MH 1&2 ER-OL

INSTRUCTION SHEET

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the site area. Madison State Hospital currently has a 502-bed capacity and a staff of approximately 550 (Williams 1982). Clifty Falls State Park had approximately 200,000 visitors during 1980, and the annual number of visits is expected to continue at about the same level (Skinner 1981). The park's peak daily attendance, which occurs during July, is estimated to be between 2500 and 3000 persons. The city of Madison annually attracts approximately 200,000 visitors to its year-round cultural, historical, and recreational events. The number of visitors peaks around July 4, when an estimated 75,000 to 100,000 people attend the Madison regatta (Renschler 1981). Approximately half the enrollment at Hanover College lives outside the area during the summer months and returns for the fall semester. The college enrollment was 997 in 1981, with a staff of 77 (Hanover College 1981). During the construction period from 1982 through 1988, the average work force at Marble Hill 1&2 is estimated to be 2565, which includes both construction workers and PSI employees. The peak annual work force, including about 850 PSI personnel, will be about 5,000 and will occur in late 1983 or early 1984. At the end of construction, the Nuclear Division staff will be composed of approximately 725 employees, including both plant operations and Nuclear Division technical support personnel. | 1

The best estimate of transient population on the Ohio River is the number of barges and boats passing through McAlpine Dam, 1-o cated approximately 37 miles downstream of the Marble Hill site. In 1980, traffic through McAlpine Dam included 40,795 barges, 5,246 tows, 515 noncommercial (mostly recreational) boats, and 15 passenger vessels (U.S. Army Corps of Engineers 1981a).

Approximately 2 miles southeast of Marble Hill 1&2 on the Kentucky side of the Ohio River, Louisville Gas and Electric Company (LG&E) is constructing a two-unit, 990 MW fossil-fueled plant, the Trimble County Generating Station. Development of the station will result in a transient population of 660 people during peak construction, and 160 people during operation. Construction of Unit 1 is scheduled to end in 1985, and of Unit 2 in 1989 (Sommers 1981). The majority of the construction work force (660 people out of 695) is commuting from the Louisville area to Trimble County, Kentucky. Approximately 35 construction workers and their families are expected to relocate to Trimble County. Only 160 of the 350 operating personnel are expected to commute from existing residences. The remaining 190 people are expected to relocate to the site vicinity (USEPA 1978, p. 3-67).

Indianapolis Power and Light is constructing Patriot Generating Station approximately 40 miles northeast of the Marble Hill site. The first of the three 650 MW units is scheduled to be on-line in October 1990. A peak construction work force of 950 and 154 permanent operating personnel are planned for Unit 1 (Berlier 1982). Because of the distance of this station from Marble Hill 1&2, it is not expected to significantly affect transient population in the site area.

2.1.3 Uses of Adjacent Lands and Waters

2.1.3.1 Land Use

The topography of the area surrounding the Marble Hill site varies considerably. On the Indiana side of the Ohio River, tracts of farmland alternate with woodland on the flat to gently rolling terrain. Near the Ohio River, however, the land becomes very hilly and slopes steeply along the major drainage courses to form ravines and bluffs. These slopes are densely forested until they reach the floodplain, which is flat and relatively open. The floodplain in Kentucky is also bordered by steep, wooded bluffs, but farther from the river the terrain continues as a rugged series of ridges and valleys. Elevations range from 420 feet above mean sea level (MSL) along the Indiana floodplain to approximately 900 feet above MSL in northeastern Trimble County, Kentucky.

ER-OL Figure 2.1-2 shows traffic volumes and rail lines within 10 miles of Marble Hill 1&2. The highest traffic volume within this area is on Indiana Route 56/62 between Hanover and Madison. In 1982, average daily traffic volume on this segment was approximately 9400; other parts of State Route 62 average 3300 to 5300 vehicles per day (Jester 1982; Kentucky Department of Transportation 1979). Construction traffic on Marble Hill/Bower Road is estimated to be 4000 vehicles per day during peak construction.

Agriculture is the predominant activity in the five counties that are partially within 10 miles of Marble Hill 1&2 (Jefferson, Clark, and Scott in Indiana, and Oldham and Trimble in Kentucky). Raising corn, soybeans, hay, and tobacco, along with livestock rearing, are the leading agricultural activities. The five counties have approximately 50% to 80% of their total land area in farms, and approximately 10% to 20% in woodland pasture and rangeland. ER-OL Tables 2.1-7 through 2.1-13 show agricultural statistics for the five-county region.

ER-OL Table 2.1-14 shows statistics for the major crops raised for human consumption in the counties within 50 miles of Marble Hill 1&2. ER-OL Table 2.1-14A shows statistics for the major crops raised for animal feed in the counties within 50 miles of Marble Hill 1&2. ER-OL Tables 2.1-15 through 2.1-17 show the estimated production of beef, pork, and milk within 50 miles of the station in each directional sector. 1

There are no schools within 5 miles of Marble Hill 1&2. The closest schools are an elementary school and a high school in New Washington, Indiana, approximately 5.5 miles to the west-southwest. In 1980-1981 the two schools had a combined enrollment of 747 students and a combined staff of 44. The 1980-1981 enrollment and staff at all schools within approximately 10 miles of the station are shown in ER-OL Table 2.1-18.

There are no prisons within 10 miles of Marble Hill 1&2. There are no hospitals, nursing homes, day care centers, or preschools within 5 miles of the station, but several of these institutions are located within approximately 10 miles. The most recent available information on the capacity, staff, and locations of these institutions is shown in ER-OL Table 2.1-18A. 1

Except for the Trimble County Generating Station, under construction 2 miles to the southeast, there are no industrial

discharge will be diluted about 1,174 times. Based on an annual average Ohio River flow of 116,000 cfs, the annual average discharge of 5.9 cfs will be diluted approximately 19,661 times. The travel time to the first surface water intake, the Louisville Water Company intake located 25 miles downstream, is about 17 hours for an average river flow, based on a flow rate of 2.15 feet per second.

Available recent data on recreational fishing in the Ohio River are presented in ER-OL Subsection 2.2.1.3.6.4. Data on commercial mussel fishing in the Ohio River are presented in the following paragraphs.

The Kentucky Department of Fish and Wildlife Resources is aware of no commercial mussel fishing in the Ohio River upstream of the Newberg Lock and Dam at River Mile 776 (Crowell 1983a). It thus appears that no such activity occurs within 50 miles downstream of Marble Hill 1&2, which is located at River Mile 570.

In 1981, 63 commercial mussel fishermen fished the Ohio River downstream of Newberg Lock and Dam; they harvested 569,564 pounds of shell valued at $159,478. In 1982, 28 commercial mussel fishermen fished the Ohio River downstream of Newberg Lock and Dam; they harvested 29,772 pounds of shell valued at $9,676 (Crowell 1983a). Mussels taken from the Ohio River are not usually consumed by humans (Crowell 1983b). The shells, which formerly were used for making buttons, now are used primarily by the Japanese cultured pearl industry for "seed." The Japanese demand for mussel shells fell in 1982, as reflected by the low harvest and reduced dollar value (Crowell 1983b). 1

2.1.3.2.2 Groundwater

There are nine municipal pumping centers that supply water to communities within 15 miles of Marble Hill 1&2. Five are located in Indiana: Washington Township Water Corporation; Kent Water Company; the town of Hanover and Hanover College; the town of Charlestown; and the town of Madison. Four are located in Kentucky: one in the town of Milton; and three county water districts in Trimble, Oldham, and Henry counties. Each of these municipal systems consists of two to thirteen wells. Two wells were constructed in Charlestown during 1975, increasing the capacity of the Charlestown pumping center to four wells. The populations served by each pumping center and their average daily water use are listed in Table 2.4-24.

Since the Milton, Trimble, Henry, and Oldham wells are all located on the Kentucky side of the Ohio River, the groundwater systems being utilized are separated from the groundwater systems at the Marble Hill site (see ER-CP Subsection 2.5.2 for a detailed discussion).

There are no municipal wells within 5 miles of Marble Hill 1&2, with the exception of the Trimble and Henry County Water District wells, which are 3 and 4 miles southeast of the station, respectively. These wells will not be affected by any accidental release of radicactive liquids from Marble Hill 1&2.

Two existing and two planned industrial wells are within 5 miles of Marble Hill 1&2. The two existing wells are on the Marble Hill 1&2 site and provide water to the potable, sanitary, batch plant, and makeup demineralizer systems. Louisville Gas and Electric plans to install two potable wells at their Trimble County Generating Station, located approximately 2 miles southeast of Marble Hill 1&2 on the opposite shore of the Ohio River.

During construction of Marble Hill 1&2, five domestic wells were discovered, bringing the total number of wells identified on the site to twelve. All of the twelve wells have been grouted to prevent groundwater contamination.

TABLE 2.1-14

MAJOR CROPS FOR HUMAN CONSUMPTION

STATISTICS FOR COUNTIES WITHIN 50 MILES OF MARBLE HILL 1&2

COUNTIES	CORN HARVESTED FOR GRAIN[a] TOTAL PRODUCTION (thousand kg)	CORN HARVESTED FOR GRAIN[a] YIELD$_2$ (kg/m^2)	SOYBEANS[a] TOTAL PRODUCTION (thousand kg)	SOYBEANS[a] YIELD$_2$ (kg/m^2)	WINTER WHEAT[a] TOTAL PRODUCTION (thousand kg)	WINTER WHEAT[a] YIELD$_2$ (kg/m^2)
INDIANA						
Bartholomew	163,393	0.50	33,192	0.23	27,523	0.34
Brown	8,138	0.51	615	0.19	109	0.27
Clark	59,004	0.55	19,775	0.21	3,851	0.26
Crawford	17,948	0.55	3,500	0.20	465	0.23
Dearborn	31,701	0.63	10,023	0.20	2,270	0.24
Decatur	337,714	0.75	27,333	0.26	18,219	0.34
Floyd	7,575	0.56	2,466	0.19	1,388	0.26
Harrison	83,113	0.58	13,564	0.22	10,366	0.30
Jackson	200,067	0.53	30,639	0.22	14,601	0.28
Jefferson	53,030	0.54	16,955	0.19	3,650	0.24
Jennings	98,953	0.56	10,655	0.21	7,188	0.28
Lawrence	70,582	0.57	8,347	0.18	3,886	0.29
Ohio	9,310	0.53	1,671	0.20	476	0.19
Orange	89,219	0.58	3,176	0.18	5,536	0.29
Ripley	126,523	0.63	25,544	0.20	10,836	0.26
Scott	55,565	0.65	9,376	0.23	1,979	0.26
Switzerland	17,702	0.56	4,801	0.18	1,622	0.25
Washington	15513	0.62	7,596	0.19	11,752	0.26
KENTUCKY						
Anderson	4,013	0.50	--	--	476	0.24
Boone	11,839	0.50	1,393	0.22	--	--
Bullitt	11,756	0.56	3,146	0.23	621	0.26
Carroll	4,214	0.50	1,225	0.20	--	--
Franklin	5,476	0.48	495	0.17	--	--
Gallatin	3,813	0.50	762	0.19	--	--
Grant	5,144	0.51	--	--	--	--
Henry	24,964	0.53	958	0.22	849	0.26
Jefferson	13,132	0.59	5,715	0.20	1,470	0.30
Nelson	40,937	0.50	5,095	0.17	5,171	0.26
Oldham	26,153	0.62	3,592	0.20	2,613	0.27
Owen	5,487	0.50	--	--	--	--
Scott	16,866	0.52	2,351	0.22	449	0.22
Shelby	56,924	0.56	7,664	0.22	4,354	0.27
Spencer	21,878	0.55	2,526	0.22	806	0.25
Trimble	8,535	0.50	2,667	0.24	1,524	0.27
Woodford	11,685	0.58	667	0.24	--	--

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See notes on last page of table.

TABLE 2.1-14 (Cont'd)

COUNTIES	OATS		BURLEY TOBACCO[a]		IRISH POTATOES[b]	
	TOTAL PRODUCTION (thousand kg)	YIELD (kg/m^2)	TOTAL PRODUCTION (thousand kg)	YIELD (kg/m^2)	TOTAL PRODUCTION (thousand kg)	YIELD (kg/m^2)
INDIANA						
Bartholomew	299	0.19	--	--	--	--
Brown	0	0.00	--	--	4	0.33
Clark	135	0.17	--	--	181	1.54
Crawford	65	0.16	--	--	19	1.52
Dearborn	135	0.17	--	--	74	1.84
Decatur	248	0.20	--	--	5	--
Floyd	67	0.16	--	--	120	0.74
Harrison	276	0.17	--	--	71	1.36
Jackson	221	0.18	--	--	--	-
Jefferson	225	0.19	--	--	71	0.84
Jennings	138	0.17	--	--	--	--
Lawrence	210	0.17	--	--	10	1.28
Ohio	62	0.15	--	--	--	--
Orange	459	0.19	--	--	--	--
Ripley	298	0.15	--	--	58	2.06
Scott	65	0.16	--	--	4	--
Switzerland	306	0.19	--	--	127	2.62
Washington	688	0.19	--	--	17	0.86
KENTUCKY						
Anderson	--	--	1,512	0.26	2	--
Boone	--	--	1,431	0.25	505	1.76
Bullitt	--	--	534	0.24	182	1.29
Carroll	--	--	1,549	0.24	--	--
Franklin	--	--	2,419	0.27	13	1.09
Gallatin	--	--	899	0.24	99	--
Grant	--	--	2,537	0.25	86	3.56
Henry	--	--	4,333	0.28	--	--
Jefferson	--	--	313	0.23	131	1.08
Nelson	--	--	2,062	0.26	24	0.59
Oldham	--	--	748	0.28	--	--
Owen	--	--	3,628	0.27	196	1.56
Scott	--	--	4,396	0.27	4	1.10
Shelby	--	--	5,341	0.28	43	0.98
Spencer	--	--	1,854	0.24	59	--
Trimble	--	--	1,635	0.26	87	--
Woodford	--	--	4,368	0.27	--	--

1

See notes on last page of table.

TABLE 2.1-14 (Cont'd)

COUNTIES	BARLEY FOR GRAIN OR SEED[b] TOTAL PRODUCTION (thousand kg)	BARLEY FOR GRAIN OR SEED[b] YIELD (kg/m^2)	SORGHUM FOR GRAIN OR SEED[b] TOTAL PRODUCTION (thousand kg)	SORGHUM FOR GRAIN OR SEED[b] YIELD (kg/m^2)
INDIANA				
Clark	61	0.24	--	--
Decatur	371	0.42	106	0.26
Floyd	27	0.29	--	--
Harrison	572	0.27	458	0.49
Jackson	--	--	410	0.37
Jefferson	309	0.37	--	--
Switzerland	12	0.15	--	--
Washington	134	0.27	59	--
KENTUCKY				
Bullitt	127	0.27	--	--
Jefferson	158	0.22	--	--
Nelson	227	0.22	--	--
Oldham	645	0.20	19	0.07
Shelby	--	--	15	--

Notes: Values represent harvest for most recent year for which data are available.

Hyphens, "---", indicte data not available because not reported.

[a]Source: Indiana Crop and Livestock Reporting Service (1981); Kentucky Crop and Livestock Reporting Service (1981).

[b]Source: U.S. Department of Commerce (1981d, Tables 28-30).

TABLE 2.1-14A

MAJOR CROPS FOR ANIMAL FEED

STATISTICS FOR COUNTIES WITHIN 50 MILES OF MARBLE HILL 1&2

COUNTIES	ALL HAY[a] TOTAL PRODUCTION (thousand kg)	ALL HAY[a] YIELD (kg/m^2)	CORN FOR SILAGE[b] TOTAL PRODUCTION (thousand kg)	CORN FOR SILAGE[b] YIELD (kg/m^2)	SORGHUM FOR SILAGE[b] TOTAL PRODUCTION (thousand kg)	SORGHUM FOR SILAGE[b] YIELD (kg/m^2)
INDIANA						
Bartholomew	14,878	0.56	17,280	4.12	--	--
Brown	8,165	0.56	--	--	--	--
Clark	22,952	0.47	14,958	4.10	504	2.59
Crawford	18,597	0.52	3,733	3.35	--	--
Dearborn	29,302	0.56	8,198	3.39	699	4.21
Decatur	18,325	0.61	45,681	4.35	618	1.70
Floyd	9,435	0.47	--	--	--	--
Harrison	41,095	0.49	14,561	3.50	--	--
Jackson	22,226	0.52	26,818	4.01	535	1.97
Jefferson	21,591	0.47	12,615	3.50	585	4.02
Jennings	12,701	0.54	9,368	3.58	--	--
Lawrence	41,730	0.54	11,893	3.34	--	--
Ohio	9,798	0.45	6,838	3.91	--	--
Orange	26,036	0.52	51,515	4.20	--	--
Ripley	26,853	0.54	24,634	3.81	--	--
Scott	10,070	0.49	6,466	4.08	--	--
Switzerland	16,239	0.45	13,004	3.60	1,429	3.30
Washington	45,904	0.52	38,475	3.87	--	--
KENTUCKY						
Anderson	17,055	0.40	16,848	3.48	--	--
Boone	25,129	0.47	18,691	3.73	164	--
Bullitt	17,599	0.40	15,324	3.74	--	--
Carroll	9,079	0.38	5,492	3.73	--	--
Franklin	18,688	0.36	7,361	3.36	--	--
Gallatin	9,072	0.45	6,192	3.36	--	--
Grant	22,317	0.43	8,231	4.24	136	1.98
Henry	45,359	0.47	40,772	3.83	518	1.27
Jefferson	20,775	0.43	7,098	3.31	--	--
Nelson	57,697	0.45	75,898	3.46	924	2.24
Oldham	20,593	0.45	26,782	3.59	--	--
Owen	29,846	0.43	17,641	3.96	211	2.08
Scott	33,566	0.38	12,927	4.02	--	--
Shelby	64,682	0.43	100,533	3.55	850	2.47
Spencer	25,038	0.40	36,435	3.28	560	1.87
Trimble	12,428	0.43	2,942	3.99	--	--
Woodford	35,652	0.43	23,377	3.30	485	--

Notes: Values represent harvest for most recent year for which data are available.

Hyphens, "---", indicte data not available because not reported.

[a]Source: Indiana Crop and Livestock Reporting Service (1981); Kentucky Crop and Livestock Reporting Service (1981).

[b]Source: U.S. Department of Commerce (1981d, Tables 28-30).

TABLE 2.1-18A

OTHER INSTITUTIONS WITHIN APPROXIMATELY
10 MILES OF MARBLE HILL 1&2

INSTITUTION	LOCATION/DISTANCE[m]	NUMBER OF STAFF	CAPACITY
NURSING HOMES			
Trimble County Nursing Center[a]	Bedford, KY 7 miles E	40	60 beds
Hanover Nursing Home[b]	Hanover, IN 7.8 miles N	90-100	151 beds
Madison Nursing Home[c]	Madison, IN 10.7 miles NNE	26	40 beds
Clifty Convalescent Center[d]	Madison, IN 10.7 miles NNE	60	116 beds
Mayfield Nursing Home[e]	Madison, IN 10.7 miles NNE	24	32 beds
DAY CARE CENTER			
The Children's House[f]	Madison, IN 10.7 miles NNE	4	12-20 children
PRESCHOOLS			
Hanover Cooperative Preschool[g]	Hanover, IN 7.8 miles N	2	40 students
Headstart, Madison State Hospital[h]	Madison, IN 10.7 miles NNE	5 full time 3 part time	50 students
North Madison Preschool[i]	Madison, IN 10.7 miles NNE	2	26 students (2-3 classes per day)
Presbyterian Preschool[i]	Madison, IN 10.7 miles NNE	2	10-22 students[n]

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TABLE 2.1-18A (Cont'd)

INSTITUTION	LOCATION/DISTANCE[m]	NUMBER OF STAFF	CAPACITY
HOSPITALS			
King's Daughters' Hospital[k]	Madison, IN 10.7 miles NNE	332	140 beds
Madison State Hospital [l]	Madison, IN 10.7 miles NNE	550	502 beds

Sources: [a]Siers 1983; [b]Wolfschag 1983; [c]Anderson 1983; [d]Lemm 1983; [e]Williamson 1983; [f]Lester 1983; [g]Palmer 1983; [h]Black 1983; [i]Sauley 1983; [j]Applegate 1983; [k]Scott 1982; [l]Williams 1983

[m]Distance and direction from the midpoint between Marble Hill Units 1 and 2 to the center of the town in which the institution is located.

[n]The number of students at the Presbyterian Preschool is expected to double (to 20-40) in 1984.

abundant green and blue-green algal growth at Station 5 resulted in a qualitative difference (low Morisita community similarity index values) between periphyton communities at this station as compared to Stations 1 and 3. This qualitative difference was most likely related to habitat differences including lower current velocity and a greater degree of shading at Station 5 than at Station 1 or 3.

Periphyton density and biomass was also variable in Little Saluda Creek. Minimal density and biomass occurred in 1979 and 1980. Although these reductions were not statistically significant, they coincided with changes observed in the benthic macroinvertebrates. Dominant periphyton species also changed during this period. These changes suggested possible plant construction effects from increased sedimentation in the creek. However, these changes were short term and were no longer apparent in 1981.

2.2.1.3.5 Benthic and Drift Macroinvertebrates

The benthic and macroinvertebrate faunas sampled during the 1977-1981 monitoring period at the Marble Hill site were composed of oligochaete worms, molluscs, small crustaceans, immature insects, flatworms, hydrozoans, and mites. No species listed as endangered or threatened by the U.S. Fish and Wildlife Service (1982) or the Indiana Department of Natural Resources (1978) has been collected since monitoring began. No commercially valuable species has been collected. From 1977 through 1981, a total of 33,249 individuals of 177 benthic and macroinvertebrate taxa was collected (see ER-OL Table 2.2-15). |1

2.2.1.3.5.1 Seasonal Variation at Ohio River Stations - Benthos

The benthic fauna at the Ohio River stations sometimes had a very patchy distribution. Mean benthic density ranged from 49 individuals/m^2 at Station 1 to 1676/m^2 at Station 5 (see ER-OL Figure 2.2-43). Density was lowest at all stations in March and highest in either August or November. When data were analyzed on a seasonal basis, March density was found to be significantly lower than densities in any other month.

Biomass at Ohio River stations was lowest in March and highest in November (see ER-OL Figure 2.2-44). Biomass varied over a very wide range and was heavily influenced by the presence or absence of molluscs. Because molluscs are relatively larger and more heavy-bodied than other benthic species, they contribute proportionately more to biomass than to density.

The most common mollusc species was the Asiatic clam Corbicula fluminea. Biomass was significantly lower in March than in any other month.

Mean diversity at Ohio River stations was lowest in March, ranging from 0.83 to 1.17, and highest in November, ranging from

categorized as sport or commercial species in the Ohio River (Preston and White 1978, p. 7). Sport fishes included white bass, rock bass, green sunfish, pumpkinseed, warmouth, bluegill, longear sunfish, smallmouth bass, spotted bass, largemouth bass, white and black crappie, and sauger. Commercial fishes included smallmouth and black buffalo, channel catfish, and freshwater drum. No species listed as endangered or threatened by the U.S. Fish and Wildlife Service (1982) or the Indiana Department of Natural Resources (1978) has been collected. |1

Of the 36 species collected during 1977-1981, 28 were also collected during the baseline study (see ER-OL Table 2.2-23). The difference in the number of species collected during the baseline and 1977-1981 monitoring periods was most likely related to differences in the level of sampling effort and time span represented and not to construction activities at the Marble Hill site. During 1977-1981 monitoring, the total number of fish species collected ranged from 22 in 1980 to 27 in 1977, with no consistent increasing or decreasing trends in the number of species among years. Also, fish community composition changed very little during 1977-1981 (see ER-OL Table 2.2-24). In general, plant construction activities have not had any measurable effect on the composition of fish communities in the Ohio River near the Marble Hill site.

2.2.1.3.6.1.1 Predominant Fish Species

Gizzard shad was the most abundant fish collected. This species made up 28.2% of the total number of fishes and 8.5% of the total weight (see ER-OL Tables 2.2-22 and 2.2-25). No appreciable differences in percentage composition by number or weight of gizzard shad were observed among the Ohio River stations.

Emerald shiner was the second most abundant fish collected. This species accounted for 17.8% of the total number of fishes found and only 0.1% of the total weight (see ER-OL Tables 2.2-22 and 2.2-25). The percentage composition by number of emerald shiner varied considerably among the Ohio River stations. These differences are due to different habitat characteristics at the stations and to the chance occurrence of large numbers of this schooling species at a particular station. No appreciable differences in percentage composition by weight of emerald shiner were observed among the Ohio River stations.

Channel catfish accounted for 9.2% by number and 19.7% by weight of the total fish collected (see ER-OL Tables 2.2-22 and 2.2-25). No appreciable differences in percentage composition by number or weight of channel catfish were observed among the Ohio River stations.

2.2.1.3.6.1.2 Predominant Fish Groups

Percentage composition by number and weight was also calculated for each of the more commonly collected taxonomic groups of

Variation in CPUE of fishes among months and among years were caused by naturally occurring monthly or yearly cycles, and not by plant construction activities.

