RIVER BEND STATION ENVIRONMENTAL REPORT

OPERATING LICENSE STAGE

SUPPLEMENT 5

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River Bend Station

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annual wind direction at the site and Ryan Airport was east during the concurrent 2-yr period. The least prevalent annual wind directions at the site and Ryan Airport during the concurrent period were southwest and south-southwest, respectively. The prevailing and least prevalent annual wind directions at Ryan Airport during the 30-yr period were southeast and west-northwest, respectively.

The differences between the frequent and least frequent aforementioned wind directions were due in part to the following:

Observer Bias: The observer at the National Weather Service (NWS) tended to report the wind direction to the primary 8 of the 16 compass points.

Conversion Bias: After January 1, 1964, wind directions were observed to tens of degrees and converted to the 16 point code for the meteorological data tape. Thirty deg sectors were considered for the north, east, south, and west compass points and 20-deg sectors for the remaining 12. The conversion procedure produced a frequency bias in the four principal compass points.

Averaging Period: For an hourly NWS wind direction observation, the observer estimates the wind direction during only a few minutes of the hour. After January 1, 1964, every 3-hr observations were used for the NWS meteorological data tape. An hourly onsite wind direction observation was determined by averaging the valid minute wind direction data (Section 6.4.1.5) recorded during the hour.

Summaries of 30- and 150-ft wind persistence episodes at the River Bend site for the period March 17, 1977 through March 16, 1979, are presented in Tables 2.7-31 and 2.7-32, respectively. The maximum wind persistence episodes at the 30- and 150-ft levels were 20 hr from the south and east-northeast, and 32 hr from the east-southeast, respectively. A summary of wind persistence episodes at Ryan Airport for the period January 1, 1949 through

December 31, 1964, is presented in Table 2.7-33. The maximum wind persistence episode was 89 hr from the southeast. 4

2.7.3.11 Stability

Atmospheric stability was classified according to the temperature gradient values listed for the seven Pasquill stability categories in Regulatory Guide 1.23[16]. Joint wind speed, wind direction, and atmospheric stability summaries, based on wind speed and wind direction at the 30-ft tower level and the temperature difference between the 30- and the 150-foot level on the meteorological tower for the period March 17, 1977 through March 16, 1979, are provided in Tables 2.7-34 through 2.7-41. Tables 2.7-42 through 2.7-73 provide seasonal joint frequency distributions for the 30-ft winds. Similar information for the same onsite data period for the 150-ft wind speed and wind direction parameters is presented in Tables 2.7-74 through 2.7-81 and Tables 2.7-82 through 2.7-113 for the annual and seasonal periods, respectively. 2

In the joint frequency summaries, separate tabulations are made for calm winds (hourly average wind speeds equal to or below anemometer or wind direction sensor threshold speed, whichever is higher) and for variable winds (hourly average wind speeds between threshold and 2 mi/hr when hourly average wind direction ranges are greater than or equal to 120 deg azimuth).

2.7.3.12 Topographical Description

The topography in the area is essentially flat, with some small rolling hills. The greatest elevation within 5 mi of the site is 220 ft msl which is 125 ft higher than plant grade. The general topography within 5 mi of the plant site is shown in Fig. 2.7-16 and topography out to 50 mi is provided in Fig. 2.7-17. Topographic cross sections for each of 16 22.5 deg sectors radiating from the plant are given in Fig. 2.7-18 through 2.7-25 for distances out to 5 mi.

The effect of topography on both short-term and long-term diffusion estimates for the site is expected to be insignificant because of the relatively flat terrain of the area.

water supply. The maximum individual was assumed to consume fish and invertebrates caught at the edge of the initial mixing zone. This location was also used in calculating the dose from swimming. Boating was assumed to occur in the outfall area. Shoreline recreation was analyzed at the closest shore of the Mississippi River.

5.4.4.1.1 Liquid Pathways

The calculated maximum organ dose to the maximum individual from liquid pathways was 0.8 mrem/yr to a child's thyroid. This dose was primarily a result of the consumption of fish. It is assumed that the child consumes 6.9 kg of fish per year which was caught at the edge of the initial mixing zone.

