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Docket No. 50-412

MEMORANDUM FOR: Thomas M. Novak, Assistant Director
for Licensing
Division of Licensing

FROM: William V. Johnston, Assistant Director
Materials, Chemical & Environmental
Technology
Division of Engineering

SUBJECT: DRAFT SER INPUT FOR BEAVER VALLEY UNIT 2

Plant Name: Beaver Valley Unit 2
Docket No.: 50-412
Licensing Stage: OL
Responsible Branch: LB #3
Project Manager: L. Lazo
Site Analysis Branch Reviewer: C. Ferrell
Requested Completion Date: January 27, 1984
Review Status: SER Review Complete

Attached is the Site Analysis Branch input for Sections 2.1, 2.2, and 2.3 of the Beaver Valley Unit 2 Draft Safety Evaluation Report. The applicant's response of May 30, 1984 satisfactorily resolved our questions 311.5-311.8 regarding the analysis of the Mobil Oil Company pipeline used for transporting gasoline. We have no open items on this nuclear plant. This review was delayed due to the participation of the reviewer in the Limerick hearings.

William V. Johnston, Assistant Director
Materials, Chemical & Environmental
Technology
Division of Engineering

Attachment:
As stated
*See Previous Conncurrence Sheet

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DATE	6/29/84	6/29/84	7/2/84	7/3/84			

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BEAVER VALLEY UNIT 2
DRAFT SER INPUT

2 Site Characteristics

Chapter 2, "Site Characteristics," for the Beaver Valley Unit 2 site has been reviewed in accordance with the July 1981 edition of the "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants" (SRP), NUREG-0800.

2.1 Geography and Demography

2.1.1 Site Location and Description

The Beaver Valley site is a 501 acre tract of land located on the south bank of the Ohio River in Beaver County, Pennsylvania. The site is approximately one mile from Midland, Pennsylvania (1980 population 4,310), five miles from East Liverpool, Ohio (1980 population 16,687) and 25 miles from Pittsburgh, Pennsylvania (1980 population 423,938). The plant is adjacent to Beaver Valley Unit 1, and the Shippingport Atomic Power Station which terminated operations in 1982. Shippingport is scheduled for decommissioning by the United States Department of Energy. Figure 2.1 shows the general region of the Beaver Valley site.

The topography of the site is shown in Figure 2.2. The topography of the Beaver Valley site consists of a fairly level river terrace on the south bank of the Ohio River at an approximate elevation of 730 feet above mean sea level (MSL). The normal pool elevation of the Ohio River due to the use of navigation locks and dams is 665 feet MSL. Hills rise to approximately 1,100 feet MSL on both sides of the Ohio River, which is about 1,300 feet wide in the vicinity of the Beaver Valley site.

The coordinates of the Beaver Valley Unit 2 are 40° 37' 23" north latitude and 80° 25' 57" west longitude. The universal transverse mercator coordinates are 580,010 meters east and 4,496,890 meters north.

2.1.2 Exclusion Area Authority and Control

The applicant has defined the exclusion area as shown in Figure 2.2. The minimum distance to the exclusion boundary is 1500 feet from the Beaver Valley Unit 2 containment building.. Phillis Island in the Ohio River is located within the exclusion area. The applicant has made arrangements with the Dravo Corporation, which owns Phillis Island, to control activities on the island. Also, arrangements have been made with the U.S. Coast Guard and the U.S. Army Corps of Engineers to control traffic on the Ohio River within the exclusion area in the event of an emergency. Arrangements have been made with both the Beaver Valley County Civil Defense and the Pennsylvania State Police to control traffic on Route 168, including the bridge, in the event of an emergency.

The Consolidated Rail Corporation (Con Rail) Railroad right-of-way, within the exclusion area, is controlled by Duquesne Light Company, and its use is limited to servicing the Shippingport and the Beaver Valley Stations. There are no residences or plant-unrelated activities within the exclusion area.

On the basis of ownership of the land within the exclusion area, including the mineral rights, and because suitable arrangements have been made to control traffic on the road, rail line and river within the exclusion area, and activities on Phillis Island, the NRC staff concludes that the applicant has the authority to control all activities within the exclusion area, as required by 10 CFR Part 100.

2.1.3 Population Distribution

The resident population in the vicinity of the Beaver Valley Station is shown as a function of distance in Table 2.1. The nearest community with a population of more than 1,000 is Midland, which had a 1980 population of 4,310 people, a decrease from the 1970 Census data value of 5,271. It is located on the opposite side of the Ohio River, approximately 1 mile northwest of the plant site. The 1980 population within 10 miles of the site was 138,800. The largest community near the site is the township of McCandless, Pennsylvania, located approximately 17 miles east of the site, which had a 1980 population of 26,250.

Table 2.1 Population in the Vicinity of the Beaver Valley Site

	Distance From the Plant (Miles)					
Year	0-1	0-2	0-3	0-4	0-5	0-10
1980	565	3653	8375	12,379	16,535	138,800
1990	580	3739	8569	12,668	16,927	142,602
2030	609	3927	9006	13,319	17,851	152,559

The applicant has chosen a low population zone (LPZ) radius of 3.6 miles. The 1980 population within this distance was 10,828 residents and approximately 4,300 transients. The school population within the LPZ in 1980 was about 2200 persons. The resident population within the LPZ is projected to reach approximately 11,400 people in the year 2030.

The applicant has indicated that the nearest densely populated center of about 25,000 or more persons, as defined in 10 CFR 100, is the township of McCandless, Pennsylvania, located 17 miles from the Beaver Valley site. This distance meets the 10 CFR 100 criterion of being at least 1-1/3 times the LPZ radius.

2.1.4 Conclusion

On the basis of (1) the 10 CFR 100 definitions of the exclusion area, LPZ, and population center distance; (2) the NRC staff analysis of the onsite meteorological data from which the relative concentration factors (X/Q) were calculated (see Section 2.3); and (3) calculated potential radiological dose consequences of design-basis accidents (see Section 15), the NRC staff concludes that the exclusion area, LPZ and population center distance meet the criteria of 10 CFR 100 and are acceptable.