2.2.1.3.6.4 Recreational Fishing in the Ohio River

As part of a continuing evaluation of the sport fishery of the Ohio River, the Fisheries Division of the Kentucky Department of Fish and Wildlife Resources conducted a creel survey from February 11 through November 1, 1981, near the McAlpine Locks and Dam at River Mile 607, approximately 37 miles downstream of the Marble Hill site. The area surveyed was 93 acres of the tailwater of the dam. The survey was conducted during one weekday and one weekend day per week. 1

According to the published results of this survey (Jackson 1982, pp. 39-47), most of the fishing pressure was on the Indiana side of the river, because the lock is located on the Kentucky side, and also because the "Falls," a Devonian age coral reef, is located on the Indiana shore. The results of this survey are reproduced in their entirety in ER-OL Tables 2.2-28A and 2.2-28B.

2.2.1.3.7 Fish Eggs and Larvae

2.2.1.3.7.1 Fish Eggs

2.2.1.3.7.1.1 Seasonal Variations

Fish eggs were generally found from April through August (see ER-OL Figure 2.2-66). The highest egg densities usually occurred during June, although the month of peak egg density varied somewhat from year to year (see ER-OL Figure 2.2-67). Egg densities were found to be significantly higher during June than during March, April, July, or August. May egg densities were found to be significantly higher than egg densities in March, April, or August. Finally, July egg densities were significantly higher than either March or April egg densities.

Densities of fish eggs were highest during 1977 (see ER-OL Figure 2.2-66). Egg densities during 1977 were significantly higher than either 1979 or 1980 egg densities. Egg densities during 1978 and 1981 were significantly higher than 1980. Egg densities decreased from a high of 0.042 egg/m^3 in 1977 to a low of 0.011 egg/m^3 in 1980 and then increased to near 1977 levels in 1981. This cycle was most likely due to natural physical or spawning stock variations and not to plant construction activities.

Natural physical variations such as the amount of river flow among years or differences in water temperature resulting from the length of the preceding winter are factors that affect the initiation and duration of spawning in fishes (Lagler et al. 1962, p. 289). Accordingly, certain species may spawn earlier or

later depending on the river conditions during any particular year. In addition, some species produce large quantities of eggs during relatively short periods of time, and their peak spawning may have occurred between scheduled sampling periods. In general, the monthly and yearly variations in egg densities observed in the study area were normal for Ohio River fish populations.

2.2.1.3.7.1.2 Spatial Variations

No statistically significant differences in egg densities were found among stations or depths. However, certain biologically important trends in egg density were observed. Egg densities were found to gradually decrease from 0.035 egg/m^3 at Station 1 to 0.016 egg/m^3 at Station 14 and from 0.035 egg/m^3 at the bottom of 0.023 egg/m^3 at the surface (see ER-OL Figure 2.2-68). These trends probably occur because of eggs settling to the bottom and eggs hatching as they drift downstream. The latter of these two explanations was supported by the increasing trend in larval

TABLE 2.2-28A

EXPANDED CREEL SURVEY TOTALS FROM THE CREEL SURVEY CONDUCTED AT McALPINE POOL TAILWATER FROM FEBRUARY 11 THROUGH NOVEMBER 1, 1981

Anglers	
Total count (trips)	17,105
% successful	16.7
Fishing Pressure	
Total man-hours (m-h)	23,740
M-h/acre	255.3
Harvest (Yield)	
Number of fish	6,146
No./acre	66.1
Pounds	4,378
Lb/acre	47.1
Catch Rate	
Fish/hour	0.72
Lb/hour	0.25
Misc. Characteristics (%)	
Male	93.7
Female	6.3
Resident	81.3
Non-resident	18.6
Boat	1.1
Bank	98.9
Method (%)	
Still fishing	72.9
Casting	27.1
Fly fishing	--
Trolling	--
Other	0.1

Source: Jackson (1982, Table 3, p. 44).

TABLE 2.2-28B

HARVEST OF SELECTED SPECIES FROM McALPINE POOL TAILWATER DERIVED FROM EXPANDED CREEL SURVEY DATA COLLECTED BETWEEN FEBRUARY 11 AND NOVEMBER 1, 1981

	CRAPPIE	SAUGER	WHITE BASS	CHANNEL CATFISH	FRESHWATER DRUM	CARP	ANYTHING [a]
Total number	487	834	185	226	4,102	212	4,984
% of total catch	7.9	13.6	3.0	3.7	66.7	3.4	81.1
Total weight (lb)	131	498	150	493	2,736	345	3,500
% of total weight	3.0	11.4	3.4	11.3	62.5	7.9	79.9
No. anglers fishing for	94	2,452	0	187	0	0	14,345
% of total anglers	0.5	14.3	0	1.1	0	0	83.9
Hr. fished by fishing for	221	2,778	0	294	0	0	20,407
No. caught fishing for	307	762	0	18	0	0	4,984
Lb. caught fishing for	88	451	0	52	0	0	3,500
No./hr. caught fishing for	1.39	0.27	0	0.06	0	0	0.24
% success fishing for	73.2	15.0	0	9.6	0	0	17.3

Source: Jackson (1982, Table 4, p. 45).

[a]Includes all species caught by "anything" fishermen having no preference.

2.4 HYDROLOGY

The information for the introductory paragraphs is unchanged from the information presented in the introductory paragraphs to ER-CP Section 2.5 except that the terrain around the plant site varies from 750 to 800 feet above mean sea level. The latter elevation was incorrectly stated in the ER-CP.

2.4.1 Surface Water Hydrology

The information for this section is unchanged from the information presented in Subsection 2.5.1 of the Marble Hill 1&2 ER-CP, except as noted in the following subsections, whose titles correspond to those of the applicable subsections of the ER-CP.

2.4.1.1 Ohio River Basin Characteristics

The information for this subsection is unchanged from the information presented in ER-CP Subsection 2.5.1.1, except that Little Saluda Creek empties into the Ohio River about 4000 feet northeast of the plant site. The direction was incorrectly stated in the ER-CP.

2.4.1.2 Ohio River Flow Characteristics

The information for this subsection is unchanged from the information presented in ER-CP Subsection 2.5.1.2, except as noted in the following paragraphs.

The nearest USGS stream gauging station on the Ohio River upstream of the site is at Markland Dam at river mile 531.5. Stream gauging records at this station are available from 1970 to the present time. The data from 1975 to 1980 are presented in Tables 2.4-1 through 2.4-6 of this report. The annual average of 10 years of stream flow at this station is 127,100 cfs. The maximum daily discharge of 542,000 cfs was recorded on March 17, 1978, and the minimum daily discharge of 6,810 cfs on June 13, 1976.

The nearest USGS stream gauging station on the Ohio River downstream from the site is at Louisville, Kentucky, at river mile 607.3. Stream gauging records at this station are available from 1928 to the present time. The data from 1975 to 1980 are presented in Tables 2.4-7 through 2.4-12 of this report. The annual average of 52 years of stream flow at this station is 116,000 cfs. Maximum and minimum flows at this station were reported in Subsection 2.5.1.2 of the ER-CP.

The flood prone area due to the 1% probability flood in the Ohio River in the vicinity of the Marble Hill site is shown in Figure 2.4-A. This figure was reproduced from the United States Geological Survey flood prone area map for Bethlehem Quadrangle, Indiana-Kentucky (U.S. Geological Survey 1971). Figure 2.4-B 1

shows the flood hazard area of the Ohio River as delineated by the Federal Insurance Administration (U.S. Department of Housing and Urban Development 1978, 1980). Figures 2.4-A and 2.4-B show the flood prone areas before the construction of Marble Hill 1&2.

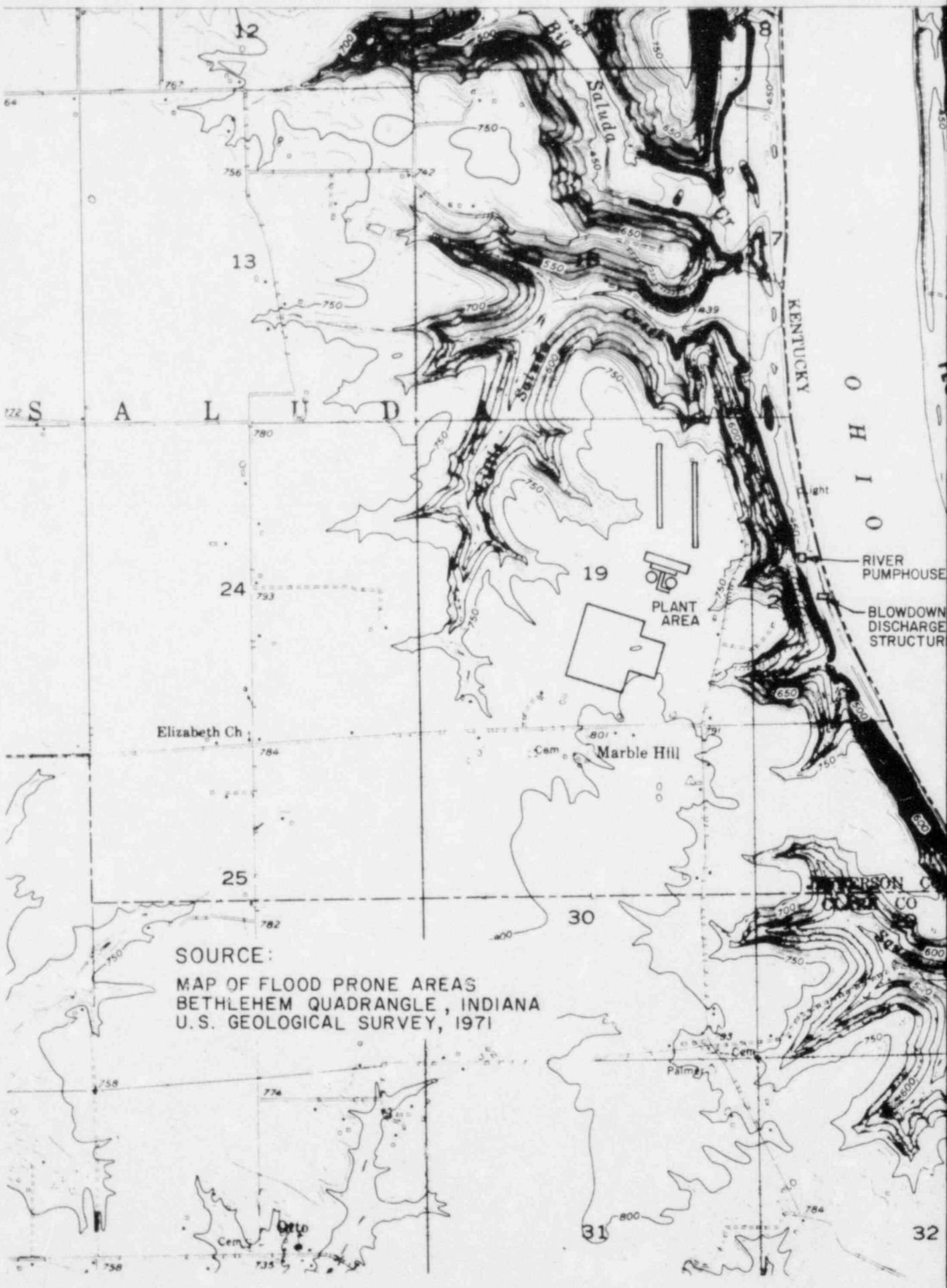
The main plant structures, river pumphouse, and blowdown discharge structure constructed for Marble Hill 1&2 are also shown in Figures 2.4-A and 2.4-B. It is evident from these figures that the main plant area, including most of the plant-related facilities, does not alter the floodplain of the Ohio River or its tributaries, and hence does not affect the flood prone areas.

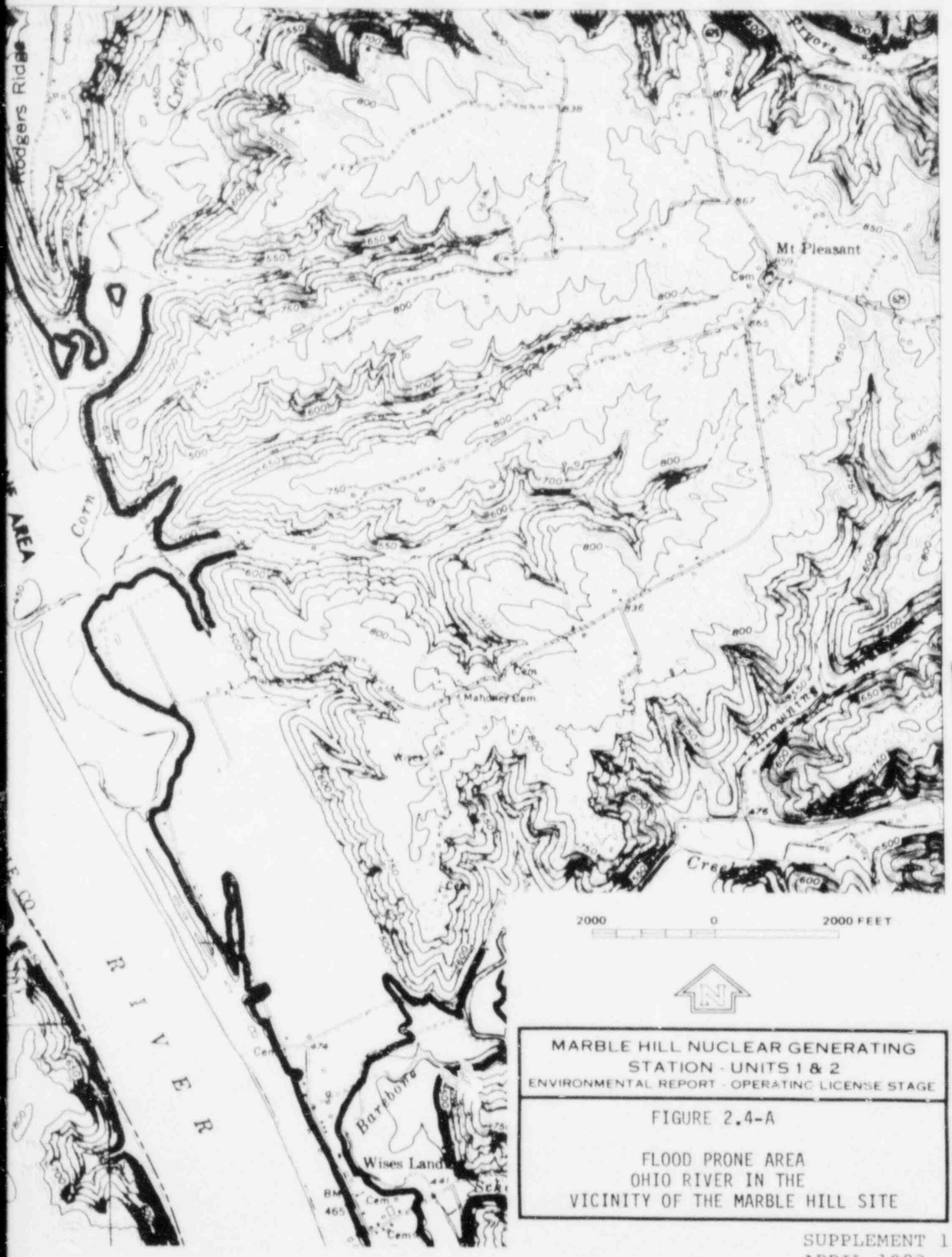
The river pumphouse and the blowdown discharge structure are the only plant-related facilities that might have a detectable effect on flood levels. They are located in the floodplain of the Ohio River, near River Mile 570, as shown in Figures 2.4-A and 2.4-B. The river pumphouse and the approach road to the pumphouse occupy a small portion of the Ohio River floodplain as shown in Figure 2.4-C. The intake to the pumphouse is by submerged intake screens connected to the pumphouse by pipelines buried under the existing grade of the floodplain. The blowdown into the river is by submerged discharge through a buried pipeline that extends into the river. Therefore, the blowdown discharge structure and intake pipelines do not affect the flood prone area.

The 100-year flood elevation in the Ohio River at the location of Marble Hill 1&2 was computed by backwater analysis, starting from a section at River Mile 604, upstream of McAlpine Dam near Louisville, Kentucky. The river cross sections were obtained from the U.S. Army Corps of Engineers, Louisville District. The 100-year flood flow in the Ohio River at McAlpine Dam is 812,000 cfs (Federal Emergency Management Agency 1980), and this flow was used for the river reach from Louisville to the Marble Hill River pumphouse. The 100-year flood elevation in the river near the river pumphouse was computed to be 459.6 feet, before the construction of the river pumphouse. Backwater computations with the river pumphouse in place also gave a flood level of 459.6 feet, demonstrating that there was no significant effect of the construction of the river pumphouse on the 100-year flood level in the river. Also, as may be seen from Figure 2.4-C, at the 100-year flood elevation of 459.6 feet, the cross-sectional area of the river before construction of the river pumphouse is 165,351 square feet, and the area of encroachment due to river pumphouse is 1,829 square feet, which is only 1.1% of the original area. Hence, it is concluded that the construction of Marble Hill 1&2 and related facilities has no significant effect on flood flows or flood levels in the Ohio River or any other stream, upstream or downstream of the Marble Hill site. 1

No debris is expected to be generated at the Marble Hill site. Debris accumulation on the plant structures is not expected;

hence, there is no potential effect on downstream flood prone areas. | 1

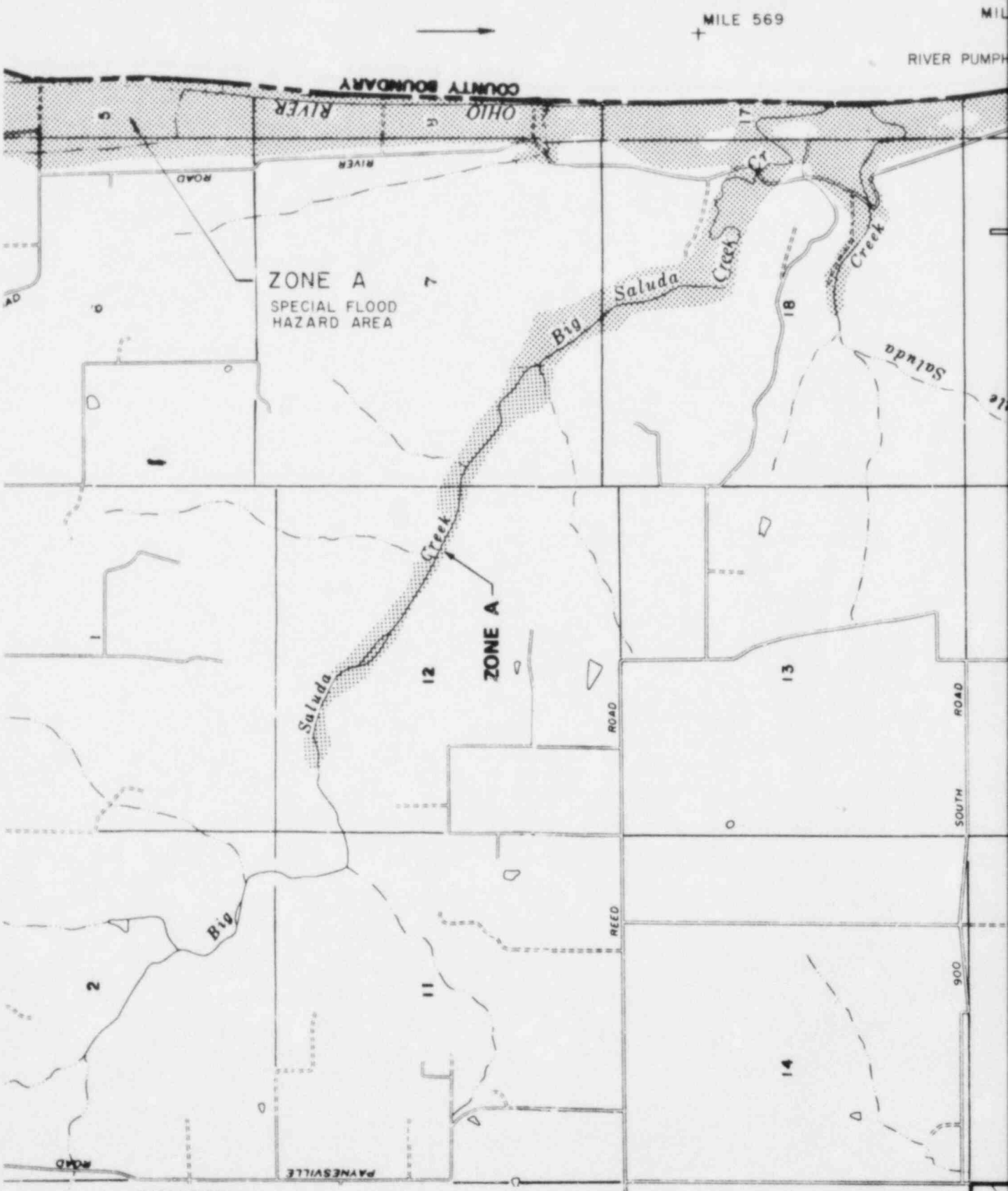

12
13
24
25
30
31
32
8
7
S A L U D
Saluda
Big
Saluda
Creek
KENTUCKY
O H I O
RIVER
PUMPHOUSE
PLANT
AREA
BLOWDOWN
DISCHARGE
STRUCTUR
Elizabeth Ch
Cem
Marble Hill
Cem
Otto
Cem
Palmyra
SOURCE:
MAP OF FLOOD PRONE AREAS
BETHLEHEM QUADRANGLE, INDIANA
U.S. GEOLOGICAL SURVEY, 1971



MARBLE HILL NUCLEAR GENERATING STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT - OPERATING LICENSE STAGE

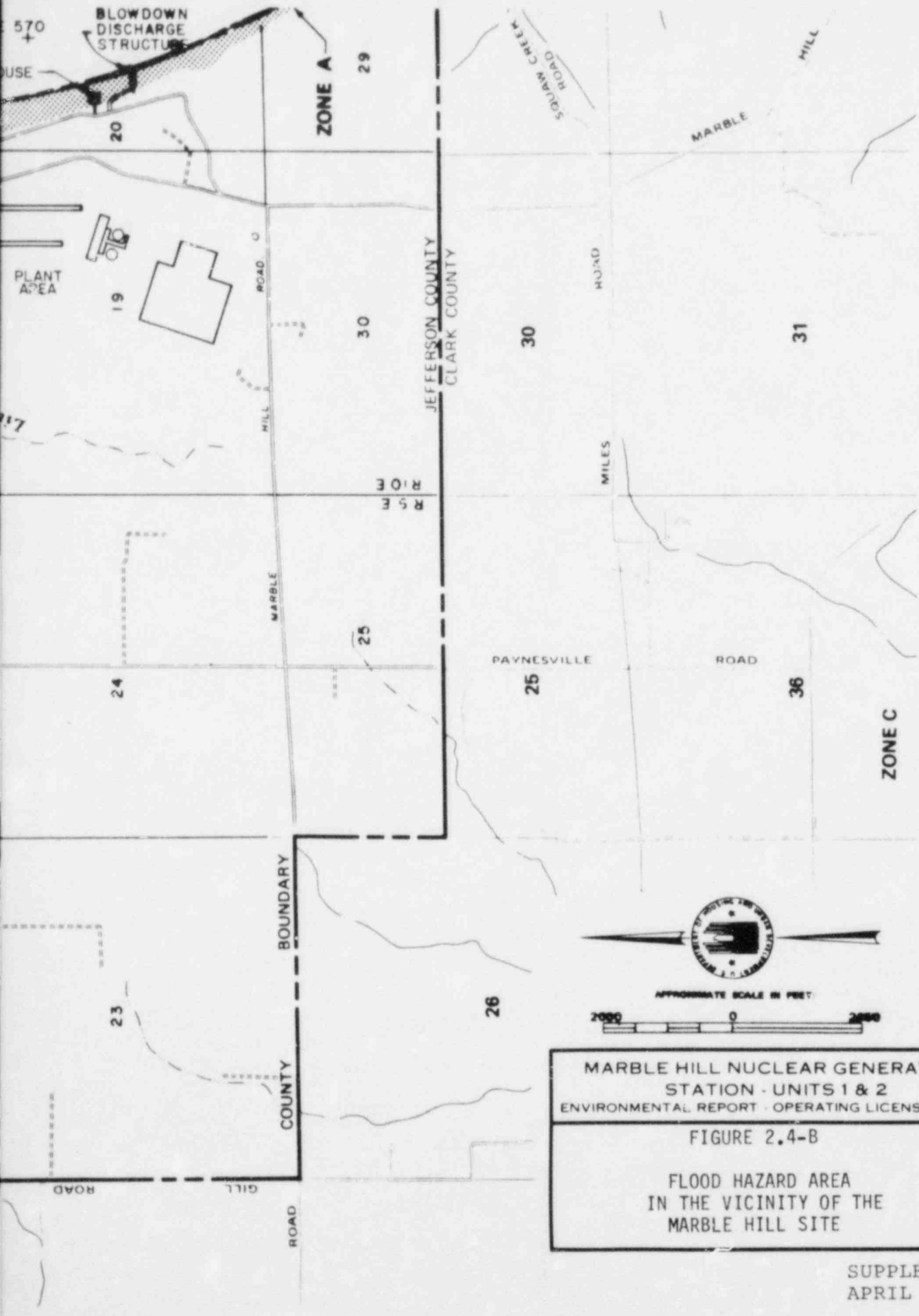
FIGURE 2.4-A

FLOOD PRONE AREA
OHIO RIVER IN THE
VICINITY OF THE MARBLE HILL SITE



SOURCE:

FLOOD HAZARD BOUNDARY MAP
JEFFERSON COUNTY, INDIANA
P.7 of 7, COMMUNITY PANEL 1801040007A
FEDERAL INSURANCE ADMINISTRATION
U.S. DEPT. of HOUSING and URBAN
DEVELOPMENT, APRIL 7, 1978



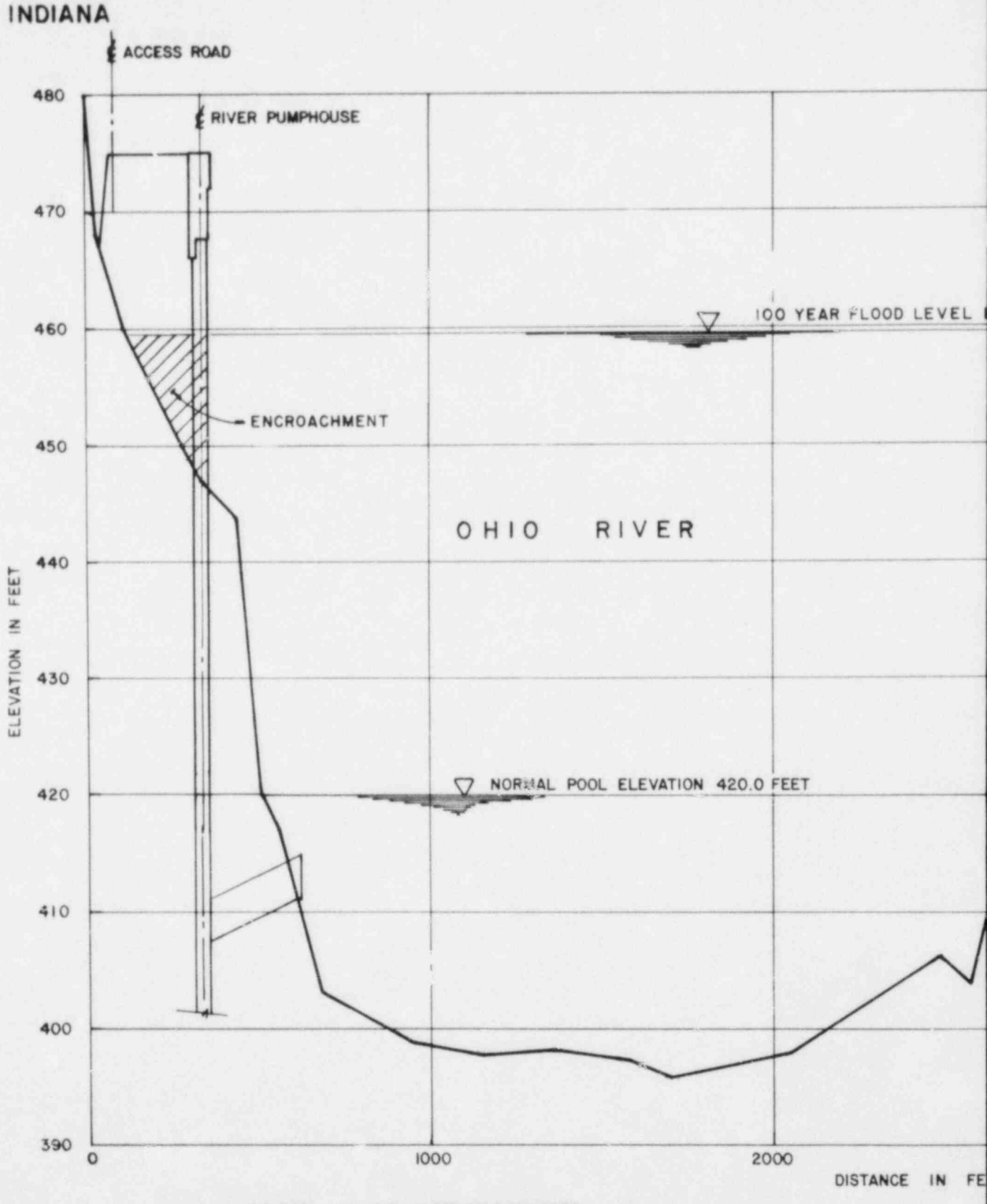
MARBLE HILL NUCLEAR GENERATING STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT - OPERATING LICENSE STAGE

FIGURE 2.4-B

FLOOD HAZARD AREA
IN THE VICINITY OF THE
MARBLE HILL SITE

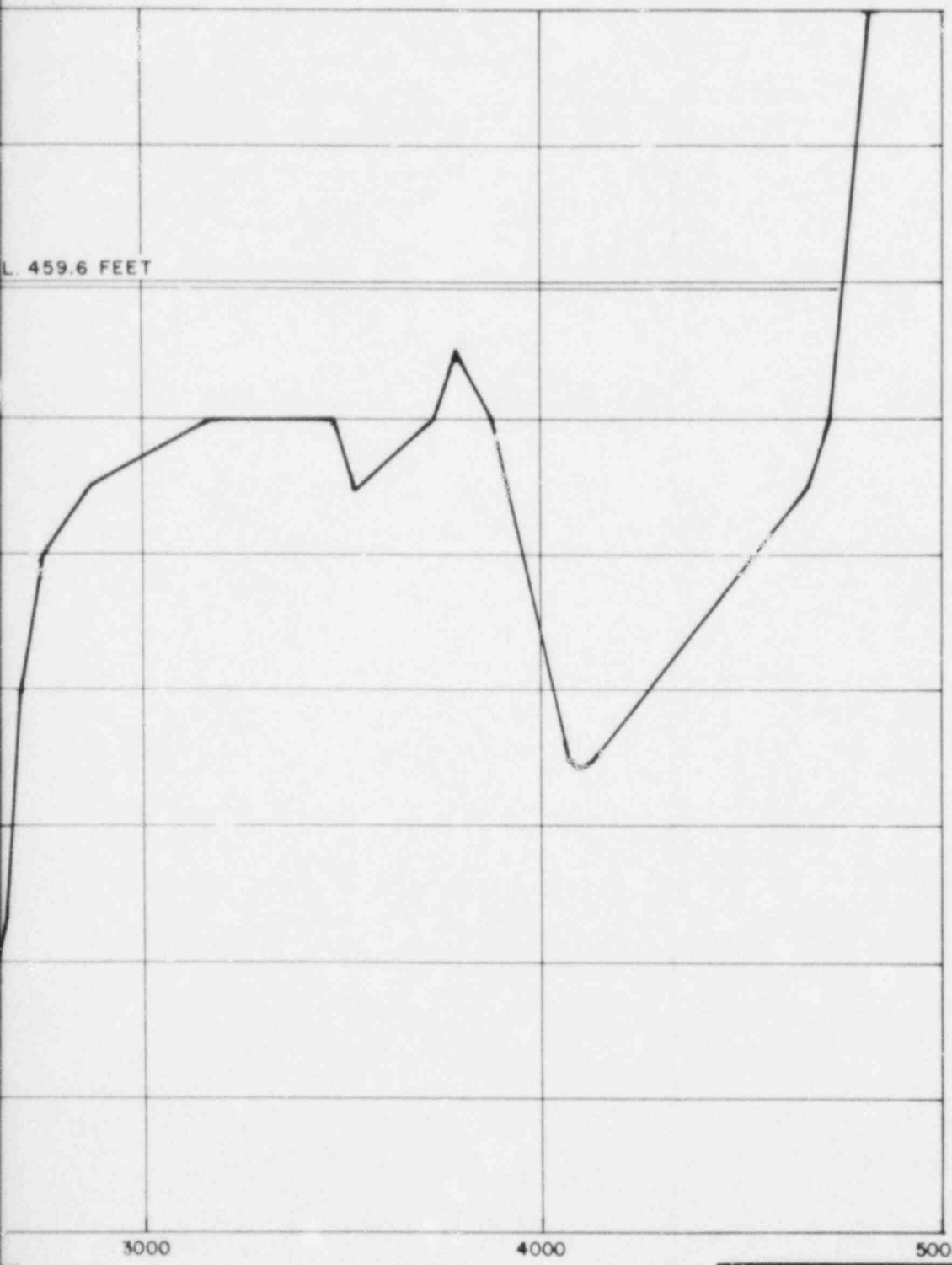
SUPPLEMENT 1
APRIL 1983

1



SOURCE: U.S. ARMY CORPS OF ENGINEERS
MAP OF OHIO RIVER, McALPINE
POOL REACH, SHEET 17, JAN. 1964.

KENTUCKY



SUPPLEMENT 1
APRIL 1983

MARBLE HILL NUCLEAR GENERATING STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT - OPERATING LICENSE STAGE

FIGURE 2.4-C

OHIO RIVER CROSS SECTION
AT RIVER PUMPHOUSE

CONTENTS (Cont'd)

TABLE 3.6-1

STATION CHEMICAL USAGE

CHEMICAL	USAGE	ASSUMED FREQUENCY	MAXIMUM QUANTITY (lb/yr)
Sulfuric Acid (H_2SO_4) (93%)[a]	Circulating Water	Continuous	7.3×10^6
	Nonessential Service Water	Continuous	d
	Essential Service Water	Continuous	5.1×10^5
	Makeup Demineralizer Regeneration	4 hr/day	4.0×10^5
	Radwaste MBD Regeneration	10 hr/week	8.9×10^3
	Blowdown MBD Regeneration	18 hr/week	6.2×10^4
	Condensate Polisher Regeneration[c]	30 hr/week	1.6×10^5
Sodium Hypochlorite (NaOCl) (15%)[b]	Circulating Water	60 min/day	2.2×10^6
	Nonessential Service Water	60 min/day	1.3×10^5
	Essential Service Water	60 min/day	4.9×10^4
	Potable Water	Continuous	2.3×10^2
	Sanitary Wastes	Continuous	2.3×10^2
Sodium Hydroxide (NaOH) (25%)[a]	Makeup Demineralizer Regeneration	4 hr/day	4.8×10^5
	Radwaste MBD Regeneration	10 hr/week	5.2×10^4
	Blowdown MBD Regeneration	18 hr/week	3.8×10^5
	Condensate Polisher Regeneration[c]	30 hr/week	5.5×10^5

Notes: Quantities apply to Units 1 and 2. The chemicals listed are those that could appear (as breakdown products) in detectable quantities in the blowdown.

[a]Percent (%) by weight.

[b]150 grams/liter.

[c]Based on normal operation.

[d]Included in circulating water use.

CHAPTER 5.0 - ENVIRONMENTAL EFFECTS OF STATION OPERATION

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5.2.4 Dose Rate Estimates for Man

Annual doses to persons due to radioactivity in the liquid and gaseous effluents released from Marble Hill 1&2 have also been estimated. Examples of the dose calculation models may be found in ER-OL Appendix 5.2A. The results of the calculations are described in the following subsections.

5.2.4.1 Liquid Pathways

Expected annual releases of radionuclides in liquid effluents from Marble Hill 1&2 are given in ER-OL Table 3.5-1. The calculation of radiological doses to persons exposed to these effluents was performed according to "Models and Computer Codes for Evaluating Environmental Radiation Doses" (Soldat et al., 1974). Activity concentrations in the cooling tower blowdown were calculated assuming an annual average blowdown flow of 2.95 cfs for one unit. Dilution of radionuclides in the Ohio River was taken into account as described in ER-OL Subsection 5.2.2.1.

Estimated annual average doses to the maximum-exposure individual exposed to radioactive liquid effluents from Marble Hill 1&2 were calculated for the fish consumption, drinking water, and recreational exposure pathways, using the standard consumption and use factors shown in ER-OL Table 5.2-7. These doses are shown in ER-OL Table 5.2-8. Actual doses are expected to be lower because of the conservative nature of the factors and assumptions used to calculate the doses shown in Table 5.2-8.

Since there is no known permanent use of Ohio River water for irrigation of crops or livestock consumption within 50 miles of Marble Hill 1&2, this dose pathway was not considered. |1

5.2.4.2 Gaseous Pathways

Expected annual releases of radioactive noble gases and particulates from Marble Hill 1&2 are shown in ER-OL Table 3.5-2, and estimated offsite doses to individuals from these effluents are given in ER-OL Table 5.2-4. Doses were calculated using the methodology of USNRC Regulatory Guide 1.109, Revision 1 (1977b, pp. 1-80).

Calculational models are discussed in ER-OL Appendix 5.2A. Plume immersion, exposure to contaminated surfaces, inhalation, and ingestion pathways were all considered. Standard consumption factors for the ingestion pathways are given in ER-OL Table 5.2-7 (USNRC 1977b, pp. 1-80). An 8-month grazing period was assumed for milk and meat animals.

5.2.4.3 Direct Radiation from Facility

The annual average external dose rates due to direct radiation exposure were estimated assuming normal station operation. Estimated dose rates in the vicinity of the station are given in ER-OL Table 5.2-9. The sources considered were the nitrogen-16 in the primary coolant and the radioactive contents of the storage tanks holding refueling water, primary water, and secondary water. All other major and potential contained sources are below grade level or surrounded by protective shields and can be considered to contribute a negligible amount to the total dose rate.

Standard techniques of geometric and material attenuation were used in the calculations. Credit was taken for the concrete in the containment walls and the air between the source and dose point, but no credit was taken for partial occupancy or for local shielding provided by buildings and dwellings and by steel tank walls and liners.

The population exposure due to direct radiation from the station was estimated based on the projected population within 50 miles of Marble Hill 1&2 in the year 2030. This calculation yielded a negligible annual population exposure of 0.012 man-rem/yr for the operation of Marble Hill 1&2.

5.2.4.4 Annual Population Doses

The population doses from gaseous effluents to all individuals living within a 50-mile radius of Marble Hill 1&2 were calculated using population data projected to the year 2030. The estimated doses appear in ER-OL Table 5.2-10. This table shows whole-body, skin, and thyroid doses from exposure via the immersion, inhalation, and ground deposition pathways.

The population dose from direct radiation to all individuals living within a 50-mile radius of Marble Hill 1&2 was also calculated using population data projected for the year 2030; it is given in ER-OL Table 5.2-11.

The population dose resulting from natural background radiation to all individuals living within a 50-mile radius of Marble Hill 1&2 is given in ER-OL Table 5.2-11. This dose was calculated assuming a dose to individuals of 100 mrem/yr (USEPA 1977, Tables 2-2 and 2-13) and was based on population data projected for the year 2030.

5.2.5 Summary of Annual Radiation Doses

The estimated radiation doses to the regional population from all station-related sources are summarized in ER-OL Table 5.2-11.

5.2.6 Comparison of Expected Doses and Releases with Design Objectives

Comparisons of the expected annual average doses and releases from Marble Hill 1&2 with the design objectives of Appendix I to 10 CFR Part 50 and RM50-2 criteria from the Annex to Appendix I to 10 CFR Part 50 are shown in ER-OL Tables 5.2-12 and 5.2-13, respectively. Note that the Appendix I objectives are on a per reactor unit basis, while the RM50-2 criteria are for all of the units at a site. As the comparison tables show, both of these sets of design objectives are satisfied by Marble Hill 1&2. 1

As a consequence of satisfying the RM50-2 criteria, a detailed cost-benefit analysis for the liquid and gaseous radwaste treatment system is not required for Marble Hill 1&2, since the construction permit application was filed between January 2, 1971 and June 4, 1976 (See Appendix I to 10 CFR 50, Section II, Paragraph D).

TABLE 5.2-12

COMPARISON OF EXPECTED DOSES FROM MARBLE HILL 1&2

WITH APPENDIX I DESIGN OBJECTIVES

TYPE OF RELEASE	UNITS	APPENDIX I[a] OBJECTIVES	EXPECTED[b] VALUES
Liquid Effluents			
Total body dose from all pathways	(mrem)	3	0.0023
Any organ dose from all pathways	(mrem)	10	0.0018
Nobel Gas Effluents (at the site boundary)			
Gamma air exposure dose	(mrad)	10	0.018
Beta air exposure dose	(mrad)	20	0.045
Total body dose	(mrem)	5	0.011
Skin dose	(mrem)	15	0.035
Airborne Radioiodines and Particulates			
Any organ dose from all pathways	(mrem)	15	0.189

[a]Per year per reactor unit.

[b]To the maximally exposed individual from one-unit operation.

TABLE 5.2-13

COMPARISON OF EXPECTED DOSES AND RELEASES FROM MARBLE HILL 1&2

WITH RM50-2 DESIGN OBJECTIVES

TYPE OF RELEASE	UNITS	RM50-2[a] OBJECTIVES	EXPECTED[b] VALUES
Liquid Effluents			
Total body or any organ dose from all pathways	(mrem)	5	0.0046
Activity release estimate, excluding tritium	(Ci/yr)	10	0.468
Noble Gas Effluents (at the site boundary)			
Gamma air exposure dose	(mrad)	10	0.036
Beta air exposure dose	(mrad)	20	0.091
Total body dose	(mrem)	5	0.021
Skin dose	(mrem)	15	0.070
Airborne Radioiodines and Particulates			
Any organ dose from all pathways	(mrem)	15	0.378
I-131 activity release	(Ci/yr)	2	0.102

[a]Per year for all units at the site.

[b]To the maximally exposed individual from two-unit operation.

CHAPTER 8.0 - ECONOMIC AND SOCIAL EFFECTS OF PLANT CONSTRUCTION AND OPERATION

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1

1984	$ 31,300
1985	$ 30,100
1986	$ 31,200
1987	$ 14,300
1988	$ 6,800
TOTAL	$ 284,375

8.1.3.2 Employment, Payrolls, and Other Expenditures

At the end of construction, the Nuclear Division staff located on the Marble Hill site will be composed of approximately 725 employees, including 432 plant operations personnel and 293 Nuclear Division technical support personnel. The estimated Nuclear Division staff annual payroll for the first year of operation of both units (1988) is approximately $29.6 million in 1988 dollars. In addition to the Nuclear Division staff, it is estimated that 100 security personnel will be employed on the site in 1988, and that their annual payroll will total $2,577,000 in 1988 dollars. The expected operational staffing for each year from 1983 through 1988 is shown in ER-OL Table 8.1-3A. The local impact generated by the Nuclear Division staff in terms of induced employment is given in ER-OL Table 8.1-4. This table does not include any impact from security force personnel, because the security force is expected to be drawn primarily from the existing local population. 1

From the experience of Public Service Indiana with a 2500 MW coal-fired generating station in southwestern Indiana, annual local expenditures can be expected to average approximately $7 million to $8 million (1986 dollars).

Since the procurement of materials and services is based on a competitive bid system, it is difficult to accurately predict which suppliers will provide the needs of the station. Therefore, the local expenditures estimated above are contingent upon the following assumptions:

a. Approximately 20% of all expenditures are made locally, and "local" is defined as within the state of Indiana.

b. Expenditures for fuel and employee salaries are not included.

TABLE 8.1-3A

EXPECTED OPERATIONAL STAFFING FROM 1983 THROUGH 1988

PERSONNEL	MONTH/YEAR 12/83	6/84	6/85	6/86	6/87	6/88
Operations	292	329	382	409	426	432
Technical Support	433	396	343	316	299	293
Security	35	35	50	160	160	100
TOTAL	760	760	755	885	885	825

1

CHAPTER 13.0 - REFERENCES

CHAPTER 2.0

SECTION 2.1

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SUPPLEMENT 1

NRC REQUEST FOR ADDITIONAL INFORMATION

QUESTIONS AND RESPONSES

This section contains U.S. Nuclear Regulatory Commission requests for additional information based on Darrell G. Eisenhut's letter of February 23, 1983, followed by the response to each question. In some cases the response includes a reference to the applicable updated sections of the text of the ER-OL.

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QUESTION 240.1

Definition (from Executive Order 11988 Floodplain Management) of Floodplain: The lowland and relatively flat areas adjoining inland and coastal waters including floodprone areas of offshore islands, including at a minimum that area subject to a one percent or greater chance of flooding in any given year.

a. Provide descriptions of the floodplains of all water bodies, including intermittent water courses, within or adjacent to the site. On a suitable scale map provide delineations of those areas that will be flooded during the one-percent chance flood in the absence of plant effects (i.e., pre-construction floodplain).

b. Provide details of the methods used to determine the floodplains in response to a. above. Include your assumptions of and bases for the pertinent parameters used in the computation of the one-percent flood flow and water elevation. If studies approved by Flood Insurance Administration (FIA), Housing and Urban Development (HUD) or the Corps of Engineers are available for the site or adjoining area, the details of analyses need not be supplied. You can instead provide the reports from which you obtained the floodplain information.

c. Identify, locate on a map, and describe all structures and topographic alterations in the floodplains.

d. Discuss the hydrologic effects of all items identified in c. above. Discuss the potential for altered flood flows and levels, both upstream and downstream. Include the potential effect of debris accumulating on the plant structures. Additionally, discuss the effects of debris generated from the site on downstream facilities.

e. Provide the details of your analysis used in response to d. above. The level of detail is similar to that identified in item b. above.

f. The floodplain mapping should be of suitable quality for use in the Environmental Statement.

RESPONSE

Marble Hill 1&2 is located in the Ohio River basin. A description of the Ohio River and the creeks around the Marble Hill site is presented in ER-OL Section 2.4.

The flood prone area due to the 1% probability flood in the Ohio River in the vicinity of the Marble Hill site is shown in Figure Q240.1-1. This figure was reproduced from the United States Geological Survey flood prone area map for Bethlehem Quadrangle, Indiana-Kentucky (U.S. Geological Survey 1971). Figure Q240.1-2 shows the flood hazard area of the Ohio River as delineated by the Federal Insurance Administration (U.S. Department of Housing and Urban Development 1978, 1980). Figures Q240.1-1 and Q240.1-2 show the flood prone areas prior to the construction of Marble Hill 1&2.

The main plant structures, river pumphouse, and blowdown discharge structure constructed for Marble Hill 1&2 are also shown in Figures Q240.1-1 and Q240.1-2. It is evident from these figures that the main plant area, including most of the plant-related facilities, does not alter the floodplain of the Ohio River or its tributaries, and hence does not affect the flood prone areas.

The river pumphouse and the blowdown discharge structure are the only plant-related facilities that might have a detectable affect on flood levels. They are located in the floodplain of the Ohio River, near River Mile 570, as shown in Figures Q240.1-1 and Q240.1-2. The river pumphouse and the approach road to the pumphouse occupy a small portion of the Ohio River floodplain as shown in Figure Q240.1-3. The intake to the pumphouse is by submerged intake screens connected to the pumphouse by pipelines buried under the existing grade of the floodplain. The blowdown into the river is by submerged discharge through a buried pipeline that extends into the river. Therefore, the blowdown discharge structure and intake pipelines do not affect the flood prone area.

The 100-year flood elevation in the Ohio River at the location of Marble Hill 1&2 was computed by backwater analysis, starting from a section at River Mile 604, upstream of McAlpine Dam near Louisville, Kentucky. The river cross sections were obtained from the U.S. Army Corps of Engineers, Louisville District. The 100-year flood flow in the Ohio River at McAlpine Dam is 812,000 cfs (Federal Emergency Management Agency 1980), and this flow was used for the river reach from Louisville to the Marble Hill river pumphouse. The 100-year flood elevation in the river near the river pumphouse was computed to be 459.6 feet above Mean Sea Level (MSL), prior to the construction of the river pumphouse. Backwater computations with the river pumphouse in place also gave a flood level of 459.6 feet MSL, demonstrating that there was no sigificant effect of the construction of the river pumphouse on the 100-year flood level in the river. Also, as may be seen from Figure Q240.1-3, at the 100-year flood elevation of 459.6 feet MSL, the cross-sectional area of the river prior to

construction of the river pumphouse is 165,351 ft^2, and the area of encroachment due to the river pumphouse is 1,829 ft^2, which is only 1.1% of the original area. Hence, it is concluded that the construction of Marble Hill 1&2 and related facilities has no significant effect on flood flows or flood levels in the Ohio River or any other stream, upstream or downstream of the Marble Hill site.

No debris is expected to be generated at the Marble Hill site. Debris accumulation on the plant structures is not expected; hence, there is no potential effect on downstream flood prone areas.

This response has been incorported in ER-OL Subsection 2.4.1.2.