The maximum annual dose resulting from the consumption of duck obtained from the edge of the initial mixing zone was 0.0017 mrem to the adult bone.

5.4.4.1.2 Radioiodine and Particulate Pathways

For the gaseous releases, a separate analysis was performed for each location of the maximum residence, milk cow, and beef animal. Each location was analyzed for submersion, inhalation, ground deposition, and ingestion of vegetation. The consumption of deer and grey squirrel was also considered.

The calculated dose to the maximum individual from gaseous pathways was 4.5 mrem/yr to an infant's thyroid. It represents a hypothetical infant who lived at the residence corresponding to the maximum cow location 1.3 km north-northwest. A majority of this dose is due to the consumption of cow milk. The thyroid dose from the ground deposition is conservatively assumed to be equivalent to the calculated total body dose as directed by Regulatory Guide 1.109.

5.4.1.1.3 Immersion Doses from Noble Gases

The doses from immersion in noble gas effluents are presented in Table 5.4-10.

5.4.4.2 Population Dose

The calculated annual doses for the population residing within a 50-mi radius of the site are presented in Table 5.4-22. For the liquid effluents, the calculated whole body and thyroid doses are 0.44 and 0.068 manrem per

year, respectively. The calculated doses from gaseous pathways are 1.8 manrem/yr whole body and 4.1 manrem/yr thyroid. These doses were calculated for a projected population in the year 2010 of 1,163,282 people within 50 mi of the site. The milk, meat, and vegetation 50-mi radius crop yield, as well as the 50-mi radius sport fish harvest, are presented in Appendix 5A.

Annual population doses to the contiguous U.S. from liquid and gaseous pathways are given in Table 5.4-22. The calculated doses to the U.S. population are 45 manrem to the whole body and 48 manrem to the thyroid.

5.4.5 Impacts to Biota Other than Man

The exposure pathways and the concentrations of radionuclides in the environment are discussed in previous sections. The doses to terrestrial and aquatic organisms other than man resulting from these radionuclides are presented in the following sections and tables. Calculated internal and external dose rates to biota are based on the model and assumptions presented in Appendix 5A.

5.4.5.1 Doses through Gaseous Pathways

Tables 5.4-23 and 5.4-24 present the calculated external and internal doses, respectively, to biota other than man from gaseous pathways. These doses are calculated for a terrestrial animal residing at the restricted area boundary. The external dose rates for terrestrial animals are based on methodology used to calculate external dose rates for man.

5.4.5.2 Doses through Liquid Pathways

Table 5.4-23 shows the maximum calculated external doses from submersion in water at the edge of the initial mixing zone and exposure to sediments at the closest accessible shoreline from the point of discharge. Table 5.4-24 shows the maximum calculated internal doses due to the bioaccumulation process.

5.4.5.3 Direct Radiation Doses

The station is designed so that neither solid nor liquid radioactive wastes are stored outside shielded buildings, thus limiting the maximum dose rate to 1 mrad/yr. The dose rates to biota other than man are expressed in units of millirads per year rather than lirems per year, since millirem is the unit used specifically to express the effect radiation on human tissue. This external exposure rate is independent of the biotic type and assumed to be the same for biota as for man.

TABLE 5.4-6

ANNUAL DOSES TO MAXIMUM INDIVIDUAL IN THE ADULT GROUP
FROM LIQUID EFFLUENTS

	Maximum Individual Liquid Pathways Annual Dose (mrem/yr)							
Pathway	Total Body	Skin	Bone	Liver	Thyroid	Kidney	Lung	GI-Tract
Potable water	4.2-05	0.0	1.1-05	4.6-05	2.1-04	3.8-05	3.3-05	3.5-05
Fish consumption	1.5-02	0.0	5.7-02	2.2-02	7.2-01	1.2-02	3.5-03	2.4-02
Invrt. consumption	5.5-03	0.0	1.4-02	1.5-02	4.3-02	4.6-03	1.9-03	4.1-02
Shoreline recreation	1.3-03	1.5-03	1.3-03	1.3-03	1.3-03	1.3-03	1.3-03	1.3-03
Fresh vegetation	8.0-06	0.0	5.6-06	9.9-06	2.9-05	5.3-06	3.6-06	3.0-06
Stored vegetation	6.3-05	0.0	4.1-05	7.8-05	2.4-05	4.1-05	2.9-05	2.6-05
Duck consumption	7.7-05	0.0	1.7-03	1.3-04	2.5-06	1.2-05	1.5-06	2.0-04
Swimming exposure	5.3-05	7.2-05	5.3-05	5.3-05	5.3-05	5.3-05	5.3-05	5.3-05
Boating exposure	1.7-04	2.3-04	1.7-04	1.7-04	1.7-04	1.7-04	1.7-04	1.7-04
TOTAL DOSE	2.2-02	1.8-03	7.4-02	3.9-02	7.6-01	1.8-02	7.0-03	6.7-02