2.2 NEARBY INDUSTRIAL, TRANSPORTATION, AND MILITARY FACILITIES

Beaver Valley Unit 2 was reviewed in accordance with SRP 2.2.1, 2.2.3, 3.5.1.5, and 3.5.1.6.

2.2.1 Transportation Routes

The Ohio River, adjacent to the Beaver Valley site, is used for barge shipment of coal, sand and gravel, iron and steel, gasoline, petroleum products and chemicals. Records for 1978 indicate that there was a grand total of approximately 20 million short tons of materials shipped through the Montgomery locks, located three miles upstream from the Beaver Valley site. During the construction permit review of Beaver Valley Unit No. 2, it was determined that the probability of damage to the reactor intake structure from barge traffic was sufficiently high to warrant specific measures. Hence, the applicant constructed an alternate intake structure to provide adequate cooling water backup in the event the original structure was damaged by gasoline barge impact and explosion.

Directly across the Ohio River from the cooling towers is a Pennzoil barge facility which handles an average of two outbound shipments per week and one inbound shipment per month of gasoline and fuel products.

[illegible] ft. across the river from the site, one of the main lines of the Consolidated Rail Corporation (Con Rail) follows the north bank of the Ohio River. There is a Con Rail easement which traverses the Beaver Valley site but is controlled by Duquesne Light Company (DLC), and its use is limited to servicing the Shippingport and Beaver Valley power stations.

State highways which provide access to the Beaver Valley site and the surrounding areas are shown in Figure 2.3. State highway 68, provides the main access to the industrial areas on the north bank of the Ohio River from the residential areas east of the site. State highway 168, passes the site from southwest until it crosses the Ohio River on the eastern section of the Beaver Valley site. U.S. Route 30, passes within 3 miles of the site in the southwest direction.

There are no military installations or missile sites within 10 miles of the Beaver Valley site. There are 13 pipelines which pass through or near the Beaver Valley site (See Figure 2.4). Six of these pipelines pass through the exclusion area on the northeast side.

The 12" natural gas pipeline was relocated during the construciton permit review. The 8" Mobil Oil pipeline, which currently carries gasoline, kerosene and heating oil, has also recently been relocated further away from Beaver Valley Unit No. 2 reactor (See Figure 2.4, Line #13). The applicant has confirmed that the pipeline will not be used for LPG. Figure 2.5 shows a more detailed drawing of the routing of this pipeline through the Beaver Valley plant site. The current routing is on the east side of the earthen embankment of Route 168 bridge, approximately 950 feet from the Unit No. 2 diesel generator building.

In the event of a pipeline rupture in this location, the release and delayed ignition of gasoline could expose the Beaver Valley facility to thermal radiation and/or blast overpressure.

The applicant, at our request, evaluated the consequences of a postulated pipeline rupture at this location and concluded that neither the thermal radiation nor the blast overpressure would endanger plant safety, even if credit was not taken for the shielding effect of the high roadway embankment. The staff's independent review confirms their analysis and conclusions.

The staff, after reviewing the topography of the Beaver Valley site area, determined that there is additional means for gasoline vapor to enter the Beaver Valley exclusion area closer to the Beaver Valley Unit 2 safety related structures than what was postulated by the applicant. A break in the Mobil Oil pipeline on the hillside southeast of the plant could drain into Peggs Run, which flows through the site between the cooling towers and the Route 168 bridge. The applicant was requested to review this scenario and evaluate the consequences. They determined that a double-ended rupture of the pipeline on the hillside above Peggs Run could release a maximum of 23,380 gallons of gasoline. The terrain topography surrounding the pipeline favors the drainage of gasoline directly into Peggs Run. The run-off of gasoline into Peggs Run would flow into a 15 foot diameter culvert 1800 feet long. This culvert exits into a ravine that is about 45 feet below plant grade. The drainage from Peggs Run then flows between the Unit 1 cooling tower and Route 168 for approximately 1000 feet before entering the Ohio River. Peggs Run passes within 550 feet of the east wall of Unit No. 2 diesel generator building. The applicant has investigated an explosion of gasoline vapor in the culvert and has determined that although the manhole covers could become missiles with a range of about 70 feet, plant safety would not be endangered since the Unit 2 diesel generator building is approximately 600 feet from the closest manhole location (See Figure 2.7). The applicant evaluated a gasoline vapor explosion in the Peggs Run ravine east of the Unit 2 diesel generator building. The evaluation indicates that, without considering the shielding effects of the ravine, the peak reflected overpressure on the building would be no more than 2.8 psi. Independent calculations by the staff indicate a peak reflected overpressure of 1.0 psi. The above overpressures are within the design basis overpressure of 3 psi for the plant due to tornado wind load considerations.

The applicant evaluated the thermal flux of a liquid gasoline fire on the surface of Peggs Run, between the exit point from the culvert and the Ohio River. They determined, without considering the shielding effects of the ravine, that the thermal flux on the diesel generator building would be 2704 watts/m^2.

The staff has made an independent analysis of the postulated gasoline fire and estimates the thermal flux to be no more than 2240 watts/m^2, which is in close agreement with that shown by the applicant's analysis. The above thermal fluxes are not a significant threat to plant safety. Moreoever, it should be noted that a fire in this area would be quickly reduced in intensity, since once the fuel was consumed the flames would burn back up Pegg's Run, to the source of the pipeline rupture.

The staff concludes that even considering an off-site break in the Mobil Oil pipeline, the relocated pipeline will not present a danger to safety related structures at the Beaver Valley site.