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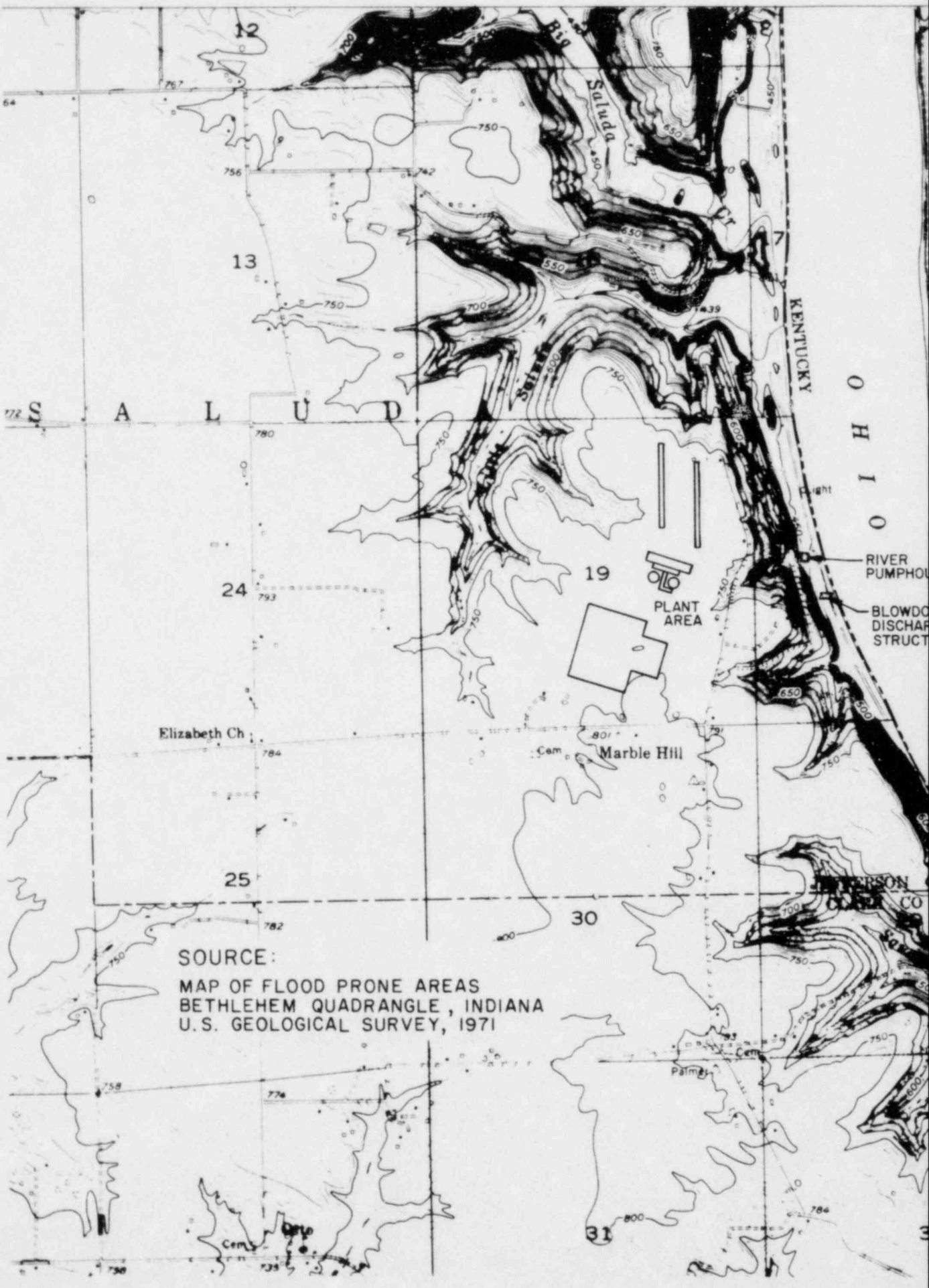
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S A L U D
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PLANT AREA
RIVER PUMPHOU
BLOWDO DISCHAR STRUCT
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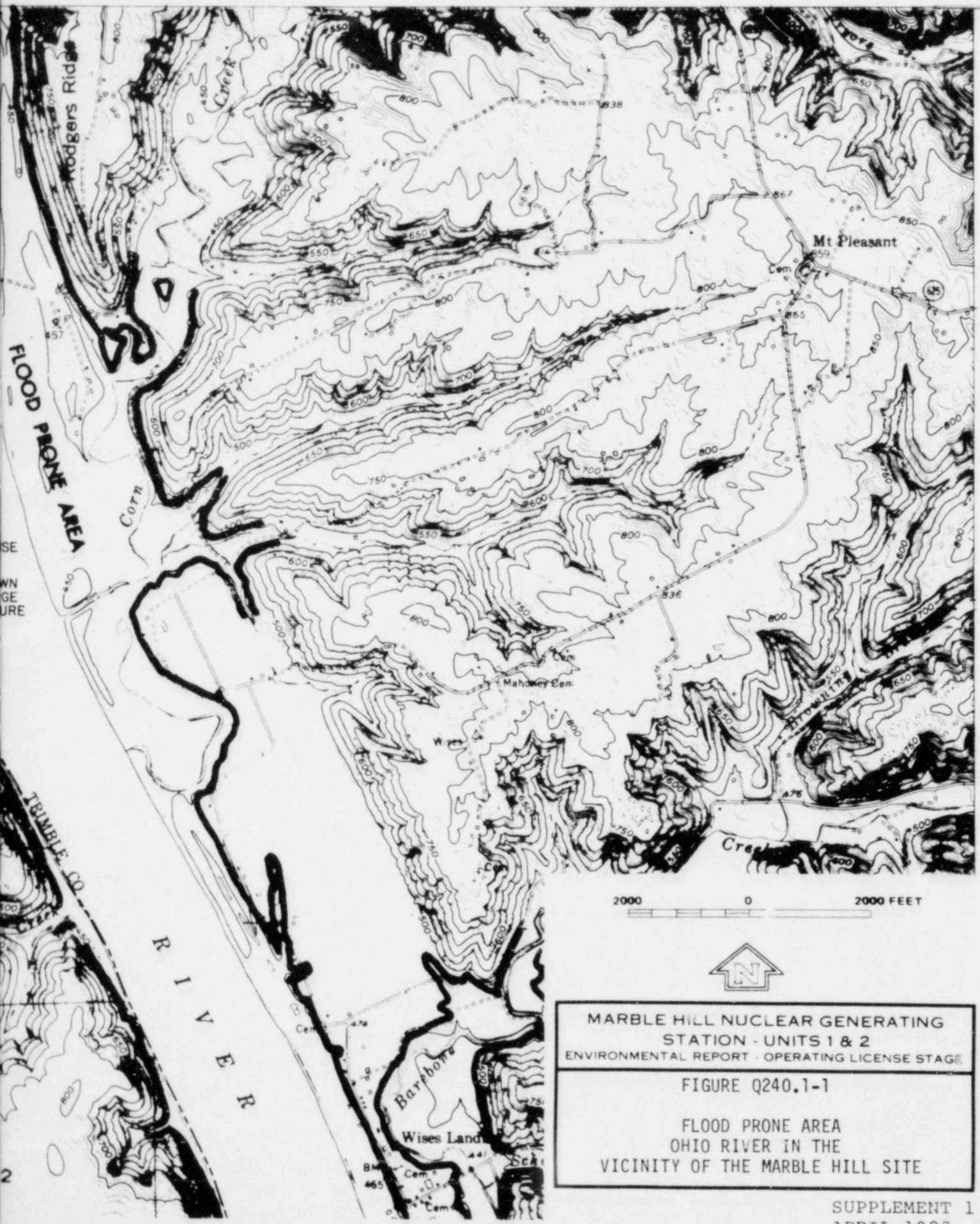
SOURCE:
MAP OF FLOOD PRONE AREAS
BETHLEHEM QUADRANGLE, INDIANA
U.S. GEOLOGICAL SURVEY, 1971

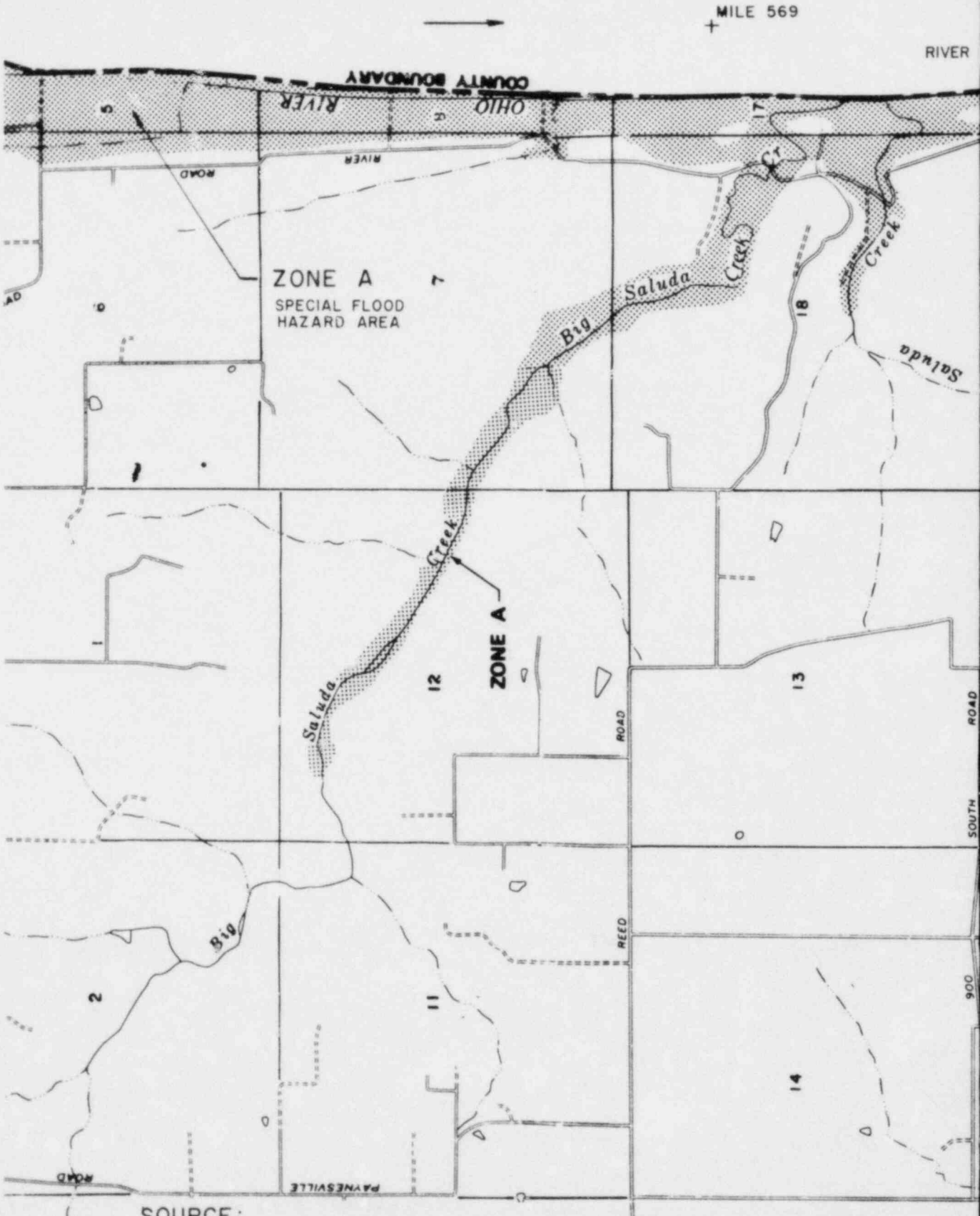


MARBLE HILL NUCLEAR GENERATING STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT - OPERATING LICENSE STAGE

FIGURE Q240.1-1

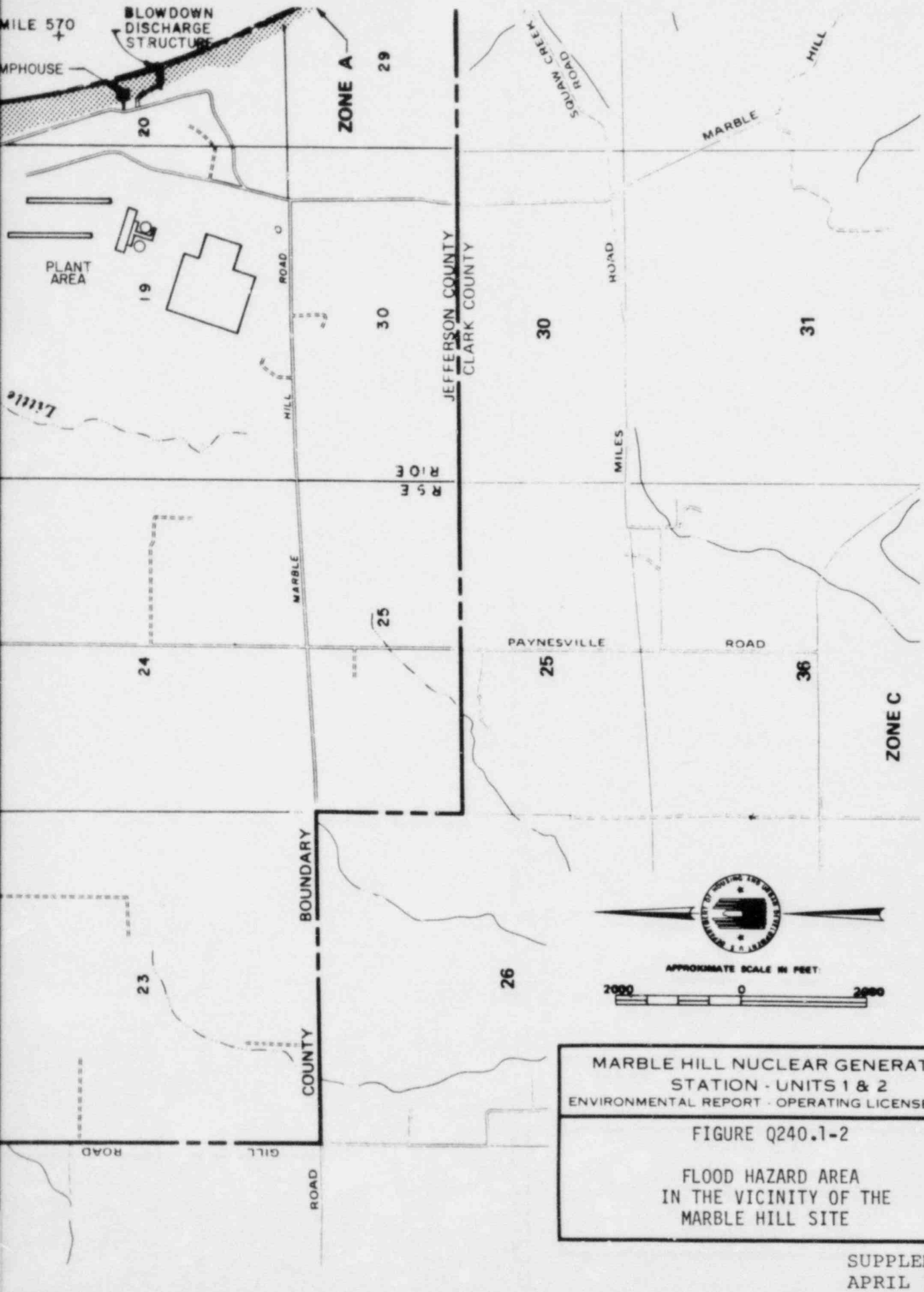
FLOOD PRONE AREA
OHIO RIVER IN THE
VICINITY OF THE MARBLE HILL SITE

SUPPLEMENT 1
APRIL 1983



SOURCE:

FLOOD HAZARD BOUNDARY MAP
JEFFERSON COUNTY, INDIANA
P. 7 of 7, COMMUNITY PANEL 1801040007 A
FEDERAL INSURANCE ADMINISTRATION
U. S. DEPT. of HOUSING and URBAN
DEVELOPMENT, APRIL 7, 1978

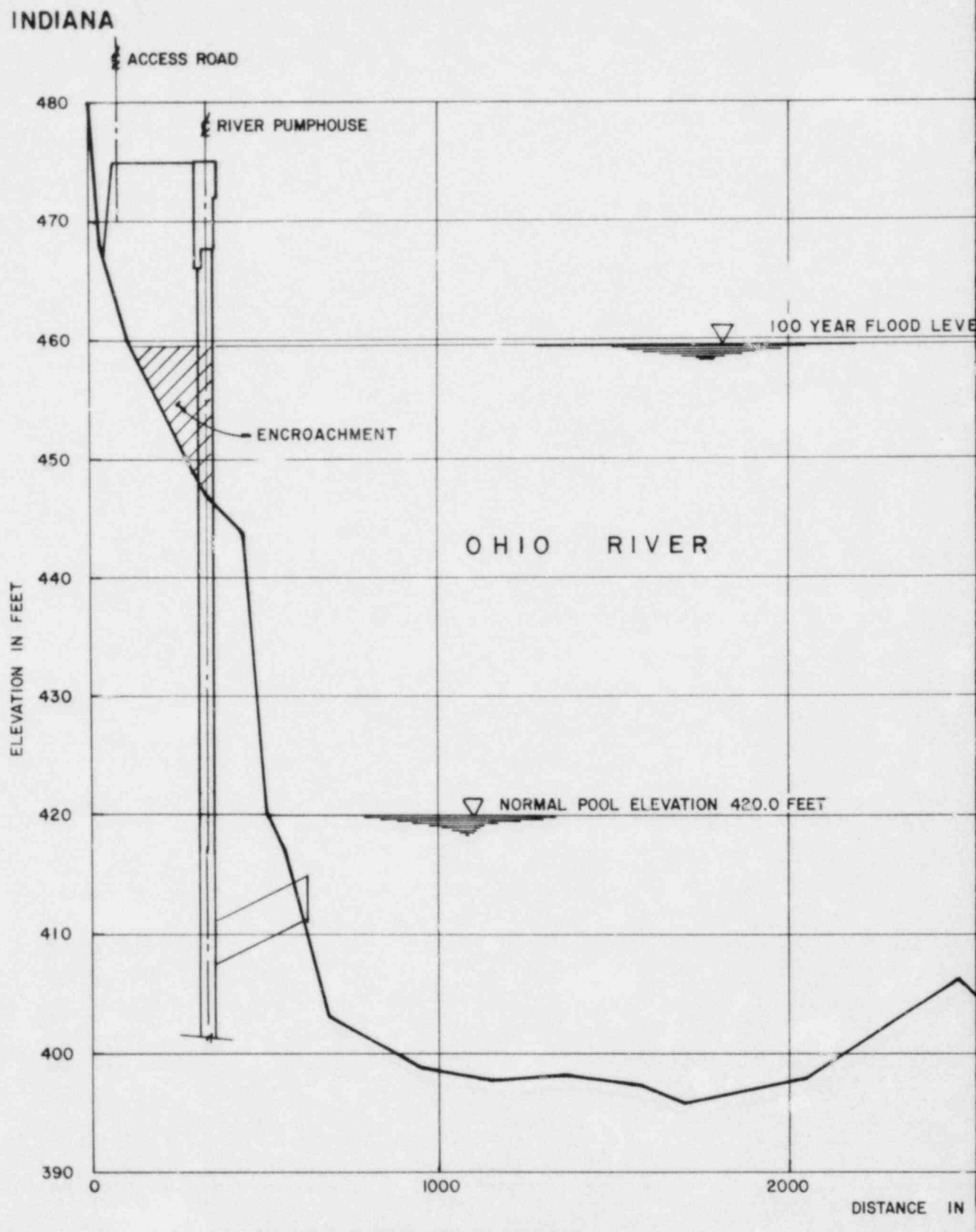


MARBLE HILL NUCLEAR GENERATING STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT - OPERATING LICENSE STAGE

FIGURE Q240.1-2

FLOOD HAZARD AREA
IN THE VICINITY OF THE
MARBLE HILL SITE

SUPPLEMENT 1
APRIL 1983



SOURCE: U.S. ARMY CORPS OF ENGINEERS
MAP OF OHIO RIVER, McALPINE
POOL REACH, SHEET 17, JAN. 1964.

KENTUCKY

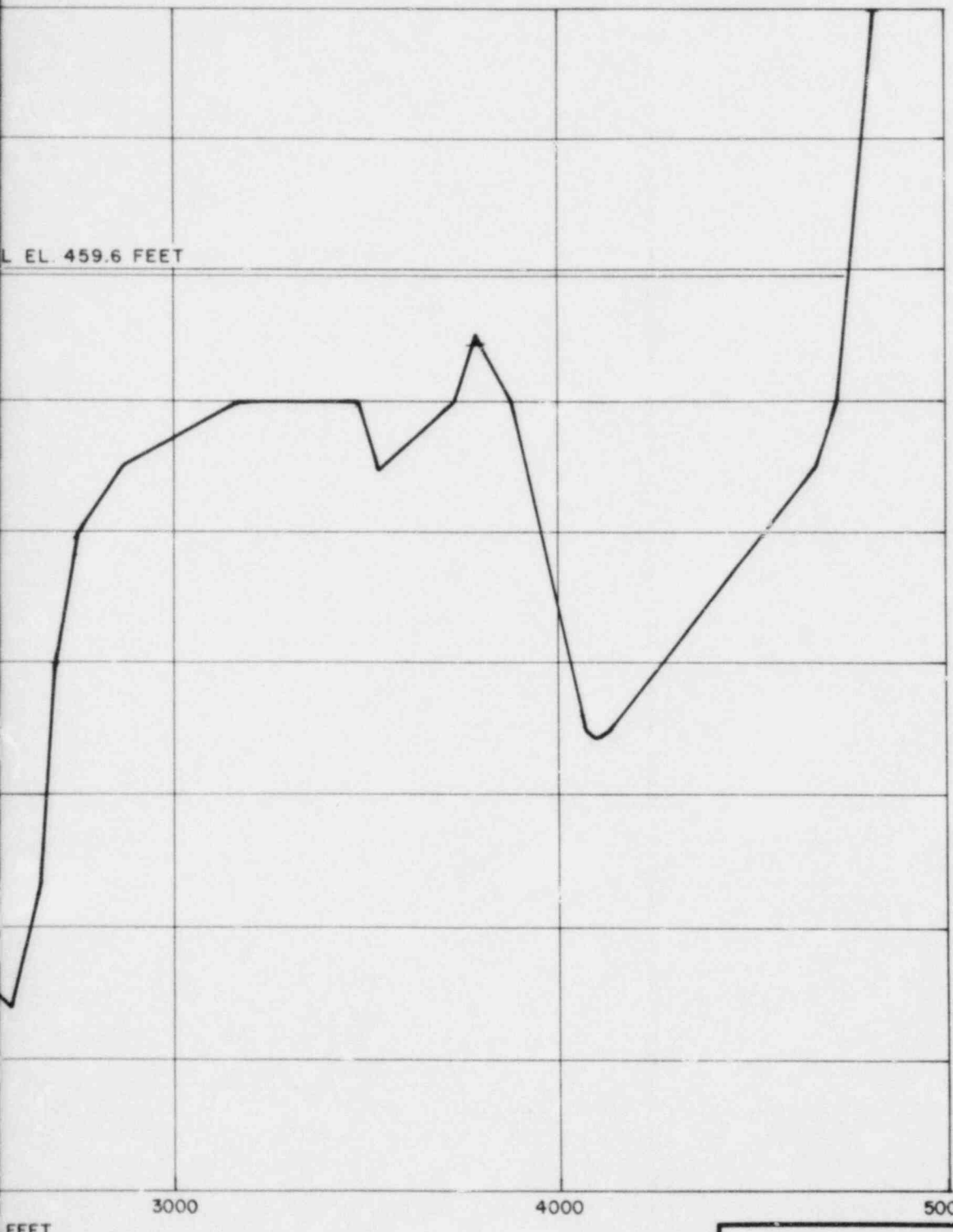


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FIGURE Q240.1-3

OHIO RIVER CROSS SECTION
AT RIVER PUMPHOUSE

QUESTION 240.2

Calculate the radiological consequences of a liquid pathway release from a postulated core melt accident. The analysis should assume, unless otherwise justified, that there has been a penetration of the reactor basemat by the molten core mass, and that a substantial portion of radioactively contaminated sump water was released to the ground. Doses should be compared to those calculated for the Liquid Pathway Generic Study (NUREG-0440, 1978) land-based river site. Provide a summary of your analysis procedures and the values of parameters used (such as permeabilities, gradients, populations affected, water use). It is suggested that meetings with the staff of the Hydrologic Engineering Section be arranged so that we may share with you the body of information necessary to perform this analysis.

RESPONSE

The "Industry Degraded Core Rulemaking Group" has been working with the NRC on large scale accidents, ie. Degraded Core, Class 9. The findings of this group will be presented to the NRC in July, 1983. We will review this information before responding to this question and expect to file an amended response by the end of 1983.

QUESTION 290.1

No data are presented on terrestrial fauna. Was any sampling conducted since the baseline data were gathered March 1974 to February 1975? If so, please supply the data.

RESPONSE

No sampling of terrestrial fauna has been conducted since the baseline study was conducted in 1974 and 1975.

Section 6.1.5.1 of the Final Environmental Statement - Construction Permit Stage for Marble Hill 1&2 (NUREG-0097, September 1976) states "The Staff finds that the applicant's baseline study and distributional maps of the fauna of Indiana are adequate to assess the ecological impacts of the station with respect to herpetofauna, invertebrates and mammals. Therefore, the staff will not require the extension of the baseline program into a preoperational monitoring program with respect to the forementioned fauna." In addition, "....a preoperational program for birds will not be required."

QUESTION 290.2

No mention is made of observations at the site or along the transmission line corridors of federal or state threatened and endangered species. Provide any information on observations of threatened and endangered species since 1977.

RESPONSE

The transmission line routes associated with Marble Hill 1&2 were selected to avoid areas of ecological significance, including areas known to be used by endangered or threatened species. As stated in the response to Question 290.1, no sampling of terrestrial fauna has been conducted on the Marble Hill site since 1974-1975. The sampling of terrestrial flora conducted on the site during 1977-1981 has identified no species that is shown as endangered or threatened on a federal, Kentucky, or Indiana list with legal status.

QUESTION 290.3

Provide an aerial photograph of the site and immediate vicinity that depicts the study area for determining vegetative cover types, the photograph should also include areas in Kentucky within a 2-mile radius of the site.

RESPONSE

Two copies of a black and white aerial photograph covering the area within a 2-mile radius of Marble Hill 1&2 will be provided to the U.S. Nuclear Regulatory Commission by May 16, 1983.

QUESTION 290.4

Provide information on the current status of transmission line construction.

RESPONSE

The status of the transmission lines and substations associated with Marble Hill 1&2 is given below as of March 1983.