NOTE: 4.2-05 = 4.2×10^{-5}

TABLE 5.4-7

ANNUAL DOSES TO MAXIMUM INDIVIDUAL IN THE TEEN GROUP
FROM LIQUID EFFLUENTS

	Maximum Individual Liquid Pathways Annual Dose (mrem/yr)							
Pathway	Total Body	Skin	Bone	Liver	Thyroid	Kidney	Lung	GI-Tract
Potable water	2.8-05	0.0	1.0-05	3.6-05	1.8-04	3.4-05	2.4-05	2.5-05
Fish consumption	1.1-02	0.0	6.1-02	2.2-02	6.8-01	1.5-02	3.4-03	1.9-02
Invrt. consumption	4.5-03	0.0	1.5-02	1.5-02	4.1-02	5.7-03	2.1-03	3.0-02
Shoreline recreation	7.2-03	8.4-03	7.2-03	7.2-03	7.2-03	7.2-03	7.2-03	7.2-03
Fresh vegetation	4.5-06	0.0	5.0-06	8.2-06	2.3-05	8.5-06	2.7-06	2.3-06
Stored vegetation	6.4-05	0.0	6.8-05	1.2-04	3.0-05	9.3-05	4.0-05	3.2-05
Duck consumption	6.2-05	0.0	1.4-03	1.0-04	1.9-06	8.4-05	1.4-06	1.4-04
Swimming exposure	3.0-04	4.1-04	3.0-04	3.0-04	3.0-04	3.0-04	3.0-04	3.0-04
Boating exposure	1.7-04	2.3-04	1.7-04	1.7-04	1.7-04	1.7-04	1.7-04	1.7-04
TOTAL DOSE	2.3-02	9.0-03	8.5-02	4.5-02	7.3-01	2.9-02	1.3-02	5.7-02

NOTE: 2.8-05 = 2.8×10^{-5}

TABLE 5.4-8

ANNUAL DOSES TO MAXIMUM INDIVIDUAL IN THE CHILD GROUP
FROM LIQUID EFFLUENTS

	Maximum Individual Liquid Pathways Annual Dose (mrem/yr)							
Pathway	Total Body	Skin	Bone	Liver	Thyroid	Kidney	Lung	GI-Tract
Potable water	4.9-05	0.0	2.9-05	7.0-05	4.3-04	5.4-05	4.6-05	4.6-05
Fish consumption	7.9-03	0.0	7.8-02	2.0-02	7.5-01	1.1-02	2.8-03	9.1-03
Invrt. consumption	4.2-03	0.0	2.0-02	1.3-02	4.7-02	3.7-03	1.9-03	1.6-02
Shoreline recreation	1.5-03	1.8-03	1.5-03	1.5-03	1.5-03	1.5-03	1.5-03	1.5-03
Fresh vegetation	3.8-06	0.0	8.7-06	1.0-05	3.4-05	5.0-06	3.1-06	2.5-06
Stored vegetation	7.3-05	0.0	1.6-04	2.0-04	4.8-05	9.3-05	6.2-05	4.7-05
Duck consumption	5.8-05	0.0	1.4-03	7.6-05	1.5-06	5.4-06	8.5-07	4.1-05
Swimming exposure	1.9-04	2.5-04	1.9-04	1.9-04	1.9-04	1.9-04	1.9-04	1.9-04
Boating exposure	9.7-05	1.3-04	9.7-05	9.7-05	9.7-05	9.7-05	9.7-05	9.7-05
TOTAL DOSE	1.4-02	2.2-03	1.0-01	3.5-02	8.0-01	1.7-02	6.6-03	2.7-02