There are three airports located within a 10 mile radius of the Beaver Valley site. These are Fino, Herron, and Beaver County Airports. Fino is a private airport with a 1750 ft. grass runway (about 1700 operations/year) located at 1.5 miles southwest of the site. Hernon (W. Va.), located 8.2 miles southwest of the site, has three paved runways, used mostly by light single engine aircraft, with an estimated 26,500 operations/year. The Beaver County airport, located 10 miles north of the site, has a single paved runway 4,500 ft long. It is used by light and multi-engine aircraft for approxiamtely 86,4000 operations per year. The greater Pittsburgh International Airport, located 11.2 miles from the site has four paved runways, the longest of which is 10,500 ft. in length. This airport is used for military, air carrier, and general aviation type aircraft. Figure 2.6 shows the air routes in the vicinity of the reactor site. There are no low level military training routes or bombing ranges in the Pittsburgh area.

The applicant has provided a study of the probability of an aircraft impacting the Beaver Valley Unit 2 facility. The applicant has estimated a total probability of 5.0×10^{-7} collisions/year with respect to critical Beaver Valley structures from all aircraft operations within an 11 mile radius of the reactor site. Approximately four tenths of this rate is attributable to small aircraft located at Fino.

On the basis of previous staff review analyses involving aircraft movements and airport locations, we find the applicant's analysis to be reasonable. The probability is within the criteria of SRP Section 2.2.3. Hence, we find that the risk of an aircraft crash causing radiological consequences in excess of the guidelines values of 10 CFR 100 is sufficiently low and acceptable.

The applicant has evaluated the shipment of explosive and toxic materials on the Con Rail line, which runs along the Ohio River on the opposite side. The applicant has determined that 94 out of 119 toxic chemicals shipped by Con Rail could have a potential to incapacitate the reactor control room operators. They have performed a probability analysis (1) which indicates that the total probability of the 94 chemicals shipped by rail causing a control room incapacitation is 4.2×10^{-6} per year. This is based on the conservative assumption that the local meterology is at all times represented by a Pasquill "G" stability condition and a wind speed of 0.5 m/sec. If the observed frequency for Pasquill "G" stability conditions and a wind speed of 0.5m/sec were used in the analysis, the above probability (4.2×10^{-6} per year) would be reduced by at least a factor of 10.

The applicant also provided a similar analysis on five toxic chemicals shipped by barge. They estimate that a total probability for control room operators becoming incapacitated from this source of toxic gases is 8×10^{-7} per year. Staff review of this analysis indicates that it is based on conservatisms similar to those used in the analysis of the rail transportation hazards.

With respect to nearby industries, the applicant has identified a number of toxic chemicals stored within 5 miles of the site (see Figure 2.7). Some of these are also stored on site by the applicant. The remaining chemicals are styrene ethylbenzene, toluene, benzene, butadiene, and pentane.

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(1) Control Room Habitability Study, Beaver Valley Power Station Units 1 and 2, prepared for Duquesne Light Company Pittsburgh, Pa. December 1, 1981 by Stone and Webster Engineering Corporation.

In order to provide protection from toxic chemicals stored at local industries, the applicant has proposed the use of communication links with local officials and industries. The reactor control room can be effectively isolated immediately upon notification of a significant spill or leak of a toxic gas. The staff concurs in the proposal and has requested the applicant to establish suitable communication links with local officials and nearby industries for prompt notificaiton in the event of an accidental release of toxic gases. We will include a technical specification requirement to assure continuous communication links with current or future local industries which use toxic materials during the operating lifetime of the Beaver Valley Unit No. 2 facility.

The Beaver Valley site facility utilizes eight principal toxic materials for plant operation. Four of these chemicals have been shown by the applicant to have the potential for control room operator incapacitation.

Chlorine, stored in eight-1 ton cylinders, is the most toxic of the chemicals used onsite. The applicant has provided chlorine detectors in the control room air intake system to isolate the control room automatically in the event of an accidental release of this toxic gas.

In the event of a CO_2 release, the control room is provided with an anunciator which will warn the operators in the event of a change in tank pressure in the 2-10 ton cylinders supply system.

A spill of ammonium hydroxide from the 415 gallon storage tank will produce a buoyant plume of ammonia which will rise well above the control room air intake during the approximate 200 feet horrizontal distance. This gas will not affect control room personnel. Hydrazine is stored in 10-55 gallon drums as a 35% aqueous solution. Based on the applicant's analysis and the conservative assumptions used, i.e., pure hydrazine vs. aqueous solution, we do not expect the airborne concentrations to exceed toxic limits at the air intake for the control room.

The staff concludes that ammonium hydroxide and hydrazine, will not require special protective measures for the control room operators.

The applicant at the consturction permit stage for Beaver Valley Unit No.2 analyzed the consequenses of rail cargo explosions on plant structures and determined that plant safety would not be impaired. We have made a revised analysis, based on the current list of explosive materials provided in the Con Rails commodities table, and reconfirmed that plant safety will not be impaired.

2.2.3 Conclusion Regarding The Evaluation of Potential Accidents

The staff review was conducted on the basis of criteria given in GDC 4, GDC 19 and SRP 2.2.3. The staff concludes that the plant is adequately protected and can be operated with an acceptable degree of safety as a result of nearby transportation, industrial and military facilities.