TRANSMISSION LINE CONSTRUCTION STATUS

1. Marble Hill to Jefferson Line (765 kV)

   Right-of-way clearing is scheduled to begin in the second quarter of 1985.

   Construction is scheduled to begin in the fourth quarter of 1985 and end in the fourth quarter of 1987.

2. Marble Hill to Columbus Line (765 kV)

   Foundation construction is 96% complete.

   Structure erection is 85% complete.

   Wire stringing is scheduled to begin in the second quarter of 1984 and end in the first quarter of 1985.

3. Marble Hill to Speed-Madison Line Loop (345 kV)

   The construction of this line has been completed, and the line is in operation.

4. Elizabethtown to Gwynneville Line (765 kV)

   Right-of-way clearing is scheduled to begin in the first quarter of 1986.

   Construction is scheduled to begin in the second quarter of 1986 and end in the second quarter of 1988.

SUBSTATION CONSTRUCTION STATUS

1. Jefferson Substation

   Steel deadened tower installation is scheduled for 1983.

Construction of the 765 kV yard is scheduled to begin in the first quarter of 1986 and end in the fourth quarter of 1987.

2. Columbus Substation

Construction of the 765 kV yard is scheduled to begin in the fourth quarter of 1983 and end in the fourth quarter of 1984.

3. Gwynneville Substation

Construction of the 765 kV yard is scheduled to begin in the third quarter of 1986 and end in the second quarter of 1988.

4. Elizabethtown Substation

Construction of the 765 kV yard is scheduled to begin in the third quarter of 1987 and end in the second quarter of 1988.

QUESTION 290.5

Provide a copy of the document entitled, "U.S. EPA 1978 Draft Environmental Impact Statement, Trimble County Generating Plant," cited on page 5.1-12 in the ER-OL.

RESPONSE

A copy of the Draft Environmental Impact Statement for the Trimble County Generating Plant has been provided to the U.S. Nuclear Regulatory Commission.

QUESTION 290.6

Identify locations and acreages by crop type for agricultural lands within the salt drift isopleths of 50 and 100 kg/hectare/year depicted in Figure 5.1-2 of the ER-OL.

RESPONSE

An aerial color infrared photograph depicting locations and acreages by crop type within a 3-mile radius of Marble Hill 1&2 will be provided to the U.S. Nuclear Regulatory Commission by June 30, 1983. The infrared photograph will be taken in May 1983 in order to allow for complete foliage development.

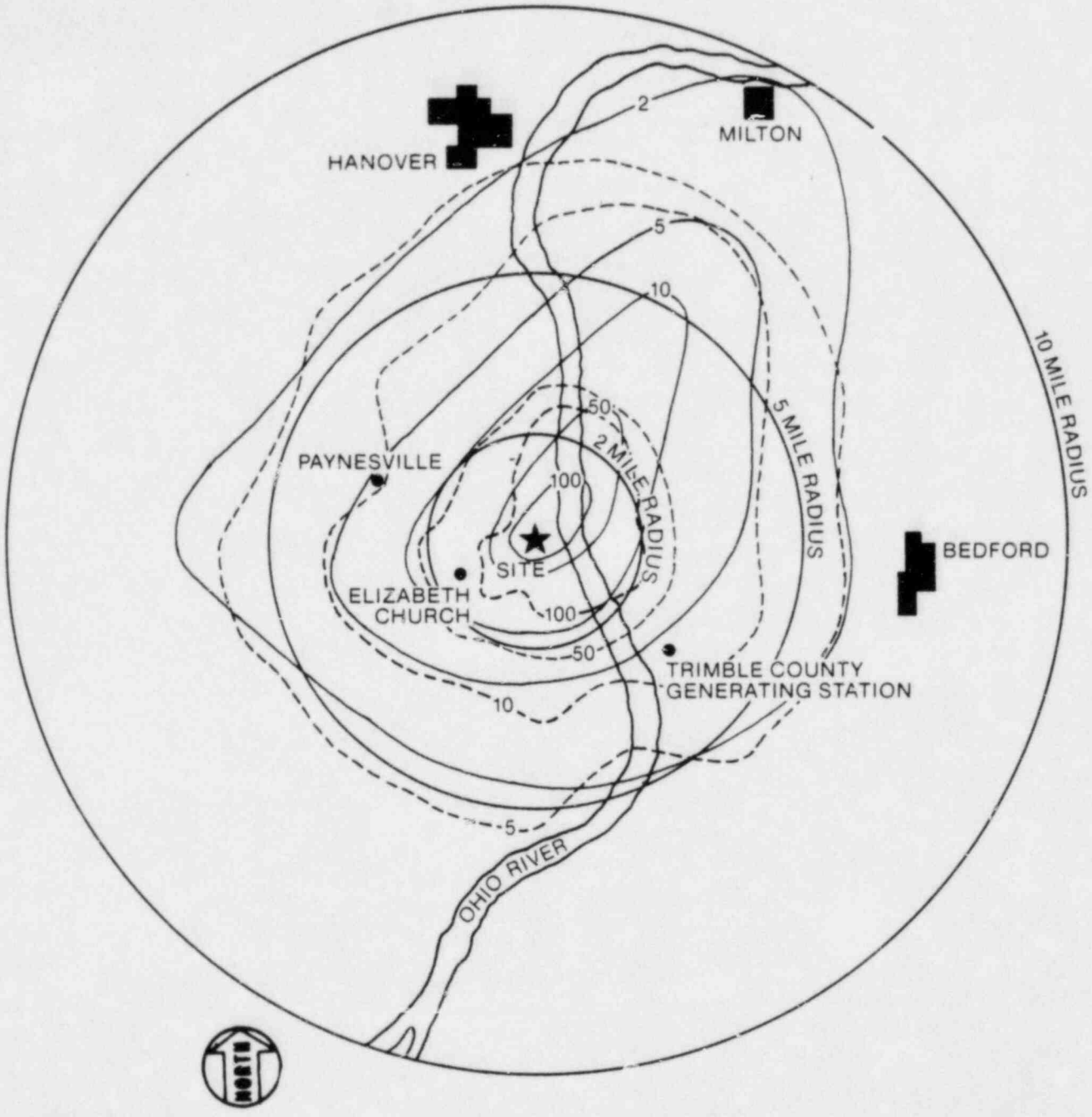
QUESTION 290.7

Why are the annual average drift deposition values shown in ER-OL Figure 5.1-2 higher than maximum values presented in the applicant's presentation in the FES-CP, page 5-8, given a reduction in drift rate from <0.02% of the flow to 0.008% of flow?

RESPONSE

The drift deposition values cited in the FES-CP were extracted from the applicant's drift deposition analysis presented in Subsection 5.1.7.3.1 of the Marble Hill Environmental Report - Construction Permit Stage (ER-CP). The ER-CP and FES-CP both contain deposition values in English units (lb/acre-month). The FES-CP also contains the equivalent values in metric units (kg/hectare-month). A comparison of the metric values and English values on page 5-8 of the FES-CP indicates that the metric values should actually be approximately 6 times higher in order to correctly correspond to the English values. If the deposition values in lb/acre-month from the FES-CP are converted to kg/hectare-year and compared with the values shown in ER-OL Figure 5.1-2, the FES-CP values are found to be higher than the ER-OL values by a factor consistent with the change in the drift rate. This comparison is shown in Figure Q290.7-1. The change in the deposition is not uniform because different periods of meteorological data were used in the FES-CP and ER-OL analyses.

In responding to this question, it was discovered that the drift deposition analysis presented in the ER-OL was based on a total dissolved solids (TDS) concentration in the circulating water of 1500 mg/l. Although this concentration was the correct value at the Construction Permit stage, the TDS concentration in the circulating water is now expected to average 1635 mg/l (see ER-OL Tables 3.6-2 and 5.3-1). For consistency and conservatism, the drift deposition analysis is being revised using the higher TDS concentration. The revised values will be provided to the U.S. Nuclear Regulatory Commission by June 30, 1983. It is expected that the revised values will still be generally lower than those presented at the Construction Permit stage and will entail no significant change in environmental impacts from those currently presented in the ER-OL.



NOTE: ISOPLETH VALUES ARE IN Kg/HECTARE-YEAR.

LEGEND:

———— ER-OL ISOPLETHS

-------- FES-CP ISOPLETHS

MARBLE HILL NUCLEAR GENERATING STATION - UNITS 1 & 2
ENVIRONMENTAL REPORT - OPERATING LICENSE STAGE

FIGURE Q290.7-1

COMPARISON OF
ANNUAL AVERAGE DRIFT DEPOSITION
RATES FROM THE FES-CP AND ER-OL

SUPPLEMENT 1
APRIL 1983

QUESTION 290.8

Provide aerial color infrared photographs of the areas expected to receive maximum cooling tower salt drift.

RESPONSE

An aerial color infrared photograph will be provided to the U.S. Nuclear Regulatory Commission (see Response to Question 290.6).

QUESTION 291.1

Provide a bibliographic listing and reprint copies of all journal and professional conference proceedings publications (by applicant or applicant's consultants) that have resulted from studies and monitoring of the Ohio River, its tributaries, and their aquatic biota associated with Marble Hill Nuclear Generating Station.

RESPONSE

The applicant is not aware of any journal or professional conference proceedings publications that have resulted from or used data collected during the aquatic ecological monitoring program conducted at the Marble Hill site.

QUESTION 291.2

Provide copies of the environmental monitoring reports prepared by applicant's consultants for the study period of 1977 through 1981.

RESPONSE

Copies of the environmental monitoring reports prepared by Applied Biology, Inc., and Normandeau Associates, Inc. (formerly Texas Instruments), for the years 1977 through 1981 have been provided to the U.S. Nuclear Regulatory Commission.

QUESTION 291.3

Section 2.2.1.3.5 describes the benthic macroinvertebrates of the Ohio River, including an increasing density of Corbicula.

(1) Provide applicant's proposed methodology for preventing or controlling biofouling by Corbicula.

(2) Provide a discussion of Corbicula biofouling problems and preventive measures used at other nearby Ohio River power plants and industries.

RESPONSE

(1) At this time a comprehensive Corbicula treatment program is being formulated for the Marble Hill 1&2 ultimate heat sink and makeup water. Treatment practices under consideration include use of a biocide paint in the intake caisson, installation of a clarifier and a chlorination system for the ultimate heat sink, and shock chlorination of individual systems. Periodic inspection and cleaning of heat exchangers cooled by service water or monitoring of flow degradation in heat exchangers by the use of differential pressure gauges also may be implemented.

(2) Several utilities that operate power plants on the Ohio River both upstream and downstream of Marble Hill 1&2 were contacted regarding Corbicula biofouling problems and preventive measures. Only moderate numbers of Corbicula shells have been found during normal maintenance outages at these power plants. Any shells found are usually removed by hand from the systems affected. No serious operation problems have been experienced at any of the surveyed plants. Routine chlorination of the circulating and service water adequately controls and appears to be effective in preventing Corbicula biofouling.

The Louisville Water Company was also contacted regarding Corbicula biofouling at their facilities on the Ohio River. Approximately 10 years ago one of their water treatment plants experienced flow restriction due to a clam infestation. A routine chlorination program was instituted and has been effective in controlling Corbicula biofouling.

QUESTION 291.4

Provide the reference citation to Preston and White (1978), which is cited in Section 2.2.1.3.6.1 (pages 22-26) but not included in ER Section 13.

RESPONSE:

The reference citation to Preston and White (1978) was provided on page 13.0-6 of the docket version of the ER-OL.

QUESTION 291.5

Provide a listing of any species collected from the Ohio River and Little Saluda Creek that are listed as endangered or threatened by the Commonwealth of Kentucky.

RESPONSE

The Commonwealth of Kentucky does not maintain a list of state endangered or threatened species that are protected by law.

QUESTION 291.6

Provide a listing of any federal or state (IN and KY) aquatic species listed as threatened or endangered that are believed to be present in the Marble Hill site vicinity that were not collected during the 1977-1981 sampling period.

RESPONSE

In order to ascertain the probable presence of threatened or endangered species not collected in the aquatic monitoring conducted at the Marble Hill site from 1977 through 1981, two reports were consulted. One of these was the Marble Hill Environmental Report - Construction Permit Stage (ER-CP), which presents the results of a one-year baseline aquatic monitoring program conducted at the Marble Hill site from 1974 to 1975. The other was the report issued by Applied Biology, Inc. (ABI), presenting the results of the 1982 aquatic monitoring program at the Marble Hill site (ABI 1983). The species lists of fish, crustaceans, and mollusks presented in these reports were compared to the appropriate federal and state endangered and threatened species lists, as described below.

The federal endangered and threatened species list that was examined was the most recent compilation by the U.S. Fish and Wildlife Service (1982). As stated in the response to Question 291.5, Kentucky does not maintain a list of state endangered or threatened species that are protected by law. The Indiana Department of Natural Resources (1978) has published one list with legal status, and this list was reviewed.

No aquatic species collected at the Marble Hill site during 1974-1975 or 1982 appears on the federal or the Indiana list of endangered and threatened species.

REFERENCES

Applied Biology, Inc. 1983, "Construction Phase Ecological Monitoring Program, Marble Hill Nuclear Generating Station, Volumes I and II," Atlanta, Georgia.

Indiana Department of Natural Resources, 1978, "Non-game and Endangered Species Conservation - A Preliminary Report," Division of Fish and Wildlife Resources, unpaginated.

U.S. Fish and Wildlife Service, 1982, "Endangered and Threatened Wildlife and Plants," Reprinted from 40 CFR 17.11 and 17.12, 13 pp.

QUESTION 291.7

(1) Provide estimates for the annual recreational and commercial fishery harvests (in kg by species) for the Ohio River and tributary backwaters for a distance of 80 km downstream of the Marble Hill site for the 1977-1981 study period.

(2) Provide estimates of the annual fishing effort (trips, hours, number of anglers) expended by recreational fishermen for the same areas and time period indicated in (1) above.

RESPONSE:

As part of a continuing evaluation of the sport fishery of the Ohio River, the Fisheries Division of the Kentucky Department of Fish and Wildlife Resources conducted a creel survey from February 11 through November 1, 1981, near the McAlpine locks and dam at approximately River Mile 607. The area surveyed was 93 acres of the tailwater of the dam. The survey was conducted during one weekday and one weekend day per week.

According to the published results of this survey (Jackson 1982, pp. 39-47) most of the fishing pressure was on the Indiana side of the river, because the lock is located on the Kentucky side and also because the "Falls," a Devonian age coral reef, is located on the Indiana shore. The results of this survey are reproduced in their entirety in Tables Q291.7-1 and Q291.7-2.

The Jackson (1982, pp. 39-47) report is the only recent data on recreational fishing that the applicant has been able to locate. The applicant has not been able to locate any data regarding commercial fishing harvest within 80 km downstream of the Marble Hill site.

This response has been incorporated in a new subsection of the ER-OL, Subsection 2.2.1.3.6.4.

REFERENCES:

Jackson, R. V., 1982, "Annual Performance Report for Statewide Fisheries Research Project, April 1981 through March 1982," 50 pp., Kentucky Department of Fish and Wildlife Resources.

TABLE Q291.7-1

EXPANDED CREEL SURVEY TOTALS FROM THE CREEL SURVEY CONDUCTED AT McALPINE POOL TAILWATER FROM FEBRUARY 11 THROUGH NOVEMBER 1, 1981

Anglers	
Total count (trips)	17,105
% successful	16.7
Fishing Pressure	
Total man-hours (m-h)	23,740
M-h/acre	255.3
Harvest (Yield)	
Number of fish	6,146
No./acre	66.1
Pounds	4,378
Lb/acre	47.1
Catch Rate	
Fish/hour	0.72
Lb/hour	0.25
Misc. Characteristics (%)	
Male	93.7
Female	6.3
Resident	81.3
Non-resident	18.6
Boat	1.1
Bank	98.9
Method (%)	
Still fishing	72.9
Casting	27.1
Fly fishing	0
Trolling	0
Other	0.1

Source: Jackson (1982, Table 3, p. 44)

TABLE Q291.7-2

HARVEST OF SELECTED SPECIES FROM MCALPINE POOL TRAILWATER DERIVED FROM EXPANDED CREEL SURVEY DATA COLLECTED BETWEEN 11 FEBRUARY AND 1 NOVEMBER 1981

	CRAPPIE	SAUGER	WHITE BASS	CHANNEL CATFISH	FRESHWATER DRUM	CARP	ANYTHING[a]
Total number	487	834	185	226	4,102	212	4,984
% of total catch	7.9	13.6	3.0	3.7	66.7	3.4	81.1
Total weight (lb)	131	498	150	493	2,736	345	3,500
% of total weight	3.0	11.4	3.4	11.3	62.5	7.9	79.9
No. anglers fishing for	94	2,452	0	187	0	0	14,345
% of total anglers	0.5	14.3	0	1.1	0	0	83.9
Hr. fished by fishing for	221	2,778	0	294	0	0	20,407
No. caught fishing for	307	762	0	18	0	0	4,984
Lb. caught fishing for	88	451	0	52	0	0	3,500
No./hr. caught fishing for	1.39	0.27	0	0.06	0	0	0.24
% success fishing for	73.2	15.0	0	9.6	0	0	17.3

Source: Jackson (1982, Table 4, p. 45).

[a]Includes all species caught by "anything" fishermen having no preference.

QUESTION 291.8

Provide, in tabular form, a comparison of all cooling system design specifications and structure locations as they now exist with those that were evaluated in the FES-CP Stage, and in the 1977 environmental hearing that resulted in NRC ASLB Partial Initial Decision LBP-77-52 [6NRC294(1977)] .

RESPONSE

The design specifications and structure locations for various aspects of the Marble Hill 1&2 cooling systems as they were reported in NUREG-0097, the Final Environmental Statement - Construction Permit Stage (FES-CP) are compared with the corresponding ER-OL values in Tables Q291.8-1 through Q291.8-3. Review of the transcripts of the 1977 environmental hearing disclosed no statements concerning cooling system design specifications or structure locations that differ significantly from the information provided in the FES-CP. Differences between the environmental impacts of cooling system operation as they were evaluated at the 1977 environmental hearing and the impacts discussed in the ER-OL are shown in the response to Question 291.11.

TABLE Q291.8-1

COMPARISON OF COOLING WATER MAKEUP AND BLOWDOWN SYSTEM DESIGN PARAMETERS SHOWN IN THE FES-CP AND ER-OL

INTAKE STRUCTURE	FES-CP	ER-OL
Source of Cooling Water	Ohio River	Ohio River
Intake Arrangement	flume divided into two 15 ft x 11.5 ft channels	two 48-inch diameter pipes, each branching into four 36-inch diameter pipes in the river
Overall Width of Intake in River	approximately 30 ft	134 ft
Intake Elevation (River)	420 ft MSL[a]	413 ft MSL[b]
Intake Elevation (Pumphouse)	420 ft MSL[a]	409 ft MSL[b]
Intake Screens	two traveling	eight stationary
Location of Screens	pumphouse	river end of intake
Intake Velocity (maximum)	0.5 ft/sec	0.104 ft/sec[c]
BLOWDOWN STRUCTURE		
Receiving Body of Water	Ohio River	Ohio River
Discharge Structure	one single-point submerged	one submerged pipe with relief holes
Pipe Diameter	20 in	20 in
Discharge Elevation	414 ft MSL[a]	412.6 ft MSL[b]
Blowdown Discharge Velocity (maximum)	8.0 ft/sec	6.0 ft/sec[c]

See notes on second page of table.

TABLE Q291.8-1 (Cont'd)

RIVER PUMP HOUSE	FES-CP	ER-OL
Operating Floor Elevation	475 ft MSL[a]	475 ft MSL[b]
Bottom Elevation of Intake Area	405 ft MSL[a]	397 ft MSL[b]
Pumps	3 circulating water makeup pumps and 2 essential service water makeup pumps	3 circulating water makeup pumps (these pumps also provide makeup for essential service water system)
Pumps Operating Capacity	circulating water pumps 40 cfs each	approximately 50 cfs each
Pumps Elevation	405 ft MSL[a]	475 ft MSL[b]
Normal Water Level	420 ft MSL[a]	419.3 ft MSL[b]
High Water Level (Historic)	470 ft MSL[a]	469.3 ft MSL[b]
Low Water Level	420 ft MSL[a]	

Note: All values are for 2 units unless otherwise stated.

a Elevations referred to Ohio River Datum.

b Elevations referred to U.S. Geological Survey, 1929 Datum - 0.7 ft lower than elevations referred to Ohio River Datum.

c Maximum monthly velocity expected during operation.

TABLE Q291.8-2

COMPARISON OF CIRCULATING WATER COOLING TOWER DESIGN PARAMETERS SHOWN IN THE FES-CP AND ER-OL

PARAMETERS	FES-CP	ER-OL
Heat Dissipation to the Atmosphere	1.65×10^{10} Btu/hr	1.68×10^{10} Btu/hr
Circulating Water Flow Rate	2660 cfs	2900 cfs
Wet-Bulb Temperature	75° F	80° F
Range	28° F	25.8° F
Blowdown[a]	8.9 cfs	8.5 cfs
Evaporation[b]	57.4 cfs	61.2 cfs
Drift	0.53 cfs	0.23 cfs
Makeup[b]	68 cfs	71.4 cfs
Number of Banks	2	2
Cells per Bank	25	36
Length of each Bank	1200 ft	1350 ft[c]
Width of each Bank	50 ft	73 ft[d]
Height of each Bank	60 ft	60 ft

Note: All values are for 2 units unless otherwise stated.

[a] For consistency with FES-CP Table 3.2, the values shown are annual averages for 100% operation.

[b] For consistency with FES-CP Table 3.2, the values shown are seasonal maximum (summer) rates for 100% operation.

[c] Length includes circulating pumphouse.

[d] Width at widest point: the fan deck.

TABLE Q291.8-3

COMPARISON OF VARIATIONS IN STATION WATER USE SHOWN IN THE FES-CP AND ER-OL

SYSTEMS	100% OPERATION		50.0% OPERATION	68.8%[a] OPERATION	HOT STANDBY[b]		COLD STANDBY[b]	
	FES-CP	ER-OL	FES-CP	ER-OL	FES-CP	ER-OL	FES-CP	ER-OL
Circulating Water Cooling Tower System								
Condenser Flow Rate (cfs)	2526	2740						
Temperature Rise Through Condenser (^{o}F)	28	24.7						
Heat Dissipated (10^{10} Btu/hr)	1.65	1.68						
Nonessential Service Water System Flow Rate (cfs)	134	156						
Blowdown (cfs)	8.9	8.5	3.7	5.9	3.7	0.0	0.0	0.0
Evaporation (cfs)	55.1	55.6	26.7	38.9	0.0	0.0	0.0	0.0
Drift (cfs)	0.53	0.2	0.53	0.2	0.53	0.0	0.0	0.0
Makeup (cfs)	64.5	65.2	30.9	45.9	4.23	0.0	0.0	0.0
Essential Service Water Cooling Tower System								
Flow Rate Through Essential Service Water System (cfs)	115.8	115.8						
Normal Heat Dissipated (10^{8} Btu/hr)	1.6							
Emergency Heat Dissipated (10^{8} Btu/hr)	6.2							
Blowdown (cfs)	2 (peak)	2 (peak)	2 (peak)	2 (peak)	2	2	0.0	0.0
Evaporation (cfs)	2 (peak)	2 (peak)	2 (peak)	2 (peak)	0.5	0.5	0.0	0.0
Drift (cfs)	0.0	0.046	0.0	0.046	0	0.0	0.0	0.0
Makeup (cfs)	4 (peak)	4 (peak)	4 (peak)	4 (peak)	2.5	2.5	0.0	0.0

Note: All values are for 2 units unless otherwise stated.

[a]68.8% was used in the ER-OL because it reflects the expected lifetime average capacity for Marble Hill 1&2.

[b]Values are subject to operating variables.

QUESTION 291.9

Provide the status of the application for an NPDES permit for operation of Marble Hill 1 and 2.

RESPONSE

A National Pollutant Discharge Elimination System (NPDES) Permit for the operation of Marble Hill 1&2 was issued by the Indiana Stream Pollution Control Board (SPCB) on May 21, 1979. This permit expires at midnight on May 20, 1984. In accordance with federal and Indiana regulations, the application for renewal of this permit will be submitted to the SPCB before the expiration date. The current NPDES permit was reproduced in its entirety in Appendix 5.3B of the docket version of the ER-OL.

QUESTION 291.10

Provide the details of the proposed plan of study for 316(a) and (b) monitoring under the NPDES permit.

RESPONSE

The NPDES permit that was issued by the Indiana Stream Pollution Control Board for Marble Hill 1&2 contains no provisions for 316(a) or 316(b) monitoring. During the NPDES process, no need for a 316(a) or 316(b) demonstration was established. It is the applicant's understanding that no 316(a) or 316(b) demonstration is required for Marble Hill 1&2 because cooling towers with cold-side blowdown will be used, no applicable thermal standards will be violated, and no significant adverse impacts on aquatic ecology are expected to occur as a result of thermal discharges or operation of the cooling water intake. The impacts of the thermal discharges and intake structure for Marble Hill 1&2 are evaluated in ER-OL Subsections 5.1.2 and 5.1.3.

QUESTION 291.11

Provide a summary and brief discussion, by ER-OL section, of differences between currently projected environmental effects (including those that would degrade and those that would enhance environmental conditions) and the effects discussed in the ER-CP Stage and the environmental hearing associated with the construction permit.

