant property boundary and the boundary of properties encompassing the exclusion area (see Figure 2.1-1). Table 2.1-1 provides the distance from release points to this boundary in each compass sector.

2.1.2 Population Distribution

Table 2.1-2 presents, by compass segment and distance, population estimates for 1980 and forecasts by decade from 1990 to 2030. The table may be keyed to Figures 2.1-3 and 2.1-4 which are maps of areas within 10 and 50 miles, respectively, of the site.

Base population within the 10-mile radius of the WNP-3 was estimated by application of 1980 Bureau of Census household size figures to housing counts developed through field surveys. The area within ten miles is a rural section of Grays Harbor County with the exception of a six square mile rural area in the southwestern corner of Mason County. The 1980 population of Grays Harbor County was 66,314, more than half of which was located in the Aberdeen-Hoquiam area. This is an increase of 11.4 percent over the 1970 population of 59,553.[1]

From its early urbanizing period in the late 1800s, the county has experienced its major growth as a result of activity in the forest products industries. The growth of the towns within this area has been somewhat erratic following fluctuations in the industries. Trends indicate a "suburban shift" of population from the urban center of the county into the smaller outlying communities and the rural area. Since 1950, Aberdeen and Hoquiam have actually declined in population while the smaller outlying communities have grown significantly. The unincorporated rural population has also grown twice as fast as the county as a whole and four times as fast as all the cities combined. The fastest growing area in the county is the Elma area, followed by the Westport-Ocosta area. The north beaches are a close third. The total urban area is growing at a relatively slow pace of 1.1% per year.

The relatively unstable and limited employment in the County has caused a large emigration of people between ages 15-44 to more metropolitan areas in the Puget Sound region where there are more employment opportunities. This emigration together with the trend of increase in the portion of the population over 65 years of age will tend to stabilize population growth.(2)

For estimating the 1980 base population in the 10-50 mile area, 1980 census division boundary maps were overlaid with an appropriately scaled sector/radii grid. Census data was then allocated relative to the portion of each enumeration district, census tract, block group or block which fell within individual compass sectors. The 1990 to 2030 forecasts presented here are based on several sources: 1981 county population forecasts provided by the Washington State Office of Financial Management (OFM), county forecasts estimated by Bonneville Power Administration, U.S. Bureau of Census population estimates and projections, and various discussions with local regional planning agencies.(3-12)

The 50-mile radius includes Grays Harbor, Pacific, Wahkiakum, Cowlitz, Lewis, Thurston, Pierce, Kitsap, Jefferson, and Mason Counties. Individual county estimates were based on OFM projections through the year 2000 in order to provide a conservative and timely assessment. The BPA projections were used for comparison purposes. The OFM population projections were distributed within each county by compass sectors using various regional planning commission published projections and insights.(5) Projections from 2000 to 2030 relied on Bureau of Census forecasts.(5)

A high growth scenario was applied to the rapid growth areas of Thurston and Pierce Counties, and an average growth scenario was applied to the more slowly growing areas.

2.1.2.1 Population Within Ten Miles

The 1980 population and projections by decade through the year 2030 for each of the sectors within ten miles of the plant site are listed in Table 2.1-2 which may be keyed to sectors shown in Figure 2.1-3.

The nearest incorporated communities with population exceeding 1,000 are the City of Elma, located approximately four miles northeast of the site with a 1980 population of 2,720, and the City of Montesano, located six miles west-northwest with a 1980 population of 3,247 people.[1] Of the 80 sectors (22.5° x 1 radial mile areas) within a 5-mile radius of the
site, 44 were uninhabited in 1980; it is anticipated that they will con- | 2
tinue to remain uninhabited during the period through 2030.[13,14]

2.1.2.2 Population Between Ten and Fifty Miles

Population estimates and projections by decade through the year 2030 for each 22.5° sector between the ten and fifty-mile radii are presented in Table 2.1-2. The 50-mile radius encompasses a ten-county region. The counties vary from a low rural population density to a high urban population density. The economic basis of the rural counties is primarily the forest products industry. These counties include Grays Harbor, Pacific, Lewis, Wahkiakum, Mason, Cowlitz, and Jefferson. Most of these counties have experienced a stable or moderate population growth for the last 30-40 years with the exception of the last decade in which higher growth rates have occurred. In the future, it is expected that these recent trends will continue as the rural counties expand their economic base.[15]

The urban counties of Pierce, Thurston, and Kitsap have high population densities and diversified economic bases. A substantial portion of industrialized Pierce County is located within the 50-mile radius. Pierce County has grown faster than most of the rural counties during the last ten years and it is projected to continue to grow at a substantial rate. Thurston County is the location of the State capital. During the last ten years, this county has experienced rapid growth in response to increased government employment. It is projected that growth in Thurston County will continue to respond to activity in the State government.

Kitsap County is less populated than Thurston or Pierce Counties, although it is still considered an urban region. Only a small portion of the county falls within the 50-mile radius of the plant. During the last ten
years the county has grown rapidly as a result of construction of the Tri- |1
dent Submarine Support Base. It is expected that Kitsap County will grow at a moderate rate in the future; although probably not to the extent it has in the past decade.

2.1.2.3 Transient Population

The transient population within ten miles is composed primarily of teachers and students at public schools, nursing home residents, employees in logging operations and at industrial facilities, and area hunters and fishermen.

Public facilities and institutions within 10 miles of the site where people may work or reside temporarily are listed in Table 2.1-3.[16-19] Also listed is the Mark E. Reed Memorial Hospital in McCleary which is slightly outside the 10-mile radius. In 1981 this institution was licensed for 26 beds and had an anverage occupancy of 50% in 22 beds.[18]

1 Excepting the Cities of Elma and Montesano and the public facilities listed in Table 2.1-3, the four largest employers in the vicinity of WNP-3 are:

Employer	Employees		Location
	July 1981	Peak	
Elma Plywood	25	120	8 mi NE
Ventron Corporation	50	75	5 mi ENE
Anderson Logging Company	35	50	5 mi ENE
Elma Cedar Products	20	40	5 mi ENE

Logging activity can vary considerably from area to area. The approximately 100,000 acres of commercial forest within the 10-mile radius are shown in Figure 2.1-6. Table 2.1-4 illustrates the number of employees which could be employed in each sector based upon an annual yield estimate. Since one logging operation employs approximately 10 persons, it could be assumed that approximately 12 different logging operations (or about 120 persons) could be employed during the course of one year within this 10-mile radius.

Fishing and hunting are also contributors to transient populations. Figure 2.1-5 shows the estimated seasonal totals of big games and upland bird hunters within 10 miles of the site. The Chehalis River and its tributaries, the Satsop and Wynoochee Rivers, provide a number of public swimming, boating, hunting and fishing areas. Table 2.1-5 provides estimates of peak numbers of fishermen for areas with 10 miles of the plants. In addition, a total of 1600 waterfowl hunters may use the 25-mile segment of the Chehalis River Valley over the course of the hunting season.[20] All of these sportsmen cannot plausibly be expected to be in the area at the same time.

Table 2.1-6 lists county and state camping and fishing facilities located within 10 miles of the site. Camp Delezene, a year-round Boy Scout camp, is located at three miles southeast of WNP-3 on Delezene Creek Road. The

Twin Harbors Boy Scout Council reports a capacity of 150 campers (staying for periods of three weeks per session) during the peak summer months of July and August. There are approximately 350 scouts using the facilities in a twelve month period.[20]

The Oaksridge golf course is located approximately three miles north of the plant site and borders the north side of U.S. Highway 12. The facility consists of a clubhouse-restaurant and an eighteen-hole golf course.

Several mobile home parks are present within the 10-mile radius. It is difficult to determine which are considered "transient" type of facilities, and which would be considered permanent. With the start of construction of WNP-3 numerous mobile home parks have developed. Six "trailer" parks with 72 mobile homes within the 10-mile radius in 1974; Table 2.1-7 shows the status based on 1981 information.[20]

Figure 2.1-6 displays the various transient population generators within the 10-mile radius of WNP-3. Symbols are used to denote approximate locations of the various transient populations. There are no major attractants, such as resorts or convention centers, that would draw large numbers of transients from outside the area. Most of the people involved in the above activities would be included in the estimates of resident population.

2.1.3 Uses of Adjacent Lands and Waters

As noted in Subsection 2.1.1.2, Supply System land ownership in the site proper totals about 1,360 acres. Miscellaneous properties, primarily for
access roads, total about 380 acres. Approximately 450 acres in the site 2
island area were cleared and grubbed for plant construction. The land permanently occupied by the plant facilities (including WNP-5) totals
about 150 acres. Land not required for operation will be revegetated to 2
natural habitat. The Supply System has also leased a 68-acre parcel at the confluence of the Satsop and Chehalis Rivers to the Washington Department of Game to be managed as game habitat in mitigation of riparian areas disturbed by plant construction. Figures 2.1-1 and 2.1-2 show the location of principal structures and boundaries relative to natural features and transportation routes. Table 2.1-8 provides the distances from WNP-3 to various activities in each sector.

The principal land uses in the site area are related timber and agricultural production. Virtually all the land out to ten miles in the SE to WSW sectors is dedicated to timber production. Large areas north of the site are also owned and managed by timber companies (see Figure 2.1-6). Agricultural activities are concentrated in the fertile bottom lands and flood plains of the Chehalis and Satsop Rivers. Only a small percentage

of the total land area contains soil suitable for sustained and intensive agriculture. The primary products are livestock, pasture grass, field crops, and vegetable crops. Livestock generally consists of poultry, sheep, hogs, and dairy and beef cattle.

All or part of ten counties lie within 50 miles of WNP-3 (see Figure 2.1-4). Table 2.1-9 lists the agricultural output from each county. The production numbers were weighted by the fraction of the land area within the 50-mile radius of WNP-3.

Dairy operations in the area ship their milk to Northwest Dairymen's Association, Seattle, for distribution through Safeway, Inc. Most of this milk is bottled as whole milk. The volume from dairies within 5 miles of the plant is estimated at 20,000 lbs/day. The total volume produced within 10 miles is estimated at 140,000 lbs/day.(31) Therefore, the dairy-dilution factor for the milk produced within 5 miles of the plant is 20,000/140,000 or 0.14.

Land use in the area has been changing since construction of WNP-3 began in 1977. The rate of residential lot creation in the unincorporated areas of eastern Grays Harbor County increased by 89 percent between 1976 and 1977, and another 45 percent in 1978. Much of the development has involved the conversion of agricultural land to residential property. In addition to short-platting and subdivision activity in the County, requests for conditional use permits for gravel operations and mobile home parks have increased. Because gravel deposits underlie much of the agricultural land along the Chehalis River, the increased gravel extraction has usurped agricultural land uses. Between January 1973 and December 1979, the County granted 47 conditional use permits for gravel extraction on agricultural land. Approximately 55 percent of all rezones in unincorporated parts of the County during the same period were conversions from agriculture to a higher density zone.(32)

Salmon and steelhead fishing is a major sport activity in the vicinity of the plant. Washington State Department of Fisheries (DOF) studies indicate that average sport salmon fishing success runs at about 0.055-0.065 fish/hour.(33) Fish caught range in weight from 1 to 14 kilograms. Steelhead fishing pressure is lighter and has an even lower fish/hour catch rate. The majority of sport fish taken from the Chehalis are non-resident fish which are migrating through to spawning areas in the tributaries. Maximum estimated residence time that these fish spend in waters mixed with the plant discharge is one month. Catch statistics compiled for 1978 by Washington State Department of Fisheries indicate that 2,900 salmon were taken by fishermen from the Chehalis River, 1,740 from the Satsop River and 840 from the Wynoochee River.(34) Commercial catch data for various species and water bodies are compiled by DOF. Data for the Chehalis River and Grays Harbor are listed in Table 2.1-10.

TABLE 2.1-2
(SHEET 1 of 4)
POPULATION WITHIN 50 MILES OF WNP-3

DISTANCE (MILES)	DIRECTION (COMPASS SECTOR)	1980	1986	1990	2000	2010	2020	2030
0-1	N	3	3	3	4	4	5	5
	ALL OTHERS	0	0	0	0	0	0	0
	SUB-TOTAL	3	3	3	4	4	5	5
	CUM-TOTAL	3	3	3	4	4	5	5
1-2	N	14	16	16	17	19	20	22
	NNE	3	3	3	3	3	3	3
	NE	11	12	12	13	14	15	16
	ENE-W	0	0	0	0	0	0	0
	WNW	32	34	35	38	41	44	47
	NW	31	33	34	38	42	46	50
	NNW	12	13	13	14	15	16	17
	SUB-TOTAL	103	111	113	123	134	144	155
	CUM-TOTAL	106	114	116	127	138	149	160
2-3	N	77	81	84	93	102	111	120
	NNE	280	302	317	367	419	474	530
	NE	13	14	14	16	18	20	22
	ENE	105	111	115	128	140	153	166
	E	3	3	3	3	3	3	3
	ESE	0	0	0	0	0	0	0
	SE	3	3	3	3	3	3	3
	SSE-W	0	0	0	0	0	0	0
	WNW	28	30	31	35	39	43	47
	NW	84	89	92	103	114	125	136
	NNW	204	215	222	246	269	293	316
	SUB-TOTAL	797	848	881	944	1,107	1,225	1,343
	CUM-TOTAL	903	962	997	1,121	1,245	1,374	1,503
3-4	N	174	183	189	209	229	249	269
	NNE	419	456	483	570	660	756	854
	NE	716	748	770	841	910	980	1,049
	ENE	100	105	109	121	133	145	157
	E	20	21	22	24	26	28	30
	ESE	6	7	7	8	9	10	11
	SE-WSW	0	0	0	0	0	0	0
	W	18	19	19	20	21	22	23
	WNW	109	115	120	135	150	165	180
	NW	477	501	518	572	625	679	732
	NNW	116	122	126	139	152	165	178
	SUB-TOTAL	2,155	2,277	2,363	2,639	2,915	3,199	3,483
	CUM-TOTAL	3,058	3,239	3,360	3,760	4,160	4,573	4,986

TABLE 2.1-2
(SHEET 2 of 4)
POPULATION WITHIN 50 MILES OF WNP-3

DISTANCE (MILES)	DIRECTION (COMPASS SECTOR)	1980	1986	1990	2000	2010	2020	2030
4-5	N	61	64	66	73	80	87	94
	NNE	38	51	62	96	132	172	214
	NE	1,955	2,104	2,209	2,555	2,909	3,284	3,664
	ENE	129	137	142	159	176	193	210
	E	74	78	81	91	101	111	121
	ESE	46	48	50	55	60	65	70
	SE-WSW	0	0	0	0	0	0	0
	W	35	36	37	40	43	46	49
	WNW	356	374	387	427	466	506	545
	NW	53	56	58	64	70	76	82
	NNW	59	62	64	71	78	85	92
	SUB-TOTAL	2,806	3,010	3,156	3,631	4,115	4,625	5,141
	CUM-TOTAL	5,864	6,249	6,516	7,391	8,275	9,198	10,127
5-10	N	210	221	229	254	279	304	329
	NNE	62	67	70	81	92	104	116
	NE	1,462	1,552	1,615	1,820	2,027	2,243	2,459
	ENE	375	403	423	489	557	629	702
	E	562	594	617	690	762	836	910
	ESE	267	283	295	332	369	408	447
	SE	119	128	134	155	176	198	221
	SSE	0	0	0	0	0	0	0
	S	0	0	0	0	0	0	0
	SSW	17	18	19	21	23	25	27
	SW	0	0	0	0	0	0	0
	WSW	3	3	3	3	3	3	3
	W	1,748	1,945	2,088	2,585	3,138	3,768	4,457
	WNW	4,214	4,452	4,618	5,162	5,713	6,291	6,875
	NW	0	0	0	0	0	0	0
	NNW	259	274	285	320	355	391	427
	SUB-TOTAL	9,298	9,943	10,396	11,912	13,494	15,200	16,973
	CUM-TOTAL	15,162	16,189	16,912	19,303	21,769	24,398	27,100
10-20	N	410	445	469	522	561	602	636
	NNE	499	544	574	637	675	716	744
	NE	1,902	2,005	2,173	2,501	2,824	3,177	3,540
	ENE	2,292	2,453	2,560	2,817	3,107	3,423	3,725
	E	406	430	446	468	496	526	547
	ESE	2,491	2,783	2,979	3,322	3,557	3,816	4,029
	SE	1,789	2,012	2,160	2,683	3,323	3,621	5,095
	SSE	440	442	444	447	454	463	474
	S	562	562	562	562	562	562	562

TABLE 2.1-2
(SHEET 3 of 4)
POPULATION WITHIN 50 MILES OF WNP-3

DISTANCE (MILES)	DIRECTION (COMPASS SECTOR)	1980	1986	1990	2000	2010	2020	2030
10-20	SSW	811	818	824	838	854	871	888
	SW	436	438	440	440	451	458	465
	WSW	147	160	168	189	213	239	266
	W	30,073	30,758	31,215	33,125	34,731	36,109	37,371
	WNW	1,107	1,143	1,167	1,259	1,341	1,420	1,490
	NW	430	444	453	486	518	549	576
	NNW	50	55	58	60	75	85	96
	SUB-TOTAL	43,485	45,486	46,692	50,356	53,242	56,637	60,504
	CUM-TOTAL	59,007	61,684	63,604	69,659	75,011	81,035	87,604
20-30	N	42	42	42	42	42	42	42
	NNE	1,019	1,110	1,172	1,301	1,379	1,448	1,506
	NE	8,680	9,461	9,982	11,080	11,745	12,450	12,948
	ENE	26,535	32,903	37,149	44,579	49,483	55,421	60,963
	E	34,920	43,300	48,888	58,666	65,119	72,934	80,227
	ESE	6,231	6,978	7,477	8,224	8,717	9,240	9,610
	SE	13,210	15,191	16,512	20,145	21,354	22,635	23,540
	SSE	638	676	702	758	803	851	885
	S	444	444	444	444	444	444	444
	SSW	1,919	1,976	2,014	2,074	2,198	2,330	2,423
	SW	4,128	4,462	4,685	4,690	4,961	5,259	5,469
	WSW	684	745	785	870	947	1,031	1,096
	W	3,937	4,059	4,143	4,462	4,745	5,014	5,254
	WNW	869	907	933	1,029	1,119	1,210	1,296
	NW	667	695	714	790	859	929	995
	NNW	145	146	146	148	148	148	148
	SUB-TOTAL	104,068	123,095	135,788	159,378	174,063	191,386	206,846
	CUM-TOTAL	163,075	184,779	199,392	229,037	249,074	272,421	294,450
30-40	N	18	18	18	18	18	18	18
	NNE	1,577	2,088	2,429	3,158	3,505	3,926	4,319
	NE	5,334	7,062	8,214	10,678	11,853	13,275	14,603
	ENE	13,321	18,116	21,314	27,708	30,756	34,447	37,891
	E	34,345	46,709	54,952	71,438	79,296	88,812	97,693
	ESE	2,760	3,174	3,450	4,209	4,462	4,730	4,919
	SE	12,560	1,444	15,700	19,154	20,303	21,521	22,382
	SSE	1,465	1,553	1,612	1,741	1,845	1,956	2,034
	S	396	396	396	396	396	396	396
	SSW	269	277	282	290	307	325	338

TABLE 2.1-2
(SHEET 4 of 4)
POPULATION WITHIN 50 MILES OF WNP-3

DISTANCE (MILES)	DIRECTION (COMPASS SECTOR)	1980	1986	1990	2000	2010	2020	2030
30-40	SW	1,056	1,141	1,198	1,310	1,389	1,472	1,531
	WSW	1,596	1,815	1,962	2,450	2,683	3,738	4,574
	W	4,075	4,702	5,173	6,717	8,617	10,987	13,883
	WNW	2,255	2,630	2,914	3,853	5,035	6,532	8,402
	NW	46	49	51	58	63	68	73
	NNW	695	753	794	930	1,075	1,235	1,406
	SUB-TOTAL	81,768	91,927	120,459	154,108	171,603	193,438	214,462
	CUM-TOTAL	244,843	276,706	319,851	383,145	420,677	465,859	508,912
40-50	N	3	3	3	3	3	3	3
	NNE	1,817	2,364	2,750	3,575	3,968	4,444	4,888
	NE	15,247	20,186	23,480	30,524	33,882	37,948	41,743
	ENE	223,901	249,835	267,125	302,535	335,814	376,112	413,723
	E	11,299	12,395	13,125	14,375	15,238	16,152	16,798
	ESE	2,438	2,584	2,682	2,897	3,071	3,255	3,385
	SE	6,619	7,015	7,280	7,862	8,334	8,834	9,187
	SSE	2,741	2,905	3,015	3,256	3,451	3,658	3,805
	S	1,111	1,135	1,144	1,184	1,208	1,214	1,263
	SSW	1,349	1,458	1,531	1,670	1,770	1,876	1,951
	SW	2,213	2,391	2,511	2,750	2,915	3,090	3,214
	WSW	0	0	0	0	0	0	0
	W	0	0	0	0	0	0	0
	WNW	73	81	87	107	135	169	209
	NW	749	854	932	1,185	1,489	1,860	2,302
	NNW	548	594	627	733	847	973	1,108
	SUB-TOTAL	270,108	303,800	326,291	372,656	412,126	459,591	503,587
	CUM-TOTAL	514,951	580,506	646,142	755,801	832,803	925,450	1,012,499

TABLE 2.1-7

MOBILE HOME PARKS AND SPACES
WITHIN 10 MILES OF WNP-3

Distance (Miles)	Direction (Compass Segments)	Number of Mobile Home Parks	Number of Spaces
0-1	ALL	0	0
1-2	ALL	0	0
2-3	N	1	19
2-3	NNE	2	84
3-4	NW	1	12
3-4	NNE	1	45
4-5	NE	1	98[a]
4-5	ENE	1	19[b]
5-6	ENE	1	36[b]
5-6	NE	2	30
5-6	WNW	4	63
6-7	NE	1	45
6-7	NNW	2	20
7-8	W	1	8
8-9	N	1	5
8-9	W	3	148[b]
9-10	W	1	15[b]
9-10	N	1	15
Total within 0-10 miles:		24	662

Source: Reference 2.1-20

[a] Primarily RV accommodations.