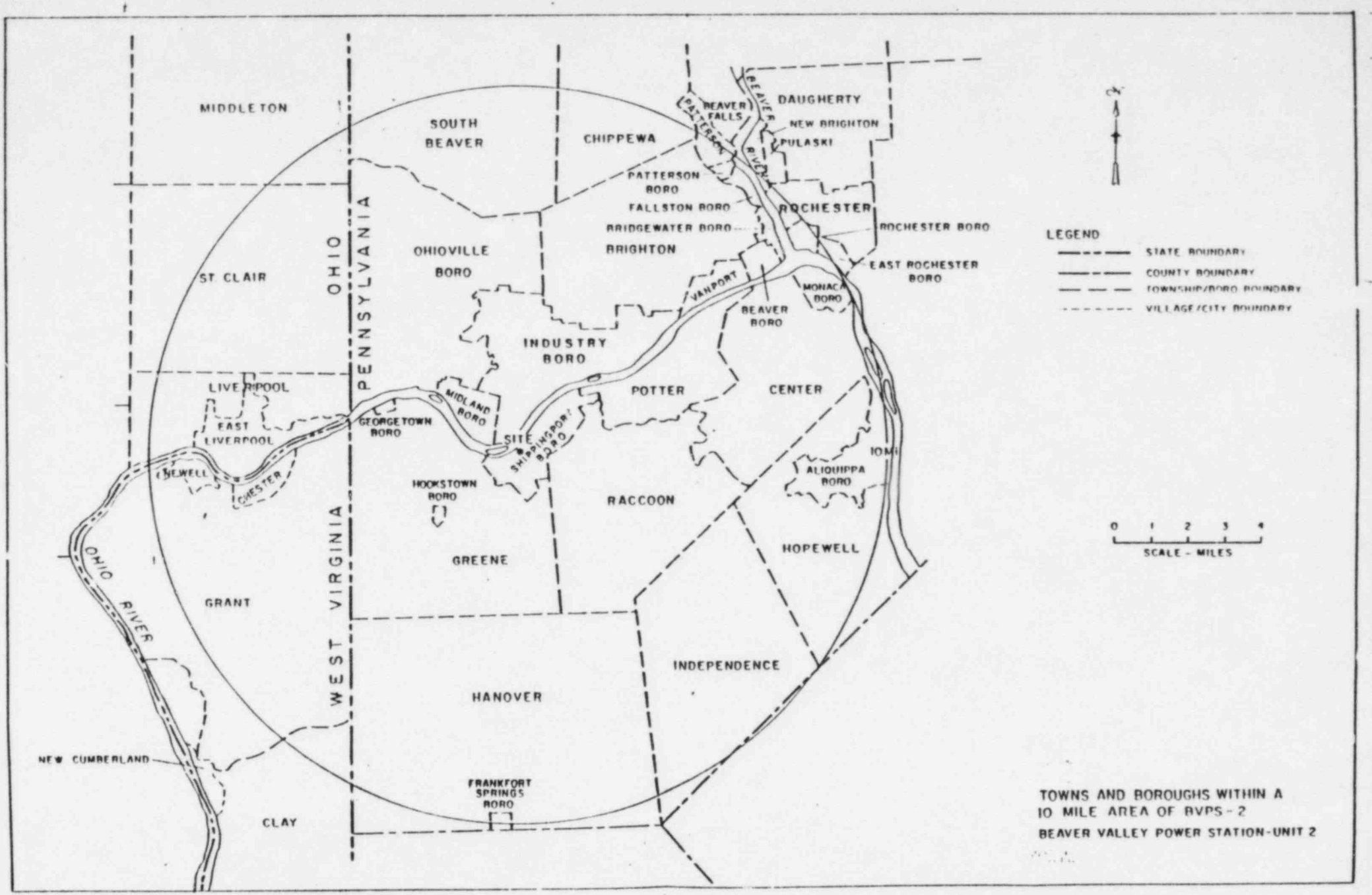

MIDDLETON
SOUTH BEAVER
CHIPPEWA
DAUGHERTY
BEAVER FALLS
NEW BRIGHTON
PULASKI
PATTERSON BORO
FALLSTON BORO
BRIDGEWATER BORO
ROCHESTER
ROCHESTER BORO
EAST ROCHESTER BORO
MONACA BORO
BEAVER BORO
VANPORT
OHIOVILLE BORO
BRIGHTON
ST CLAIR
OHIO
PENNSYLVANIA
INDUSTRY BORO
LIVERPOOL
EAST LIVERPOOL
MIDLAND BORO
GEORGETOWN BORO
SITE
SHIPPINGPORT BORO
POTTER
CENTER
NEWELL
CHESTER
HOOKSTOWN BORO
RACCOON
ALIQUIPPA BORO
HOPEWELL
GREENE
OHIO RIVER
GRANT
WEST VIRGINIA
INDEPENDENCE
HANOVER
NEW CUMBERLAND
FRANKFORT SPRINGS BORO
CLAY
LEGEND
STATE BOUNDARY
COUNTY BOUNDARY
TOWNSHIP/BORO BOUNDARY
VILLAGE/CITY BOUNDARY
0 1 2 3 4
SCALE - MILES
TOWNS AND BOROUGHS WITHIN A
10 MILE AREA OF BVPS-2
BEAVER VALLEY POWER STATION-UNIT 2