NOTE: 4.9-05 = 4.9×10^{-5}

TABLE 5.4-9

ANNUAL DOSES TO MAXIMUM INDIVIDUAL IN THE INFANT GROUP
FROM LIQUID EFFLUENTS

	Maximum Individual Liquid Pathways Annual Dose (mrem/yr)							
Pathway	Total Body	Skin	Bone	Liver	Thyroid	Kidney	Lung	GI-Tract
Potable water	4.7-05	0.0	8.1-05	7.6-05	6.5-04	5.4-05	4.6-05	4.4-05
TOTAL DOSE	4.7-05	0.0	8.1-05	7.6-05	6.5-04	5.4-05	4.6-05	4.4-05

NOTE: 4.7-05 = 4.7×10^{-5}

CHAPTER 6

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6.2 RADIOLOGICAL

Parts 20 and 50 of 10CFR require that radiological environmental monitoring programs be established to provide data on measurable levels of radiation and radioactive materials in the site area. In addition, Appendix I to 10CFR50 requires the evaluation of the relationship between the quantities of radioactive material released in effluents during normal operation, including anticipated operational occurrences, and the resultant radiation doses to individuals from principal pathways of exposure. The River Bend Station environmental monitoring program will be conducted to determine the effectiveness of in-plant measures used for controlling the release of radioactive materials. Surveillance will be established to identify changes in the use of unrestricted areas (e.g., for agricultural purposes), to provide a basis for modifications in the monitoring programs for evaluating doses to individuals from principal pathways of exposure (identified in Section 5.4), and to better ensure that resulting radiation doses to the public will be minimal.

The results of the environmental radiological monitoring program are intended to confirm that the measured concentrations of radioactive materials and levels of radiation are not greater than federal limitations. The program provides measurements of radiation and radioactive materials in those pathways which lead to the highest potential radiation exposures of individuals, resulting from station operation.

The radiological monitoring program for the station will be conducted in two phases: the preoperational phase and the operational phase. The preoperational phase will be conducted during the 2-yr period prior to commercial operation. This phase is designed to determine background levels of radioactivity and to identify important pathways of exposure to man and biota. Following this period, modifications to the preoperational phase, resulting from experiences with procedures and equipment, will be incorporated into the operational phase to establish a more efficient monitoring program.

Guidelines for the radiological monitoring program are outlined in: 1) Regulatory Guide 4.1, 2) A Branch Technical Position on Radiological Environmental Monitoring Program Requirements, and 3) Radiological Effluent Technical Specification (RETS) for conformance to the provisions of 10CFR50, Appendix I.The radiological surveillance program at | 5

the River Bend site will be based on these recommended programs[1,2,3].

6.2.1 Preoperational Monitoring

The preoperational environmental monitoring program will be instituted 2 yr prior to commercial operation. The purposes of this program are: 1) to measure background radiation levels and their variations along the anticipated critical pathways near the station; 2) to train personnel, and 3) to evaluate procedures, equipment, and techniques. The elements (sampling medium and type of analysis) of both the preoperational and operational programs will be essentially the same. The duration of the preoperational program and specific mediums sampled are as follows:

6 months	1 yr	2 yr
Airborne iodine	Airborne particulates	Direct radiation
Iodine in milk (while animals are on pasture)	Milk	Fish and invertebrates
	Surface water	Food products
	Drinking water	Shoreline sediment

The preoperational radiological monitoring program is summarized in Table 6.2-1. A map showing locations of monitoring stations and nearest receptors is provided in Figure 6.2-1. Figure 6.2-2 shows monitor locations within a 10 km radius of the station.