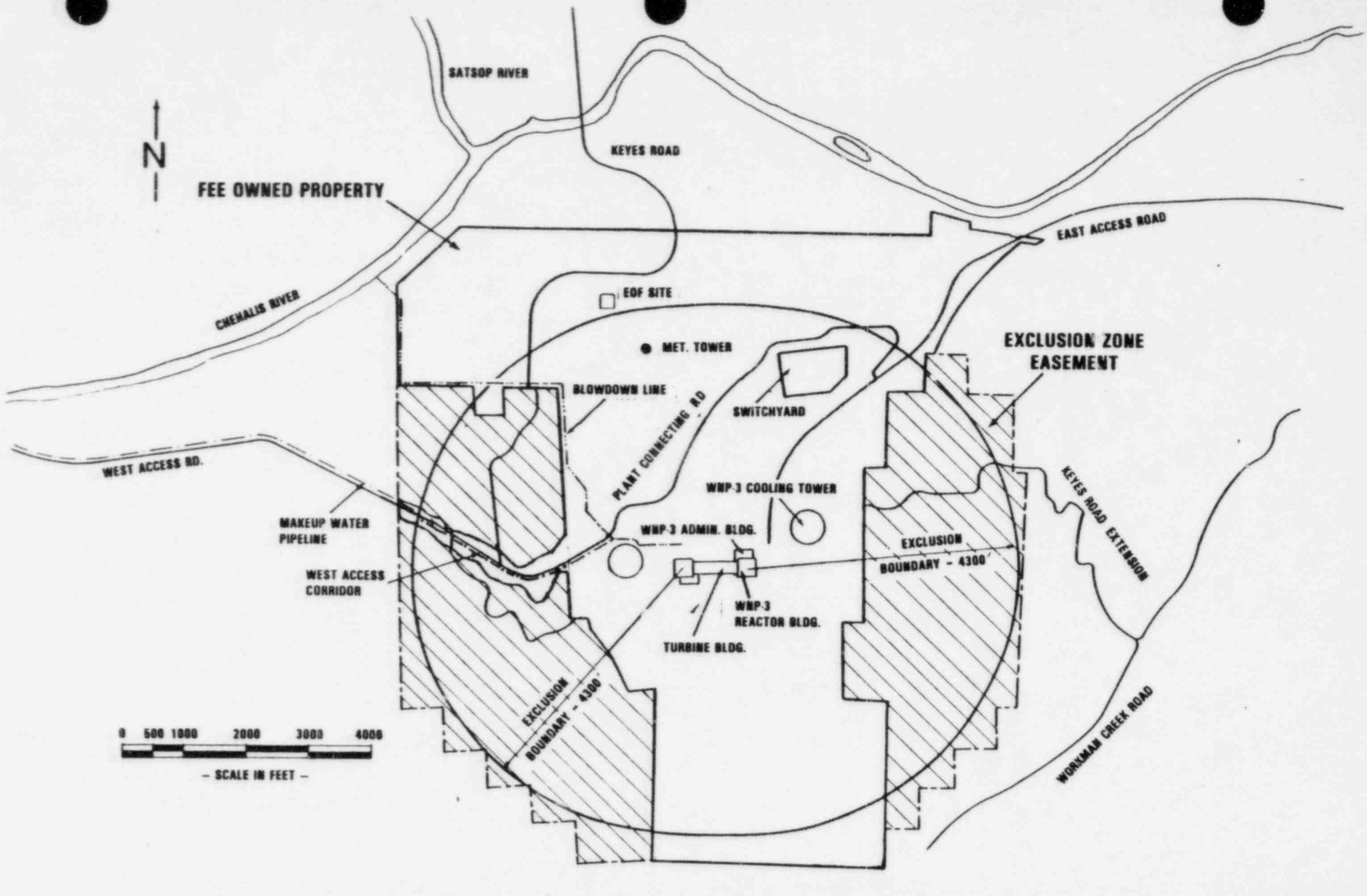
[b] One park divided by sector.

TABLE 2.1-8

DISTANCE (MILES) FROM WNP-3 TO POINTS OF INTEREST

	Sector	Resident	Veg. Garden	Beef Cattle	Milk Cow	Milk Goat
	N	1.0	1.0	1.7	1.2[a]	--
	NNE	1.5	1.5	1.6	1.5[a]	--
	NE	1.6	1.6	1.6	1.7	1.7
	ENE	2.3	2.3	2.2	2.6	4.1
2	E	2.7	2.7	4.2	--	--
	ESE	3.9	3.9	3.9	--	3.8
2	SE	2.7	--	--	--	--
	SSE	--	--	--	--	--
	S	--	--	--	--	--
	SSW	--	--	--	--	--
	SW	--	--	--	--	--
	WSW	--	--	--	--	--
	W	3.7	3.7	3.8	--	--
	WNW	1.1	1.2	1.5	1.5[a]	--
	NW	2.0	2.0	3.1	1.8[a]	--
2	NNW	1.2	1.2	2.6	1.1	4.2

[a] Dairy operations.



Amendment 2 (May 84)

WASHINGTON PUBLIC POWER SUPPLY SYSTEM NUCLEAR PROJECT No. 3 OPERATING LICENSE ENVIRONMENTAL REPORT	SITE FEATURES	FIGURE 2.1-1

2.2 ECOLOGY

2.2.1 Terrestrial Ecology

General descriptions and data collected before 1975 on flora and fauna found in the vicinity of WNP-3 are described in Section 2.7 of the Environmental Report-Construction Permit Stage.[1] The following discussions of the terrestrial ecology focuses on data collected from 1975 through 1980.

2.2.1.1 Vegetation

The vegetation communities surrounding the site can be divided into three topographic areas: upland areas, river terraces, and riparian areas along the Chehalis River and creek bottoms. In general, the site area is forested with some pasture and agriculture usage along the river (Figure 2.2-1). The upper creek bottoms and terraces are populated by conifers 1
and stands of second growth hardwood dominated by red alder (Alnus rubra). Mixed stands of hardwoods and conifers are found on the river terraces. On the steep upper slopes, Douglas fir (Pseudotsuga menziesii) is the dominant timber and above the 300-foot contour, nearly pure stands of conifers have developed. Bigleaf maple (Acer macrophyllum), vine maple (Acer circinatum), willow (Salix sp.), black cottonwood (Populas trichocarpa), cascara (Rhamnus purshiana), western hemlock (Tsuga heterophylla) and western red cedar (Thuja plicata) are the common species in the area. Forests in this area are generally managed so that they maintain the earlier stages of succession, because red alder is used for pulpwood and the Douglas fir for saw timber. Most of the vegetation on the site had been harvested once before and represented second growth at the initiation 2
of construction activities.

Table 2.2-1 presents a representative list of 219 plant species identified near the site, representing 165 genera and 65 families. The understories in forested areas are dominated by a dense growth of shrubs, herbaceous species, ferns and bryophytes. The principal shrub is salal (Gaultheria shallon). This straggling plant forms dense tangles in many areas. Red huckleberry (Vaccinium parvifolium), oregon grape (Berberis nervosa), and sword fern (Polystichum munitum) are also common. 1

The approach of the Terrestrial Ecology programs in 1978 through 1980 was to use intensive sampling within four small watersheds as a basis for evaluating potential impacts. The watersheds were selected to be representative of the two major habitat types surrounding the site (i.e., maturing second-growth coniferous forests and recent clearcuts). They were selected in matched pairs so that areas adjacent to the plant site could be compared with areas outside the influence of the plant. Two forested watersheds (called treatment and control) near WNP-3 were sampled in 1978 (Figure 2.2-2).[1] The dominant species were similar in both forested areas. Sword fern (Polystichum munitum) covered 32 and 17 per-

cent of the treatment and control forest plots, respectively. Salal was second to sword fern in cover dominance, with values of about 10 percent in both forests. Deer fern (Blechnum spicant) was third in dominance at over 6 percent in the treatment forest, but covered less than 1 percent in the control forest. Foamflower (Tiarella trifoliata) had a mean coverage of 5 percent in both forests, ranking third in dominance in the control forest and fourth in the treatment forest. Both salal and foamflower were widely distributed in the forested watersheds. Although low in coverage, Pacific brome grass (Bromus pacificus) and immature grass plants were well-distributed only in the control forest. Seedlings of western red-cedar and western hemlock yielded low coverage and frequency values in both forests, but only the control forest contained seedlings of Douglas fir.

Two clearcut watersheds (called treatment and control) near WNP-3 were
sampled 1978-1980 (Figure 2.2-2).[2,3,4] The treatment and control
clearcut watersheds were similar in plant species coverage and frequency
in 1978 through 1980. In 1980, 39 and 41 vascular plant species were
1| found in sampled areas of the control and treatment clearcuts, respectively. Approximately 75 percent of the plants were common to both watersheds. Pacific blackberry (Rubus ursinus) was the dominant cover species, with coverage of 40.7 and 28.3 percent in the treatment and control clearcuts, respectively. Other species with relatively high cover values in both watersheds were bracken fern (Pteridium aquilinum) and common velvet-grass (Holcus anatus). In the treatment clearcut, 13 species had cover values exceeding 2 percent. Predominant among these species were thimbleberry (Rubus parviflorus), Oregon grape, pearly-everlasting (Anaphalis margaritacea), and Douglas fir seedlings. In the control clearcut, 12 species had cover values exceeding 2 percent; predominant among these were hairy cat's-ear (Hypochaeris radicata), fireweed (Epilobium augustifolium), and seedlings of Douglas fir, vine maple and bitter cherry (Prunus emarginata).

In summary, vegetation near the site can be described as follows: (1)
within the study site vegetation is highly diverse and is no longer repre-
sentative of the former climax vegetation of the Western Hemlock Zone; (2)
much of the vegetation diversity can be attributed to timber and agricul-
tural practices; (3) the dominant vegetation in the lower elevation and
1| moist areas is red alder and on the upper steep slopes and level uplands
Douglas fir is the dominant species; (4) the forest land produces high-
quality timber; (5) forest management techniques (e.g., natural and arti-
ficial seeding, thinning, fertilization, etc.) are used to maintain
vegetation in a state of intermediate forest succession so yields of the
commercially valuable Douglas fir can be sustained; and (6) the early
successional stages on the upper terraces and along the creeks result in
1| an interspersion of cover types ideal for some wildlife species.

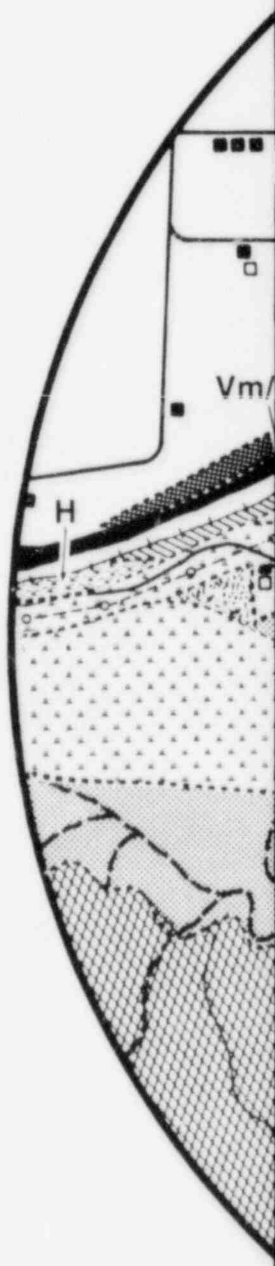
2.2.1.2 Wildlife

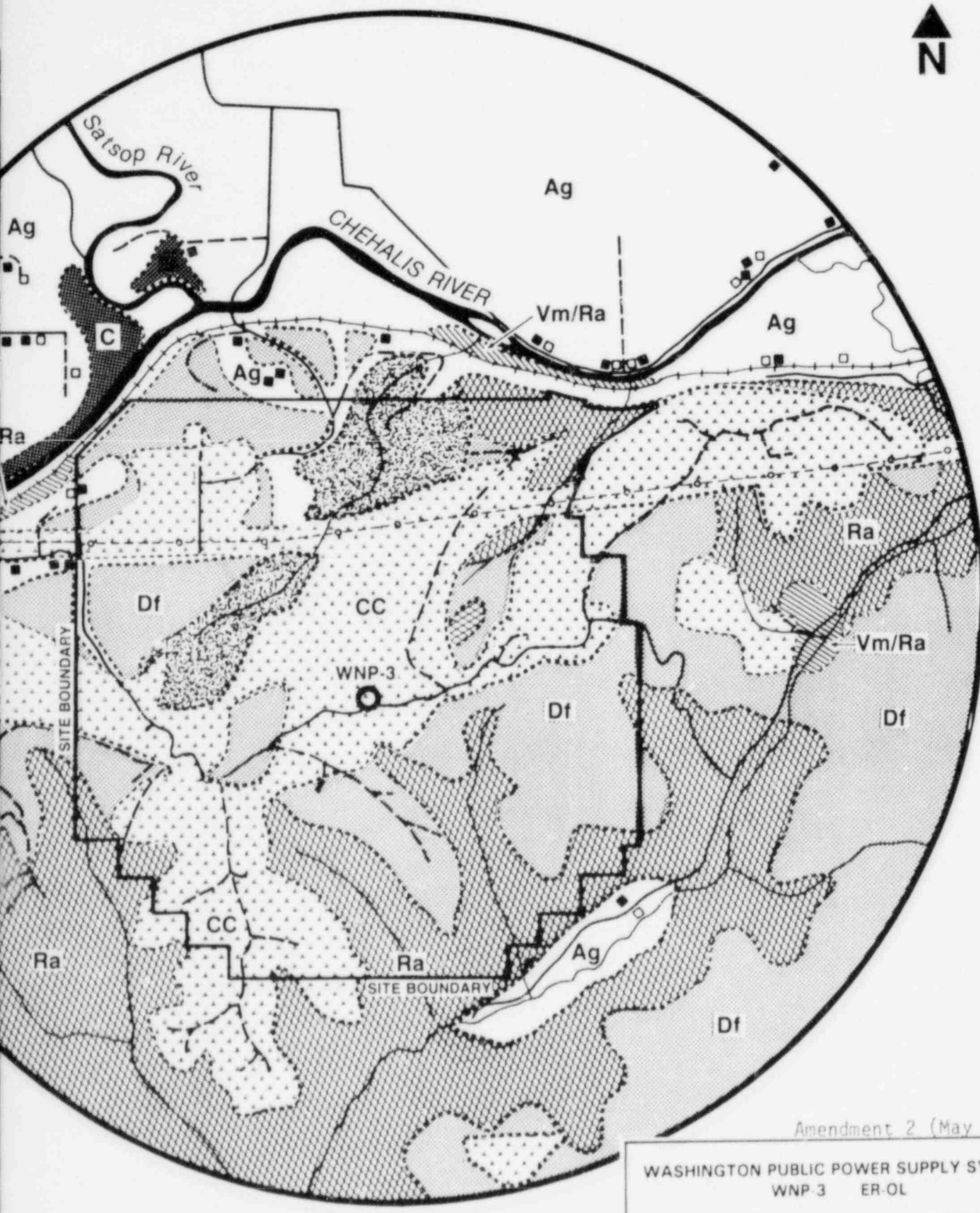
Visual observations and consultations with State game biologists indicate that the characteristic wildlife species of the region are well represented

KEY

DOUGLAS	Df
RED ALDER	Ra
HEMLOCK	H
RED ALDER - DOUGLAS FIR MIX	Ra/Df
VINE MAPLE - RED ALDER MIX	Vm/Ra
COTTONWOOD	C
AGRICULTURAL	Ag
CLEAR CUT	CC

0 1 2
miles





Amendment 2 (May 84)

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
WNP-3 ER-OL

VEGETATION IN THE SITE AREA

FIGURE 2.2-1

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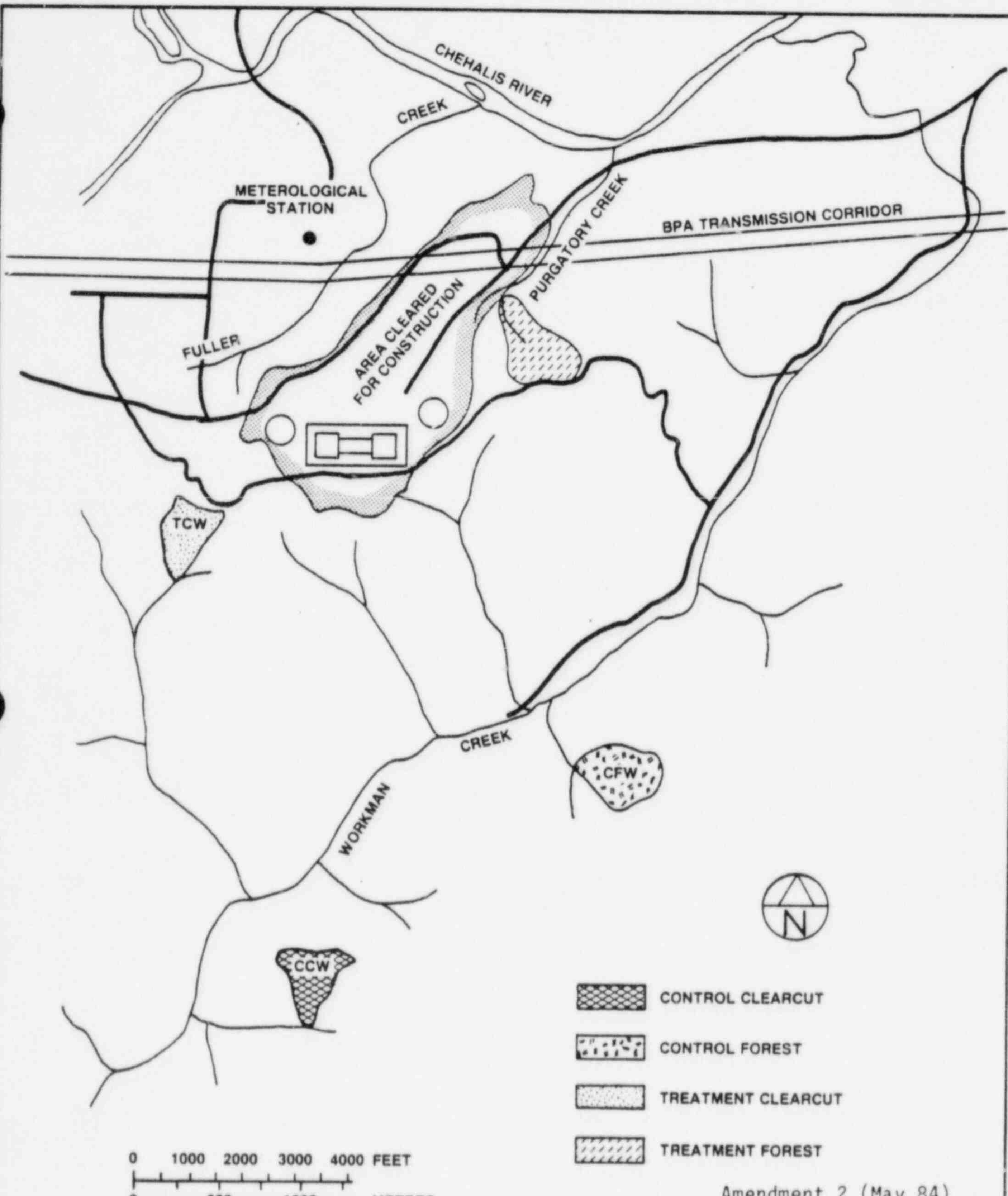


Amendment 2 (May 84)

WASHINGTON PUBLIC POWER SUPPLY SYSTEM
WNP-3 ER-OL

ADAPTED FROM FIGURE 3-1
OF REFERENCE 2.2-4

TERRESTRIAL ECOLOGY SAMPLING SITES

FIGURE 2.2-2

2.3 METEOROLOGY

2.3.1 Regional Climatology

The climate of the lowlands of western Washington is dominated by two large-scale meteorological factors: the mid-latitude westerly winds and the proximity of the Pacific Ocean. The mid-latitude westerly winds are a feature of the global climate from about 30°N to 60°N. The westerlies carry a recurring progression of low-pressure systems called synoptic storms, which develop, move east, and dissipate in the mid-latitudes. The westerlies and their associated storms are most intense in the winter months; they weaken and shift northward in the summer months.

The Pacific Ocean moderates the seasonal and daily variability in climate as air masses move eastward over the land. Winters are warmer and summers cooler than at other locations of the same latitude. Cloudiness and high humidities are also persistent features. The topography of Grays Harbor County does little to obstruct the eastward flow, especially at locations in the west-east trending Chehalis River Valley.

The westerlies and the proximity and exposure to the Pacific Ocean combine to cause a predominance of maritime polar air masses over the region. Humidities are generally high in these air masses with the morning maxima usually above 90 percent. The passage of storm systems often includes the passage of a boundary or front between the subtropical and polar air masses. The fronts are often indistinct and are related to broad bands of weather activity.

Winters in Grays Harbor County tend to have the worst weather of any season. The synoptic storms move repeatedly through the area, bringing continuous rain, cloudiness and windy conditions to exposed locations. Often, there is persistent cloudiness for several weeks duration. Heavy snows do occur about once every two or three years. Low temperatures are in the 30°F to 40°F range, with little daily variation.

The summer climate in this area reflects the weakening of the westerly winds and storms. Skies are often fair to partly cloudy and precipitation generally comes in the form of brief, rarely intense showers. Stormy cloudy conditions can dominate for several days in a row, but they are generally less pervasive or severe than in the winter months. The summer climate is generally pleasant and mild, with daily afternoon high temperatures in the 70°F to 80°F range.