FIGURE 2.1

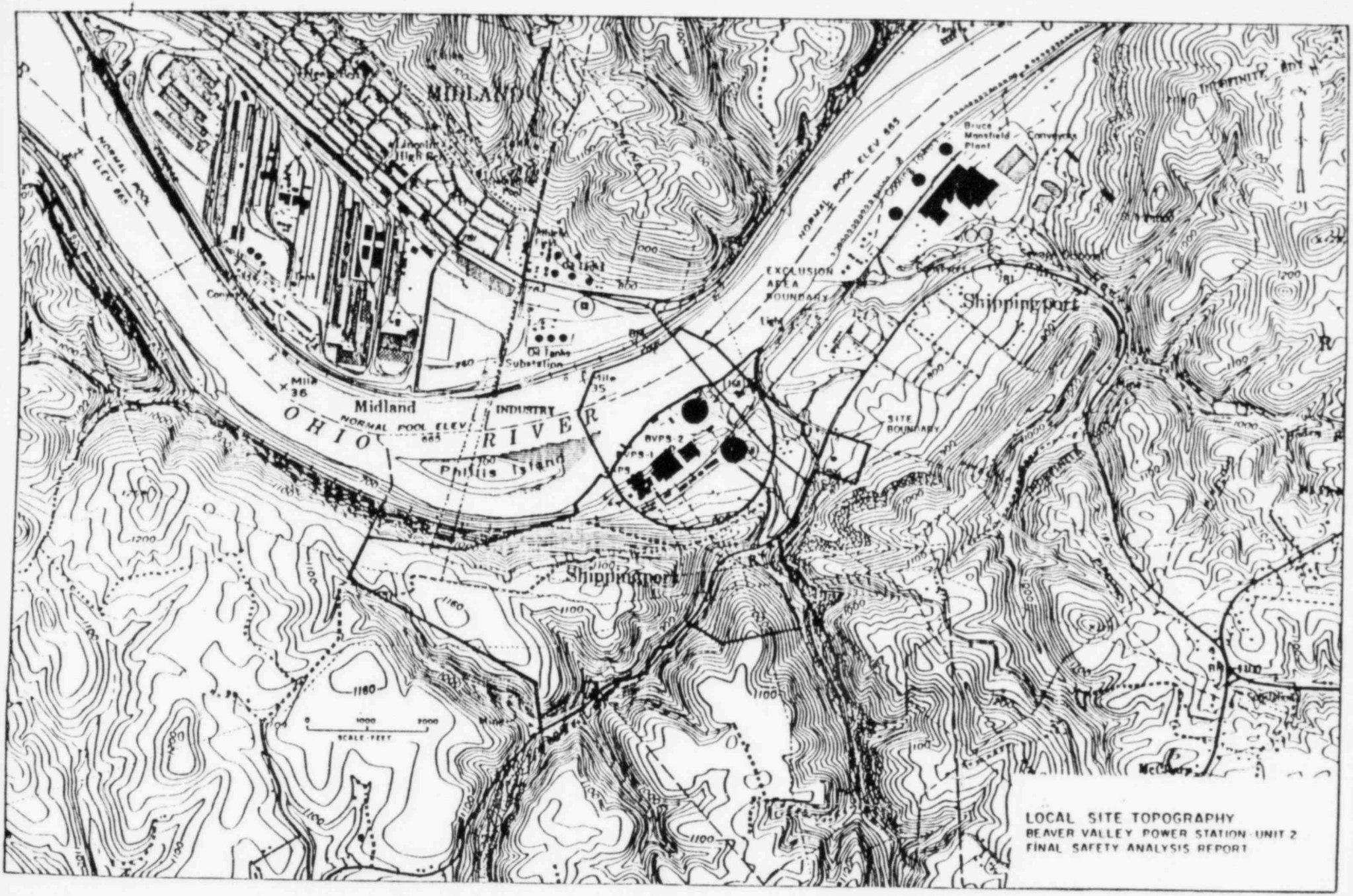