6.2.1.1 Sampling Locations, Techniques, and Frequencies

6.2.1.1.1 Atmospheric Discharges

Particulates

Locations for 8 indicator and 1 control continuous air monitoring stations have been selected. Three samples will be collected near site property boundaries (in different directional sectors) with the highest calculated annual average ground-level D/Q, i.e, north-northeast, north, north-northwest directions. Special interest samples will be collected from the following 5 locations:

1. Near the station meteorological tower, approximately 1 km west of the Unit 1 reactor containment.

2. Along the River Access Road between the plant and the intake embayment, 2.8 km south-southwest of the Unit 1 reactor containment (to monitor the impact on site air quality from Big Cajun No. 2 operation).

3. At the GSU St. Francis Substation, 5 km west-northwest of the plant, in the community with the highest calculated annual average ground-level D/Q (St. Francisville). 5

4. At the GSU service center in Zachary, a major community 17 km east-southeast of the plant.

5. At the GSU office building in downtown Baton Rouge, approximately 40 km south-southeast of the plant.

A control location has been established at the GSU Parlange Substation, approximately 20 km from the plant in the least prevalent wind direction (southwest).

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Airborne particulate samples will be collected by drawing air at 3 x 10^{-2} cu m/min through a filter. After passing through the filter, the air passes through an iodine cartridge. The dust filters will be changed weekly or as required by dust loading, whichever is more frequent. After standing for 3 or 4 days to allow the daughter isotopes of radon and thoron to decay, the filters will be assayed weekly for gross beta activity and examined quarterly for gamma isotopes.

Airborne Iodine

The indicator and control sampling stations will utilize iodine cartridges, which will be replaced and assayed weekly for radioactive iodine-131.

6.2.1.1.2 Direct Radiation

Forty-five thermoluminescent dosimeter (TLD) stations will be established to measure offsite exposure due to direct radiation. An indicator station will be located in each of 16 compass directions surrounding the plant near the restricted area boundary. Another set of indicator stations will be located within a 6- to 10-km range of the site in each of the 16 compass directions. Ten stations will be located in areas of special interest, such as local population centers, schools, or hospitals. These special locations are listed in Table 6.2-2. Three other stations will be maintained as control stations located at a distance of 16, 18, and 20 km in the east, north, and southwest directions, respectively. 5

The indicator stations will contain two TLDs. One TLD will be replaced and read monthly, the other quarterly. The background stations will contain four TLDs. Two will be replaced and read monthly, the other two quarterly.

6.2.1.1.3 Ingestion

Milk

Milk appears to be the most direct and sensitive means for monitoring iodine-131 (the limiting isotope) in terrestrial pathways. The known locations of milk animals within a 5-km radius of the plant in 1980 are listed in Table 2.7-115 for dose assessment purposes. These locations, specifically 1,600 m NW, 1,400 m N, and 1,300 m N-NW, were identified in the Livestock Survey for Radiation Exposure Pathways within a 3 1/10 mi (5-km) Radius of GSU's River Bend Nuclear Power Plant, as prepared by Gulf South Research Institute (GSRI), 4

March 1980. In a subsequent effort to establish milk sampling stations for the monitoring program at these locations, it was determined that the milking animals no longer existed. According to the referenced Branch Technical Position on Radiological Environmental Monitoring Program Requirements, the maximum organ dose to the individual at the 5-km distance in the highest dose potential areas (W, WNW, NW, and NNW) was determined and found to be 0.30 (from cow milk) and 0.75 mrem (from goat milk) in the WNW location. Although this value is significantly less than 1 mrem/year, a milk surveillance program will be implemented. The number of sampling sites selected and their respective locations, and the location of the control sample site, differs from those recommended in the referenced Branch Technical Position. Justification for these alternates is provided.

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Samples from the McKowen Dairy, located 6 km ESE from the station, will be obtained for gamma isotropic and iodine-131 analysis semimonthly when animals are on pasture, and monthly at other times. This sampling site is the only known location within the 5- to 8-km distance from which milk samples can be readily obtained.

A control sample from milking animals at the Louisiana State Penitentiary, located approximately 35 km (21.7 mi) NW of the station, will also be analyzed at the same frequency. This site, 35-km distant, is the most practical location from which to obtain control samples.

The milking animal locations used in the Appendix I analysis to evaluate the radiation dose to individuals from the cow-milk-man pathway (Section 5.4) differs from that used in this sampling program. The Appendix I analysis is based on the milking animal locations identified in the GSRI survey. The analysis remains applicable however, since these milking animals were present at the time the analysis was being performed and are the most conservative (highest dose potential) from the cow-milk-man pathway.