2.3.2 Local Meteorology

Local meteorological conditions are described by both the onsite monitoring program (see Subsection 6.1.3) and longer term records for nearby stations. The data recorded between October 1979 and September 1981 are summarized in this section; additional detail and interpretation are provided in Section 2.3 of the WNP-3 Final Safety Analysis Report.

2.3.2.1 Temperature and Dew Point

The long-term temperatures for the site area can be described by data reported by first-order National Weather Service stations and cooperative observers at Aberdeen, Elma, Oakville, and Olympia.[1-5] Monthly temperatures at these locations are shown in Table 2.3-1. Also listed for comparison are the average monthly temperatures observed onsite during the two-year period ending September 1981. The moderating influence of the ocean noted in Subsection 2.3.1 is obvious when temperatures at Aberdeen are compared with those for the inland locations. Regarding extremes, the highest temperature on record at Elma is a July reading of 105°F while the lowest is 0°F recorded in January. The extremes of record for
2 | Olympia are 103°F (July 1941) and -7°F (January 1972).

Annual frequency distributions for onsite temperature versus time of day are given in Tables 2.3-2a and 2.3-2b for the two heights (10m and 60m). Temperatures above 30°C (86°F) occurred about 0.3 percent of the time.

The National Weather Service Station at Olympia provides a long-term record for regional dew point and humidity data. The monthly mean values of dew point and relative humidity for Olympia are compared with the two-year means recorded onsite in Table 2.3-3. Tables 2.3-4 and 2.3-5 provide the annual frequency distributions versus hour of day for measured dew points and calculated wet bulbs, respectively, for onsite data.

The representativeness of Olympia temperature and dew point data relative to the plant site is illustrated by Table 2.3-6 which compares the monthly means for the two locations for the same 12-month period. From this data it is seen that the site experiences slightly lower mean maximums and higher mean minimums than Olympia. Relative humidities at the site are lower than those for Olympia.

2.3.2.2 Wind Speed and Direction

Composite average wind rose data recorded on site at the 10-meter level from October 1979 through September 1981 are shown in Tables 2.3-7a through 2.3-7l. These data illustrate the climatological phenomenon of slightly stronger winds and more frequent calms during the winter months. The late fall and winter winds have a strong easterly component while the Spring-summer winds are dominated by the SSW direction. The annual summaries for each 12-month period are shown in Tables 2.3-8a and 2.3-8b. The first year (October 1979 - September 1980) had considerably more observations of calms than did the second year. The directional distributions for each year match very closely with the SSW wind predominating.

Tables 2.3-9a and 2.3-9b provide comparison of wind roses for 10m and 60m, respectively, for the two-year monitoring program. Average wind speeds at 10m and 60m were 1.5 and 3.1 m/sec, respectively. In addition to the expected higher winds, the 60m level has directional peaks in the ENE and WSW-W as compared with the singular SSW peak at the 10m level. The ENE direction is dominant at the 60m level during the winter months.

TABLE 2.3-14

MEAN SEASONAL AND ANNUAL MIXING HEIGHTS FOR SEATTLE[(a)]

	Time of day[(b)]	Mixing Height (m)		Percent	Mean Wind Speed (m/sec)	
		Non-P	All	Non-P[(c)]	Non-P	All
Winter	M	626	824	49.8	5.1	6.2
	A	585	718	45.8	4.7	5.4
Spring	M	611	838	55.2	4.6	5.5
	A	1490	1577	56.5	5.7	6.2
Summer	M	532	576	85.1	4.0	4.2
	A	1398	1419	89.5	4.8	4.9
Autumn	M	476	565	61.5	4.3	5.0
	A	898	987	66.3	4.6	5.0
Annual	M	578	705	62.8	4.5	5.2
	A	1092	1175	64.5	4.9	5.4

(a) From Reference 2.3-7.

(b) M = Morning, A = Afternoon

(c) Non-P = Non-precipitating cases, All = All cases.
Non-precipitating cases exclude those in which precipitation occurred near time of measurement and exclude those with missing data and those for which no mixing height could be calculated.

TABLE 2.3-15

MONTHLY AND ANNUAL PRECIPITATION (inches) IN THE SITE VICINITY

Month	Aberdeen[a]	Elma[b]			Oakville[c]	Olympia[d]
		Max	Min	Mean		
January	12.70	23.61	1.59	10.48	8.49	7.93
2 February	10.23	14.96	2.34	7.95	6.56	5.97
March	9.19	13.16	0.82	7.22	5.70	4.81
April	5.56	8.17	0.48	4.49	3.34	3.14
May	3.43	6.47	0.33	2.56	2.28	1.88
June	2.70	5.53	0.12	1.98	1.86	1.57
July	1.51	3.41	0.02	1.02	0.65	0.70
August	1.79	5.40	0.04	1.53	1.10	1.17
September	3.71	6.21	0.03	2.84	2.25	2.12
October	8.13	14.51	0.97	6.47	5.46	5.28
November	11.09	17.44	1.72	9.36	7.42	7.98
December	14.50	16.67	3.93	10.71	9.44	8.19
Annual	84.54	80.27	41.01	66.51	54.55	50.74

(a) Period of record 1931 - 1960
(b) Period of record 1940 - 1977
(c) Period of record 1931 - 1960
(d) Period of record 1941 - 1970

2.4 HYDROLOGY

2.4.1 Surface Water

The WNP-3 project is located on a ridge 1.4 miles south of the confluence of the Chehalis and Satsop Rivers, and approximately 21 river miles (RM) upstream of the Chehalis River's confluence with Grays Harbor. Nominal plant grade is 390 ft mean sea level (MSL), about 370 ft above the Chehalis River floodplain. Makeup water for the Circulating Water System is supplied from induced infiltration of surface waters and groundwater within the Chehalis River by Ranney collector wells located slightly more than three miles downstream from the Satsop River confluence. Blowdown from the natural-draft cooling tower is discharged to the Chehalis River through a submerged multiport diffuser located 0.5 miles downstream from the confluence (see Section 3.4). The Chehalis River watershed is shown in Figure 2.4-1, and principal hydrologic features of the site vicinity are shown in Figure 2.4-2.

2.4.1.1 Chehalis River Hydrology and Physical Characteristics

The Chehalis River basin is a major river basin draining west-central Washington. The river heads in the Willapa Hills in southwestern Washington, flows generally northeastward to Grand Mound, and enters into Grays Harbor at Aberdeen. The higher portions of the river basin, where the river has an average slope of about 16 feet per mile, are rugged and densely forested. The slope flattens to about 3 feet per mile near the city of Chehalis and then 2 feet per mile near Satsop. The river and its tributaries have a drainage area of about 2,115 sq mi; the total area draining to the site is about 1,765 sq mi, of which approximately 300 sq mi is drainage area of the Satsop River.

A stream gage for the Chehalis River was installed and operated at the site by the United States Geological Survey (USGS) in 1977 using temporary facilities (rated up to about 10,000 cfs); permanent facilities were constructed in 1981. There are no long-term gaging station records for the lower reach of the Chehalis River. However, long-term records are available for USGS gaging stations on the Chehalis at Grand Mound (1929-present) (RM 59.9), Porter (1952-1972; 1972-1979)(RM 33.3) and on the Satsop River near Satsop (1929-present)(RM 2.3 upstream from mouth).
River flows near the discharge diffuser are estimated by adding the Satsop 1
River flow to the flow in the Chehalis River at Porter or Grand Mound
adjusted to the site by drainage area ratio.

The annual mean flow near the diffuser is 6,633 cubic feet per second
(cfs); the monthly mean flow ranges from 806 cfs in August to 14,668 cfs 2
in January. The minimum monthly flow, 526 cfs, occurred in August 1967,
while the maximum monthly flow, 40,876 cfs, occurred in December 1934.
Estimated monthly average flows in the Chehalis River just below the con- 1
fluence of the Satsop are shown in Table 2.4-1. As indicated in the
table, the flow in the river is quite variable and reflects the seasonal
rainfall distribution within the basin. Also listed in Table 2.4-1 are
the record minimum monthly flows for each month. 2

The lowest daily flows in the site vicinity are normally expected in August and September. The one percent non-exceedence flows for these two months are 500 and 460 cfs, respectively. The once-in-10-year, 7-day duration low flow for the Chehalis River downstream of the Satsop confluence is 530 cfs based on recorded flow data for the period 1930-1981 (WNP-3 FSAR Appendix 2.4A). The 7-day low-flow frequency curve is shown on Figure 2.4-3.

Floods occur in the region primarily in December and January, but damaging floods may occur as early as the beginning of November and as late as the end of April. The estimated momentary maximum flood flow in the Chehalis
1| River below the Satsop, 97,100 cfs, occurred on December 21, 1933. The annual momentary maximum flows from 1930 to 1979 are listed in Table 2.4-2, and a frequency analysis of flood flow data is presented in Figure 2.4-4.

The Chehalis River channel at the site is approximately 250 feet wide and varies in depth from a few feet during low flow to greater than 30 feet during flooding conditions when the entire flood plain is inundated. Channel geometry varies considerably in the site vicinity. Figure 2.4-5 shows river cross-sections in the vicinity of the blowdown diffuser (see Subsection 3.4.4). River bed elevations near the site are variable, ranging from mean sea level just downstream of the Satsop confluence to approximately 19 feet below MSL just upstream of the confluence. The channel gradient or slope from about 10 miles upstream of the site to Grays Harbor (21 miles downstream of the site), is approximately 0.04 percent. The Satsop River exhibits a much steeper slope which ranges from approximately one percent in the vicinity of its confluence with the Chehalis River to nearly 15 percent at its head waters in the Olympic Mountains.

The velocity of the Chehalis River is quite variable. During low-flow conditions (< 200 cfs) upstream of the Satsop confluence, velocities of less than 0.2 fps are experienced. For the reach of river downstream of the Satsop confluence, velocities increase to approximately 0.4 fps during low-flow conditions (~ 400 cfs) due to the Satsop River inflow. During flood conditions (> 30,000 cfs) channel velocities reach 6 to 7 fps.

River flow in the site vicinity may also be influenced by tidal action. The degree of tidal effect depends on the river flow and the height of the ocean tide. The influence is most noticeable during spring high tides and low river flows, which in combination reduce and sometimes reverse the current velocity. During periods of high streamflow, the tidal effects on the river stage and flow are considerably less pronounced. Natural bathymetric features also affect river flow and tidal propagation in the river; a riffle area (approximately River Mile 19) reduces the effect of tidal propagation near the site area. In a 1975 field survey, the daily average flow ranged from 1,040 to 1,610 cfs; no reversals were observed during high tides above the riffle area, although current velocity at the riffle was reduced to about 10 percent of its steady flow velocity.(1) In 1977, when the daily average flow was 570 cfs, the velocity at River Mile 20.5 was decreased to 15 percent of the steady flow speed during peak high

References for Section 2.4 (contd.)

13. Mikels, F.C., Feasibility of a Ranney Collector Water Supply, Flink Farm, Lower Chehalis River, Washington Public Power Supply System Nuclear Project No. 3, Ranney Method Western Corporation, Kennewick, Washington, October 7, 1975.

14. Mikels, F.C., Additional Hydrogeological Studies, Ranney Collector Water Supply, Flink Farm, Lower Chehalis River, Washington Public Power Supply System Nuclear Projects Nos. 3 and 5, Satsop, Washington, Ranney Method Western Corporation, Kennewick, Washington, December 15, 1978.

15. Mikels, F.C., Report on Preliminary Test, Ranney Collector No. 1, Washington Public Power Supply System Nuclear Projects Nos. 3 and 5, Ranney Method Western Corporation, Kennewick, Washington, December 8, 1980.

TABLE 2.4-1

SUMMARY OF CHEHALIS RIVER FLOWS BY MONTH[a]

Month	Average Monthly Flow (cfs)	Minimum Monthly Flow (cfs)	Year Of Minimum Occurrence
Jan	14,668	3,318	1977
Feb	13,450	3,813	1977
Mar	10,429	3,873	1941
Apr	6,841	2,707	1939
May	3,437	1,675	1939
Jun	2,039	1,094	1934
Jul	1,127	706	1951
Aug	806	526	1967
Sep	1,111	551	1938
Oct	2,752	578	1952
Nov	8,665	759	1936
Dec	14,663	2,913	1976

(a) Period of record October 1929 - May 1981. Representative of flows at diffuser location (RM 20.5).

TABLE 2.4-2

ESTIMATED MAXIMUM ANNUAL FLOOD FLOW OF THE CHEHALIS RIVER NEAR WNP-3[(a)]

	Water Year	Date	Momentary Max. Q (cfs)	Water Year	Date	Momentary Max. Q (cfs)
	1930	Feb 8, 1930	24190	1955	Nov 18, 1954	43520
	1	Apr 1, 1931	38100	6	Dec 23, 1955	42300
	2	Feb 26, 1932	52600	7	Dec 10, 1956	50260
	3	Dec 3, 1932	42760	8	Dec 28, 1957	31610
	4	Dec 21, 1933	97100	9	Jan 26, 1959	33690
	5	Jan 22, 1935	81340			
	6	Jan 13, 1936	70000	1960	Nov 23, 1959	52600
	7	Apr 15, 1937	49300	1	Feb 23, 1961	40710
2	8	Dec 29, 1937	92610	2	Dec 23, 1961	34100
	9	Feb 16, 1939	47200	3	Nov 28, 1963	38710
				4	Jan 27, 1964	47630
	1940	Dec 17, 1939	46110	5	Jan 31, 1965	49100
	1	Jan 18, 1941	49660	6	Jan 8, 1966	39030
	2	Dec 20, 1941	51720	7	Dec 15, 1966	49030
	3	Feb 7, 1943	39900	8	Jan 19, 1968	58220
	4	Dec 3, 1943	36750	9	Jan 7, 1969	53100
	5	Feb 9, 1945	48670			
	6	Dec 30, 1945	45250	1970	Jan 22, 1970	67430
	7	Jan 26, 1947	54200	1	Jan 26, 1971	86300
	8	Jan 3, 1948	39440	2	Jan 22, 1972	76370
	9	Feb 23, 1949	73380	3	Dec 16, 1972	59170
				4	Jan 17, 1974	72290
	1950	Feb 26, 1950	60120	5	Jan 15, 1975	48400
	1	Feb 10, 1951	93560	6	Dec 5, 1975	66570
	2	Feb 5, 1952	39430	7	Mar 10, 1977	25960
	3	Jan 31, 1953	46180	8	Dec 16, 1977	52030
	4	Jan 7, 1954	48200	9	Feb 9, 1979	31560

[(a)]Derived from data of USGS Gaging Station on the Chehalis River at Porter or Grand Mound by the drainage area ratio plus corresponding flow in the Satsop River.

TABLE 2.4-3

CHARACTERISTICS OF STREAMS AT WNP-3 SITE

Stream	Length (feet)	Total Watershed Area (acres)	Watershed Area Within Plant Construction Area (acres)	(%)	Watershed Area Clearcut from 1965 - 1977 (acres)	(%)
Workman	48,000	7,090	60	1.1	2,690	37.9
Stein	6,700	360	40	11.7	40	11.1
Purgatory	7,000	320	120	37.5	130	40.6
Fuller	12,300	720	230	33.3	220	30.6
Hyatt	10,000	540	60	11.1	260	48.1
Elizabeth	21,000	2,730	10	0.4	520	19.0

Source: Reference 2.4-3

TABLE 2.4-4

SURFACE WATER AND GROUNDWATER QUALITY NEAR WNP-3 SITE[a]

		Discharge Area[b]		Intake Area[c]		Groundwater[d]	
		Mean	Range	Mean	Range	Mean	Range
		mg/l		mg/l		mg/l	
Calcium D		6.2	4.2 - 8.2	6.6	4.5 - 8.4	12.1	11.0 -13.1
Magnesium D		1.9	1.5 - 2.2	1.9	1.5 - 2.4	4.3	3.9 - 4.8
Sodium D		4.3	3.0 - 5.4	4.4	3.2 - 5.4	6.0	5.6 - 6.5
Potassium D		0.48	0.45- 0.50	0.55	0.45- 0.76	0.70	0.65- 0.77
Alkalinity (as $CaCO_3$)		28	20 - 34	28	14 - 38	56	51 -64
Hardness (as $CaCO_3$)		29	21 - 36	29	22 - 38	54	49 -60
TSS		14.2	0 -370			1	
DO		10.6	8.0 - 13.1				
pH			6.5 - 7.4		6.3 - 7.5		6.6 - 7.5
		µg/l		µg/l		µg/l	
Barium	T[e]			10	6 - 22	4	2 -12
	D			7	4 - 12	3	2 -10
Cadmium	T			< 0.1	< 0.1 - 0.5	< 0.1	< 0.1 - 0.2
	D			< 0.1	all < 0.1	< 0.1	all < 0.1
Chromium	T	1.0	< 0.5- 2.1	1.2	< 0.5 - 10.8	0.6	< 0.5 - 1.2
	D	0.9	< 0.5- 1.3	0.6	< 0.5 - 3.3	0.5	< 0.5 - 1.2
Copper	T	1	1 - 2	2	< 1 - 8	< 1	< 1 - 7
	D	1	< 1 - 1	1	< 1 - 3	< 1	< 1 - 4
Iron	T	512	200 -1260	861	80 -7400	16	< 1 -90
	D	107	50 - 200	98	12 - 820	8	< 1 -80
Lead	T			4	< 1 - 36	< 1	< 1 - 1
	D			< 1	all < 1	< 1	all < 1
Manganese	T			29	11 - 80	1	< 1 - 4
	D			9	6 - 19	< 1	< 1 - 3
Mercury	T			0.4	< 0.2 - 1.3	< 0.2	< 0.2 - 0.7
	D			-		-	
Nickel	T	< 1	all < 1	1	< 1 - 14	< 1	< 1 -10
	D	< 1	all < 1	< 1	< 1 - 3	< 1	< 1 - 5
Zinc	T	< 5	all < 5	< 5	< 5 - 37	< 5	< 5 - 7
	D	< 5	all < 5	< 5	< 5 - 9	< 5	all < 5

(a) Sources: References 2.4-5 and 2.4-6
(b) River Mile 20.5
(c) River Mile 18
(d) Sample well near makeup water intake wells
(e) T = total, D = dissolved

TABLE 2.4-5

SUMMARY OF CHEHALIS RIVER TEMPERATURES BY MONTH[a]

Month	Temperature (°F/°C) 1st Percentile	Mean	99th Percentile
January	32/ 0.0	42/ 5.6	48/ 8.9
February	34/ 1.1	42/ 5.6	50/10.0
March	39/ 3.9	45/ 7.2	53/11.7
2 April	41/ 5.0	51/10.6	60/11.7
May	50/10.0	56/13.3	68/20.0
June	52/11.1	63/17.2	75/23.9
July	58/14.4	64/17.8	78/25.6
August	60/15.6	65/18.3	78/25.6
September	53/11.7	61/16.1	72/22.2
October	41/ 5.0	53/11.7	64/17.8
November	40/ 4.4	47/ 8.3	56/13.3
December	33/ 0.6	42/ 5.6	49/ 9.4
Annual Mean		52.6/11.4	

(a)Mean temperature is weighted for monthly mean Porter and Satsop flow rates. Representative of temperatures at diffuser location (RM 20.5).