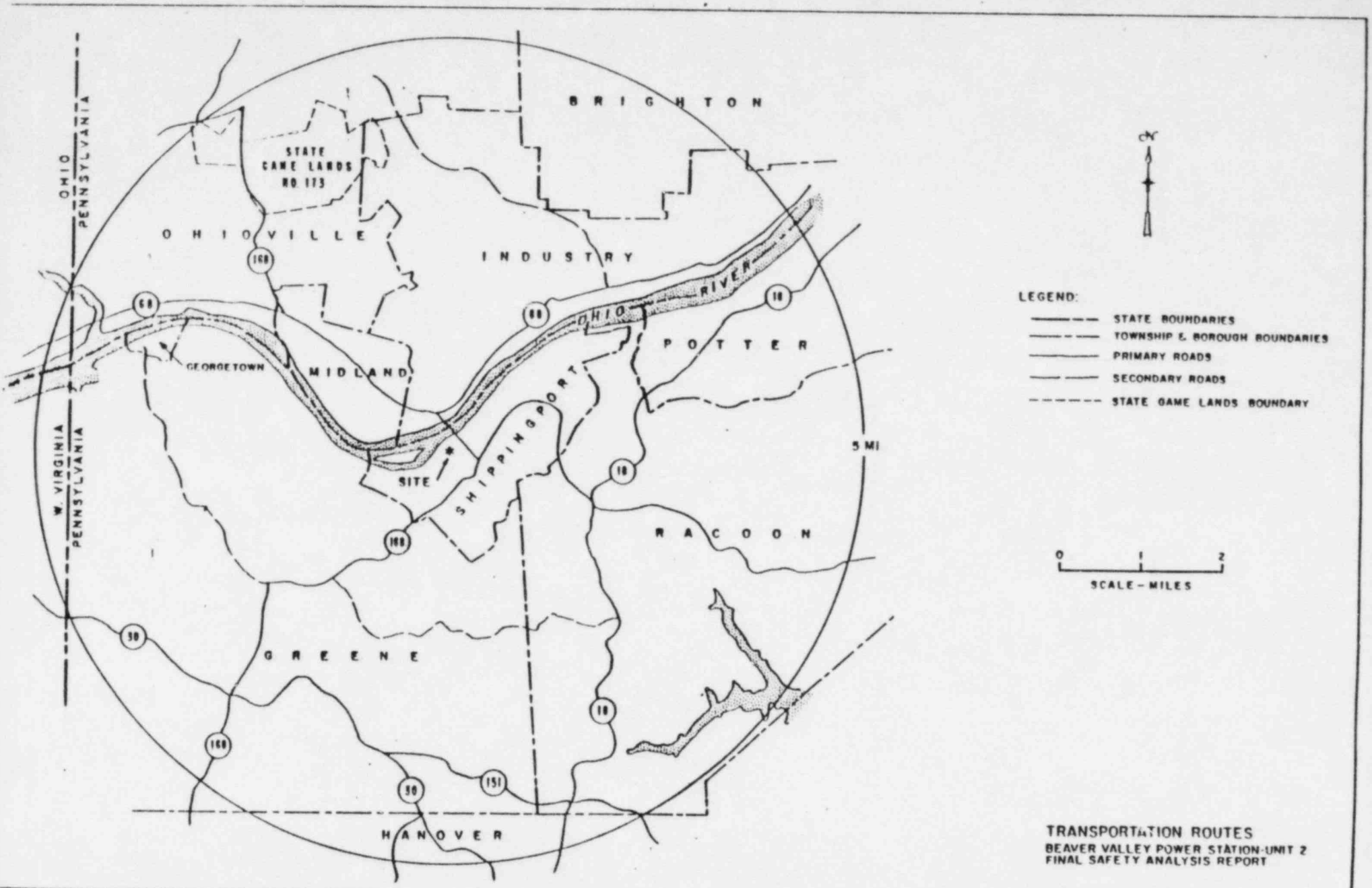
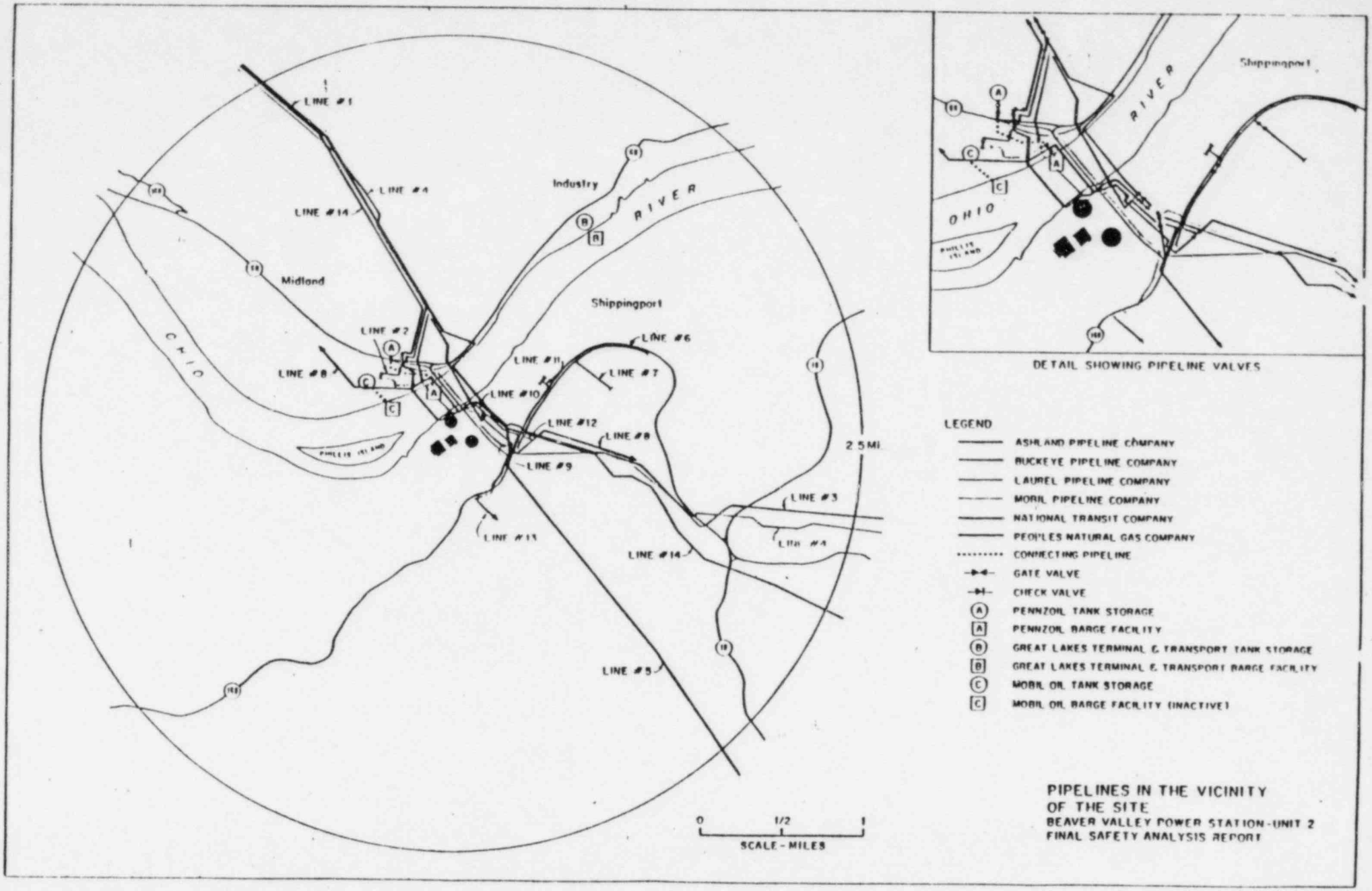