RESPONSE

The differences between the environmental impacts predicted in the ER-OL and those predicted in the Environmental Report - Construction Permit Stage (ER-CP), the Final Environmental Statement - Construction Permit Stage (FES-CP, NUREG-0097), and the testimony presented at the environmental hearing for the Construction Permit are presented in Table Q291.11-1.

TABLE Q291.11-1

DIFFERENCES BETWEEN ENVIRONMENTAL IMPACTS PREDICTED IN THE ER-OL AND THOSE PREDICTED IN THE ER-CP, FES-CP, AND ENVIRONMENTAL TESTIMONY

ER-OL	ER-CP	FES-CP (NUREG-0097)	ENVIRONMENTAL TESTIMONY
SECTION 3.9 ITEM DISCUSSED: TRANSMISSION FACILITIES			
Station will require three new 765 kV transmission lines.	Station will require two new 765 kV transmission lines.		
Marble Hill to Jefferson 765 kV transmission line right-of-way is 13 miles long, 250 feet wide, and covers 394.8 acres. Additional details are in Table 3.9-1.	Line not proposed.		
Marble Hill to Columbus 765 kV transmission line right-of-way is 48.5 miles long, 250 feet wide, and covers 1,469.7 acres. Additional details are in Table 3.9-1.	Marble Hill to Columbus 765 kV transmission line right-of-way is 45.7 miles long, 200 feet wide, and cover 1,107.9 acres. Additional details are in Table 3.9-1.	Marble Hill to Columbus line right-of-way will be 250 feet wide for a total area of 1,385 acres, including a portion of the 1.2-mile common corridor near the station (see Sections 3.7 and 3.7.2).	
Elizabethtown to Gwynneville 765 kV transmission line right-of-way is 36.6 miles long, 250 feet wide, and covers 1,110.0 acres. Additional details are in Table 3.9-1. This line replaces the proposed Marble Hill to Rush line.	Marble Hill to Rush 765 kV transmission line right-of-way was to be 65.5 miles long, 200 feet wide, and cover 1,587.9 acres. Additional details are in Table 3.9-1	Marble Hill to Rush line right-of-way was to be 250 feet wide and have an area of 1,985 acres, including a portion of the 1.2-mile common corridor near the station (see Sections 3.7 and 3.7.1).	
Marble Hill to Speed-Madison 345 kV line loop right-of-way is 0.05 mile long and is within the right-of-way occupied by the two 765 kV lines exiting Marble Hill.	Marble Hill to Speed-Madison 345 kV line loop right-of-way is 5.6 miles long, 150 feet wide, and covers approximately 101.8 acres.		
Columbus Station upgrades will require no additional land.	Columbus Substation upgrades will require 100 acres of agricultural land.		

Note: Blanks in the FES-CP and Environmental Testimony columns indicate either that the item was not discussed or that impacts were no different from those predicted in the ER-CP.

TABLE Q291.11-1 (Cont'd)

ER-OL	ER-CP	FES-CP (NUREG-0097)	ENVIRONMENTAL TESTIMONY
	SECTION 3.9 (Cont'd)		
Rush Substation will not be built; however, Gwynneville Substation, which will require 16 acres of agricultural land, and Elizabethtown Substation, which will require 10 acres of agricultural land, will be built.	The new Rush Substation will require 100 acres of agricultural land; no other substations will be built.		
	SECTION 4.1 ITEM DISCUSSED: SITE PREPARATION		
Construction activities will ultimately disturb 440 acres of the site, including 85 acres of hardwood forest.	Construction activities will initially disturb 170 acres of the site, including less than 20 acres of hardwood forest.	Construction activities will initially disturb about 250 acres of the site (see Subsection 4.1.1).	
New borrow area will disturb 14 acres adjacent to the site.	Not discussed.		
Emergency Operations Facility Building will be built off of the site.	Not discussed.		
Average of 2,565 construction workers and peak work force of about 5,000.	Average of 1,100 construction workers and peak work force of 2,200.		
One settling pond for runoff.	Several settling ponds for runoff.		One settling pond for runoff.
Sanitary waste treatment system discharges to Little Saluda Creek via the settling pond during station construction.	Sanitary waste treatment system will discharge to Ohio River at all times.		
Construction work force schedule on Table 4.1-1.	Construction work force schedule on Table 4.1-1.		

Note: Blanks in the FES-CP and Environmental Testimony columns indicate either that the item was not discussed or that impacts were no different from those predicted in the ER-CP.

TABLE Q291.11-1 (Cont'd)

ER-OL	ER-CP	FES-CP (NUREG-0097)	ENVIRONMENTAL TESTIMONY
	SECTION 4.1 (Cont'd)		
Site construction activities as they affected existing land use on Figure 4.1-1; includes minor changes to site boundary.	Site construction activities as they affect existing land use on Figure 4.1-1.		
	SECTION 4.2 ITEM DISCUSSED: TRANSMISSION FACILITIES CONSTRUCTION		
Transmission line right-of-way width is 250 feet.	Right-of-way width is 200 feet (see Subsection 3.9.2).	Most transmission line rights-of-way are 250 feet wide (see Section 3.7).	Transmission line right-of-way width is 250 feet.
Windrows will be less than 20 feet wide.	Windrows will be less than 15 feet wide.		
Compacted piles will be at least 70 feet from ROW centerline.	Compacted piles will be at least 40 feet from ROW centerline.		
Notes that the herbicides listed in the ER-CP may be used in combination and that the list may be added to or shortened depending on applicable regulations.	Lists specific herbicides that may be used.	Lists specific herbicides that may not be used (see Subsection 4.3.1.2).	
Will observe construction practices described in Final Environmental Statement (NUREG-0097) to mitigate potential environmental impacts.	Not applicable.	Construction practices to mitigate impacts listed in Subsection 4.5.1.2.	
	SECTION 4.3 ITEM DISCUSSED: RESOURCES COMMITTED		
Site is 960 acres.	Site area is 987 acres.		

Note: Blanks in the FES-CP and Environmental Testimony columns indicate either that the item was not discussed or that impacts were no different from those predicted in the ER-CP.

TABLE Q291.11-1 (Cont'd)

ER-OL	ER-CP	FES-CP (NUREG-0097)	ENVIRONMENTAL TESTIMONY
	SECTION 4.3 (Cont'd)		
Area of four transmission corridors and four substations is 3,012 acres (see Section 3.9 for areas of individual transmission corridors and substations).	Area of three transmission corridors and two substations is 2,997.6 acres (see Subsection 3.9 for areas of individual transmission corridors and substations).	Area of transmission corridors is 3,475 acres, of which 1,170 acres of regrowth deciduous forest will be destroyed (see Section 5.1).	
170 acres within site boundary occupied by station facilities.	130 acres of plant site occupied by plant facilities.		
An additional 36 acres permanently occupied by trackwork and ballast of railroad spur.	Not discussed.	Railroad right-of-way will occupy 255 acres (see Subsection 4.1.3).	
	SECTION 4.4 (ER-CP Subsection 5.3.4) ITEM DISCUSSED: RADIOACTIVITY		
Direct Radiation Doses given in Table 4.4-1 for 1 unit.	Direct Radiation Doses given in Table 5.3-4 for 2 units, not 1 unit as stated.		
Estimated doses to construction work force after Unit 1 fuel loading given in Table 4.4-2.	Estimated doses to Unit 2 construction work force after Unit 1 loading given in Table 5.3-5.	Estimated integrated dose to Unit 2 construction workers of 10 man-rem. (see Subsection 4.1.4).	
Exposure of offsite population within 50 miles from direct radiation is 0.006 man-rem/year-unit for population in year 2030.	Exposure of offsite regional population from direct radiation is 0.018 man-rem/year-unit (see Table 5.3-6) for population in year 2000 (see Subsection 5.3.4.1).		
	SECTION 4.5 (ER-CP Section 4.4) ITEM DISCUSSED: CONSTRUCTION IMPACT CONTROL PROGRAM		
Burning is not permitted on the site.	Trash will be disposed of in an environmentally acceptable manner.		

Note: Blanks in the FES-CP and Environmental Testimony columns indicate either that the item was not discussed or that impacts were no different from those predicted in the ER-CP.

TABLE Q291.11-1 (Cont'd)

ER-OL	ER-CP	FES-CP (NUREG-0097)	ENVIRONMENTAL TESTIMONY
SECTION 4.5 (ER-CP Section 4.4) (Cont'd)			
Gentle slopes will be established in graded areas to minimize erosion.	Topsoil will be spread on slopes to improve seeding.		All impacted areas will be sodded, seeded, or graded back according to the PSI plan of revegetation and erosion control.
A fence was installed around cemetery.	Not discussed in Section 4.4. The Response to Question 39 in Supplement 3 states that the cemetery will remain undisturbed.		
SECTION 5.1 ITEM DISCUSSED: EFFECTS OF OPERATION OF HEAT DISSIPATION SYSTEM			
Thermal plume predictions in Tables 5.1-1 and 5.1-2; for example— Maximum 3°F isotherm under extreme conditions encompasses 0.07 acre (see Table 5.1-1).	Thermal plume predictions in Figures 5.1-1 through 5.1-9; for example— Maximum 3°F isotherm under extreme conditions encompasses 14.8 acres (see Figure 5.1-5).	Thermal plume predictions in Table 5.6; for example— Maximum 3°F isotherm under extreme conditions encompasses 0.60 acre.	
Notes that all discharge temperatures will be below upper lethal temperature limit for predominant fish species except sauger.	Notes that discharge temperatures should remain within tolerance limits of most fish species in Ohio River.		
Intake velocity through screens of 0.065 ft/sec under normal operating conditions.	Intake velocity through screens of 0.25 ft/sec under normal operating conditions.	Intake velocity no greater than 0.5 ft/sec at surface of traveling screen and 0.01 ft/sec at grating surface (see Subsection 3.4.2).	
Fixed screen openings 0.25 inch.	Fixed screen openings between 0.25 and 0.50 inch.	Traveling screen openings 3/8-inch (see Subsection 3.4.2).	
Impingement of fish larger than 20 mm virtually eliminated.	Modified intake design will allow most fish to escape impingement.	Proposed intake design may increase fish impingement.	
Maximum discharge velocity is about 6 ft/sec.	Maximum discharge velocity is about 8 ft/sec.		

Note: Blanks in the FES-CP and Environmental Testimony columns indicate either that the item was not discussed or that impacts were no different from those predicted in the ER-CP.

TABLE Q291.11-1 (Cont'd)

ER-OL	ER-CP	FES-CP (NUREG-0097)	ENVIRONMENTAL TESTIMONY
	SECTION 5.1 (Cont'd)		
Frequency of occurrence of visible cooling tower plumes on Table 5.1-3; for example— Plumes will extend at least 1 km for 3,832 hr/yr.	Annual occurrence of condensed water plumes on Table 5.1-11; for example— Plumes will extend at least 1 km for between 1,632 and 2,840 hr/yr.		
Plume shadowing frequencies given on Table 5.1-5; for example— 18 hours per season average duration of shadowing 3 km from towers.	Plume shadowing frequencies given on Table 5.1-11A; for example— 15 hours per season average duration of shadowing 3 km from towers.		
Contours of visible cooling tower plumes on Figure 5.1-1.	Contours of visible cooling tower plume: lower bound on Figure 5.1-10, upper bound on Figure 5.1-11.		
Downwash induced ground fog about 16% of the time.	Downwash induced ground fog about 25% of the time.		
Ground fog estimates in ER-CP are overestimates, and studies show that ground fog does not extend more than 200 to 500 meters from mechanical draft towers.	Ground fog can occasionally extend 0.6 mile from towers (contours of ground level fog due to downwash shown on Figure 5.1-12).		
Drift rate of 0.008%, for emission rate of 52 gpm per unit.	Drift rate of 0.02%, for emission rate of 120 gpm per unit.		
Expected rate of deposition of drift solids on Table 5.1-6.	Expected rate of deposition of drift solids on Table 5.1-15.		

Note: Blanks in the FES-CP and Environmental Testimony columns indicate either that the item was not discussed or that impacts were no different from those predicted in the ER-CP.

TABLE Q291.11-1 (Cont'd)

ER-OL	ER-CP	FES-CP (NUREG-0097)	ENVIRONMENTAL TESTIMONY
	SECTION 5.1 (Cont'd)		
Area affected by various magnitudes of drift residue deposition on Table 5.1-7.	Area affected by various magnitudes of drift residue deposition on Table 5.1-16.		
Ground-level concentration of drift minerals in ambient air on Table 5.1-8.	Ground-level concentration of drift minerals in ambient air on Table 5.1-17.		
Comparisons of ground-level concentrations of drift minerals with air quality standards on Table 5.1-9.	Comparisons of ground-level concentrations of drift minerals with air quality standards on Table 5.1-18.		
Annual average drift deposition rate contours on Figure 5.1-2.	Anual average drift deposition rate contours on Figure 5.1-13.		
	SECTION 5.2 ITEM DISCUSSED: RADIOLOGICAL IMPACT FROM ROUTINE OPERATION		
Bioaccumulation factors of radionuclides in discharge (32 listed) on Table 5.2-1.	Bioaccumulation factors of significant isotopes (12 listed) on Table 5.2-2.		
Annual average site boundary doses on Table 5.2-3.	Expected annual doses, showing maximum at site boundary, shown on Table 5.3-?		
Expected individual doses from gaseous effluents on Table 5.2-4; for example— Total body dose from plume at nearest residence (0.60 mile S) is 0.003 mrem/yr	No corresponding table.		Annual individual doses due to gaseous and particulate effluents on Table 5.9, for example— Total body dose from plume at nearest residence (0.83 mile NNE) is 0.23 mrem/yr.

Note: Blanks in the FES-CP and Environmental Testimony columns indicate either that the item was not discussed or that impacts were no different from those predicted in the ER-CP.

TABLE Q291.11-1 (Cont'd)

ER-OL	ER-CP	FES-CP (NUREG-0097)	ENVIRONMENTAL TESTIMONY
SECTION 5.2 (Cont'd)			
Internal dose to biota other than man on Table 5.2-6; no credit taken for dilution in the river.	Summary of doses to biota other than man on Table 5.2-5; credit taken for some dilution in the river.	Dose to biota other than man on Table 5.16.	
Whole body and critical organ pathway doses from liquid effluents on Table 5.2-8; credit taken for full dilution in the river.	Doses due to radioisotopes in the blowdown stream from two units on Table 5.3-1; no credit taken for dilution in the river.	Annual doses to maximum individual (adult) due to liquid effluents on Table 5.12.	
Offsite direct radiation doses on Table 5.2-9; for example— Site boundary dose is 1.04×10^{-1} mrem/yr per unit.	Offsite direct radiation doses on Table 5.3-4; for example— Site boundary dose is 2.07×10^{-1} mrem/yr for both units.	Offsite direct radiation dose will be undetectable (less than 5 mrem/yr) (see Subsection 5.4.1.4).	
Estimated doses to population within 50 miles from gaseous effluents on Table 5.2-10.	Corresponding information is presented in different form on Tables 5.3-2 and 5.3-6.		
Estimates of annual whole-body dose to population within 50 miles through all pathways on Table 5.2-11; for example— Plume immersion dose to general population based on one-unit operation is 0.077 man-rem/yr.	Information is presented in different form on several tables: 5.3-1, 5.3-2, 5.3-5, and 5.3-6; for example from Table 5.3-6— Whole body dose to regional population from gaseous releases is 1.54 man-rem/yr-unit.	Annual population dose commitments in the year 2000 on Table 5.10; for example— Gaseous cloud dose to general public within 50 miles is 2.7 man-rem.	
SECTION 5.3 (ER-CP Section 5.4) ITEM DISCUSSED: EFFECTS OF CHEMICAL AND BIOCIDE DISCHARGES			
Maximum drift loss will be 0.008% of circulating and nonessential service water flow.	Maximum drift loss specified as 0.02% of circulating water flow		
Blowdown concentrations on Table 5.3-1.	Blowdown concentrations on Table 5.4-1.		

Note: Blanks in the FES-CP and Environmental Testimony columns indicate either that the item was not discussed or that impacts were no different from those predicted in the ER-CP.

TABLE Q291.11-1 (Cont'd)

ER-OL	ER-CP	FES-CP (NUREG-0097)	ENVIRONMENTAL TESTIMONY
	SECTION 5.3 (ER-CP Section 5.4) (Cont'd)		
TDS plume distribution concentrations on Table 5.3-2 (average conditions) and Table 5.3-3 (extreme conditions).	TDS plume distribution concentrations on Table 5.4-2 (low flow conditions).		
	SECTION 5.4 (ER-CP Section 5.5) ITEM DISCUSSED: EFFECTS OF SANITARY WASTE DISCHARGES		
Chlorine residual of between 0.5 mg/l and 1.0 mg/l will be maintained in sanitary waste treatment system effluent, which, after combination with cooling tower blowdown, will result in chlorine residual of 0.2 mg/l or less.	Sanitary waste treatment system effluent will have chlorine residual of 0.5 mg/l of free chlorine, which, after combination with blowdown, will result in final concentration of 0.1 mg/l of free chlorine.	Chlorine discharges are not to exceed 0.2 ppm (see Subsection 5.5.2).	
	SECTION 5.5 (ER-CP Section 5.6) ITEM DISCUSSED: EFFECTS OF OPERATION AND MAINTENANCE OF THE TRANSMISSION SYSTEMS		
Updates recent research substantiating conclusion of no significant effects.	Notes that there will be no significant effects from the operation of transmission lines.		
Signal interference is greatest with AM radio, UHF TV, and 2-way CB using AM; two way radios using FM, and FM radios in general are largely unaffected (see Subsection 5.5.1.1.2).	Radio and TV reception may be subject to some interference during adverse weather conditions, particularly in areas where signal strength is low (see Subsection 5.6.1.1).		Possibly some interference with standard AM radio broadcast (0.54 to 1.6 MHz) at the edge of the right-of-way. No significant interference with CB radio or FM communication.
Under worst conditions, noise level at edge of right-of-way is expected to be less than 53 dBA.	Not discussed.		Corona activity will generate audible noise expected to be less than 60 dBA under worst weather conditions.
Calculated maximum field strength where conductors sag closes to the ground (36 feet) will be approximately 15 kV/meter (see Subsection 5.5.1.2.1).	Not discussed.		Design criteria of line: maximum electric field of 12 kV/meter; maximum ground-level magnetic field of 1 gauss; maximum induced current of 5 mA.

Note: Blanks in the FES-CP and Environmental Testimony columns indicate either that the item was not discussed or that impacts were no different from those predicted in the ER-CP.

TABLE Q291.11-1 (Cont'd)

ER-OL	ER-CP	FES-CP (NUREG-0097)	ENVIRONMENTAL TESTIMONY
	SECTION 5.6 (ER-CP Section 5.7) ITEM DISCUSSED: OTHER EFFECTS		
Comparison of site boundary noise levels with U.S. EPA recommendations on Table 5.6-1; for example— Predicted plant L_{dn} to the north is 61 dBA.	Comparison of site boundary noise levels with U.S. EPA recommendations on Table 5.7-2; for example— Predicted plant L_{dn} to the north is 58 dBA.		
	SECTION 5.7 (ER-CP Section 5.8) ITEM DISCUSSED: RESOURCES COMMITTED		
Total site area is 960 acres.	Total site area is 987 acres.		
311 acres devoted to agriculture were removed from production.	424 acres devoted to agriculture will be removed from production.		
170 acres will be occupied by paving or structures.	130 acres will be occupied by paving or structures.		
Evaporation and drift loss for both units will be 39.1 cfs for expected average lifetime capacity factor; this is 0.034% of annual average Ohio River flow.	Evaporation and drift loss will be between 53 and 58 cfs; this is 0.05% of annual average Ohio River flow.	Evaporation and drift loss will be between 55 and 60 cfs (see Subsection 5.2.1). Water withdrawal of 69 cfs is 0.06% of annual average Ohio River flow (see Subsection 5.2.1).	
Average through-slot intake velocity of 0.065 ft/sec and monthly maximum of less than 0.104 ft/sec.	Not given in this section; average intake velocity of 0.25 ft/sec and maximum of 0.5 ft/sec given in ER-CP Subsection 3.4.1.		

Note: Blanks in the FES-CP and Environmental Testimony columns indicate either that the item was not discussed or that impacts were no different from those predicted in the ER-CP.

TABLE Q291.11-1 (Cont'd)

ER-OL	ER-CP	FES-CP (NUREG-0097)	ENVIRONMENTAL TESTIMONY
SECTION 7.1 ITEM DISCUSSED: STATION ACCIDENTS INVOLVING RADIOACTIVITY			
Additional meteorological data have resulted in revised χ/Q estimate, which have resulted in revised dose estimates from design-basis accidents: Class 3.0 accidents on Table 7.1-3, Class 5.0 accidents on Table 7.1-4, Class 6.0 accidents on Table 7.1-5, Class 7.0 accidents on Table 7.1-6, and Class 8.0 accidents on Table 7.1-7.	The corresponding design-basis accident release tables are as follows: Class 3.0 accidents on Table 7.1.5, Class 5.0 accidents on Table 7.1-6, Class 6.0 accidents on Table 7.1-7, Class 7.0 accidents on Table 7.1-8, and Class 8.0 accidents on Table 7.1-9.		
Summary of calculated plant accident offsite doses on Table 7.1-8; for example— Population dose from large LOCA pipe break is 15.95 man-rem (whole body) and 3422.0 man-rem (thyroid).	Summary of calculated plant accident offsite doses on Table 7.1-3; for example— Population dose from large LOCA pipe break is 8.36 man-rem (whole body) and 2266.0 (thyroid).	Summary of radiological consequences of postulated accidents on Table 7.2; for example— Dose to population within 50 miles from large LOCA pipe break is 430 man-rem.	
Summary of atmospheric releases in a hypothetical Class 9 accident on Table 7.1-9.	Not presented in ER-CP.		
Probability distribution for population exposure from a Class 9 accident on Figure 7.1-2.	Not presented in ER-CP.		
Probability distribution for acute facalities from a Class 9 accident on Figure 7.1-3.	Not presented in ER-CP.		
Probability distribution for latent health effects from a Class 9 accident on Figure 7.1-4.	Not presented in ER-CP.		

Note: Blanks in the FES-CP and Environmental Testimony columns indicate either that the item was not discussed or that impacts were no different from those predicted in the ER-CP.

TABLE Q291.11-1 (Cont'd)

ER-OL	ER-CP	FES-CP (NUREG-0097)	ENVIRONMENTAL TESTIMONY
	SECTION 7.1 (Cont'd)		
Probability distribution for mitigation costs from a Class 9 accident on Figure 7.1-5.	Not presented in ER-CP.		
	SECTION 7.2 ITEM DISCUSSED: TRANSPORTATION ACCIDENTS INVOLVING RADIOACTIVITY		
Transportation accidents involving radioactivity involve the risks described in Summary Table S-4 of 10 CFR 51.	Not discussed in the ER-CP.		
	SECTION 7.3 (ER-CP Section 7.2) ITEM DISCUSSED: OTHER ACCIDENTS		
Liquid and gaseous chemical stored at the station on Table 7.3-1.	Liquid chemicals stored at the station on Table 7.2-1.		
	SECTION 8.1 ITEM DISCUSSED: BENEFITS		
Direct and indirect benefits from Marble Hill Station tabulated on Table 8.1-1.	Direct benefits from Marble Hill Station tabulated on Table 8.1-1.		
Revenues from kilowatt-hours generated on Table 8.1-2; total $11,250 million in 1986 dollars.	Revenues from kilowatt-hours generated on Table 8.1-1; total $3,177 million in 1983 dollars.		
Life-of-plant property taxes at 1986 present value estimated to be $37 to $38 million.	Life-of-plant property taxes at 1983 present worth estimated to be $36,177,250.		

Note: Blanks in the FES-CP and Environmental Testimony columns indicate either that the item was not discussed or that impacts were no different from those predicted in the ER-CP.

TABLE Q291.11-1 (Cont'd)

ER-OL	ER-CP	FES-CP (NUREG-0097)	ENVIRONMENTAL TESTIMONY
	SECTION 8.1 (Cont'd)		
Income taxes over life of the station estimated to be $672.3 million federal and $106.5 million state.	Income taxes over life of the station estimated to be $508.0 million federal and $123.0 million state.		
Induced employment of approximately 493; PSI personnel on the site is 725 (details on Table 8.1-4).	Induced employment of approximately 155; PSI personnel on the site is 106 (details on Table 8.1-4).		
Estimated annual payroll for first year of operation of both units is about $29.6 million.	Value not given in ER-CP.		
	SECTION 8.2 ITEM DISCUSSED: COSTS		
Facility construction cost in future worth 1986 dollars estimated to be $5,062,500,000.	Facility construction cost in future worth 1983 dollars estimated to be $1,144,213,000.		
Plant life O&M costs in 1986 present worth dollars estimated to be $662,500,000.	Plant life O&M costs in 1983 present worth dollars estimated to be $240,157,926.		
1986 future worth of plant site land is $3,535,072.	1983 future worth of plant site land is $2,056,176.		
1986 future worth of transmission line right-of-way is $9,765,500.	1983 future worth of transmission right-of-way is $7,144,740.		
1986 future worth of land required for substations is $1,255,237.	Not presented in ER-CP.		
Annual real estate and property taxes once both units are in operation expected to be about $3.0 million per year for both units, and $37.4 million, 1986 present worth, over the life of the station.	Annual real estate and property taxes expected to be at least $2 million per year for each unit, and $36,177,250, 1983 present worth, over the life of the station.		