TABLE 2.4-6

CHEMICAL ANALYSES OF GROUNDWATER IN THE CHEHALIS RIVER BASIN[a]

Well Number	Owner or Tenant	Parts Per Million						Well Depth
		Hardness ($CaCO_3$)	Iron (Fe)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved Solids	
17/6-1C1	Chris Wheeler	22	0.04	4.4	3.0	3.5	67	76
17/6-4D1	City of Elma	24	0.00	2.1	4.0	1.9	58	40
17/7-7P1	Weyerhaeuser Timber Company	92	1.20	-	37.0	-	-	201
17/7-8Q1	"	60	0.50	-	11.0	-	-	141
17/7-9N1	"	51	0.30	-	20.2	-	-	160
17/7-9N2	"	50-54	0.03-0.11	-	9.5-12	-	-	102
17/7-9P1	"	50	0.20	-	11.0	-	-	153
17/7-11B1	Earl Richard	62	2.40	0.6	2.8	0.7	106	50
17/7-11E1	Robert Smith	76	0.73	0.6	3.2	0.2	119	36
17/7-11H1	Milton Larson	52	0.19	4.2	3.5	3.5	93	10
17/7-11K1	G. W. Stretter	58	0.29	4.0	4.0	0.6	108	51
17/7-11P1	Weyerhaeuser Timber Company	54	0.6-1.7	-	1.2	-	-	188
17/8-14K1	"	50	0.30	-	12-16	-	-	180
18/6-31H1	Erling Olson	52	0.33	2.6	3.5	0.1	100	98
18/12-27F1	Frank Minard	26	0.33	2.9	11.0	0.1	127	358

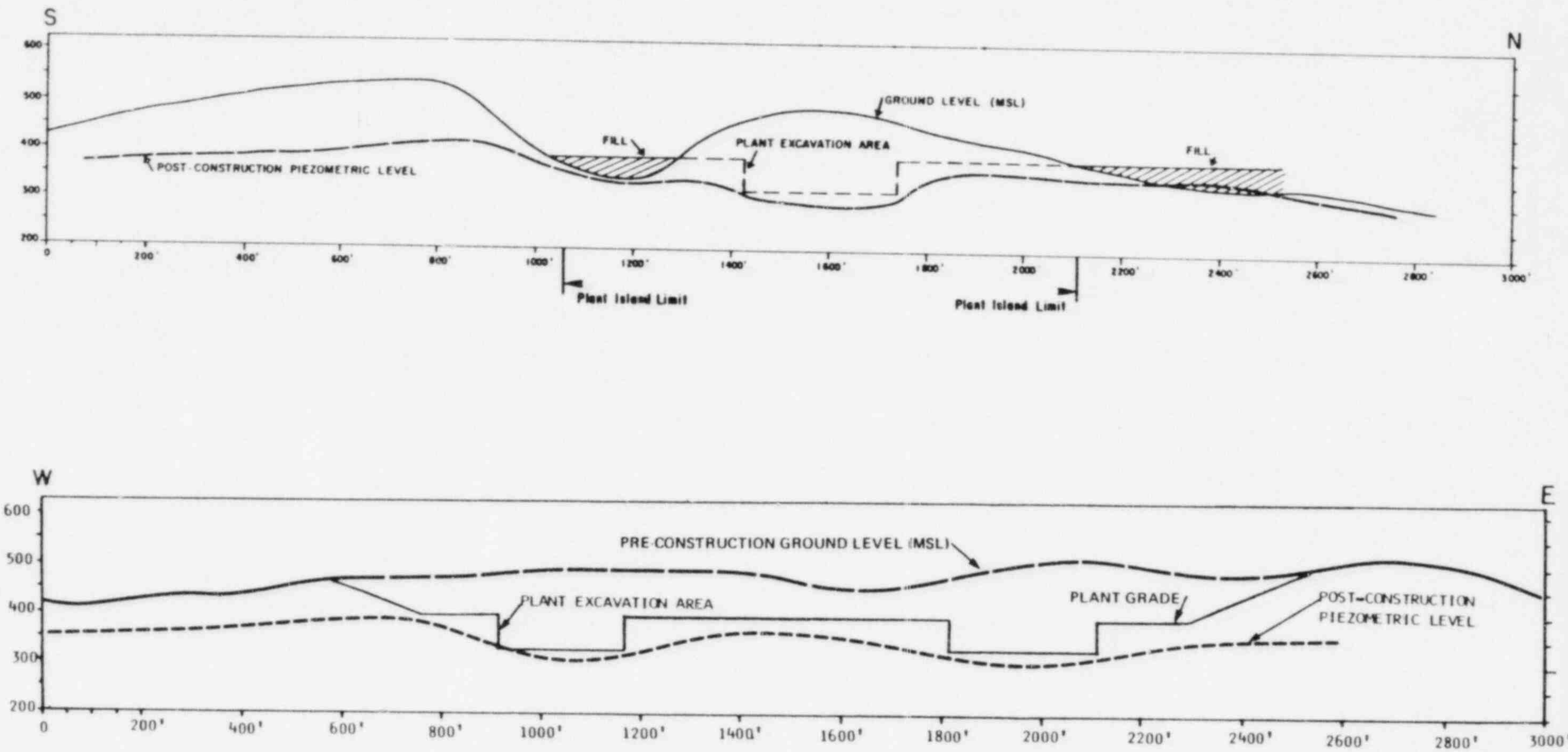
(a)Source: Reference 2.4-11

TABLE 2.4-7

MAKEUP WELL WATER QUALITY[a]

Parameter	Concentration[b]
Biochemical Oxygen Demand	<1
Chemical Oxygen Demand	<5
Ammonia (as N)	<0.0005
Total Organic Carbon	<2
Bromide	0.30
Color (Color Units)	0
Fecal Coliform (MF) (colonies/100ml	<2
Fluoride	0.122
Nitrate + Nitrate (as N)	0.54
Total Organic Nitrogen (as N)	<0.50
Oil and Grease	<1
Total Phosphorus (as P)	0.240
Sulfate	2.7
Sulfide	<0.10
Surfactants (LAS-mg/l	<0.01
Gross Alpha (picocuries/l)	<0.60
Gross Beta (picocuries/l)	<10
Aluminum	<0.10
Boron	<0.01
Cobalt	<0.001
Molybdenum	<0.001
Tin	<0.03
Titanium	0.018
Antimony	<0.15
Arsenic	<0.001
Beryllium	<0.003
Silver	<0.0003
Thallium	0.008
Total Cyanide	<0.003
Phenol	<0.004
Iron	0.017
Maganese	<0.001
Barium	<0.10
Cadmium	<0.0001
Chromium	0.0006
Copper	<0.001
Lead	<0.001
Mercury	<0.0002
Nickel	0.002
Selenium	<0.002
Zinc	0.005
Magnesium	4.0

(a) Ranney Collector No. 1 test of November 25, 1980. 2
(b) Units of mg/l or as indicated.



Amendment 2 (May 84)

WASHINGTON PUBLIC POWER SUPPLY SYSTEM NUCLEAR PROJECT No. 3 OPERATING LICENSE ENVIRONMENTAL REPORT	POST-CONSTRUCTION PIEZOMETRIC LEVELS AT WNP-3	FIGURE 2.4-11

TABLE 3.4-1

COOLING SYSTEM OPERATING PARAMETERS

Month	Intake Water Temperature	Discharge[a] Temperature w/ Heat Exchanger Full Time	Discharge[b] Temperature w/ Heat Exchanger As Needed	Average[c] Wet Bulb Temperature	Critical[d] Wet Bulb Temperature	Range in $\Delta T^{(e)}$ Discharge-River	Maximum[f] Blowdown	Maximum[f] Evaporation	Maximum[f] Makeup
	($^oF/^oC$)	($^oF/^oC$)	($^oF/^oC$)	($^oF/^oC$)	(^oC)	(^oC)	(cfs)	(cfs)	(cfs)
January	47.5/ 8.6	50.5/10.3	65.0/18.3	36.1/ 2.3	49.4/ 9.7	1.7-15	5.9	29.2	35.1
February	46.5/ 8.1	49.5/ 9.7	66.5/19.2	38.4/ 3.6	51.1/10.6	1.7-15	5.9	29.5	35.4
March	44.5/ 6.9	47.5/ 8.6	67.0/19.4	39.2/ 4.0	54.0/12.2	1.7-15	6.0	30.3	36.3
April	45.0/ 7.2	48.0/ 8.9	68.0/20.0	43.4/ 6.3	56.0/13.3	1.7-15	6.1	30.5	36.6
May	48.5/ 9.2	51.5/10.8	68.0/20.0	48.1/ 8.9	61.0/16.1	0-10	6.3	31.5	37.8
June	52.5/11.4	55.5/13.1	68.0/20.0	53.1/11.7	66.0/18.9	0- 8.9	6.3	32.3	38.7
July	58.0/14.4	61.0/16.1	68.0/20.0	56.1/13.4	65.4/18.6	0- 5.6	6.4	32.3	38.7
August	60.5/15.8	63.5/17.5	68.0/20.0	55.8/13.2	60.9/16.1	0- 4.4	6.3	31.5	37.8
September	62.0/16.7	65.0/18.3	68.0/20.0	52.4/11.3	62.8/17.1	0- 8.3	6.3	31.8	38.1
October	60.5/15.8	63.5/17.5	68.0/20.0	47.3/ 8.5	56.0/13.3	1.7-15	6.1	30.5	36.6
November	56.5/13.6	59.5/15.3	67.5/19.7	40.5/ 4.7	52.9/11.6	1.7-15	6.0	30.0	30.0
December	52.0/11.1	55.0/12.8	66.5/19.2	38.3/ 3.5	52.1/11.2	1.7-15	5.9	29.8	35.7

(a) Heat exchanger operated to 3^oF approach to makeup temperature.

(b) Heat exchanger used only as necessary to comply with NPDES permit.

(c) Average wet-bulb temperatures at Olympia for 1948-1968.

(d) Daily critical wet-bulb temperatures at Olympia 1952-1977.

(e) Based on minimum and maximum river temperatures (Table 2.4-5) and assuming possible operation of the supplemental heat exchanger.

(f) Based on 40 percent relative humidity, critical wet-bulb temperatures, and operation at 6 cycles of concentration.

TABLE 3.4-2

COOLING TOWER DESIGN PARAMETERS

Wet-Bulb Temperature[a]	68°F
Approach to Wet-Bulb	18°F
Range	34°F
Water Flow	525,000 gpm[b]
Evaporation (maximum)	14,700 gpm
Drift Losses	15.8 gpm
Blowdown (maximum)	4,000 gpm

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[a] This wet-bulb temperature is estimated to be exceeded only 22 hours per year.

[b] The maximum cooling capacity by flow rate is 603,750 gpm (15 percent over design).

3.5.1.3 Fuel Pool System

The Fuel Pool System is designed to remove decay heat and the soluble and insoluble foreign matter from the spent fuel pool. Figure 3.5-1 presents a simplified block flow diagram of the Fuel Pool System. The detailed piping and instrument diagram is presented in Section 9.1 of the FSAR, along with the principal component design data. The radionuclide concentrations in the fuel pool during plant operations and refueling are listed in Table 3.5-4.

The values presented in Table 3.5-4 are based on the assumption that, upon shutdown for refueling, the Reactor Coolant System (RCS) is cooled for approximately two days. During this period, the primary coolant is let down through the purification filter, purification ion exchanger, and letdown strainer prior to return to the suction of the low-pressure safety injection pumps. When continuous degassification of primary coolant is desired, the letdown flow is diverted to the gas stripper and then to the VCT prior to return to the RCS. This serves two purposes: removal of noble gases in the gas stripper to avoid large releases of radioactivity to the Reactor Building following reactor vessel head removal, and reduction of dissolved fission and corrosion products in the coolant by ion exchange and filtration. At the end of about two days, the coolant above the reactor vessel flange is partially drained. The reactor vessel head is unbolted and the refueling water cavity is filled with a minimum of 470,000 gallons of water from the refueling water storage tank (RWST). | 2
The remaining reactor coolant volume containing radioactivity is then mixed with water in the refueling cavity and the Fuel Pool System. After refueling, the Fuel Pool System is isolated and the water in the refueling cavity is returned to the RWST. This series of events determines the | 2
total activity to the Fuel Pool System. The specific activities of the radionuclides given in Table 3.5-4 are based upon a volume of 260,000 gallons. These values will be reduced by decay during refueling as well as by operation of the Fuel Pool System.

The Fuel Pool System has two basic parts: a cooling subsystem and a cleanup subsystem. The cooling subsystem of the Fuel Pool System is a closed-loop system consisting of two full-capacity pumps and heat exchangers. Water is withdrawn from the fuel pool near the surface and is circulated by pumps through a exchanger that rejects heat to the Component Cooling Water System. From the outlet of the fuel pool heat exchanger, the cooled water is returned to the bottom of the fuel pool through a distribution header.

The clarity and purity of the water in the fuel pool, refueling canal, and refueling water storage tank are maintained by the cleanup subsystem of | 2
the Fuel Pool System. The cleanup loop consists of two parallel trains of equipment, which include cleanup pump, ion exchanger, filter, strainers and surface skimmer. Most of the cleanup flow is drawn from the bottom of the fuel pool while a small fraction is drawn through the surface skimmer. A basket strainer is provided in the cleanup suction line to remove

any relatively large particulate matter. The fuel pool water is circulated through a filter that removes particulates larger than five microns, then through an ion exchanger to remove ionic material, and finally through a strainer, which prevents resin beads from entering the fuel pool in the unlikely event of a failure of an ion exchanger retention element.

2 | The refueling water storage tanks hold a maximum of approximately 970,000 gallons with a usable volume of 826,800 gallons. At the time of refueling a minimum of 470,000 gallons of water are used to fill the reactor canal, fuel transfer canal, and refueling water cavity.

The release rates of radioactive materials in gaseous effluents due to evaporation from the surface of the fuel pool and refueling canals during refueling and normal operation are presented in Table 3.5-4.

3.5.1.4 Ventilation System Exhausts

Liquid and steam leakage from various coolant and process streams can result in small quantities of radioactive gases entering the building atmospheres. These systems are described in detail in Subsection 3.5.3.1.

3.5.2 Liquid Radwaste System

3.5.2.1 System Description

The Liquid Radwaste System (LRS) collects all primary and secondary side radioactive liquid wastes and processes the wastes to permit its reuse or recycle within the plant. Differences in primary and secondary system water chemistry must be considered prior to reusing liquids. Untreatable radioactive process wastes, residues and concentrates are sent to the Solid Waste System (SWS) for disposal.

The LRS is divided into five subsystems. The subsystems and the sources of the water processed in each are:

Floor Drain System (FDS)

1) Radioactive floor drains
2) Component cooling water (if radioactive)
3) Decontamination area drains (no detergents)
4) Hot chemical lab drains
5) Primary sampling panel drains

Detergent Waste System (DWS)

1 | 1) Hot shower drains
2) Decontamination area drains (detergent solutions)

Secondary High Purity Waste System (SHP)

1) Turbine Building drains (high purity equipment)
2) Low dissolved solids (low particulate) waste

Secondary Particulate Waste System (SPWS)

1) Low dissolved solids (high particulate) waste
2) Turbine Building drains (floor drains)

Inorganic Chemical Waste System (ICW)

1) Demineralizer regeneration chemicals
2) Cold chemical lab drains
3) Secondary sampling panel drains

Radioactive liquid wastes are collected from the above subsystems and segregated based on their composition and process requirements. The LRS is capable of processing the design and anticipated off-standard system loads without affecting normal operation or plant availability. This includes leakage or spillage due to equipment malfunction or failure. The waste quanitities that must be processed by the five subsystems are shown in Table 3.5-5. The subsystems are discussed in the following paragraphs; more detail is included in Section 11.2 of the FSAR.

Floor Drain System (FDS)

Figure 3.5-2 presents a simplified flow diagram of the FDS. The floor drain tanks accumulate that which is collected in the containment, Reactor Auxiliary Building and Fuel Handling Building floor drain sumps. Additional sources of input to the FDS include the Detergent Waste System, the chemical labs, the Decontamination Sample Tank, and the Component Cooling Water System. This water is processed using filtration, organic scavenging, evaporation and ion exchange. Holdup is provided to store waste accumulation for an average of 14 days. The processed water is monitored and used as reactor makeup water. If the water quality does not meet the standards for reactor makeup, the water will be further processed. The radioactive concentrate produced during processing of this water is handled by the Solid Waste System.

Detergent Waste System (DWS)

Figure 3.5-3 presents a simplified block flow diagram of the DWS. The detergent waste tanks collect water from the hot shower and hot sink drains. In addition, the detergent waste tanks collect water that has been diverted from the decontamination sample tank. This water is processed by filtration and blended with the regenerative waste solutions from the Inorganic Chemical Waste System.

Inorganic Chemical Waste System (ICWS)

Figure 3.5-4 presents a simplified block flow diagram of the ICWS. The ICWS accumulates wastes from chemical lab drains and chemicals used to regenerate resins of the steam generator blowdown demineralizers and the condensate polishers. Additionally, the ICWS is used to transfer contents of ICW waste tanks to the neutralizing pond provided the tank contents are not radioactive as described in FSAR Subsection 9.2.3.2. The ICWS provides means to adjust pH to expedite processing and to sample contents of ICW tanks for radioactivity. The ICWS processes water accumulated in the inorganic chemical waste drain tanks when the waste is radioactive or when processing by the low-volume waste treatment system (see Subsection 3.6.6) is undesirable. Processing is accomplished by filtration, evaporation, and ion exchange. Water which satisfies chemical criteria is transferred to the secondary makeup water system. Water that does not satisfy these criteria will be processed further. The ICWS minimizes the volume of wastes that are handled by the SWS.

Secondary High Purity Waste System (SHP)

Figure 3.5-5 presents a simplified block flow diagram of the SHP. The SHP collects and processes water from the secondary side drains which contain low dissolved solids and particulates. The SHP also accumulates rinse water from the condensate polisher and steam generator blowdown demineralizer. This water is processed by filtration and ion exchange and, after processing, is used as secondary makeup water if chemical criteria are satisfied. If the criteria are not satisfied the water will be processed further. The system provides approximately three days
2 storage capacity. Spent resins from the SHP are processed in the Solid Waste System (Subsection 3.5.4).

Secondary Particulate Waste System (SPWS)

Figure 3.5-6 presents a simplified block flow diagram of the SPWS. The SPWS accumulates water which normally has a high concentration of particulates including backflush water from the condensate polishers, steam generator blowdown demineralizers, steam generator blowdown electromagnetic filters, water sent to the Turbine Building drains after being collected in an oil separator or sump and monitored for chemical and radiochemical contamination. Water from secondary particulate waste tanks are processed using filtration and organic scavenging. Water which meets chemical criteria is used as secondary makeup water. Water which does not meet chemical criteria is reprocessed using the secondary high purity demineralizer. The system provides approximately two days storage capacity.

3.5.2.2 Radionuclide Releases

Releases to the environs of liquid radwastes are controlled and monitored to meet the concentration limits of 10 CFR Part 20 and the as low as is reasonably achievable (ALARA) criterion and the numerical guidelines of 10 CFR Part 50, Appendix I. The design release limits are based on normal

The gas recombiner system effluent is then returned to the gas surge header where it reenters the system again through the gas surge tank and waste gas compressors. The gas recombiner will process until the gas decay tank pressure reaches a predetermined low level. The gas decay tank which is currently lined up to the waste gas compressors will collect the normal influents plus the hydrogen free gas recombiner effluent. When this gas decay tank is filled the process is repeated.

The gas which is in the isolated gas decay tank is allowed to decay for a period of time to reduce the activity of the gas. Source term generation was conservatively based on a 90-day holdup. |1

The GWMS provides a means to control the discharge of gaseous waste. The operator in the WMS control room discharges the gas decay tanks through a flow meter and recorder, and a radiation monitor, which automatically terminates discharge flow on high activity. The Main Control Room operator must give permission to discharge activity and has overriding switches to terminate the discharge if required. The release of radioactive gases from the GWMS is controlled by the WMS operator by manually lining up the proper gas decay tank to the discharge header after sampling the tank for activity. If the activity released exceeds a predetermined setpoint, the process flow monitor automatically shuts two valves to terminate the release. The procedure of sampling the gas decay tank prior to release and continuous monitoring of the release protects against operator error such as sampling one tank and lining up a different tank for discharge. The procedure for sampling and monitoring also protects against radiation monitor malfunction since the sample prior to discharge will be representative of tank contents.

The gases which are routed to the <u>recycle subsystem</u> are the nitrogen cover gases in the equipment drain tank (EDT) and the reactor drain tank (RDT). These tanks contain an initial nitrogen cover at a preset positive pressure. When liquid leakage enters either or both tanks it will raise the pressure of the cover gas. When the pressure reaches a specified upper limit the recycle compressor is actuated. The compressor discharges to the nitrogen recycle tank until the pressure in the equipment drain tank and reactor drain tank reduces to the normal operating pressure. Conversely when liquid is removed from either or both tanks, the cover gas pressure will drop to a lower limit. A pressure regulator valve then opens allowing nitrogen to flow into either or both tanks from the nitrogen recycle tank. The nitrogen recycle tank is periodically sampled by the gas analyzer. In the event of hydrogen or oxygen instrusion into the cover gas, the nitrogen recycle tank can be manually lined up with the gas recombiner system. The nitrogen recycle tank gas flows through a regulator valve into the gas recombiner system. The effluent, essentially nitrogen, from the gas recombiner system is returned by the gas recombiner compressor into the nitrogen recycle tank.

Gas Collection Header (GCH)

The GCH receives low activity gases containing oxygen from aerated tanks, ion exchangers, and concentrators. Detail on the sources and volumes to the GCH is provided in Table 11.3-6 of the FSAR.

Ventilation and Exhaust Systems

The major sources of building ventilation and exhaust include:

a) Reactor Building Heating, Ventilation, Air Conditioning (HVAC) System
b) Reactor Auxiliary Building HVAC System
c) Turbine Building HVAC System
d) Fuel Handling Building HVAC System.
e) Exhaust from the Steam Generator Blowdown System, Condenser Vacuum System and Gland Seal System

The Reactor Building HVAC System includes an internal containment recirculation system, known as the Airborne Radioactivity Removal System (ARRS).
2 | The ARRS includes two separate systems, each with a 12,000 cubic feet per minute (cfm) capacity. The system is designed to reduce airborne particulate and iodine activity within the Reactor Building and reduce discharge rates at times of purging the Reactor Building. The ARRS includes HEPA and charcoal filter beds.

During plant operation, the Reactor Building will be isolated or vented via eight-inch lines. Airborne activity can accumulate due to primary coolant leakage. Leak rates from the coolant to the Reactor Building atmosphere of 1.0 percent per day of the noble gases and 0.001 percent per day of the iodines are assumed.[1] Some of the activity will be released to the environment at times when the Reactor Building is vented. Such venting is assumed to be continuous at 2500 cfm. It is also assumed that during venting the Reactor Building atmosphere is passed through the ARRS continuously. During venting the release passes through HEPA and charcoal filters prior to discharge to the plant vent stack.

During shutdown, the containment is assumed to be continually purged through 48-inch purge lines. The radionuclide release rate from purging during shutdown is processed through HEPA and charcoal filters prior to discharge to the plant vent stack.

The HVAC exhaust from the RAB is discharged through the RAB exhaust filters. The Turbine Building and the Fuel Handling Building HVAC exhaust are normally released unfiltered due to their very small potential for contamination from radioactivity. Capability for filtration of Fuel Handling Building exhaust, in the event of an accident, is provided.

Additional potential sources of airborne radioactivity are: the non-condensible gases exhausted from the Steam Generator Blowdown System, Condenser Vacuum System, and Gland Seal System. Non-condensible gases from the main condenser and from the Gland Seal System are removed by the Condenser Mechanical Vacuum Pumps and passed through a demister, prefilter, charcoal adsorber, and an after-filter at a rate of 60 scfm (holding), and 5500 scfm (hogging).