MIDLAND
Bruce Mansfield Plant
Conveyors
INFINITY
NORMAL POOL ELEV 665
EXCLUSION AREA BOUNDARY
Shippingport
Oil Tanks
Substation
Mile 36
Mile 35
Midland
INDUSTRY
NORMAL POOL ELEV 665
OHIO RIVER
Phillis Island
BVPS 2
PS-1
PS
SITE BOUNDARY
Shippingport
1180
1100
0 1000 2000
SCALE - FEET
LOCAL SITE TOPOGRAPHY
BEAVER VALLEY POWER STATION UNIT 2
FINAL SAFETY ANALYSIS REPORT

FIGURE 2.2



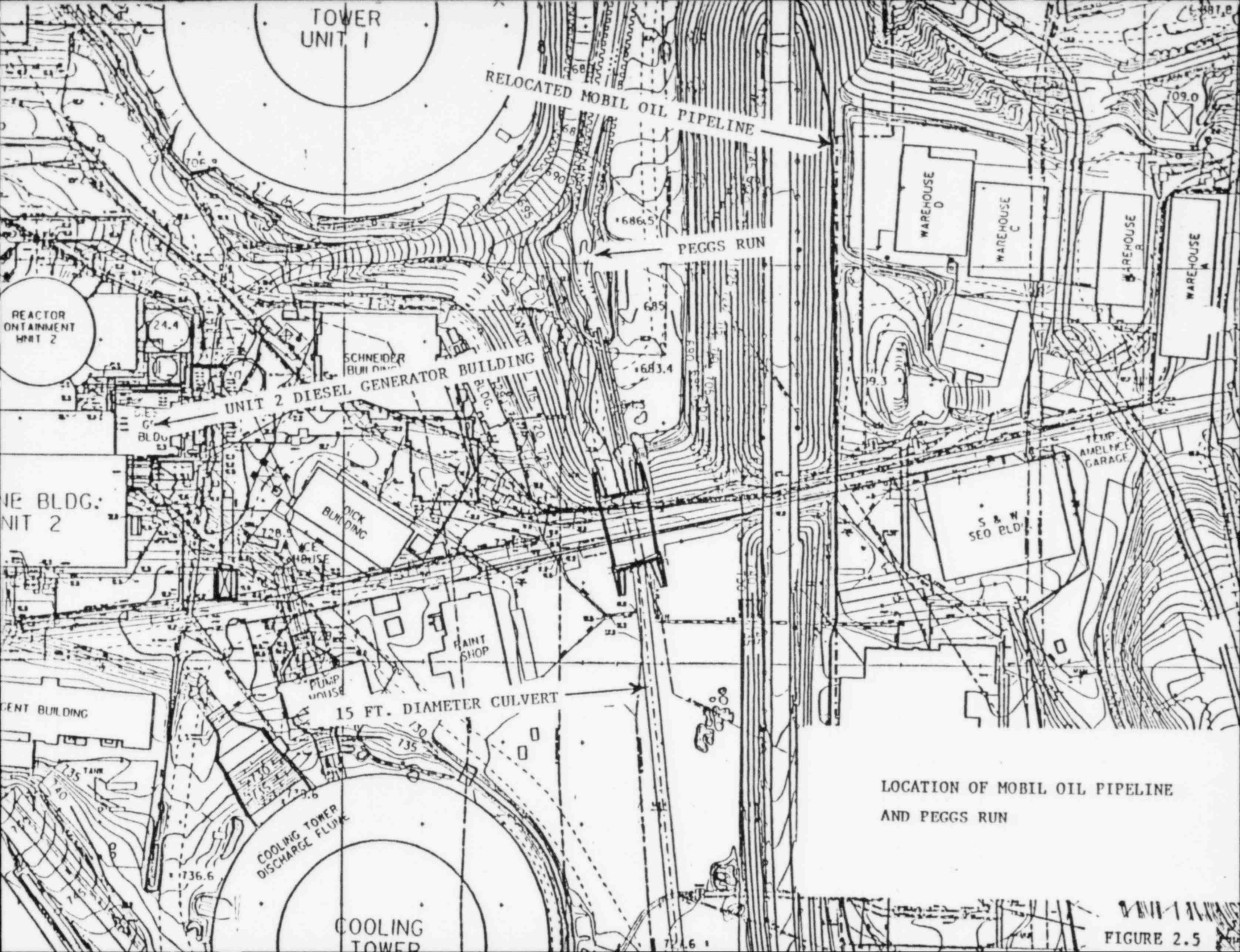
TRANSPORTATION ROUTES
BEAVER VALLEY POWER STATION-UNIT 2
FINAL SAFETY ANALYSIS REPORT

FIGURE 2.3



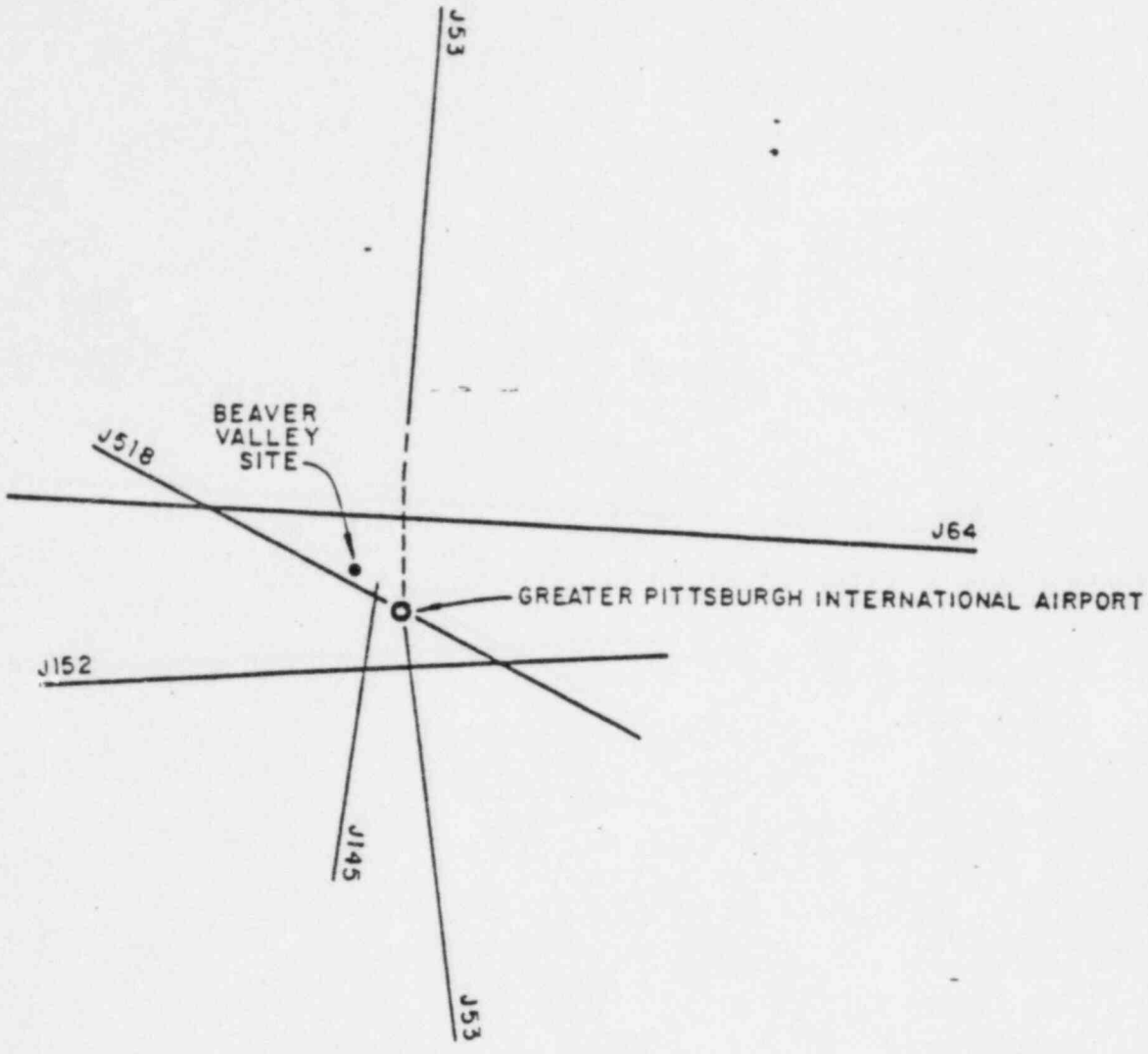
PIPELINES IN THE VICINITY
OF THE SITE
BEAVER VALLEY POWER STATION-UNIT 2
FINAL SAFETY ANALYSIS REPORT