Note: Blanks in the FES-CP and Environmental Testimony columns indicate either that the item was not discussed or that impacts were no different from those predicted in the ER-CP.

TABLE Q291.11-1 (Cont'd)

ER-OL	ER-CP	FES-CP (NUREG-0097)	ENVIRONMENTAL TESTIMONY
	SECTION 8.2 (Cont'd)		
Madison and Hanover sewage systems can handle an additional 8,000 people; hence the 725 new plant employees will not require additional capacity.	Minor increase expected in local government costs for providing sewage treatment.		Madison and Hanover sewage systems can handle an additional 13,500 people; hence the immigration of 250 construction and 155 operations personnel and their families will not require additional capacity.
Existing and planned capacities of water distribution systems can easily handle increased plant population.	Minor increase expected in local government costs for providing water treatment.		The added demand caused by the increase in plant population is well within the capabilities of the Madison and Hanover water supplies.
Madison school system can handle 2,685 more students; hence, no expansion due to children of plant personnel is required.	Minor increase expected in local government costs for providing education.		Madison school system can handle 996 more students, local parochial schools are also under capacity; hence, no expansion due to children of plant personnel is required.
Occupancy rate for primary source of hospital services is 79.7%, and influx of PSI personnel will not increase it by more than 2%; hence, hospital facilities are sufficient.	Not discussed in ER-CP for operating phase.		Occupancy rate for primary source of hospital services is 78.5%, and influx of PSI personnel will not increase it by more than 3%; hence, hospital facilities are sufficient.
	CHAPTER 11 ITEM DISCUSSED: COST-BENEFIT ANALYSIS		
Summary cost-benefit analysis presented on Table 11.0-1.	Summary cost-benefit analysis presented in Chapter 11 text and tables.	Summary of environmental effects from construction in Table 4.8, of operation in Table 5.20, and of construction and operation in Table 10.3.	

Note: Blanks in the FES-CP and Environmental Testimony columns indicate either that the item was not discussed or that impacts were no different from those predicted in the ER-CP.

QUESTION 291.12

Tables reporting predicted blowdown concentration of chemicals (ER-OL 5.3-1, ER-OL 3.6-2) show TDS concentration to be less than the sum of the concentrations of the cations and anions. The predicted TDS also exceeds the value indicated in the CP-FES (Table 3.7, footnote C) as the control value. Confirm predictions of the concentrations of chemical constituents in the circulating water system under average and extreme conditions. Explain methods for making these predictions.

RESPONSE

The ambient Ohio River concentrations of individual anions and cations shown in ER-OL Tables 5.3-1, 2.4-23, and 3.3-1 were obtained from the U.S. Environmental Protection Agency's (EPA's) "STORET" data recording system. The EPA STORET program was selected because it has the longest historical record (years 1955 through 1980) and has values for all of the important constituents in the water. The mean concentration values for each anion and cation as recorded in the STORET files were used to complete the ambient river concentration columns of Tables 5.3-1, 2.4-23, and 3.3-1. The STORET records also included a mean total dissolved solids (TDS) concentration value of 217 mg/l. This value is less than the sum of the individual cation and anion concentrations because the samples recorded in the STORET files are taken at different locations (for the ER-OL, values were used from locations covering the Ohio River 10 miles upstream and 10 miles downstream of the Marble Hill 1&2 intake and discharge area), at different times and, possibly, using different sampling methods. It was necessary to use data from different sample locations to obtain data for all of the important constituents.

In addition to the overall averages described above, average monthly TDS values were necessary for the discharge plume studies presented in ER-OL Chapter 5. These average monthly TDS data were available only from a small subset of the STORET data described above. The average of these monthly TDS values is 200 mg/l, and this value was included in Tables 5.3-1 and 3.3-1 to be consistent with the plume studies.

Using the ambient river water quality data from STORET, the circulating water chemistry was reoptimized for the ER-OL. This optimization study resulted in 7.5 cycles of concentration as the optimal mode of operation for the Marble Hill 1&2 cooling towers. The blowdown concentrations for the individual anions and cations were obtained by multiplying the ambient river values by 7.5 cycles of concentration. The blowdown value for sulfate includes a full cycling of the ambient river sulfate concentration plus the sulfates

resulting from 66° Baume (93% by weight) sulfuric acid addition. The blowdown TDS value was obtained by cycling the ambient river TDS concentration plus 34% of the sulfate due to acid addition 7.5 times. This calculation was performed as follows:

Blowdown TDS = 7.5 cycles [river TDS + 0.34 (sulfate added)]

The multiplier of 0.34 was obtained from textbook methods for estimating the increase in TDS due to sulfuric acid addition.

The predictions of the concentrations of chemical constituents in the circulating water system given in ER-OL Tables 5.3-1 and 3.6-2 have been reviewed and they are correct. It should be noted that although the ER-OL TDS concentration (1635 mg/l) is higher than the concentration predicted at the Construction Permit Stage (1500 mg/l), the TDS plume analysis presented in ER-OL Tables 5.3-2 and 5.3-3 indicates no conflict with applicable water quality standards.

QUESTION 291.13

Several different numbers are presented for annual sulfuric acid usage. Table 5.3-1 shows that sulfate in the blowdown will be increased by 390 mg/l by acid addition. Using an annual average blowdown rate of 5.9 cfs, this indicates an acid usage rate of roughly 2260 tons/year. Section 3.6.1.1 indicates the maximum feed rate of acid to 0.91 gpm. At this rate for one year, and with sulfuric acid at about 79% concentration this would amount to about 2900 tons per year. The average feed rate is 0.64 gpm, or about 2000 tons/year. The same paragraph cites the maximum yearly usage as 3700 tons/year. Confirm acid addition rates and sulfate concentrations in the circulating water system. The major concern at this time is the quality of the cooling tower drift. However, acid usage plans should be clarified.

RESPONSE

The initial estimates of acid usage for the ER-OL were based on an addition rate of 53 mg of 100% sulfuric acid per liter of makeup water. Because 66° Baume sulfuric acid (93% by weight) will be used at Marble Hill, the acid usage rates presented in the ER-OL were adjusted for 66° Baume concentrations. The density of the 93% acid is significantly higher than the density of the 79% acid quoted in the U.S. Nuclear Regulatory Commission's (NRC's) question, explaining much of the difference between the NRC's and the applicant's usage estimates.

The applicant's estimates of yearly acid usage were calculated based on makeup water flow rates for average conditions (68.8% capacity factor and average temperatures) and maximum conditions (100% capacity factor and monthly maximum temperatures). Under average conditions, with an acid feed rate of 0.64 gpm to the makeup water, a usage rate of 2472 tons/year of 66° Baume sulfuric acid with a density of 14.7 pounds per gallon is estimated. This value agrees fairly well with the value of 2260 tons/year estimated by the NRC from the annual average blowdown rate of 5.9 cfs. Under maximum conditions, with an acid feed rate of 0.91 gpm to the makeup water, a usage rate of 3700 tons/year of 66° Baume sulfuric acid is estimated. Based on the blowdown rate under maximum conditions (8.5 cfs), an acid usage rate of 3263 tons/year would be estimated. The differences between acid usage rates based on blowdown and makeup water flows result from variations in makeup flow rates that occur due to essential service operation, as well as from approximations made in these calculations. Since the sulfuric acid addition rate is keyed to the makeup water flow, acid usage values calculated with makeup flow are considered more accurate.

QUESTION 291.14

Table ER-OL 3.6-1 shows that the maximum usage of sodium hypochlorite will exceed the maximum sulfuric acid usage. Revise Table ER-OL 5.3-1 to show the effect of sodium hypochlorite to circulating water quality.

RESPONSE

The effect of sodium hypochlorite addition on circulating water chemistry was ignored because of its low dosage and infrequent addition. The increase in circulating water sodium and chloride concentrations as a result of sodium hypochlorite addition are calculated to be 1.0 ppm and 1.5 ppm respectively, based on a design of 10 ppm maximum dosage rate and 60 minutes of chlorination per day. Since these are design values and actual dosages may be much less, the applicant feels that ER-OL Table 5.3-1 does not require revision.

However, in reviewing ER-OL Table 3.6-1, it was found that the maximum sodium hypochlorite usage rate (lb/yr) shown for the circulating water, nonessential service water, and essential service water systems were actually based on a 1% solution, not a 15% solution as stated in the table. Therefore, the sodium hypochlorite usage rates in ER-OL Table 3.6-1 have been revised to reflect a 15% solution by dividing 15 into the values previously shown. The revised values are given below.

CHEMICAL	USAGE	FREQUENCY	MAX. QUANTITY (lb/yr)
Sodium Hypochlorite (NaOCl) (15%)	Circulating Water	60 min/day	2.2×10^6
	Nonessential Service Water	60 min/day	1.3×10^5
	Essential Service Water	60 min/day	4.9×10^4

These revised values have been incorporated in ER-OL Table 3.6-1.

QUESTION 291.15

Provide a copy of the Indiana DNR Water Withdrawal Permit.

RESPONSE

A copy of the Indiana DNR Water Withdrawal Permit for Marble Hill 1&2 has been provided to the U.S. Nuclear Regulatory Commission.

QUESTION 310.1

What is the basis for estimating $3.0 million in local tax payments made to local governments (Section 8.1.3.1)?

RESPONSE

The state of Indiana taxes public utilities on the depreciated Internal Revenue Service "tax" basis of an asset. (The "tax" basis of an asset is merely the asset's cost less certain items that are deductible for tax purposes, such as Allowance For Funds Used During Construction [AFUDC]). Such basis is then assessed (at roughly 1/3 that amount) and added to the overall taxing units' tax base. The money that each taxing unit needs to operate local government in the coming year is divided by this overall tax base to determine a tax rate. This tax rate is then charged to each taxpayer for his own assessment and a bill rendered. The following illustration may be useful.

Asset Cost	$1,000,000	Money Needed by Local Government (Levy)	$ 5,000,000
AFUDC and Other	(200,000)		
Tax Basis	800,000		
Depreciation	(80,000)		
Depreciated Tax Basis	$ 720,000	Assessed Value in Tax Unit:	
Assessed Value (1/3)	$ 240,000	-All Other Property	$49,760,000
		-Your Asset	240,000
		TOTAL	$50,000,000
Tax Rate per $100	$10	Tax Rate Per $100	$10
Your Tax Bill	$ 24,000		

Therefore, Public Service Indiana (PSI) cost projections included the following basic data using the sources or assumptions noted below to calculate values as shown above.

1. Asset Tax Basis = PSI corporate model projections
2. Depreciation = Used appropriate PSI depreciation rates
3. Money Needed by Local Government (Levy) = Estimated by using latest historical data and escalating for growth.
4. Assessed Value of all Other Property = Estimated by using latest historical data and escalating for growth.

From the above, a tax rate was estimated for each year and applied to the estimated Marble Hill 1&2 assessed value.

QUESTION 310.2

Does the estimate of local tax payments give any consideration to state property tax abatement or exemption programs which may be applicable (Section 8.1.3.1)? If not, what would be the effects of such programs on tax payments to localities?

RESPONSE

Pollution control facilities exemptions, the only tax abatement or exemption program known to be applicable to Marble Hill 1&2, were included in local tax payment estimates. However, as the Marble Hill project will account for approximately 90% to 95% of the taxing units' total assessed valuation, any decrease from an abatement or exemption program would merely result in a corresponding tax rate increase. In other words, Marble Hill 1&2 will pay the vast majority of the taxing units' cost of government with or without tax abatement or exemption programs.

QUESTION 310.3

What is the rationale for using a 14% discount rate for property tax payments (Section 8.1.3.1)?

RESPONSE:

The 14% discount rate equates to the projected Allowance For Funds Used During Construction (AFUDC) rate for the 1986 to 1991 time period as calculated in the official Public Service Indiana (PSI) 1982 Ten-Year Forecast. This rate reflects only the embedded cost of debt and preferred stock and the cost of common equity capital during that time period. As these costs represent the allowed cost of money to PSI under rate-making concepts in effect at such time, they also equate to an appropriate discount rate for PSI.

QUESTION 310.4

The operating staff for Marble Hill is estimated to be 432 employees (Section 8.1.3.2). Does this figure include security forces and other contractor employees who would regularly be employed at the Marble Hill site? If not, the Applicant should provide data on such employment and its contribution to payroll. Is the dollar figure for annual payroll ($29.6 million) expressed in current dollars or constant dollars? If the latter, which year is used for reference?

RESPONSE

The estimate of 432 employees given in ER-OL Subsection 8.1.3.2 does not include security forces and other contractor employees who would regularly be employed at the site. It is estimated that in 1988, the first year in which the full complement of operating staff is on site, 100 security personnel will be employed on site and their contribution to the payroll will be $2,577,000 in current 1988 dollars. The estimate of $29.6 million for the annual payroll, not including the security personnel payroll, is also expressed in current 1988 dollars. At this time there is no estimate of other contractor personnel to be regularly employed at the site.

This response has been incorporated in ER-OL Subsection 8.1.3.2.

QUESTION 310.5

Are the Nuclear Division technical support employees intended to be permanent onsite employees as implied by Section 8.2.2?

RESPONSE

Nuclear Division technical support employees are considered to be permanent onsite employees.

QUESTION 310.6

The applicant should provide a table showing the midyear numbers of operating phase workers at the site. These data should reflect utility employees and contractor personnel (e.g., security guards) who would normally be found on the site, but should exclude intermittent or occasional employees, such as those employed in fuel loading. The Applicant should provide these data for a period beginning in 1983 and ending when the complement of operating staff is on site.

RESPONSE:

Operational staffing is estimated as follows:

PERSONNEL	12/83	6/84	6/85	6/86	6/87	6/88
Operations	292	329	382	409	426	432
Technical Support	433	396	343	316	299	293
Security	35	35	50	160	160	100
TOTAL	760	760	775	885	885	825

The number of security personnel will decrease in 1988 due to the completion of Unit 2 and the corresponding decrease in the number of construction workers on site.

This response has been incorporated in ER-OL Subsection 8.1.3.2.

QUESTION 311.1

Your documentation states that PSI owns and controls all of the land within the Marble Hill exclusion area. However, it does not mention anything pertaining to:

a. the mineral rights within the exclusion area. Please discuss the status and/or the legal implications regarding the mineral rights and PSI's authority to control them.

b. the cemetery located within the exclusion area. Please provide information as to its designation, location, status (whether it is active or abandoned), and whether there are any visitation or sightseeing privileges involved.

RESPONSE

a. This question was responded to at the Construction Permit stage by answering Question 310.1 on the Marble Hill Preliminary Safety Analysis Report (PSAR).

Public Service Company of Indiana, Inc. (PSI), owns the entire Marble Hill site, including the exclusion area, in fee simple. This includes the ownership and control of mineral rights.

b. This question was responded to at the Construction Permit stage by answering Question 310.10 on the PSAR and Question 39 of Supplement 3 to the Environmental Report - Construction Permit Stage (ER-CP).

Public Service Company of Indiana, Inc., owns the tract of land on which the cemetery is located in fee simple. As already discussed, the entire exclusion area will be under PSI control. Provisions have been made for allowing interested persons, who request to do so, to visit the cemetery under appropriate conditions to protect both the plant and the public. PSI expects the number of persons requesting to visit the cemetery to be minimal. Levena McCormick, the former owner of the 180-acre farm on which the cemetery was located, has filed an affidavit stating that she had, as of January 1975, resided on the farm for 55 or more years prior to that date, and that to her knowledge no one had been buried in the cemetery or requested permission to visit the cemetery during that period of time. During PSI's period of ownership, no one has been buried in the cemetery or requested permission to visit the cemetery.

As outlined in Section 8.2.3.2 of the ER-CP, access to the cemetery will be maintained during station construction and after Marble Hill 1&2 becomes operational. The cemetery will remain undisturbed. ER-OL Figure 2.1-1 indicates the location of the cemetery.

QUESTION 311.2

Please provide information on any prisons, nursing/convalescent homes, day care centers, or other institutions within 10 miles of the site. Please designate their locations and distances relative to the plant, the number of persons employed, and the capacity of each facility.

RESPONSE

There are no prisons within a 10-mile radius of Marble Hill 1&2. Information on elementary, junior high, and high schools within approximately 10 miles is given in ER-OL Table 2.1-18. Information on other institutions within approximately 10 miles is shown in Table Q311.2-1.

This response has been incorporated in ER-OL Subsection 2.1.3.1.

REFERENCES

Anderson, M., 1983, Madison Nursing Home, Madison, Indiana, telephone conversation of March 18 with S. A. Hallaron, Cultural Resource Analyst, Sargent & Lundy, Chicago, Illinois.

Applegate, S., 1983, Presbyterian Preschool, Madison, Indiana, telephone conversation of March 21 with S. A. Hallaron, Cultural Resource Analyst, Sargent & Lundy, Chicago, Illinois.

Black, M., 1983, Headstart, Madison State Hospital, Madison, Indiana, telephone conversation of March 21 with S. A. Hallaron, Cultural Resource Analyst, Sargent & Lundy, Chicago, Illinois.

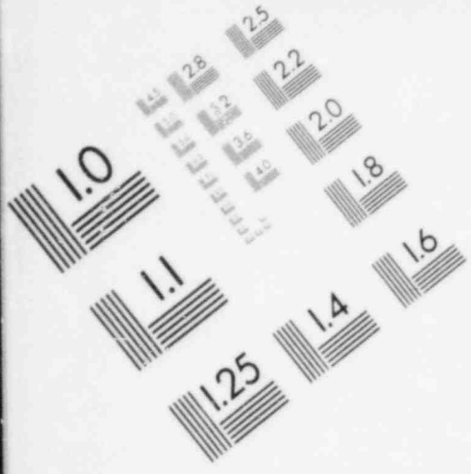
Lemm, M., 1983, Clifty Convalescent Center, Madison, Indiana, telephone conversation of March 18 with S. A. Hallaron, Cultural Resource Analyst, Sargent & Lundy, Chicago, Illinois.

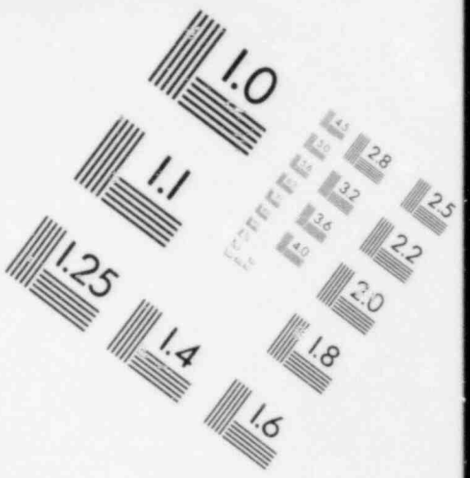
Lester, M., 1983, The Children's House, Madison, Indiana, telephone conversation of March 21 with S. A. Hallaron, Cultural Resource Analyst, Sargent & Lundy, Chicago, Illinois.

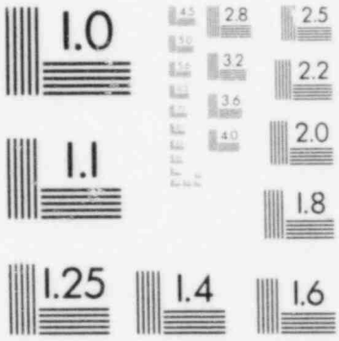
Palmer, N., 1983, Hanover Cooperative Preschool, Hanover, Indiana, telephone conversation of March 21 with S. A. Hallaron, Cultural Resource Analyst, Sargent & Lundy, Chicago, Illinois.

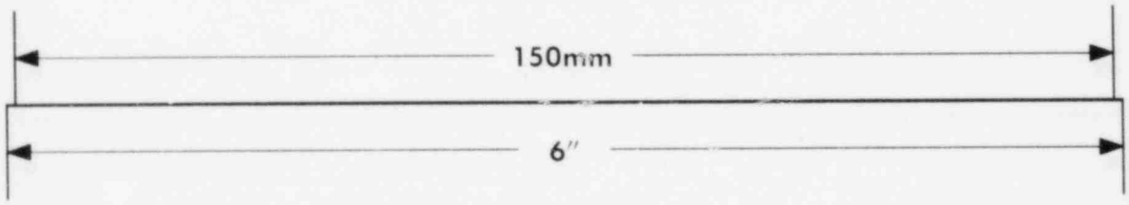
Sauley, J., 1983, North Madison Preschool, Madison, Indiana, telephone conversation of March 21 with S. A. Hallaron, Cultural Resource Analyst, Sargent & Lundy, Chicago, Illinois.

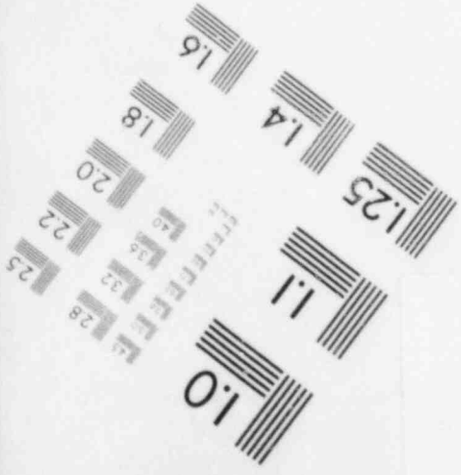
IMAGE EVALUATION
TEST TARGET (MT-3)

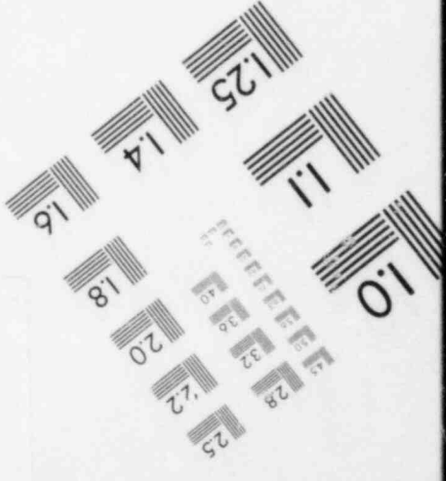












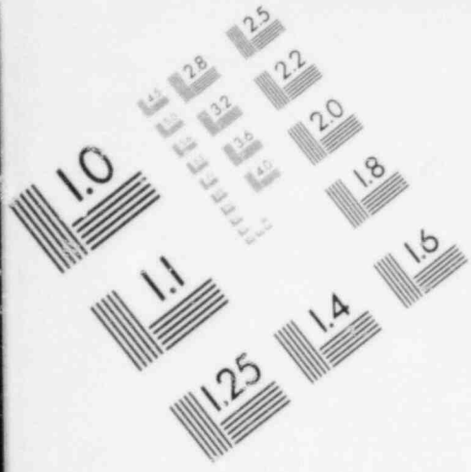
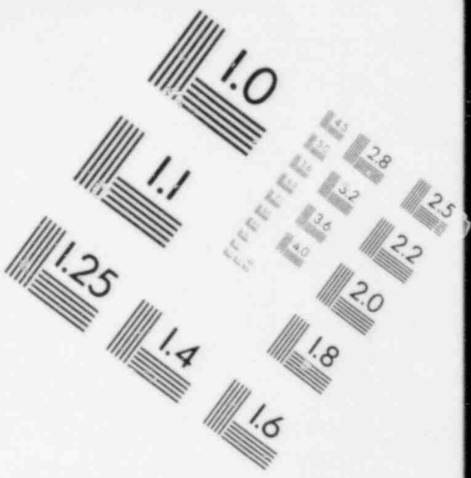
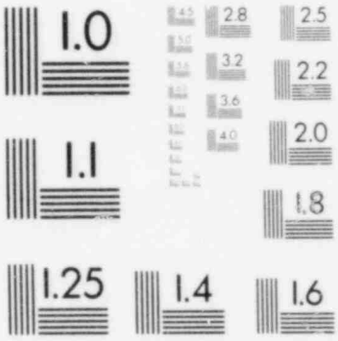
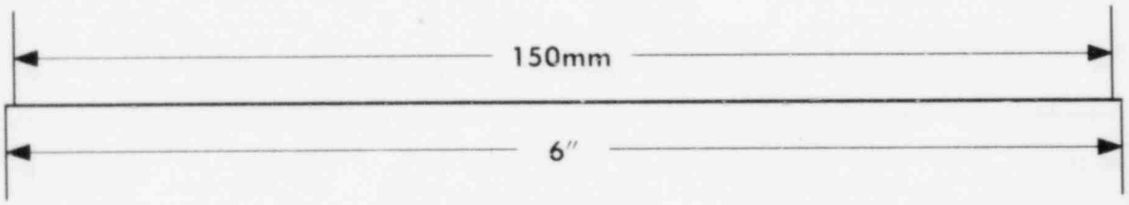
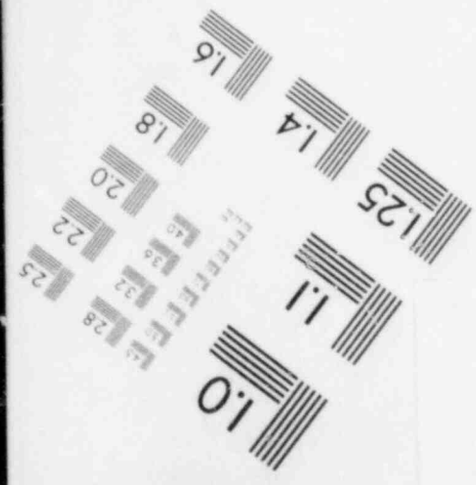


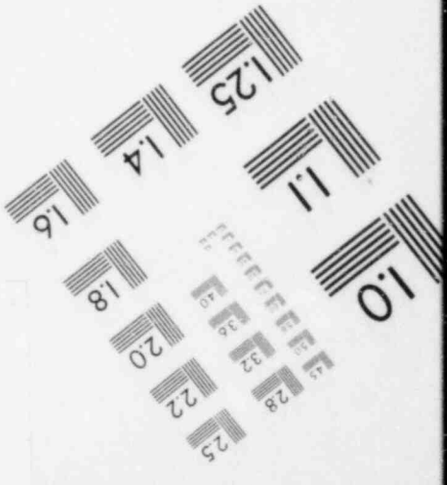
IMAGE EVALUATION TEST TARGET (MT-3)











Scott, D. J., 1982, King's Daughters' Hospital, Madison, Indiana, letter of March 4 to S. A. Hallaron, Cultural Resource Analyst, Sargent & Lundy, Chicago, Illinois.