The release points for all sources of gaseous effluents described above are shown in Figure 3.5-8. For the radioactive release points, more specific information, including vent elevation, diameter, flow rate, temperature, and area or system ventilated, is given in Table 3.5-8. 2

3.5.3.2 Radionuclide Releases

The numerical design objectives for gaseous releases from the plant during normal operations, including anticipated operational occurrences, are based on 10 CFR Part 50, Appendix I which mandates:

a) The calculated annual air dose due to gamma radiation at or beyond the site boundary is not to exceed 10 millirads.

b) The calculated annual air dose due to beta radiation at or beyond the site boundary is not to exceed 20 millirads.

c) The calculated annual total quantity of radioactive gaseous effluent will not cause an estimated annual dose to any individual in an unrestricted area in excess of 5 mrem to the whole body.

d) The calculated annual total quantity of all radioactive iodine and radioactive material in particulate form will not result in an annual dose to any individual in an unrestricted area from all pathways in excess of 15 mrem/year to any organ.

Compliance with these criteria, and the cost-benefit criteria of Appendix I was provided as testimony at the June 1975 Environmental Hearings and additional material was provided in Supplement No. 6 to the ER-CP. This material demonstrated that individual dose criteria were limiting.

The results of the GALE code analysis for gaseous source terms are provided in Table 3.5-9. Assumptions and parameters used as input to the GALE code is provided in Table 3.5-10. An evaluation of compliance with the Appendix I criteria is included in Section 5.2.

3.5.4 Solid Waste System

The Solid Waste System (SWS) collects, processes, packages, and stores prior to transport to an offsite burial facility any disposable wet or dry solid radwaste generated in the operation of the plant. Types of wastes, quantities (maximum and expected volumes), activities, and radionuclide

distributions are given in Tables 3.5-11 through 3.5-15. Figure 3.5-9 is a simplified block flow diagram of the SWS. Additional detail on the system is included in Section 11.4 of the FSAR.

The SWS handles liquids and slurries to be solidified and packaged by collecting them in the appropriate treatment tanks. These liquids and slurries (wet solid wastes) are processed and pumped to a mixer where they are combined with a solidification agent and are discharged into liners or 55-gallon drums. Solid disposable wastes are compressed into 55-gallon drums by a hydraulic compactor. The liners and drums are then stored in the onsite temporary storage area. After sufficient decaying time has elapsed, the liners or drums are shipped offsite to a burial facility. Spent filter cartridges are transferred to the drumming station in a cask especially designed for this purpose. At the drumming station each cartridge is transferred into a liner and solidified with waste and the solidification agent.

The concentrate storage tank receives and stores concentrate from the floor drain evaporator. Concentrate from the boric acid evaporator is collected in the concentrate storage tank only if the concentrate is not suitable for recycle to the Chemical and Volume Control System (CVCS). Exhausted resins from ion exchangers in the CVCS, the Fuel Pool Cooling and Cleanup System, and the LRS are sluiced to the spent resin tank. The concentrate storage tank and the spent resin tank both transfer their waste to the dewatering tank. The dewatering tank feeds, by means of the resin metering pump, the cement-solidification agent waste mixer at fillhead station B. The secondary particulate pre-treatment hopper receives the secondary particulate filter discharge and suitable quantities of inorganic chemical waste evaporator bottoms (concentrate) and/or detergent waste. The resultant waste mixture is transferred to the cement-solidification agent-waste mixer at fillhead station A by means of the particulate metering pump. The Volume Reduction System (VRS) collects and concentrates the inorganic chemical concentrator bottoms and detergent wastes. The waste is fed to the cement-solidification agent-waste mixer at fillhead station A by means of the VRS hopper metering pump. There is a cross-tie between the trains feeding stations A and B before the cement-solidification agent-waste mixers. Thus flexibility of controlling the final volume and activity of the solidified waste is provided.

The spent resin dewatering tank, the secondary particulate pre-treatment hopper and the VRS hopper are used primarily for waste processing and not for waste storage. Desired volumes of resins, concentrates, and sludges can be transferred to these process tanks and the waste conditioned for processing and solidification. The volume per batch depends on the size of the container used and the number of containers to be filled, however, the batch size is normally limited by the size of the spent resin dewatering tank or the secondary particulate filter pre-treatment hopper and VRS hopper. After producing a desirable mixture of wastes, the operator can set the total amount and rate of feed for both the waste and solidifying agent.

TABLE 3.5-8

POTENTIALLY RADIOACTIVE EMISSIONS RELEASE POINTS

Release Point	Elevation (ft MSL)	Inside Diameter (ft)	Flow Rate (cfm)	Temperature (°F)	Systems/Components Exhausted
1	501.0	8.50	76,200 (min) 199,550 (max)	60 (min) 115 (max)	RAB Main Ventilation, DG Area Ventilation, RB Ventilation, Shield Building Annulus Vacuum Maintenance Containment Purge, Mechanical Vacuum Pumps
2	483.3	5.50	4,800 (min) 50,200 (max)	60 (min) 104 (max)	Control Room Ventilation, Electric Battery Room Ventilation
3	483.3	5.50	4,800 (min) 50,200 (max)	60 (min) 104 (max)	Control Room Ventilation, Electric Battery Room Ventilation
4	502.8	9.17	76,310 (min) 228,355 (max)	60 (min) 104 (max)	RAB Main Ventilation, DG Area Ventilation, Shield Building Annulus Vacuum Maintenance, FHB Ventilation

TABLE 3.5-9

GASEOUS SOURCE TERMS FOR
NORMAL OPERATIONS INCLUDING ANTICIPATED OPERATIONAL OCCURRENCES[a]

Nuclide	Primary Coolant (μCi/gm)	Secondary Coolant (μCi/gm)	Release Rate (Ci/yr) Gas Stripping[b] Shutdown	Continuous	Building Ventilation Reactor	Auxiliary	Turbine	Blowdown Vent Offgas	Air Ejector Exhaust	Total
Kr-83M	1.937E-02	4.671E-09	0.[c]	0.	2.0E+00	0.	0.	0.	0.	2.0E+00
Kr-85M	8.500E-02	2.091E-08	0.	0.	1.4E+01	2.0E+00	0.	0.	1.0E+00	1.7E+01
Kr-85	2.347E-03	5.737E-10	1.0E+00	2.7E+02	2.0E+00	0.	0.	0.	0.	2.7E+02
Kr-87	5.798E-02	1.350E-08	0.	0.	3.0E+00	1.0E+00	0.	0.	0.	4.0E+00
Kr-88	1.721E-01	4.133E-08	0.	0.	2.0E+01	4.0E+00	0.	0.	2.0E+00	2.6E+01
Kr-89	5.354E-03	1.309E-09	0.	0.	0.	0.	0.	0.	0.	0.
Xe-131M	6.065E-03	1.492E-09	0.	0.	4.0E+00	0.	0.	0.	0.	4.0E+00
Xe-133M	4.270E-02	1.051E-08	0.	0.	2.5E+01	0.	0.	0.	0.	2.5E+01
Xe-133	1.803E+00	4.373E-07	0.	0.	1.2E+03	3.8E+01	0.	0.	2.4E+01	1.3E+03
Xe-135M	1.367E-02	3.304E-09	0.	0.	0.	0.	0.	0.	0.	0.
Xe-135	2.073E-01	5.017E-08	0.	0.	5.8E+01	4.0E+00	0.	0.	3.0E+00	6.5E+01
Xe-137	9.629E-03	2.335E-09	0.	0.	0.	0.	0.	0.	0.	0.
Xe-138	4.617E-02	1.099E-08	0.	0.	0.	0.	0.	0.	0.	0.
Total Noble Gases										1.7E+03
I-131	3.089E-01	7.072E-06	0.	0.	2.1E-02	4.9E-03	3.8E-04	0.	3.1E-03	2.9E-02
I-133	4.263E-01	9.301E-06	0.	0.	1.8E-02	6.8E-03	5.0E-04	0.	4.2E-03	3.0E-02
Tritium Gaseous Release										1400
Ar-41										25
C-14										8

TABLE 3.5-9 (contd.)

Nuclide	Release Rate (Ci/yr)			
	Waste Gas System	Building Ventilation		Total
		Reactor	Auxiliary	
Airborne Particulate				
Mn-54	4.5E-05	2.2E-04	1.8E-04	4.5E-04
Fe-59	1.5E-05	7.4E-05	6.0E-05	1.5E-04
Co-58	1.5E-04	7.4E-04	6.0E-04	1.5E-03 |1
Co-60	7.0E-05	3.3E-04	2.7E-04	6.7E-04
Sr-89	3.3E-06	1.7E-05	1.3E-05	3.3E-05
Sr-90	6.0E-07	2.9E-06	2.4E-06	5.9E-06
Cs-134	4.5E-05	2.2E-04	1.8E-04	4.5E-04
Cs-137	7.5E-05	3.7E-04	3.0E-04	7.5E-04

(a) At 0.12% failed fuel as derived from Reference 3.5-1.

(b) The actual gas release point is the waste gas decay tanks.

(c) 0. indicates release is less than 1.0 Ci/yr for noble gas, 0.0001 Ci/yr for iodine.

TABLE 3.5-10

ASSUMPTIONS USED TO CALCULATE
GASEOUS RADIOACTIVITY RELEASES

	Continuous stripping of full letdown flow		
2	Flow rate through gas stripper (gpm)		74
	Holdup time for Xenon (days)		90
	Holdup time for Krypton (days)		90
	Fill time of decay tanks for the gas stripper (days)		90
	Primary coolant leak to Auxiliary Bldg (lb/day)		160
	Auxiliary Building leak	Iodine partition factor	0.0075
	Gas Waste System	Particulate release fraction	0.0100
	Auxiliary Building	Iodine release fraction	0.1000
		Particulate release fraction	0.0100
2	Containment volume (10^6 cuft)		3.405
	Frequency of primary coolant degassing (times/yr)		2
	Primary to secondary leak rate (lb/day)		100
	There is a kidney filter		
	Containment atmosphere cleanup rate (thousand cfm)		11.5
	Cleanup filter efficiency	Iodine	0.9000
		Particulate	0.9900
	Cleanup time of containment (hours)		16
	Iodine partition factor (gas/liquid) in steam generator		0.0100
	Frequency of containment high-volume purge (times/yr)		4
	Containment high-vol purge	Iodine release fraction	0.1000
		Particulate release fraction	0.0100
	Containment low-volume purge rate (cfm)		2500
		Iodine release fraction	0.1000
		Particulate release fraction	0.0100
	Steam leak to Turbine Bldg (lb/hr)		1700
	Fraction of Iodine released from blowdown tank vent		0.0
	Fraction of Iodine released from main condenser ejector		0.1
	No cryogenic off-gas system		

TABLE 3.5-11

SOLID WASTE SYSTEM INFLUENT STREAMS

Source	Form	Quantity[a] (ft^3/yr)	
Spent Resins			
CVCS [b] Chemical and Volume Control	Dewatered	180	
Fuel Pool[b]	Dewatered	180	
Floor Drain System [c]	Dewatered	80	
Secondary Liquid Treatment Systems[c]	Dewatered	80	
Organic Traps[c]	Dewatered	60	
Condensate Polishers[d]	Dewatered	500	
Blowdown Demineralizers[d]	Dewatered	100	
Evaporator Bottoms			
Floor Drains[e]	12 percent $Na_2B_4O_7$	2,930	
ICW (Inorganic Chemical Waste)[f]	15 percent Na_2SO_4	5,000	
CVCS (Boric Acid Concentrator)[g]	12 percent H_3BO_3	1,800	2
Filters			
Sludge	Precoat and Particulates in slurry	120	
Cartridges	43 cartridges	101	
Compressible Solids	Plastic, Rags, Paper, etc.	11,000	
Detergent Waste[h]	Laundry Waste	40,000	
Non-Compressible Solids	Tools, etc.	3,000	2

(a) Bases for Values: Maximum annual volumes; normal operation, including anticipated operational occurrences. Expected annual volumes are inputs from the primary side treatment systems excluding the 12 percent boric acid concentrate.

(b) Normally changed during annual refueling.

(c) Normally changed twice per year.

(d) Reference 3.5-3.

(e) Based on volume reduction ratio of 50.

(f) Based on volume reduction ratio of 20.

(g) Assuming five percent of the boric acid concentrator thoughput is concentrated to twelve percent boric acid for disposal.

(h) Total volume collected in Detergent Waste System.

TABLE 3.5-12

SOLID WASTE SYSTEM INFLUENTS (CURIES/YEAR)
FROM EVAPORATOR BOTTOMS

Nuclide	Floor Drain Evaporator	ICW Evaporator	Boric Acid Evaporator
H-3	4.23E-00	1.46E-00	5.1E+01
Br-84	**	**	1.3E-05
I-129	4.90E-06	**	**
I-131	1.72E+02	3.78E-00	2.3E-01
I-132	2.84E-03	4.68E-04	2.1E-03
I-133	1.88E+01	7.08E-01	6.5E-02
I-134	**	**	3.8E-04
I-135	9.26E-01	5.14E-02	1.1E-02
Rb-88	**	**	2.7E-04
Rb-89	**	**	**
Sr-89	4.55E-01	7.01E-03	5.1E-04
Sr-90	2.37E-02	3.34E-04	1.7E-05
Sr-91	3.86E-03	1.79E-04	5.5E-05
Y-90	9.79E-04	3.05E-06	1.2E-04
Y-91	2.26E-01	3.46E-04	3.4E-03
Zr-95	6.73E-01	8.29E-03	4.2E-03
Mo-99	4.51E-01	1.39E-01	1.7E+00
Ru-103	7.51E-01	1.18E-02	6.2E-05
Ru-106	1.90E-01	2.71E-03	4.9E-05
Te-129	1.34E-00	2.15E-02	1.7E-05
Te-132	7.53E-00	2.22E-01	1.3E-02
Te-134	**	**	**
Cs-134	3.45E+01	4.89E-01	1.4E-02
Cs-136	2.03E+01	3.85E-01	5.2E-03
Cs-137	1.39E+02	1.97E-00	1.0E-02
Cs-140	**	**	**
Ba-140	5.30E-01	1.02E-02	2.3E-04
La-140	6.85E-02	2.34E-03	4.6E-05
Pr-143	4.06E-01	7.67E-02	5.3E-05
Ce-144	4.49E-01	6.45E-03	5.3E-05
Cr-51	5.37E-02	8.81E-05	2.5E-04
Mn-54	1.48E-03	2.12E-06	5.1E-05
Co-58	1.23E-01	1.86E-04	2.3E-03
Co-60	1.51E-02	2.14E-05	3.3E-04
Fe-59	7.08E-04	1.10E-06	1.4E-04

**Denote nuclide activity less than 1.0E-06 Curies/year.

TABLE 3.5-15

SOLID WASTE SYSTEM INFLUENTS (CURIES/YEAR) FROM
SECONDARY PARTICULATE FILTER SLUDGE

Nuclide	Activity
Cr-51	3.36E-05
Mn-54	7.42E-07
Co-58	6.68E-05
Co-60	7.44E-06
Fe-59	4.04E-07
Zr-95	3.45E-07

TABLE 3.5-16

SOLID WASTE SYSTEM EFFLUENT VOLUMES

	Type of Waste	Form	Quantity (ft^3/yr) Expected	Maximum
	Spent Resins	Solidified	650	1760
	Evaporator Bottoms			
	Floor Drain	Solidified	4395	4395
	ICW	Solidified	7500	7500
2	CVCS	Solidified		2700
	Filters			
	Backflush	Solidified	180	180
	Cartridges	Solidified	162	162
	Compressible Solids	Compressed in drums (Compaction factor = 4)	2750	2750
	Detergent Concentrates	Solidified[a]	1200	1200
2	Non-Compressible Solids	Packed in drums	3000	3000

[a] Based on a volume reduction factor of 50 for volume reduction unit.

TABLE 3.5-19

SOLID WASTE SYSTEM EFFLUENT (MICROCURIES/GRAM)[a] FROM PRECOAT AND PARTICULATE SLURRIES, DETERGENT CONCENTRATE, AND ICW CONCENTRATE

Nuclide	Normal Operation	Nuclide	Design Basis	
Br-83	*[b]	Br-84	*	
Br-84	*	I-129	1.64E-12	| 2
I-130	*	I-131	2.20E-11	
I-131	1.73E-12	I-132	*	
I-132	*	I-133	*	
I-133	*	I-134	*	
I-134	*	I-135	*	
I-135	*	Rb-88	*	
Rb-86	4.33E-12	Rb-89	*	
Rb-88	*	Sr-89	1.62E-08	
Cs-134	1.27E-05	Sr-90	6.09E-09	
Cs-136	3.29E-11	Sr-91	*	
Cs-137	2.63E-05	Y-90	*	
Sr-89	1.28E-09	Y-91	3.22E-09	
Sr-90	4.35E-10	Zr-95	5.94E-08	
Sr-91	*	Mo-99	6.76E-25	
Y-90	*	Ru-103	1.60E-08	
Y-91M	*	Ru-106	4.73E-06	
Y-91	3.27E-10	Te-129	*	
Y-93	*	Te-132	*	
Zr-95	2.12E-08	Te-134	*	
Nb-95	5.44E-08	Cs-134	3.49E-05	
Mo-99	*	Cs-136	1.54E-10	
Tc-99M	*	Cs-137	7.93E-05	
Ru-103	5.84E-09	Cs-138	*	
Ru-106	1.81E-06	Ba-140	1.19E-11	
Ru-103M	*	La-140	*	
Te-125M	1.43E-10	Pr-143	2.93E-12	
Te-127M	3.66E-09	Ce-144	8.92E-06	
Te-127	*	Cr-51	9.37E-10	
Te-129M	1.31E-09	Mn-54	1.92E-07	
Te-129	*	Co-58	3.05E-07	
Te-131M	*	Co-60	2.45E-06	
Te-131	*	Fe-59	2.80E-06	| 2
Te-132	*	Fe-55	6.38E-08	
		Total	1.31E-04	

TABLE 3.5-19 (contd.)

Nuclide	Normal Operation
Ba-140	4.74E-13
La-140	*
Ce-141	6.19E-11
Ce-143	*
Ce-144	3.41E-06
Pr-143	2.06E-13
Pr-144	*
Np-239	*
Cr-51	9.37E-10
Mn-54	7.96E-08
Fe-55	6.38E-08
Fe-59	2.80E-09
Co-58	1.94E-07
Co-60	9.92E-07
Total	4.56E-05

(a) Based on 6-months decay of input activities and mixed with one-third volume of solidification material.

(b) * denotes activity less than 1.0E-20.

TABLE 3.5-20

RADIOLOGICAL PROCESS AND EFFLUENT MONITORS

Monitor	Function
Component Cooling Water Monitor (2 ea) 335-ft (elev) level of Fuel Handling Bldg (FHB)	Detect leakage into component cooling water system. Diagnostic, indicating need for addition surveys.
Service Water Monitor (2 ea) 335-ft level of FHB	Detect leakage from component cooling water system. Diagnostic, indicating need for addition surveys.
Steam Generator Blowdown Monitor 402-ft level of RAB	Detect small primary to secondary leakage through steam generators. Diagnostic tool.
CVCS Preholdup Monitor 362-ft level of RAB	Indicates activity reactor coolant from gas stripper before routing to holdup tanks. Exceedence of set-points indicates need for additional surveys.
CVCS Letdown Monitor 373.5-ft level of RAB	Detect increased activity in reactor coolant. Exceedence of setpoints indicates need for additional surveys.
FHB Airborne Radiation Monitor 2| 417-ft level of RAB	Detects activity in FHB indicating need for verification or additional surveys on set point exceedence.
Containment Atmosphere/Purge Airborne Radiation Monitor (2 ea) 2| 362.5-ft level of RAB	Detect activity in either containment atmosphere or containment purge to identify leakage sources.
Steam Generator Blowdown Area Monitors (2 ea) 417.5-ft level of RAB	Detect primary to secondary leakage. Setpoint exceedence indicates need for additional surveys. Indicates need to isolate steam generator with high leak rate.
Refueling Pool Area Monitors (4 ea) on walls of refueling pool	Provides alarm for evacuation of refueling pool area and automatically isolates containment purge lines.

TABLE 3.5-20 (contd.)

Monitor	Function
Spent Fuel Pool Area Monitors (4 ea) 425-ft level of FHB	Provides alarm for evacuation of spent fuel pool area and isolates FHB ventilation system.
Plant Vent Radiation Monitors 1 for each of 4 plant vents	Sample and monitor particulates, sample halogens (iodine), and monitor radioactive gases in effluent air. Alarm setpoints to prevent concentrations in excess of 10 CFR 20 limits. Alarm indicates need for additional surveys.
Administration Building Discharge Monitor 2| 405-ft level of Admin Bldg	Same as vent radiation monitors.
Condenser Mechanical Vacuum Pump Discharge Monitor 390-ft level of Turbine Bldg	Samples for particulates and halogens and monitors radioactive gas content. Alarm setpoints to prevent concentration in excess of 10 CFR 20 limits.
Waste Gas Discharge Monitor 362.5-ft level of RAB	Provide record of activity released during waste gas discharge. High alarm terminates discharge. Set-points established to prevent concentrations in excess of 10 CFR 20 limits.
Auxiliary Condensate Flash Tank Monitor	Detect in-leakage to auxiliary steam system and alert to the need for additional sampling.
Waste Management System Discharge Monitor 390-ft level of TB	Provide record of activity released from waste management system. If activity exceeds setpoint, established to prevent concentrations in excess of 10 CFR 20 limits, discharge is automatically terminated.
Common Plant Effluent Monitor outside building	Provides record of radioactivity in common liquid effluents. Alarm indicates need for additional analyses and/or cessation of discharge.

TABLE 3.5-20 (contd.)