FIGURE 2.4



LOCATION OF MOBIL OIL PIPELINE
AND PEGGS RUN

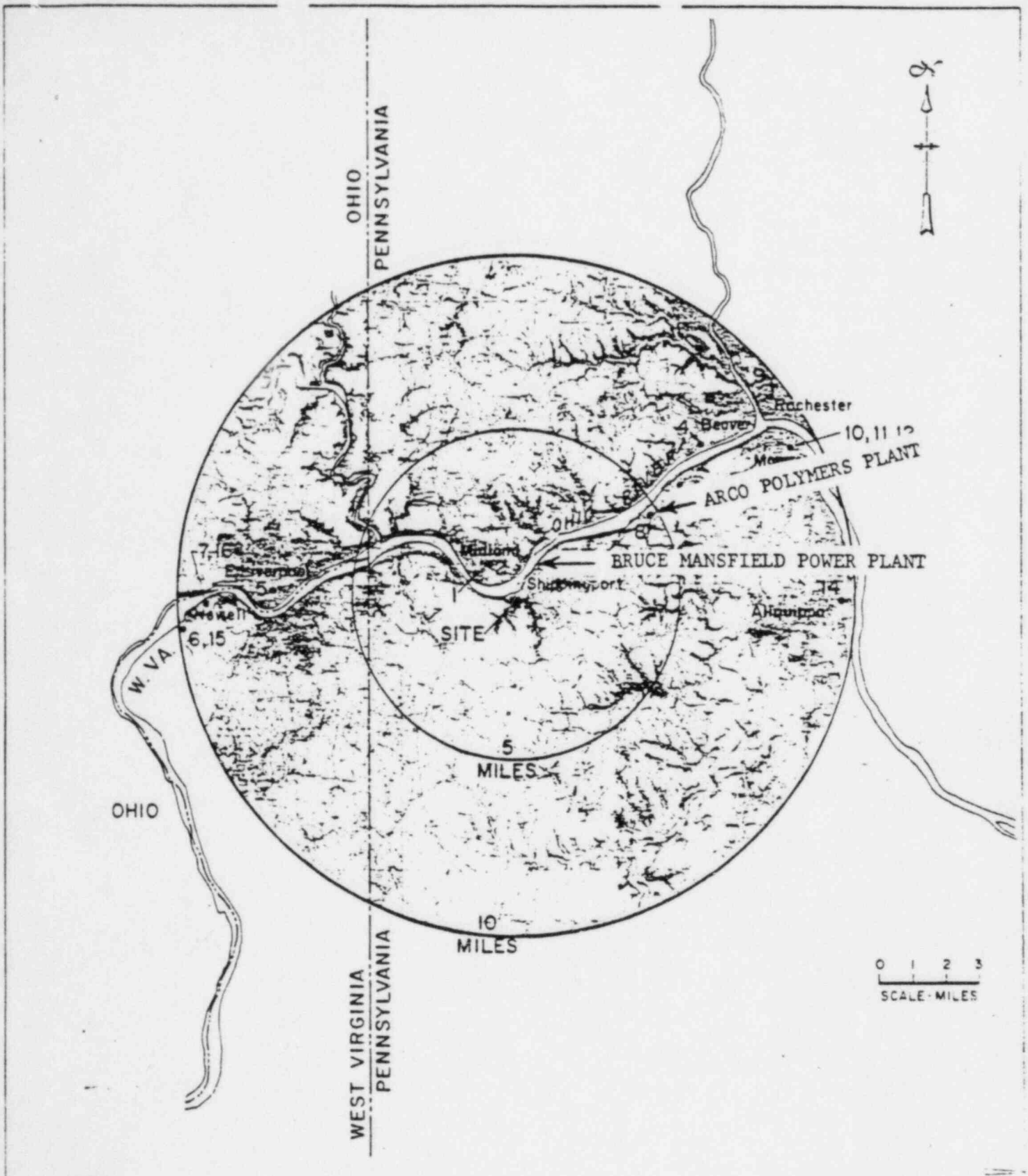
FIGURE 2.5



JET AIR ROUTES IN THE
BEAVER VALLEY AREA

BEAVER VALLEY POWER STATION – UNIT 2
FINAL SAFETY ANALYSIS REPORT

FIGURE 2.6



NOTE:
NUMBERS CORRESPOND TO TABLE 2.2-2

MAJOR INDUSTRIES WITHIN
10 MILES OF THE SITE
BEAVER VALLEY POWER STATION - UNIT 2
FINAL SAFETY ANALYSIS REPORT

FIGURE 2.7