Siers, N., 1983, Trimble County Nursing Center, Bedford, Kentucky, telephone conversation of March 18 with S. A. Hallaron, Cultural Resource Analyst, Sargent & Lundy, Chicago, Illinois.

Williams, S., 1982, Madison State Hospital, Madison, Indiana, telephone conversation of March 2 with S. A. Hallaron, Cultural Resource Analyst, Sargent & Lundy, Chicago, Illinois.

Williamson, S., 1983, Mayfield Nursing Home, Madison, Indiana telephone conversation of March 21 with S. A. Hallaron, Cultural Resource Analyst, Sargent & Lundy, Chicago, Illinois.

Wolfschag, K., 1983, Hanover Nursing Home, Hanover, Indiana, telephone conversation of March 18 with S. A. Hallaron, Cultural Resource Analyst, Sargent & Lundy, Chicago, Illinois.

TABLE Q311.2-1

OTHER INSTITUTIONS WITHIN APPROXIMATELY

10 MILES OF MARBLE HILL 1&2

INSTITUTION	LOCATION/DISTANCE[m]	NUMBER OF STAFF	CAPACITY
NURSING HOMES			
Trimble County Nursing Center[a]	Bedford, KY 7 miles E	40	60 beds
Hanover Nursing Home[b]	Hanover, IN 7.8 miles N	90-100	151 beds
Madison Nursing Home[c]	Madison, IN 10.7 miles NNE	26	40 beds
Clifty Convalescent Center[d]	Madison, IN 10.7 miles NNE	60	116 beds
Mayfield Nursing Home[e]	Madison, IN 10.7 miles NNE	24	32 beds
DAY CARE CENTER			
The Children's House[f]	Madison, IN 10.7 miles NNE	4	12-20 children
PRESCHOOLS			
Hanover Cooperative Preschool[g]	Hanover, IN 7.8 miles N	2	40 students
Headstart, Madison State Hospital[h]	Madison, IN 10.7 miles NNE	5 full time 3 part time	50 students
North Madison Preschool[i]	Madison, IN 10.7 miles NNE	2	26 students (2-3 classes per day)
Presbyterian Preschool[j]	Madison, IN 10.7 miles NNE	2	10-22 students[n]

TABLE Q311.2-1 (Cont'd)

INSTITUTION	LOCATION/DISTANCE[m]	NUMBER OF STAFF	CAPACITY
HOSPITALS			
King's Daughters' Hospital[k]	Madison, IN 10.7 miles NNE	332	140 beds
Madison State Hospital[l]	Madison, IN 10.7 miles NNE	550	502 beds

Sources: [a]Siers 1983; [b]Wolfschag 1983; [c]Anderson 1983; [d]Lemm 1983; [e]Williamson 1983; [f]Lester 1983; [g]Palmer 1983; [h]Black 1983; [i]Sauley 1983; [j]Applegate 1983; [k]Scott 1982; [l]Williams 1983

[m]Distance and direction from the midpoint between Marble Hill Units 1 and 2 to the center of the town in which the institution is located.

[n]The number of students at the Presbyterian Preschool is expected to double (to 20-40) in 1984.

QUESTION 451.1

Chapter 3 does not contain some of the necessary information for estimating radiological effluents. Provide the following additional information describing each gaseous effluent release point and characteristics of release:

a. height of release point above adjacent structures,

b. location relative to adjacent structures, including cooling towers,

c. average temperature difference between gaseous effluents and ambient air,

d. average rate of air flow, cfm,

e. size of flow orifice,

f. shape (type) of flow orifice,

g. release frequency,

h. containment purge air flow rate and frequency.

RESPONSE

Two ventilation stacks will exhaust gaseous emissions from Units 1 and 2 to the outdoors.

a. The elevation of the top of both stacks is 200 ft above the plant grade elevation, 65 ft above the adjacent turbine room roof, and 1 ft above the tops of the containment buildings.

b. The Unit 1 stack is located approximately 550 ft from the closest edge of the Unit 1 cooling tower; the Unit 2 stack is approximately 650 ft from the closest edge of the Unit 2 cooling tower. The locations of the vent stacks relative to adjacent structures are shown in ER-OL Figures 2.1-1 and 3.1-1.

c. The average exhaust air temperature is 115^{o}F, whereas the outside air design dry-bulb summer (ASHRAE 1%) condition is 95^{o}F and the design dry-bulb winter (ASHRAE 99%) condition is 5^{o}F.

d. The following exhaust air will be released during normal plant operation:

Unit 1 stack - 180,205 cfm
Unit 2 stack - 171,600 cfm

e. The inside dimensions of both stacks are 13.3 ft by 5.0 ft at the point of exit.

f. The shape of both stacks is rectangular.

g. The ventilation stacks will exhaust air emissions to the outdoors continuously.

h. The containment purge is divided into three systems: (1) mini-flow purge, (2) normal purge, and (3) post-LOCA purge. These systems serve the containment (1) during normal plant operating conditions, (2) during planned reactor shutdown, and (3) during post-LOCA operating conditions, respectively. The airflow rates are:

Mini-flow Purge System - 3,000 cfm
Normal Purge System - 43,900 cfm
Post-LOCA Purge System - 400 cfm

Purge flows are mixed with the normal exhaust air flows given in part d. for release.

QUESTION 470.1

Section 5.2, "Radiological Impact From Routine Operation," does not provide either a cost-benefit analysis to determine if additional radwaste systems and equipment should be required, or a comparison of the estimated radioactive effluents and doses with the Rulemaking 50-2 design objectives. Provide a cost-benefit analysis, or, if applicable (see 10 CFR 50 Appendix I), provide a comparison with the RM50-2 design objectives.

RESPONSE

Comparisons of the expected annual average doses and releases from Marble Hill 1&2 with the design objectives of Appendix I to 10 CFR Part 50 and the RM50-2 criteria from the Annex to Appendix I to 10 CFR Part 50 are shown in Tables Q470.1-1 and Q470.1-2, respectively. Note that the Appendix I objectives are on a per reactor unit basis, while the RM50-2 criteria are for all of the units at a site. As the comparison tables show, both of these sets of design objectives are satisfied by Marble Hill 1&2.

As a consequence of satisfying the RM50-2 criteria, a detailed cost-benefit analysis for the liquid and gaseous radwaste treatment systems is not required for Marble Hill 1&2, since the construction permit application was filed between January 2, 1971 and June 4, 1976 (see Appendix I to 10 CFR Part 50, Section II, Paragraph D).

This response has been incorporated in a new subsection of the ER-OL, Subsection 5.2.6.

TABLE Q470.1-1

COMPARISON OF EXPECTED DOSES FROM MARBLE HILL 1&2

WITH APPENDIX I DESIGN OBJECTIVES

TYPE OF RELEASE	UNITS	APPENDIX I[a] OBJECTIVES	EXPECTED[b] VALUES
Liquid Effluents			
Total body dose from all pathways	(mrem)	3	0.0023
Any organ dose from all pathways	(mrem)	10	0.0018
Nobel Gas Effluents (at the site boundary)			
Gamma air exposure dose	(mrad)	10	0.018
Beta air exposure dose	(mrad)	20	0.045
Total body dose	(mrem)	5	0.011
Skin dose	(mrem)	15	0.035
Airborne Radioiodines and Particulates			
Any organ dose from all pathways	(mrem)	15	0.189

[a]Per year per reactor unit.

[b]To the maximally exposed individual from one-unit operation.

TABLE Q470.1-2

COMPARISON OF EXPECTED DOSES AND RELEASES FROM MARBLE HILL 1&2

WITH RM50-2 DESIGN OBJECTIVES

TYPE OF RELEASE	UNITS	RM50-2[a] OBJECTIVES	EXPECTED[b] VALUES
Liquid Effluents			
Total body or any organ dose from all pathways	(mrem)	5	0.0046
Activity release estimate, excluding tritium	(Ci/yr)	10	0.468
Noble Gas Effluents (at the site boundary)			
Gamma air exposure dose	(mrad)	10	0.036
Beta air exposure dose	(mrad)	20	0.091
Total body dose	(mrem)	5	0.021
Skin dose	(mrem)	15	0.070
Airborne Radioiodines and Particulates			
Any organ dose from all pathways	(mrem)	15	0.378
I-131 activity release	(Ci/yr)	2	0.102

[a]Per year for all units at the site.

[b]To the maximally exposed individual from two-unit operation.

QUESTION 470.2

Section 5.2 states that doses were calculated using the methodology in USNRC Regulatory Guide 1.109, Revision 1. If the GASPAR and LADTAP computer codes were used to estimate doses from exposure to radioactive effluents, provide a listing of input parameters that were used in the GASPAR and LADTAP computer runs to estimate the doses in Tables 5.2-4, 8, 10 and 11.

RESPONSE

The GASPAR and LADTAP computer codes were not used to estimate radiological doses for the Marble Hill 1&2 ER-OL. The doses shown in ER-OL Tables 5.2-4, 8, 10, and 11 were estimated using Sargent & Lundy computer codes in accordance with the methodology of USNRC Regulatory Guide 1.109, Revision 1.

QUESTION 470.3

Section 2.1 does not discuss the annual recreational harvest of fish and invertebrates. Since these quantities are needed to compute doses to the population downstream of the plant, provide data on the annual fish and invertebrate harvests within 50 miles downstream of the plant. If this data is not readily available, a conservative (i.e., high) estimate and the bases for the estimate will be sufficient.

RESPONSE

Available information on recreational fishing in the Ohio River is presented in the response to Question 291.7 and in the new ER-OL Subsection 2.2.1.3.6.4. The applicant has been able to locate no information on recreational harvest of invertebrates. The only data on invertebrate harvest that the applicant has been able to locate concern commercial mussel fishing; these data are presented in the following paragraphs.

The Kentucky Department of Fish and Wildlife Resources is aware of no commercial mussel fishing in the Ohio River upstream of the Newberg Lock and Dam at River Mile 776 (Crowell 1983a). It thus appears that no such activity occurs within 50 miles downstream of Marble Hill 1&2, which is located at River Mile 570.

In 1981, 63 commercial mussel fishermen fished the Ohio River downstream of Newberg Lock and Dam; they harvested 569,564 pounds of shell valued at $159,478. In 1982, 28 commercial mussel fishermen fished the Ohio River downstream of Newberg Lock and Dam; they harvested 29,772 pounds of shell valued at $9,676 (Crowell 1983a). Mussels taken from the Ohio River are not usually consumed by humans (Crowell 1983b). The shells, which formerly were used for making buttons, now are used primarily by the Japanese cultured pearl industry for "seed." The Japanese demand for mussel shells fell in 1982, as reflected by the low harvest and reduced dollar value (Crowell 1983b).

This response has been incorporated in ER-OL Subsection 2.1.3.2.1.

REFERENCES

Crowell, E. F. 1983a, Assistant Director, Division of Fisheries, Kentucky Department of Fish and Wildlife Resources, Frankfort, letter of March 10 to S. A. Hallaron, Cultural Resource Analyst, Sargent & Lundy, Chicago, Illinois.

Crowell, E. F., 1983b, Assistant Director, Division of Fisheries, Kentucky Department of Fish and Wildlife Resources, Frankfort, telephone conversation of March 14 with S. A. Hallaron, Cultural Resource Analyst, Sargent & Lundy, Chicago, Illinois.

QUESTION 470.4

Section 2.1.3.2.2 (p. 2.1-8) discusses groundwater use. Provide the following information on offsite domestic wells within 3 miles of the plant, if any, that might be affected by the discharge of radioactive liquid effluents from normal operations: designation of the well, distance and direction from the plant.

RESPONSE

Discharge of radioactive liquid effluents from normal operation will take place as part of the blowdown to the Ohio River. The only domestic wells within 3 miles that might conceivably be affected by these normal releases of radioactive liquid effluents are those that might receive some component of recharge from the Ohio River. These wells would be completed in the alluvial-glaciofluvial aquifer bordering the Ohio River. Examination of U.S. Geological Survey (USGS) topographic maps and an inventory of wells in the local and site area indicates that there are no wells within 3 miles downstream of the blowdown discharge on the Indiana side of the Ohio River that are completed in the alluvial-glaciofluvial aquifer. Examination of USGS topographic maps indicates that all dwellings within 3 miles downstream on the Kentucky side of the Ohio River are at least 600 feet from the river. Before any normal release of radioactive liquid effluent could affect any domestic well on the Kentucky side of the Ohio River, the following would take place: the release would be diluted with Ohio River water by an average factor of 19,661 times, as discussed in ER-OL Subsection 5.2.2.1; the release would be further diluted with groundwater while traveling to the well through the alluvial-glaciofluvial aquifer; and the concentration of radionuclides present would be reduced by radioactive decay during the travel time through the river and through the aquifer to the well. Therefore, there are no wells within 3 miles of the blowdown discharge that might be affected by the discharge of radioactive liquid effluents from normal operation.

QUESTION 470.5

Section 2.1 does not provide data on crops for animal feed and crops for human consumption within 50 miles of the plant. Provide the total annual crop harvests for animal feed and human consumption within 50 miles of the plant. If a cost-benefit analysis is to be done, then provide this information for 16 sectors and various annuli.

RESPONSE

Data on the harvest of crops for human consumption for the counties within 50 miles of Marble Hill 1&2 are shown on Table Q470.5-1. Data on the harvest of crops for animal feed for the same counties are shown on Table Q470.5-2. It should be noted that these statistics are conservative, because they include crops harvested from any portions of the counties that are more than 50 miles from Marble Hill 1&2. The applicant does not plan to perform a cost-benefit analysis using these data, so they are not presented in sectors or annuli.

This response has been incorporated in ER-OL Subsection 2.1.3.1.

REFERENCES

Indiana Crop and Livestock reporting Service, 1981, "Indiana Crop and Livestock Statistics: Annual Crop and Livestock Summary, 1980," No. A 81-1, U.S. Department of Agriculture and Purdue University, West Lafayette, Indiana

Kentucky Crop and Livestock Reporting Service, 1981, "Kentucky Agricultural Statistics: 1980-1981," U.S. Department of Agriculture and Kentucky Department of Agriculture, Louisville, Kentucky

U.S. Department of Commerce, 1981, "1978 Census of Agriculture," Indiana and Kentucky County Summary, U.S. Bureau of the Census, Government Printing Office, Washington, D.C.

TABLE Q470.5-1

MAJOR CROPS FOR HUMAN CONSUMPTION

STATISTICS FOR COUNTIES WITHIN 50 MILES OF MARBLE HILL 1&2

COUNTIES	CORN HARVESTED FOR GRAIN[a]		SOYBEANS[a]		WINTER WHEAT[a]	
	TOTAL PRODUCTION (thousand kg)	YIELD, (kg/m^2)	TOTAL PRODUCTION (thousand kg)	YIELD, (kg/m^2)	TOTAL PRODUCTION (thousand kg)	YIELD, (kg/m^2)
INDIANA						
Bartholomew	163,393	0.50	33,192	0.23	27,523	0.34
Brown	8,138	0.51	615	0.19	109	0.27
Clark	59,004	0.55	19,775	0.21	3,851	0.26
Crawford	17,948	0.55	3,500	0.20	465	0.23
Dearborn	31,701	0.63	10,023	0.20	2,270	0.24
Decatur	337,714	0.75	27,333	0.26	18,219	0.34
Floyd	7,575	0.56	2,466	0.19	1,388	0.26
Harrison	83,113	0.58	13,564	0.22	10,366	0.30
Jackson	200,067	0.53	30,639	0.22	14,601	0.28
Jefferson	53,030	0.54	16,955	0.19	3,650	0.24
Jennings	98,953	0.56	10,655	0.21	7,188	0.28
Lawrence	70,582	0.57	8,347	0.18	3,886	0.29
Ohio	9,310	0.53	1,671	0.20	476	0.19
Orange	89,219	0.58	3,176	0.18	5,536	0.29
Ripley	126,523	0.63	25,644	0.20	10,826	0.26
Scott	55,565	0.65	9,376	0.23	1,979	0.26
Switzerland	17,702	0.56	4,801	0.18	1,622	0.25
Washington	15513	0.62	7,596	0.19	11,752	0.26
KENTUCKY						
Anderson	4,013	0.50	--	--	476	0.24
Boone	11,839	0.50	1,393	0.22	--	--
Bullitt	11,756	0.56	3,146	0.23	621	0.26
Carroll	4,214	0.50	1,225	0.20	--	--
Franklin	5,476	0.48	495	0.17	--	--
Gallatin	3,813	0.50	762	0.19	--	--
Grant	5,144	0.51	--	--	--	--
Henry	24,964	0.53	958	0.22	849	0.26
Jefferson	13,132	0.59	5,715	0.20	1,470	0.30
Nelson	40,937	0.50	5,095	0.17	5,171	0.26
Oldham	26,153	0.62	3,592	0.20	2,613	0.27
Owen	5,487	0.50	--	--	--	--
Scott	16,866	0.52	2,351	0.22	449	0.22
Shelby	56,924	0.56	7,664	0.22	4,354	0.27
Spencer	21,878	0.55	2,526	0.22	806	0.25
Trimble	8,535	0.50	2,667	0.24	1,524	0.27
Woodford	11,685	0.58	667	0.24	--	--

See notes on last page of table.

COUNTIES	OATS		BURLEY TOBACCO[a]		IRISH POTATOES[b]	
	TOTAL PRODUCTION (thousand kg)	YIELD (kg/m^2)	TOTAL PRODUCTION (thousand kg)	YIELD (kg/m^2)	TOTAL PRODUCTION (thousand kg)	YIELD (kg/m^2)
INDIANA						
Bartholomew	299	0.19	--	--	--	--
Brown	0	0.00	--	--	4	0.33
Clark	135	0.17	--	--	181	1.54
Crawford	65	0.16	--	--	19	1.52
Dearborn	135	0.17	--	--	74	1.84
Decatur	248	0.20	--	--	5	--
Floyd	67	0.16	--	--	120	0.74
Harrison	276	0.17	--	--	71	1.36
Jackson	221	0.18	--	--	--	-
Jefferson	225	0.19	--	--	71	0.84
Jennings	138	0.17	--	--	--	--
Lawrence	210	0.17	--	--	10	1.28
Ohio	62	0.15	--	--	--	--
Orange	459	0.19	--	--	--	--
Ripley	298	0.15	--	--	58	2.06
Scott	65	0.16	--	--	4	--
Switzerland	306	0.19	--	--	127	2.62
Washington	688	0.19	--	--	17	0.86
KENTUCKY						
Anderson	--	--	1,512	0.26	2	--
Boone	--	--	1,431	0.25	505	1.76
Bullitt	--	--	534	0.24	182	1.29
Carroll	--	--	1,549	0.24	--	--
Franklin	--	--	2,419	0.27	13	1.09
Gallatin	--	--	899	0.24	99	--
Grant	--	--	2,537	0.25	86	3.56
Henry	--	--	4,333	0.28	--	--
Jefferson	--	--	313	0.23	131	1.08
Nelson	--	--	2,062	0.26	24	0.59
Oldham	--	--	748	0.28	--	--
Owen	--	--	3,628	0.27	196	1.56
Scott	--	--	4,396	0.27	4	1.10
Shelby	--	--	5,341	0.28	43	0.98
Spencer	--	--	1,854	0.24	59	--
Trimble	--	--	1,635	0.26	87	--
Woodford	--	--	4,368	0.27	--	--

See notes on last page of table.

Q470.5-1 (Cont'd)

COUNTIES	BARLEY FOR GRAIN OR SEED[b] TOTAL PRODUCTION (thousand kg)	BARLEY FOR GRAIN OR SEED[b] YIELD (kg/m^2)	SORGHUM FOR GRAIN OR SEED[b] TOTAL PRODUCTION (thousand kg)	SORGHUM FOR GRAIN OR SEED[b] YIELD (kg/m^2)
INDIANA				
Clark	51	0.24	--	--
Decatur	371	0.42	106	0.26
Floyd	27	0.29	--	--
Harrison	572	0.27	458	0.49
Jackson	--	--	410	0.37
Jefferson	309	0.37	--	--
Switzerland	12	0.15	--	--
Washington	134	0.27	59	--
KENTUCKY				
Bullitt	127	0.27	--	--
Jefferson	158	0.22	--	--
Nelson	227	0.22	--	--
Oldham	645	0.20	19	0.07
Shelby	--	--	15	--

Notes: Values represent harvest for most recent year for which data are available.

Hyphens, "---", indicte data not available because not reported.

[a]Source: Indiana Crop and Livestock Reporting Service (1981); Kentucky Crop and Livestock Reporting Service (1981).

[b]Source: U.S. Department of Commerce (1981, Tables 28-30).

TABLE Q470.5-2

MAJOR CROPS FOR ANIMAL FEED

STATISTICS FOR COUNTIES WITHIN 50 MILES OF MARBLE HILL 1&2

COUNTIES	ALL HAY[a] TOTAL PRODUCTION (thousand kg)	ALL HAY[a] YIELD (kg/m^2)	CORN FOR SILAGE[b] TOTAL PRODUCTION (thousand kg)	CORN FOR SILAGE[b] YIELD (kg/m^2)	SORGHUM FOR SILAGE[b] TOTAL PRODUCTION (thousand kg)	SORGHUM FOR SILAGE[b] YIELD (kg/m^2)
INDIANA						
Bartholomew	14,878	0.56	17,280	4.12	--	--
Brown	8,165	0.56	--	--	--	--
Clark	22,952	0.47	14,958	4.10	504	2.59
Crawford	18,597	0.52	3,733	3.35	--	--
Dearborn	29,302	0.56	8,198	3.39	699	4.21
Decatur	18,325	0.61	45,681	4.35	618	1.70
Floyd	9,435	0.47	--	--	--	--
Harrison	41,095	0.49	14,561	3.50	--	--
Jackson	22,226	0.52	26,818	4.01	535	1.97
Jefferson	21,591	0.47	12,615	3.50	585	4.02
Jennings	12,701	0.54	9,368	3.58	--	--
Lawrence	41,730	0.54	11,893	3.34	--	--
Ohio	9,798	0.45	6,838	3.91	--	--
Orange	26,036	0.52	51,515	4.20	--	--
Ripley	26,853	0.54	24,634	3.81	--	--
Scott	10,070	0.49	6,466	4.08	--	--
Switzerland	16,239	0.45	13,004	3.60	1,429	3.30
Washington	45,904	0.52	38,475	3.87	--	--
KENTUCKY						
Anderson	17,055	0.40	16,848	3.48	--	--
Boone	25,129	0.47	18,691	3.73	164	--
Bullitt	17,599	0.40	15,324	3.74	--	--
Carroll	9,079	0.38	5,492	3.73	--	--
Franklin	18,688	0.36	7,361	3.36	--	--
Gallatin	9,072	0.45	6,192	3.36	--	--
Grant	22,317	0.43	8,231	4.24	136	1.98
Henry	45,359	0.47	40,772	3.83	518	1.27
Jefferson	20,775	0.43	7,098	3.31	--	--
Nelson	57,697	0.45	75,898	3.46	924	2.24
Oldham	20,593	0.45	26,782	3.59	--	--
Owen	29,846	0.43	17,641	3.96	211	2.08
Scott	33,566	0.38	12,927	4.02	--	--
Shelby	64,682	0.43	100,533	3.55	850	2.47
Spencer	25,038	0.40	36,435	3.28	560	1.87
Trimble	12,428	0.43	2,942	3.99	--	--
Woodford	35,652	0.43	23,377	3.30	485	--

Notes: Values represent harvest for most recent year for which data are available.

Hyphens, "---", indicte data not available because not reported.

[a]Source: Indiana Crop and Livestock Reporting Service (1981); Kentucky Crop and Livestock Reporting Service (1981).

[b]Source: U.S. Department of Commerce (1981, Tables 28-30).

QUESTION 470.6

Section 5.2.4.1 states that there is "no known permanent use of Ohio River water for irrigation of crops." Either confirm that river water is not consumed by animals in the human food chain pathway, or provide estimates of the quantities of river water consumed.

RESPONSE

Contact with the Agricultural Extension Offices for the seven counties that border the Ohio River within 50 miles downstream of the Marble Hill site (Jefferson, Clark, Floyd, and Harrison Counties, Indiana; Trimble, Oldham, and Jefferson Counties, Kentucky) indicated that there is no permanent use of Ohio River water for either crop irrigation or livestock consumption. Any such use is on a temporary basis by local farmers, and no records are kept of the quantities of water used.

This response has been incorporated in ER-OL Subsection 5.2.4.1.

MARBLE HILL NUCLEAR GENERATING STATION

REMOTE SENSING AND GROUND TRUTH PROGRAM

FINAL REPORT

SEPTEMBER 1980

Prepared for

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by

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