Monitor	Function
Sump and Secondary High Purity Discharge Monitor outside building	Provides record of activity in Sumps Nos. 2 and 10 and the secondary high purity water discharge. Alarm setpoints established to prevent concentrations from exceeding 10 CFR 20 limits.
Neutralization Pond Influent Monitor 362.5-ft level of RAB	Provides record of activity in discharge to neutralization pond. Alarm, with setpoints to prevent concentrations in excess of 10 CFR 20 limits, indicates need for additional sampling. High radiation alarm terminates discharge to pond.
Groundwater Drain Area Monitor	Provides record of activity in the RAB foundation drain. Setpoints as close as practicable to natural background. Alarm indicates need for additional samples to determine reason for alarm.
Steam Generator Blowdown Flash Tank Vent Monitor	Provides indication and record of contamination of the Secondary Steam System due to in-leakage of primary coolant and the potential for release through the Flash Tank Vent. Setpoints as close as practicable to plant background. Alarm indicates need for additional sampling and further action.
Steam Seal Gland Steam Condenser Exhaust Radiation Monitor	Provides indication and record of contamination of the Secondary Steam System due to in-leakage of primary coolant and the potential for release through the steam seal gland steam condenser vent. Setpoints as close as practicable to plant background. Alarms indicate need for additional sampling and further action.

2

TABLE 3.5-20 (contd.)

Monitor	Function
Auxiliary Condensate Flash Tank Monitor	Provides indication and record of contamination of the Auxiliary Steam System due to in-leakage of various radioactive systems and the potential for release via various vents in the Auxiliary Steam and Condensate System. Setpoints as close as practicable to plant background. Alarm indicates need for additional sampling and further action.
Hot Machine Shop Discharge Sampler	Provides representative sample of particulates and halogens (iodine) entrained in air discharged from the Hot Machine Shop. Samples are available for later laboratory analysis.

2

Release Point	Release Point Elevation (Ft. MSL)	Normal Flow Rate (cfm)	Systems/Components Exhausted
1	501.0	76,200 to 199,550	RAB Main Ventilation System, Diesel Generator Area Ventilation System. (ECCS/FHB Filtered exhaust, SBVS)
2	483.3	4,800 to 50,200	Control Room and Electric Battery Room Air Conditioning Vent Train B
3	483.3	4,800 to 50,200	Control Room and Electric Battery Room Air Conditioning Vent Train A
4	502.8	76,310 to 228,355	RAB Main Ventilation System, Fuel Handling Bldg Ventilation System, Diesel Generator Area Ventilation System (ECCS/FHB Filtered Exhaust, SBVS)
5	497.7	140,000	Turbine Building Ventilation System
6	497.7	140,000	Turbine Building Ventilation System
7	470.0	1,565	Administration Building Air Conditioning Vent
8	470.0	5,165	Administration Building Air Conditioning Vent
9	425.0	19,600	Administration Building Vent (CU-51)
10	497.0	1,510	Vent from the Main Turbine Lube Oil Reservoir
11	497.0	100 (each)	Feed Pump Lube Oil System Vent (2 release points next to each other)
12	497.0	70	Turbine Generator Loop Seal Tank
13	497.0	Natural Ventilation	Lube Oil Batch Tank Vent
14	435.0	Natural Ventilation	Refueling Water Storage Tanks A and B
15	432.0	Natural Ventilation	Reactor Makeup Storage Tank
16	485.0	79,300	Diesel Generator Exhaust-B (Normal Path)
17	409.3	79,300	Diesel Generator Exhaust-B (Alternate Path)
18	409.3	79,300	Diesel Generator Exhaust-A (Alternate Path)
19	485.0	79,300	Diesel Generator Exhaust-A (Normal Path)
20	429.0	Natural Ventilation	Diesel Oil Storage Tank A
21	429.0	Natural Ventilation	Diesel Oil Storage Tank B
22	413.0	Natural Ventilation	Diesel Generator Day Tank A
23	413.0	Natural Ventilation	Diesel Generator Day Tank B
24	404.3	Natural Ventilation	Diesel Generator Lube Oil Tank A
25	404.3	Natural Ventilation	Diesel Generator Lube Oil Tank B

Amendment 2 (May 84)

WASHINGTON PUBLIC POWER SUPPLY SYSTEM NUCLEAR PROJECT No. 3 OPERATING LICENSE ENVIRONMENTAL REPORT	WNP-3 GASEOUS EFFLUENT RELEASE POINTS (SHEET 2 OF 2)	FIGURE 3.5-8

3.6 CHEMICAL AND BIOCIDE SYSTEMS

This section discusses the sources and treatment of chemical wastes resulting from plant operation. The anticipated water quality of the makeup and discharge is described in Table 3.6-1 and water treatment additives used in plant systems are listed in Table 3.6-2. The applicable discharge limitations are stipulated by the NPDES Permit included in Appendix A.

3.6.1 Makeup Demineralizer System

The Makeup Demineralizer System processes raw water from the plant Makeup Water System to produce high quality demineralized water. The demineralized water is required for Primary and Secondary System makeup and other miscellaneous plant uses.

The Makeup Demineralizer System consists of two cross-connected demineralizer trains, each with a normal capacity of 250 gpm and a maximum capacity of 375 gpm. Each demineralizer train consists of a cation exchange unit, an anion exchange unit, and a mixed-bed ion exchange unit. The cation exchange units are followed by a forced-draft deaerator.

The demineralizer trains are regenerated on the basis of ionic exhaustion or throughput. Each train is expected to have a throughput of about 280,000 gallons. The resins are first backflushed to remove suspended material. Cation resin is regenerated with dilute sulfuric acid (2 to 4 weight percent). Anion resin is regenerated with dilute sodium hydroxide (4 weight percent). After regeneration the resins are rinsed to remove excess regenerant solution. The backflush water, spent regenerant solution, and rinse water are transferred to the low volume waste treatment system. The waste will contain suspended material, ionic inpurities originating from the plant makeup water and excess regeneration reagents. The low-volume waste treatment system is described in Subsection 3.6.7 below.

3.6.2 Condensate Demineralizer System

The Condensate Demineralizer System processes secondary system feedwater to remove suspended material and ionic impurities. The system consists of 12 mixed-bed demineralizer units with 10 in service and 2 in standby as spares. The demineralizer units are removed from service based on throughput, pressure drop across the beds, or ionic exhaustion. The resins are transferred to a separate facility for regeneration. In the cation regeneration tank the resins are first backflushed to remove suspended matter. The anion resin is separated from the cation resin by classification and transferred to the anion regeneration tank for regeneration. The cation resin is regenerated with dilute sulfuric acid, and the anion resin is regenerated with dilute sodium hydroxide. The resins are then rinsed to remove excess regenerant solution. | 2
Following regeneration the resins are transferred to the resin mixing tank where they are mixed and stored until required.

The waste will contain suspended material, consisting primarily of corrosion products from plant heat transfer surfaces, excess regenerants and rinse water. The waste is normally transferred to the low-volume waste treatment system for treatment and subsequent disposal. During normal operations portions of the waste including the backflush and the rinse water, can be processed in the SHP and SPWS (see Subsection 3.5.2.1) for reuse in the plant. Additionally, when primary to secondary system leakage occurs resulting in radioactive contamination of the condensate demineralizer system the waste is processed in the radwaste system.

3.6.3 Corrosion Control

Hydrazine is used in several plant systems to remove residual oxygen and as a corrosion inhibitor. During normal operation the concentration of hydrazine
1 in the Secondary System feedwater is maintained in the range of 10 to 50 ppb. Hydrazine reacts with oxygen to yield nitrogen and water. Hydrazine decomposes to nitrogen and ammonia at higher temperatures. Essentially all of the hydrazine reacts or decomposes such that only trace quantities are released from the system.

Hydrazine is similarly used in the Primary System and the Auxiliary Boiler. The hydrazine concentration in the primary coolant is maintained in the range of 30 to 50 ppm at any time the temperature of the coolant is less than 150°F.

Most of the hydrazine utilized in the above applications decomposes or is oxidized. Any hydrazine released from these systems as a result of leakage or other mode of release is removed by subsequent treatment in the radwaste or secondary high purity waste treatment systems. Since hydrazine is a strong reducing agent its residual time is limited.

2 Ammonia is used to control pH in the Secondary Feedwater System and the Auxiliary Boiler System. The corrosion rate for steel is less at higher pH. In the Auxiliary Boiler System, ammonia provides the required conductivity for proper operation. As with hydrazine, any leakage from these systems is removed by subsequent treatment.

2 Sodium chromate is used as a corrosion inhibitor in the Component Cooling Water System. To provide effective corrosion control, the concentration is maintained in the range of 300-500 ppm. Portable storage tanks are used to contain the coolant during maintenance of system equipment. Leakage is processed in the Liquid Radwaste System by evaporation and ion exchange. There is no liquid release of sodium chromate.

3.6.4 Biocide Control

Biocide control for the plant circulating water systems is provided by the addition of sodium hypochlorite. Sodium hypochlorite solution is injected at the intake to the circulating water pumps to produce a maximum concentration of 3 ppm (as chlorine) in the circulating water. Treatment periods vary from 20 to 30 minutes in duration. The treatment may be repeated up to twice daily

depending on the biological activity in the cooling tower and the circulating water system. The maximum daily requirements for sodium hypochlorite will be approximately 800 pounds (as chlorine). The estimated average daily requirements will be less than 200 pounds (as chlorine).

Any residual chlorine (from sodium hypochlorite) remaining in the cooling tower blowdown is neutralized with sulfur dioxide before discharge from the plant. Since the residual chlorine concentration is expected to be about 0.02 ppm the contribution of sulfate to the blowdown will be minimal.

3.6.5 Scaling Control

Sulfuric acid is added to the Circulating Water System (cooling tower) makeup, to prevent scaling. The acid injection system includes two positive displacement acid injection pumps, each with a maximum capacity of 35 gallons per hour. The quantity of acid required will depend upon the analysis of the makeup water.

Sulfuric acid is also used to control scaling in the HVAC cooling towers. Blowdown from the HVAC cooling towers is transferred to the Low-Volume Waste Treatment System for additional treatment prior to disposal. The combined blowdown from the HVAC cooling towers is approximately 15 gpm.

3.6.6 Low-Volume Waste Treatment

The Low-Volume Waste Treatment System receives regeneration waste from the
Makeup Demineralizer System. Small quantities of waste may also be received 2
from the radwaste system. During normal operation treated liquid radwaste is
recycled for use in the primary system. This waste is treated by filtration, demineralization, and evaporation to produce high quality water. Infrequently, because of excess plant water inventory, small quantities of this waste water along with secondary high-purity waste may be discharged to the Low-Volume Waste Treatment System.

The low-volume waste is treated in the neutralization basin where the waste is
neutralized to a pH in the range of 6 to 8.5, by the addition of sodium hydrox-
ide or sulfuric acid. A substantial amount of sedimentation also occurs in the 2
neutralization basin. The waste is discharged to the cooling tower blowdown line at a rate of approximately 300-400 gpm.

3.6.7 Miscellaneous Chemicals Released

During construction, storm drainage and construction water runoff was treated by flocculation and sedimentation prior to discharge from the site. The pH of the drainage and runoff was adjusted with sulfuric acid. Flocculation and sedimentation was aided by the addition of polyelectrolyte flocculation reagents. It is expected that use of the equalization and sedimentation basins will not be needed during the plant operation phase.

Prior to startup, plant piping and equipment is cleaned by flushing with plant makeup or demineralized water. Flushing water will contain small quantities of hydrazine, metal oxides (rust), and other suspended material. Following any required treatment and analysis, the waste is pumped to the equalization basin and released through the sedimentation basin.

Chemical reagents used in plant laboratories are routed from the laboratory drains to the Radwaste System for processing. The drains are segregated as follows: primary sample drains, secondary sample drains, hot laboratory drains, and cold laboratory drains. There are no normal releases from the Radwaste System which is discussed in Section 3.5.

TABLE 3.6-1

WATER QUALITY PARAMETERS - INTAKE AND DISCHARGE

	Intake Well[a]		Total Combined Discharge[b]		
	Ave	Max	Ave	Max	
	mg/l		mg/l		
Calcium	12.0	13.1	72.0	97.1	
Magnesium	4.3	4.8	25.8	35.4	
Sodium	6.0	6.5	36.0	164	
Potassium	0.70	0.77	4.20	5.70	2
Chloride	4.2	4.2	25.2	31.7	
Fluoride	0.113	0.122	0.68	0.90	
Sulfate	2.8	2.8	300	560	
Phosphorus	0.142	0.240	0.85	1.66	
Ammonia N	0.014	0.028	0.08	0.19	
NO_3 and NO_2 N	0.51	0.54	3.06	4.02	
Oil and Grease	< 1.0	< 1.0	1.0	1.0	
Chlorine (total residual)				0.05	
Alkalinity (as $CaCO_3$)	56	64	76	86	
Hardness (as $CaCO_3$)	54	60	324	360	
TDS	96[c]		735	883	2
TSS	1		6	8	
pH	6.9	7.5	7.1	8.5	
	ug/l		ug/l		
Barium	4.0	12.0	24.0	78.2	
Cadmium	< 0.1	0.2	0.6	1.4	
Chromium	0.6	1.2	23.1	28.4	
Copper	< 1.0	7.0	21.5	61.3	
Iron	16.0	90	183	655	
Lead	< 1.0	< 1.0	6.0	7.5	
Manganese	1.0	4.0	8.2	27.8	
Mercury	< 0.2	0.7	1.2	4.5	
Nickel	< 1.0	10.0	18.6	74.6	2
Zinc	< 5.0	7.0	31.2	56.9	

(a) Compiled from Metals Monitoring Program report (Reference 2.4-6) and Ranney Well Test of November 25, 1980. 2

(b) Includes concentrated makeup water, corrosion products, treatment additives, and low-volume waste. Where makeup constituents are below detection, the calculation assumed the less-than value. 2

(c) From Table 2.5-10 of ER-CP (Reference 2.2-1).

TABLE 3.6-2

WATER TREATMENT ADDITIVES

	Additive	Systems Served	Purpose	Annual Quantities (lbs/yr) Ave	Annual Quantities (lbs/yr) Max
2	Hydrazine (As 35 wt % solution)	Primary Coolant Condensate and Feedwater Auxiliary Boiler System	Oxygen Scaverging and Corrosion Inhibitor	10,000	16,000
2	Ammonia (As 29 wt % solution)	Condensate and Feedwater Auxiliary Boiler	pH Control and Corrosion Inhibitor	300,000	400,000
	Sodium Hydroxide (As 50 wt % solution)	Makeup Demineralizer Condensate Polishing Low Volume Waste Treatment Chemical and Volume Control Radwaste System	Resin Regeneration pH Control and Adjustment	175,000	250,000
	Sulfuric Acid (As 93 wt % solution)	Makeup Demineralizer Condensate Polishing Circulating Water System Storm and Construction Runoff	Resin Regeneration pH Control and Adjustment	2,700,000	3,000,000
	Polyelectrolyte (Magnafloc 573C liquid)	Storm and Construction Runoff	Flocculation and Sodimentation	20,000	42,000
	Sodium Hypochlorite (As 15 wt % solution)	Circulating Water Potable Water	Biocide Treatment	160,000	250,000
	Sulfur Dioxide (Compressed Cas)	Circulating Water	Chlorine Neutralization	10,000	12,000
	Hydrogen (Liquefied Gas)	Primary System Turbine-Generator	Oxygen Scavenger Coolant	3,000	4,000
	Nitrogen (Liquefied Gas)	Chemical and Volume Control Gaseous Waste System	Cover Gas Purge Gas	15,000	20,000
	Carbon Dioxide (Liquefied Gas)	Turbine-Generator Fire Protection	Purge Gas Fire Retardant	4,000	6,000
	Boric Acid (Crystalline Powder)	Primary Coolant	Chemical Shim	1,000	2,000
2	Sodium Chromate (Crystalline Powder)	Component Cooling Water	Corrosion Inhibitor	100	200

3.9 TRANSMISSION FACILITIES

3.9.1 Transmission Line Description

3.9.1.1 Location

Two transmission lines will be constructed between WNP-3 and the Bonneville Power Administration (BPA) Satsop substation. System requirements beyond the Satsop substation are evaluated, designed and built by BPA. The substation (Elev 310 ft MSL) is located approximately 3000 feet north of WNP-3 and adjacent to the BPA Olympia-Aberdeen transmission corridor. One transmission line will be a 500kV line from the 500kV disconnect switches on the plant island to the 500kV bus in the substation. The other line will be a 230kV line from the substation to the 230kV disconnect switches at the plant. The 230kV line will be an underground low-pressure oil-filled cable. Figure 3.9-2 shows the relative locations of the plant, the BPA substation, and the 500kV line. The right-of-way lies completely within the project boundaries and crosses no public roads. 2

3.9.1.2 Routing

The transmission lines between the plant and BPA's Satsop substation will satisfy the requirements of NRC General Design Criteria 17. These lines and their interconnection with the BPA system are shown schematically in Figure 3.9-1. 2

The 500kV line for WNP-3 will be connected, via the 500kV switchyard bus, to a new 500kV BPA transmission line which will extend approximately 46 miles to BPA's Paul switchyard. This line will parallel the existing Aberdeen-Olympia-Paul corridor. It will be single-circuit except for a six mile double-circuit section located west of Olympia. The double-circuit section will be shared with the Satsop-Olympia 230kV #2 line (see Figure 3.9-1).

The two existing Olympia-Aberdeen 230kV lines will be looped into the Satsop 230kV switchyard and connected in a modified breaker and a half bus configuration to the 230kV lines feeding each plant. The length of each of these lines from Satsop to Olympia is approximately 27 miles (see Figure 3.9-1).

The Olympia-Aberdeen corridor, which passes north of the plant, will contain the following transmission facilities:

the Cosmopolis - South Elma	115kV line
the Satsop - Olympia No. 2	230kV line
the Satsop - Olympia No. 3	230kV line
the Satsop - Aberdeen No. 2	230kV line
the Satsop - Aberdeen No. 3	230kV line
the Satsop - Paul	500kV line

Although there will be crossings of the transmission lines and some multiple circuits, no single contingency will leave less than two power sources feeding the Satsop substation. This is due to the routing and the spacing of the transmission lines. Further reliability is provided by interconnection through an auto transformer of the 500 and 230kV buses in the Satsop substation.

3.9.1.3 Structures

The transmission line structures between the plant and the Satsop substation will be constructed of lattice steel in a single circuit delta configuration. The towers will be about 120 feet high and 40 feet wide. Land requirements for each tower will average 400 square feet.

3.9.2 Environmental Parameters

The environmental parameters associated with the transmission system beyond the Satsop substation have been evaluated by BPA as owner/operator.[1] The environmental effects of a transmission system were also evaluated generically by the BPA in its Draft Role EIS.[2] The following discussion addresses principally the lines between the plant and the substation.

3.9.2.1 Land Use

The transmission lines are located in a previously forested area which was cleared to make laydown area for plant construction. Because the lines are within the project boundaries, use of the land will continue to be limited to activities associated with plant operation.

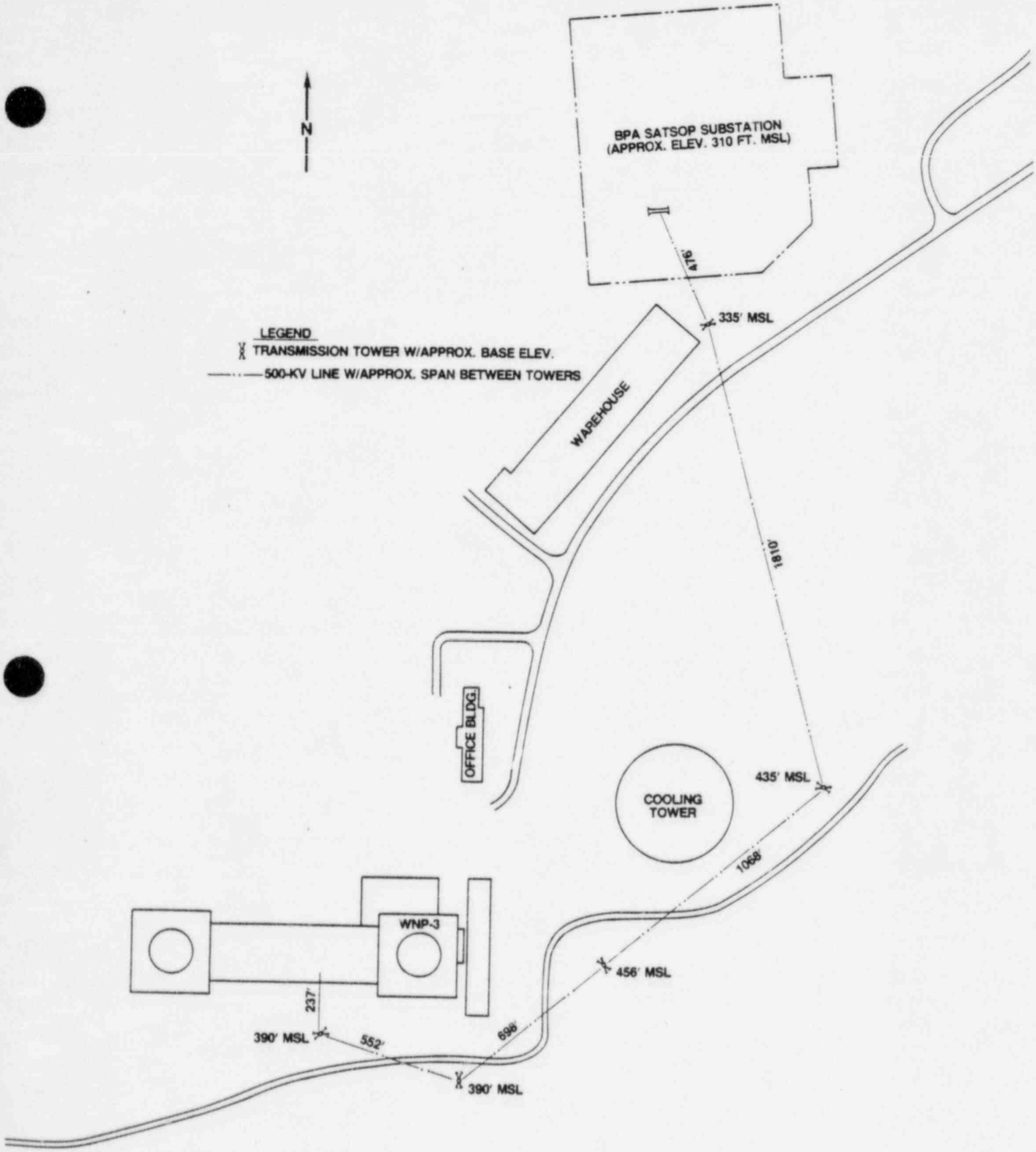
3.9.2.2 Aesthetics

That portion of transmission lines on higher ground near the plant may be visible from State Route 12. However, the transmission structures will not be seen in isolation from the much larger plant structures.

3.9.2.3 Corona Effects

Corona loss is the loss of energy to the atmosphere caused by localized electrical discharges from an energized conductor; these usually result from small irregularities or foreign particles (e.g., dust or water droplets) on the conductor surface. The result is a breakdown of the air immediately adjacent to the conductors and effects associated with this highly stressed air include audible noise, radio interference, and ozone production.

Audible noise due to the corona phenomenon may be evident in the area immediately beneath and adjacent to the 500kV line. It will be most noticeable in fog or drizzling rain, however, it will not be detectable off-site. Electrical noise causing radio and television interference may



Amendment 2 (May 84)

WASHINGTON PUBLIC POWER SUPPLY SYSTEM NUCLEAR PROJECT No. 3 OPERATING LICENSE ENVIRONMENTAL REPORT	PLANT-TO-SUBSTATION TRANSMISSION LINE (500kv) ROUTING	FIGURE 3.9-2

ENVIRONMENTAL EFFECTS OF STATION OPERATION

5.1 EFFECTS OF OPERATION OF HEAT DISSIPATION SYSTEM

The heat dissipation system is described in Section 3.4. This section discusses the physical and biological effects of system operation.

5.1.1 Effluent Limitations and Water Quality Standards

The Water Quality Standards of the State of Washington[1] classify the reach of the Chehalis River in the vicinity of the plant as "Class A (Excellent)". The standards specify that the increase in water temperature outside a specified mixing zone shall not exceed $t = 28/(T + 7)$, where t is the permissible increase and T is the existing water temperature in ^{o}C. When the ambient water temperature exceeds $18.0^{o}C$ the maximum permissible increase is $0.3^{o}C$.

Discharges from WNP-3 are controlled to comply with the National Pollutant Discharge Elimination System (NPDES) Permit (see Appendix A) issued by the State of Washington in compliance with Chapter 155, laws of 1973 (RCW 90.48), as amended, and the Clean Water Act (PL 95-217), as amended. This permit incorporates the Water Quality Standards and establishes a dilution zone with longitudinal boundaries 50 feet upstream and 100 feet downstream from the diffuser and lateral boundaries 25 feet from the midpoint of the diffuser. Vertically, the dilution zone extends from the surface to the river bottom. Consistent with the applicable guideline of 40 CFR Part 432, the permit limits the temperature of the blowdown to the lowest temperature of the recirculated cooling water prior to the addition of makeup water. In addition, the permit specifies that when ambient river temperatures are $20^{o}C$ or less, the discharge temperature shall be $20^{o}C$ or less and shall not exceed the ambient temperature by more than $15^{o}C$; and when the ambient river temperatures are greater than $20^{o}C$, the discharge temperature shall be equal to or less than the ambient temperature. No discharge is permitted when downstream velocities are less than 0.3 feet per second (fps).

5.1.2 Physical Effects

The thermal dispersion characteristics of the multiport blowdown diffuser were studied using a hydraulic model with a scale of 1:12.[2] The studies were conducted to support the dilution zone definition in the NPDES Permit and, consequently, focused on abnormal conditions. These conditions included minimum daily flowrates estimated from data recorded at upstream gaging stations and river temperatures which are exceeded 99 percent of the time. These conditions are shown in Table 5.1-1 and may be compared with the average data listed in Tables 2.4-1 and 2.4-5. It 2
should be noted that the August - October low flows which were used are less than the once-in-10-yr, single-day low flow of about 500 cfs (WNP-3 FSAR Figure 2.4-33). The plant operating parameters (discharge temperature and blowdown flow) that were modelled are shown in Table 3.4-1.

Additional conservatism is provided by the fact that the above-mentioned model tests were conducted primarily for two-unit (both WNP-3 and WNP-5) operation. Some results are shown in Figures 5.1-1 through 5.1-3. Figures 5.1-1 and 5.1-2 are for two-unit operation in January and August, respectively. Figure 5.1-2 can be compared with Figure 5.1-3 which depicts the August isotherms with only a single unit operating. A critical period for meeting water quality standards is expected to be October when the flows are low and the initial temperature differences are greatest. However, as shown in Table 5.1-1, dilution zone boundary temperatures are predicted to meet water quality standards in every month.

The river reach in the vicinity of the discharge is subject to flow stagnation and reversal during the infrequent coincidence of low river flow and extreme high tides. Several cases (e.g., river flow @ 440 cfs, Aberdeen tide @ 5.6 ft MSL) resulting in the stagnation or reversal phenomena were studied using the hydraulic model. However, the results are not discussed here because, as noted in Subsection 5.1.1, the NPDES Permit prohibits discharges when downstream river velocities go under 0.3 fps.

The unidirectional flow examples discussed above provide predictions of the seasonal variation of blowdown plume temperatures under severe conditions (low river flow, large initial temperature differences). The near- and intermediate-field temperatures of the dilution zone are seen to comply with water quality standards (see Table 5.1-1). Bulk river temperatures in the far-field will be increased no more than $0.05^{\circ}C$ in any season due to the maximum incremental addition of approximately 10,000 Btu/sec of heat in the blowdown from WNP-3.

5.1.3 Biological Effects

5.1.3.1 Intake Structure Effects

Two subsurface infiltration-type intake structures (Ranney collector wells) located on the south bank of the Chehalis River near River Mile 18 will supply makeup water for WNP-3. Impingement and entrainment of aquatic organisms is precluded by the use of the collector wells.[3] Loss of aquatic habitat and benthic macroinvertebrates due to drawdown of the river channel (0.1 ft or less in an area with tidal fluctuations of 2 or more ft) will be negligible. Nearby Elizabeth Creek may become dry in the fall blocking the stream to both anadromous and resident fish. The number of annual juvenile coho and chum that would be lost as a result of this blockage was estimated to be 0.1% of the total run and is considered an acceptable loss.[3] The actual impact on coho and chum is probably less than previously estimated because of clearcutting in the upper Elizabeth Creek watershed during 1973 to 1976.[4] This has increased siltation, and along with numerous other obstacles (eg. fallen trees), has decreased
1 the spawning potential from approximately 65 redds in 1968-1969 to 15 in 1977-1978, at the most recent estimate.[5]

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TABLE 5.1-1

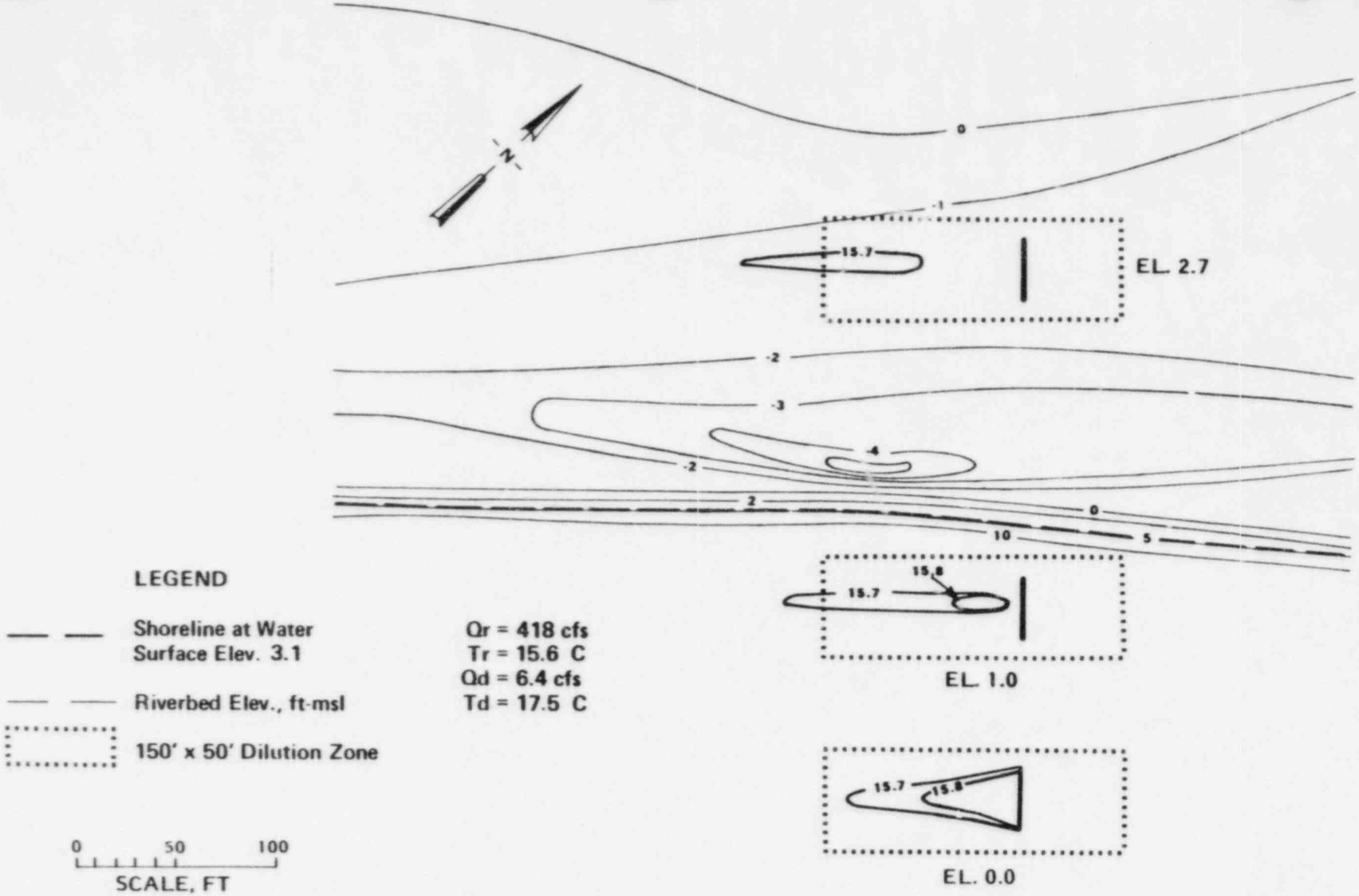
PREDICTED DILUTION ZONE BOUNDARY TEMPERATURES VS. WATER QUALITY STANDARD

		Temperatures (°C)			
Month	River Flow (cfs)	River	Discharge	Dilution Zone[a]	WQS[b]
January	1,698	0.0	10.3	0.9	4.0
February	1,739	1.1	9.7	1.9	4.3
March	2,410	3.9	8.6	4.3	6.5
April	2,164	5.0	8.9	5.3	7.3
May	1,308	10.0	10.8	10.1	11.6
June	821	11.1	13.1	11.3	12.5
July	540	14.4	16.1	14.6	15.7
August	418	15.6	17.5	15.8	16.8
September	399	11.7	18.3	12.4	13.2
October	397	5.0	17.5	6.1	7.3
November	539	4.4	15.3	5.4	6.9
December	674	0.6	12.8	1.7	4.3

2

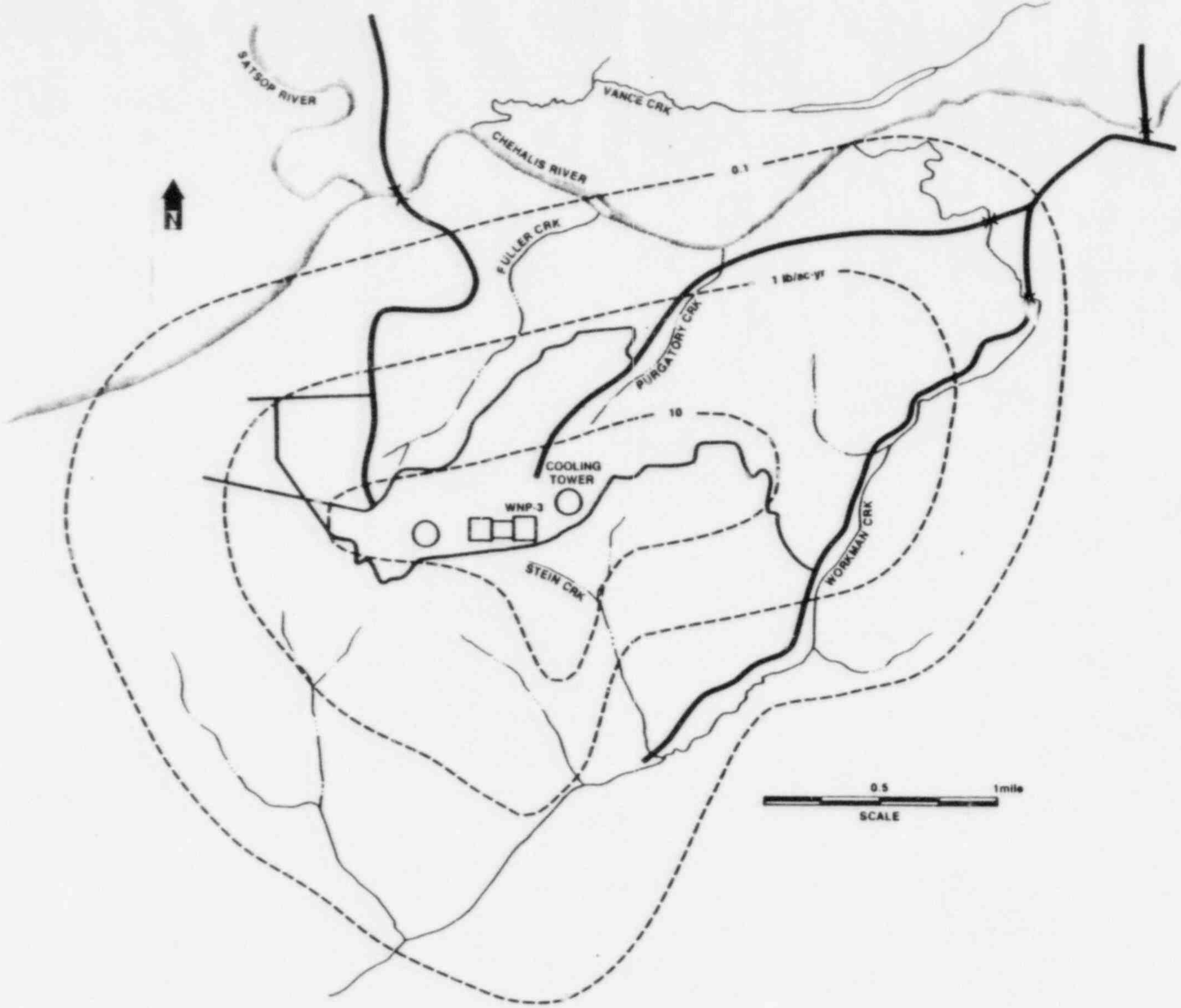
(a) Two units operating. Peak surface temperature 100 ft downstream from diffuser, from Reference 5.1-2.

(b) Water quality standards from Reference 5.1-1. See Subsection 5.1.1.



Amendment 2 (May 84)

WASHINGTON PUBLIC POWER SUPPLY SYSTEM NUCLEAR PROJECT No. 3 OPERATING LICENSE ENVIRONMENTAL REPORT	BLOWDOWN PLUME ISOTHERMS (°C) IN AUGUST WITH SINGLE-UNIT OPERATION	FIGURE 5.1-3



Amendment 2 (May 84)

WASHINGTON PUBLIC POWER SUPPLY SYSTEM NUCLEAR PROJECT No. 3 OPERATING LICENSE ENVIRONMENTAL REPORT	PREDICTED COOLING TOWER DRIFT DEPOSITION PATTERN (lb/acre-yr)	FIGURE 5.1-4

TABLE 5.2-8

ESTIMATED MAXIMUM ANNUAL DOSE TO AN INDIVIDUAL FROM WNP-3

Pathway	Annual Exposure	Location	Dilution Factor	Annual Dose (mRem) to an Adult: Skin	Total Body	GI-LLI	Thyroid	Bone	
Liquid									
Drinking Water	730 l	2.0 mile downstream	1/1100		2.3E-03	2.0E-03	2.1E-02	3.9E-04	
Fish	21 kg	2.0 mile downstream	1/1100		3.0E-02	2.2E-03	9.4E-03	2.1E-02	
Shoreline	12 hr	2.0 mile downstream	1/1100	2.3E-05	2.0E-05	2.0E-05	2.0E-05	2.0E-05	
Food Products									
Vegetables	520 kg	2.0 mile downstream	1/1100		1.4E-03	1.3E-03	1.3E-03	1.1E-04	
Leafy Vegetation	64 kg	2.0 mile downstream	1/1100		1.7E-04	1.6E-04	1.6E-04	1.3E-05	
Milk	310 l	2.0 mile downstream	1/1100		9.5E-04	7.6E-04	3.4E-03	1.5E-04	
Meat	110 kg	2.0 mile downstream	1/1100		2.9E-04	3.0E-04	3.5E-04	1.7E-05	
Invertebrate Seafood	5 kg	2.0 mile downstream(b)	1/11000		1.3E-04	4.5E-03	1.9E-04	1.4E-03	
Swimming	40 hr	2.0 mile downstream	1/1100		2.3E-06	2.3E-06	2.3E-06	2.3E-06	
Boating	200 hr	Downstream	1/1100		5.8E-06	5.8E-06	5.8E-06	5.8E-06	1
			Total(a)	2.3E-05	3.5E-02	1.1E-02	3.6E-02	2.3E-02	
Air									
Submersion	8766 hr	1.0 mile N	3.0E-06	1.6E-01	5.2E-02	5.2E-02	5.2E-02	5.2E-02	
Inhalation	8000 m^3	1.0 mile N	3.0E-06	1.7E-01	1.7E-01	1.7E-01	2.4E-01	2.7E-04	
Ground Contamination	8766 hr	1.0 mile N	3.0E-06	5.0E-03	4.3E-03	4.3E-03	4.3E-03	4.3E-03	
Food Products									
Vegetables	520 kg	1.5 mile NNE	3.1E-06	5.0E-01	5.0E-01	5.0E-01	6.0E-01	6.5E-01	
Cow Milk	310 l	1.5 mile NNE	3.1E-06	1.9E-01	2.0E-01	1.9E-01	9.4E-01	2.9E-01	1
Infant(d)	330 l	1.5 mile NNE	3.1E-06	9.7E-01	9.8E-01	9.7E-01	6.6E+00	2.6E+00	
Goat Milk	310 l	1.7 mile NE	1.4E-06	1.5E-01	1.5E-01	1.5E-01	5.2E-01	1.3E-01	
Infant(d)	330 l	1.7 mile NE	1.4E-06	6.4E-01	6.4E-01	6.4E-01	2.8E+00	1.2E+00	
Meat	110 kg	1.6 mile NNE	2.8E-06	1.0E-01	1.0E-01	1.0E-01	1.2E-01	2.4E-01	
			Total(c)	1.1E-00	1.0E-00	1.0E-00	2.0E+00	1.2E-00	2

(a) Person assumed to drink Chehalis River water, eat fish caught in the river, consume crab caught in Grays Harbor, eat food grown with river irrigation, and use the river for recreation. 1
(b) Harvested in Grays Harbor.
(c) Adult cumulative dose from all pathways, excluding goat milk.
(d) Consumption of goat milk by an infant is assumed to be the same as the consumption of cow milk. It is also assumed that infant milk consumption is the same as child consumption.

TABLE 5.2-9

ESTIMATED ANNUAL POPULATION DOSES FROM WNP-3

	Pathway	Thyroid Dose (thyroid-rem)	Total Body Dose (man-rem)
	Air		
	Submersion	1.4E-01	1.4E-01
	Ground Contamination	8.7E-03	8.7E-03
	Inhalation	1.5E+00	1.1E+00
	Farm Products		
	Milk	2.1E+00	1.0E+00
	Meat	1.3E-01	1.2E-01
	Vegetation	6.1E-01	4.7E-01
	Total:	4.6E+00	2.9E+00
	Water		
	Drinking Water	1.4E-05	1.1E-06
	Aquatic Foods [a]		
1	Fish	7.4E-03	3.9E-02
	Invertebrates	6.5E-05	5.5E-05
	Water Recreation [b]	4.6E-05	4.6E-05
	Farm Products		
	Milk	1.2E-01	3.0E-02
	Meat	1.2E-02	9.4E-03
1	Vegetation [c]	6.6E-03	7.0E-03
	Total:	1.5E-01	8.6E-02

(a) Sport and commercial fishing.
(b) Shoreline activities, swimming and boating combined.
(c) Vegetation and leafy vegetables combined.

5.3 EFFECTS OF LIQUID CHEMICAL AND BIOCIDAL DISCHARGES

The expected impacts of chemical and biocidal discharges at the construction permit stage were presented in the ER-CP in Subsections 5.4.3 and 5.4.4 and in the NRC Final Environmental Statement (FES). Since that time additional water quality data have been collected and are presented in Sections 2.4 and 3.6. The expected chemical releases to the Chehalis River via the cooling tower blowdown are described in Section 3.6 and summarized in Table 3.6-1. This section covers the effects of such discharges on aquatic life.

Table 5.3-1 presents the potential discharge concentrations and changes in concentration of chemical constituents in the Chehalis River at the downstream mixing zone boundary (see Subsection 5.1.1) for the low river flow condition.[a] The table shows that the expected discharge concentrations are less than the effluent limitation guidelines (40 CFR Part 423) and the NPDES Permit limitations. An exception is the maximum value for nickel which results primarily from a high concentration (10 μg/l) in the makeup water (see Table 3.6-1).

A comparison between the present Environmental Protection Agency (EPA) water quality criteria[1,2] and the chemical concentrations at the edge of the mixing zone reveals that all parameters for which criteria exist are less than the criteria with the exception of average values (at 440 cfs river flow) for cadmium, lead and mercury and the maximum value for copper. In regard to the concentration of cadmium, lead and mercury, operation of WNP-3 does not include the chemical addition of these parameters; however, they may be present due to concentration of the makeup water. Moreover, the average upstream ambient Chehalis River values for these metals may exceed water quality criteria (Table 5.3-1). In fact, the concentrations of average cadmium, lead and mercury at the edge of the mixing zone are all less than 0.2 μg/l above ambient levels upstream of the discharge.

5.3.1 Copper

Some of the WNP-3 auxiliary heat exchangers (totaling 90,000 sq ft) are made with copper and nickel alloy tubes. Therefore, copper and nickel releases in the discharge come from two sources: the makeup water, and corrosion and/or erosion of the heat-exchange tubes. Copper levels in the Chehalis River upstream of the intake wells range from <1.0 to 8.0 μg/l(see Section 2.4). The 2
discharge level for copper may range from 21.5 to 61.3 μg/l (Table 5.3-1). The copper concentrations at the edge of the mixing zone are greatly reduced by dilution; the concentration ranges from 3.9 to 13.3 μg/l at the edge of the mixing zone with the river at the very low flow of 440 cfs.

(a) Thermal and chemical dilution studies assumed a once-in-10-yr, 7-day low flow of 440 cfs as reported in Subsection 2.5.1 of the ER-CP. Reanalysis, including the most recent flow data for the site area, has shown this flow to be 530 cfs as noted in Subsection 2.4.1.1.

A literature review on the biological effects of copper in aquatic environments was prepared in 1978 by Chu et.al.[3] In assessing the impacts of chemical discharges the salmonids are the most important species economically and recreationally. A review of copper toxicity data indicates that the salmonids, particularly steelhead/rainbow trout (Salmo gairdneri), are among the most sensitive and most frequently tested species.[3]

Most toxicity studies on salmonids have been performed with the early life stages, ranging from egg to juvenile. However, the discharge plume from the WNP-3 cooling tower blowdown does not intersect any known spawning areas. Therefore, the discharge is not expected to affect the incubation success of salmonids in the Chehalis River. Nevertheless, the toxicity studies of the early life stages are described below.

Shaw and Brown[4] observed that rainbow trout eggs could hatch after fertilization in a solution containing 1000 ug/l copper; however, this exposure level increased time to hatching. Grande[5], in studying the effects of copper sulfate on eggs and fry in the yolk-sac stage for rainbow trout, brown trout (Salmo trutta), and Atlantic salmon (Salmo salar), found that copper reduced egg hatching. Furthermore, copper inhibited egg development at 1| about the same concentration as was toxic to fry--40 to 60 ug/l at 21 days. Concentrations as low as 20 ug/l appeared to have a sublethal effect (i.e., unwillingness to feed). In another study that compared eggs and yolk-sac fry, Hazel and Meith[6] concluded that eggs were more resistant than fry to the 1| toxic effects of copper. From a continuous-flow bioassay using chinook salmon, the authors reported that copper concentrations of 80 ug/l had little effect on the hatching success of eyed eggs; acute toxicity to fry was observed at 40 ug/l, while increased mortality and inhibition of growth was shown at 20 ug/l.

Chapman[7], also using a continuous-flow bioassay method, tested the relative resistance to copper, zinc, and cadmium of newly-hatched alevins, swim-up fry, parr and smolts of chinook salmon and steelhead trout. Chapman found that steelhead trout were consistently more sensitive to these metals than were chinook salmon. His results are summarized in Table 5.3-2.

Finlayson and Verrue[8] determined an 83-day LC_{10} (lethal concentration to 10 percent of the organisms) of 64 ug/l copper for chinook salmon eggs, alevins and swim-up fry. Similar studies by Finlayson and Ashuckian[9] determined a 60-day LC_{10} of 33 ug/l copper for steelhead trout eggs, alevins, and swim-up fry.

A number of studies have demonstrated that copper toxicity is related to water hardness and alkalinity. In general, copper toxicity is roughly inversely proportional to water hardness[6,10-13]. The work of Lloyd and Herbert[14] illustrates the relationship between lethality and total hardness or alkalinity (see Figure 5.3-1). When hardness increases over a range of 15 to 320 mg/l, a corresponding increase in the LC_{50} is observed with rainbow trout and chinook salmon.

References for Section 5.3 (contd.)

34. Becker, C. D. and T. O. Thatcher, Toxicity of Power Plant Chemicals to Aquatic Life, Battelle, Pacific Northwest Laboratories, Richland, Washington, 1973, 221 pp.

TABLE 5.3-1

POTENTIAL CHANGE IN CHEHALIS RIVER WATER QUALITY RESULTING FROM WNP-3 DISCHARGES

	Chemical in ppm	River Ambient (a) Ave	River Ambient (a) Max	Discharge Ave	Discharge Max	Edge of Mixing Zone (River @ 440 cfs) Ave	Edge of Mixing Zone (River @ 440 cfs) Max	Effluent Limitations (b) Ave	Effluent Limitations (b) Max	Water Quality Criteria (c) Ave	Water Quality Criteria (c) Max
	Calcium	6.6	8.4	72.0	97.1	13.1	17.3				
	Magnesium	1.9	2.4	25.8	35.4	4.3	5.7				
	Sodium	4.4	5.4	36.0	164	7.6	21.3				
2	Potassium	0.55	0.76	4.20	5.70	0.91	1.25				
	Chloride	5.6	7.9	25.2	31.7	7.6	10.3				
	Fluoride	--	--	0.68	0.90						
	Sulfate	4.0	5.1	300	560	33.6	60.6				
	Phosphorus	0.039	0.073	0.85	1.66	0.12	0.23	5.0	5.0		
	Ammonia N	0.016	0.026	0.08	0.19	0.02	0.04				
	NO_3 and NO_2 -N	0.63	1.15	3.06	4.01	0.87	1.44				
	Oil and Grease	2.5	14.0	1.0	1.0	2.3	12.7				
	T.R. Chlorine	--	--		0.05		0.005		0.05		0.002
	Alkalinity (as $CaCO_3$)	28	38	76	86	33	43				
	Hardness (as $CaCO_3$)	29	38	324	360	58	70				
2	TDS	75	89	735	883	141	168				
	TSS	18	370	6	8	16.8	334				
	pH	7.0	7.5	7.1	8.5			6.5-8.5			
	Metals in ppb										
	Barium	10.0	22.0	24.0	78.2	11.4	27.6				
	Cadmium	0.1	0.5	0.6	1.4	0.2	0.6			0.007	1.0
	Chromium	1.2	10.8	23.1	28.4	3.4	12.6		100		
	Copper	2.0	8.0	21.3	61.3	3.9	13.3	30	65	5.6	8.5
	Iron	860	7400	183	665	792	6726		1000		
	Lead	4.0	36.0	6.0	7.5	4.2	33.1			0.2	49.5
	Manganese	29.0	80.0	8.2	27.8	27.0	74.8				
	Mercury	0.4	1.3	1.2	4.5	0.5	1.6			0.2	4.1
2	Nickel	1.0	14.0	18.6	74.6	2.7	20.1		65	36	849
	Zinc	5.0	37.0	31.2	56.9	7.6	39.0		75	47	138

[a] Complied from 1980 Environmental Monitoring Program (Reference 2.2-4) and 1980-1981 Metals Monitoring Program (Reference 2.4-6)
[b] From EPA Effluent Guidelines (40 CFR Part 423) or WNP-3 NPDES Permit (see Appendix A)
[c] References 5.3-1 and 5.3-2

sensitivity of detection, radiochemical procedures will be used. Radiochemical procedures in this type of program serve mainly to separate or concentrate the radionuclide of interest from the inorganic or organic matrix in preparation for counting.

The following paragraphs describe the general program to be instituted, including the expected types of samples, collection frequency, and analysis to be accomplished on each sample type. The preoperational (i.e., prior to loading of fuel) phase of the REMP is summarized in Table 6.1-7. Planned sample locations are shown in Figure 6.1-2. Final details of the program will not be determined until just prior to implementation.

6.1.5.1 Airborne Radiation

Airborne iodine and particulates will be sampled by continuous low volume air samplers with a flow rate of approximately 1 ft^3/min. Radioiodine will be collected via charcoal canisters fitted in series with a glass fiber filter for particulate collection.

The particulate filters will be changed weekly and analyzed for gross beta (beta analysis will occur no sooner than 24 hours from time of collection to allow for radon and thoron daughter decay). Filters composited quarterly by location, will be analyzed for gamma emitting nuclides. Individual weekly filters will have gamma isotopic analysis performed only if gross beta results are ten times the mean of the control location. Charcoal canisters will be analyzed weekly for ^{131}I.

The air sampling network will consist of at least five stations indicated on Table 6.1-7. Particulate sampling will be initiated at least one year before fuel load and radioiodine analysis will begin at least six months before fuel load.

6.1.5.2 Direct Radiation 2

Direct radiation levels will be measured by a TLD (thermoluminescent dosimeter) system consisting of at least 40 stations. The TLDs will be located on an inner ring at a radius of approximately one mile and an outer ring at a radius of about four to five miles. Other stations will be at controls and special areas of interest.

Duplicate TLD sets will be placed at each location. One set will be exchanged on a quarterly basis; the other set of dosimeters will be collected annually. At least two years of preoperational TLD data will be collected.

6.1.5.3 Waterborne Radiation

2 River water will be sampled upstream and downstream of the discharge. These water samples will be collected using an automatic sampler; small volumes will be collected intermittently and composited over a one-month period. The composite sample will receive a gamma isotopic analysis monthly and will be composited for tritium analysis quarterly. Water monitoring will begin at least one year before fuel loading.

Groundwater will be sampled on a quarterly grab-sample basis from a domestic well of a nearby resident south of the Chehalis River. This sample will receive gamma isotopic and tritium analysis.

Sediment samples will be collected semi-annually from a fishing area on
2 the north bank of the Chehalis River about 1 to 3 miles downstream from the discharge diffuser. Gamma isotopic analysis will be performed on the samples.

6.1.5.5 Ingestible Products

2 Milk samples will be collected from four locations. Three will be at milk animal locations having the highest dose potential. A control sample will be collected from a milk animal in the vicinity of Chehalis, Washington. The milk samples will be collected twice a month during pasture season and once a month during the remainder of the year. Gamma isotopic analysis will be performed on all samples; ^{131}I analysis will be performed by radiochemical separation on all samples collected during the pasture season. Milk sampling will begin one year prior to WNP-3 operation, and analyses of ^{131}I will start six months before operation.

Three fish samples will be collected semi-annually. Two will be taken
2 near the plant discharge and one at a control location (possibly on the Wynoochee River or Wishkah River). Gamma isotopic analysis will be performed on the edible portions of the fish.

One sample of each principal class of food products (fruit, root vege-
2 table, leafy vegetable) from areas downstream (which are irrigated by surface water from the Chehalis River) will be taken monthly or at harvest times when available. A control sample of a similar fruit/ vegetable will be collected in the community of Chehalis.

TABLE 6.1-7

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Sample Media	Location	Sampling Frequency[a]	Analysis Type	Analysis Frequency
Airborne				
Radioiodine[b] Particulates[c]	Samples from 5 locations: 3 samples from offsite in 3 different sectors having highest calculated annual average groundlevel D/Q	Continuous sampling with weekly collection	Radioiodine: ^{131}I	Weekly
	1 in the vicinity of community (Elma) having highest calculated annual average groundlevel D/Q		Particulates: Gross Beta[d]	Weekly
			Gamma Isotopic [e]	Weekly Composite by location, quarterly
	1 control in Chehalis, 30 miles SE of the site			
Direct Radiation[f]	A minimum of 40 stations as follows:	Quarterly and Annually	Gamma dose	Quarterly and Annually
	An inner ring of stations in each of 16 sectors in the general vicinity of the site boundary.			
	An outer ring of 16 stations in each sector in the range of four to five miles from the site.			
	The balance of the stations (8) in areas of special interest (e.g., population centers, schools) including 2 controls. One control near Chehalis approximately 30 miles SE and one near Aberdeen approximately 17 miles west.			

TABLE 6.1-7 (contd.)

	Sample Media	Location	Sampling Frequency[a]	Analysis Type	Analysis Frequency
	Waterborne				
	River Water[c]	Upstream and downstream of the discharge	Composite[g] for month	^{3}H	Quarterly composite
				Gamma Isotopic[e]	
	Groundwater[c]	Nearby resident domestic well	Quarterly grab sample	^{3}H	Quarterly
				Gamma Isotopic	Quarterly
2	Sediment[f]	1-3 miles downstream from discharge	Semi-annually	Gamma Isotopic	Semi-annually
	Ingestion				
	Milk[h]	4 locations as follows: Samples from 3 different locations within 3 miles distance having highest calculated dose potential	Semi-monthly during grazing season; monthly at other times	Gamma Isotopic[c] ^{131}I [b]	Semi-monthly; monthly
		A control to be collected near Chehalis			
	Fish[f]	2 in vicinity of discharge.	Semi-annually	Gamma Isotopic (edible portion)	Semi-annually
		1 control - Wynoochee or Wishkah River			
2	Fruit and Vegetables[f]	1 sample of each principal food product from areas irrigated downstream and a control in the vicinity of Chehalis	Monthly during growing season	Gamma Isotopic	Monthly

TABLE 6.1-7 (contd.)

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[a]Deviation may be required if samples are unobtainable due to hazardous conditions, seasonal availability, malfunction of automatic sampling equipment, or other legitimate reasons. All deviations will be documented in the annual report.

[b]Minimum six months preoperational sampling.

[c]Minimum one year preoperational sampling.

[d]Particulate sample filters will be analyzed for gross Beta after at least 24 hours decay. If gross Beta activity is greater than 10 times the mean of the control sample, gamma isotopic analysis should be performed on the individual sample.

[e]Gamma isotopic means identifications and quantification of gamma emitting radionuclides that may be attributable to the effluents of the facility.

[f]Minimum of two years preoperational monitoring.

[g]Composite samples will be collected with equipment which is capable of collecting an aliquot at time intervals which are short relative to the compositing period.

[h]Milk samples will be obtained from farms or individual milk animals which are located in sectors with the higher calculated annual average ground-level D/Q's. If Cesium-134 or Cesium-137 is measured in an individual milk sample in excess of 30 pCi/l, then Strontium-90 analysis should be performed.

2 [i]Fruit and vegetables will be obtained, if possible, from farms or gardens which use Chehalis River water within ten miles of the discharge for irrigation and different varieties will be obtained in season. One sample each of root food, leafy vegetables, and fruit should be collected each period.

TABLE 6.1-8

SUMMARY OF RIVER ELECTROFISHING AND BEACH SEINING, 1976-1980

Station	Year	Month J	F	M	A	M	J	J	A	S	O	N	D
Fuller Bridge	1976					ES	ES	ES	ES		ES		
	1976						ES	ES	ES	S	ES	E	
	1978	E		E	ES	E	E	E	E	E	E	E	E
	1979			E	E	E	E	E	E	E	E	E	E
	1980	E	E	E	E	E	E	E	E	E	E	E	E
Satsop River	1976				S	E	ES	ES	ES	ES	S		
	1977						S	S	S	S	ES	E	
	1978	E			ES	S		E	E	E	E	E	
	1979			E	E				E	E	E	E	
	1980	E	E	E	E						E	E	
Holding Area	1976					ES	ES	ES	ES	ES	ES		
	1977				E	ES	ES	ES	ES	S	ES	E	
	1978				E	ES	ES	ES	ES	E	ES	E	
	1979			ES	ES	ES	ES	ES	ES	ES	ES	E	E
	1980	E	E	E	E	E	E	E	E	E	E	E	E
Upstream Discharge Area	1977				E	E	E	E	E		E		
	1978				E	E	E	E	E	E	E	E	E
Discharge	1977				E	E	ES	ES	ES	ES	ES		
	1977					ES	ES	ES	ES	S	ES	E	
	1978	E			E	ES	ES	ES	ES	E	ES	E	E
	1979			ES	ES	ES	ES	ES	ES	ES	ES	ES	E
	1980	E	E	E	ES	ES	ES	ES	ES	ES	ES	E	E
Downstream Discharge Area	1977				E	E	E	E	E		E		
	1978	E			E	E	E	E	E	E	E	E	
Intake Area	1976					ES	ES	ES	ES	ES	ES		
	1977				E	ES	ES	ES	ES	S	ES	E	
	1978	E			ES	ES	ES	ES	ES	E	ES	E	
	1979			ES	ES	ES	ES	ES	ES	ES	ES	E	E
	1980	E	E	E	E	E	E	E	E	E	E	E	E
Greenbanks Area	1976					ES	ES	ED	ES	ES	ES		
	1977						ES	ES	ES	S	ES		
	1978	E			E	E	E	E	E	E	E	E	E

E = Electrofishing
S = Seining

7.2 TRANSPORTATION ACCIDENTS INVOLVING RADIOACTIVITY |2

The transportation of cold fuel to the reactor, irradiated fuel from the reactor to a reprocessing plant, and solid radioactive wastes to waste burial grounds is within the scope of 10 CFR Part 51.20(g). The environmental risks of the transportation of radioactive materials to and from WNP-3 are as described by Table S-4 of 10 CFR Part 51.20.

TABLE 7.3-1

CHEMICALS STORED ONSITE

	Type	Quantity	Storage Location
	Sodium Hypochlorite Solution	Two 7,500 gallon containers	Near Cooling Towers (outside)
2	Diesel Oil	88,000 gallons 1,100 gallons	Reactor Auxiliary Building Underground adjacent to Fire Pump House Structure
	Sulfuric Acid	one 10,000 gallon container one 5,000 gallon container	Outside Water Treatment Building
	Sodium Hydroxide	one 10,000 gallon container	Inside Water Treatment Building
	Bottled Hydrogen Gas	8,000 gallons	Outside Northeast Wall of Turbine Building
	Nitrogen Gas	20,000 ft^3	Outside Northeast Wall of Turbine Building
	Oxygen Gas	12,000 ft^3	Outside Northeast Wall of Turbine Building
2	Carbon Dioxide	3 tons liquid	Outside Northeast Wall of Turbine Building
	Aqua Ammonia	15,000 gallons	Outside Reactor Auxiliary

ENVIRONMENTAL APPROVALS AND CONSULTATION

The 1970 Washington State Legislature adopted an act creating a Thermal Power Plant Site Evaluation Council (TPPSEC) to consolidate state approval and oversight of thermal power plant siting and operation. In 1976 the authority of this council was extended to all energy sources and facilities and it was renamed the Energy Facilities Site Evaluation Council (EFSEC). The Council consists of the Directors (or their designees) of the various departments of State government which have an interest in or are affected by the construction of energy facilities. The legislation creates a means by which a utility proposing to build and operate a generating plant with capacity in excess of 250 MWe can, through one proceeding, obtain certification from the State for a proposed site of such a generating facility. The issuance of the certificate is in lieu of any permit, license or similar document required for any department, agency, commission or board of the State and has therefore been termed a "one stop" licensing procedure for energy facilities. The original statute and amendments are codified in the Revised Code of Washington. The regulations adopted to implement the legislation are in Chapter 463 of the Washington Administrative Code.

As an initial step in obtaining the required approvals the Supply System filed a Site Certification Application for WNP-3 with TPPSEC in December of 1973. This application was amended in July 1974 to include a duplicate unit (WNP-5). Site Certification hearings were commenced in April 1975 and the Site Certification Agreement was signed by the Governor on October 27, 1976.

Federal licensing began with the docketing of the Construction Permit applications for WNP-3 and WNP-5 in August 1974. A Limited Work Authorization was issued for both units in April 1977 and Construction Permits were issued in April 1978. As noted in Chapter 1, construction of WNP-5 was terminated in January 1982.

Table 12.0-1 lists the permits and approvals required relative to the protection of the environment. The Bonneville Power Administration is constructing the transmission lines and will operate the Satsop Substation serving the plants. BPA has responsibility for all approvals and NEPA requirements associated with the transmission facilities.

TABLE 12.0-1

ENVIRONMENTAL PERMITS AND APPROVALS REQUIRED FOR
CONSTRUCTION AND OPERATION OF WNP-3

Agency	Authority	Permit/Approval	Date of Approval
Nuclear Regulatory Comm.	42 U.S.C. 2131 et seq., 42 U.S.C. 4321	Construction Permit No. CPPR-154	4/78
		Operating License	(6/85)
Corps. of Engineers	33 U.S.C. 403 (Sec. 10) 33 U.S.C. 1251 (Sec. 404)	Construction Permits Nos.	
		071-OYB-4-003881	4/77
		071-OYB-4-003880	5/77
		071-OYB-4-004456	3/80
		071-OYB-2-004359	5/80
		071-OYB-2-006179	7/80
		071-OYB-2-006180	9/80
		071-OYB-2-007109	5/81
		071-OYB-2-008661	6/83 | 2
Washington State Energy Facility Site Evaluation Council (EFSEC)	Chap. 80.5 R.C.W.	Site Certification	10/76
EFSEC	33 U.S.C. 466 et seq. Chap. 463-38 W.A.C.	Certification of Compliance with Water Quality Regulations (401)	
		National Pollutant Discharge Elimination System Permit (402)	9/81
State Department of Natural Resources	EFSEC Cert. Agreement Article II.A.2	Public Land Leases Nos.	
		11660	9/80
		11661	9/80
		11687	10/80
		11753	7/81