Food Products

Because of the limited availability of milk samples from within a 5-km radius, broadleaf vegetation (leafy
5 vegetables, e.g., spinach) will be sampled monthly when crops are available from a 40-sq m onsite garden near the area of the highest calculated annual average ground-level D/Q, 1 km WNW from the station.

Similar vegetation will be sampled monthly as available from at least two additional gardens located in the highest calculated D/Q areas (N, NW, and WNW sectors). Edible portions of the vegetables will be analyzed for gamma isotopic and radioiodine activity. Vegetables will also be sampled from a control location, the Louisiana State Penitentiary at Angola, 35 km northwest, at the same frequency. 5

The potential radiological impact of station operation on nearby vegetable crops, including the sweet potato, was reviewed. No waterborne pathway to man exists via the sweet potato. Irrigation and surface and ground waters in the station vicinity do not reach the vegetable croplands, since there is no use of Mississippi River water for sweet potato or other vegetable crop. 5

6.2.1.1.4 Liquid Discharges

Surface Water

River water will be collected at a control station approximately 4 km upriver from the plant liquid outfall, near the Louisiana Highway 10 ferry crossing. Samples will also be taken at a point about 4 km downstream, near Crown-Zellerbach papermill, where the plant effluent is completely mixed with river water. Weekly grab samples will be composited monthly for gross beta and gamma isotopic analyses and quarterly for tritium analysis. 5

Drinking Water

A monthly composite sample of the raw intake at the first downriver water supply (Peoples Water Service Company - Bayou Lafourche, River Mile 175.5) will be collected and analyzed on the same schedule as that of surface water. Analysis of gross beta and isotopic gamma activity will be performed. Since the calculated dose for the consumption of

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water is less than 1 mrem per year, composite analysis of iodine-131 will not be performed (Section 5.4). A composite analysis for tritium will be performed quarterly. Similar analyses of a sample from the upstream control station at the Louisiana Highway 10 ferry crossing, approximately 4 km upriver from the plant, will be performed. 5

Groundwater

Preoperational groundwater radioactivity data will be collected on a quarterly basis for one year from samples obtained from a downgradient Upland Terrace Aquifer well on site property. Control samples will be taken at the same frequency from an upgradient well in the Upland Terrace Aquifer. Gross beta, gamma isotopic, and tritium analyses will be performed on groundwater samples. 5

Shoreline Sediment

One sample of shoreline sediment will be selected for semiannual gamma analysis from the east bank of the Mississippi River near the Crown-Zellerbach papermill. This is upstream of shoreline areas with existing or potential recreational value and public access.

Fish and Invertebrates

One sample of each of the following commercially and/or recreationally important species will be taken semiannually or in season from a location downstream of the plant liquid discharge outfall for gamma isotopic analysis in edible portions: river shrimp (Macrobrachium ohione), blue catfish (Ictalurus furcatus); and freshwater drum (Aplodinotus grunniens). One sample of each of the same species from a control area upstream of the plant discharge will be taken and analyzed at the same frequency. 5

6.2.1.2 Radiological Sample Analyses

The radiological monitoring program will adhere to the standards outlined in Regulatory Guide 4.15, Revision 1, February 1979, for quality assurance of the surveillance methods used. Results will be confirmed through participation in the Environmental Protection Agency's Environmental Radioactivity Laboratory Intercomparisons Studies Program.

Typical detection capabilities for the environmental sample analyses are provided in Table 6.2-3.

6.2.2 Operational Monitoring

The purpose of the operational monitoring program is to monitor for radiological releases along pathways identified in the preoperational program. The operational program will

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preoperational monitoring phase, program adjustments will be made to establish a more efficient operational monitoring program.

TABLE 6.2-1

PREOPERATIONAL AND OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Samples and Locations[1]	Sampling and Collection Frequency[1]	Type, Frequency, and Analysis
AIRBORNE			
Radioiodine and Particulates	Samples from 9 locations: 3 samples from locations near property boundaries (in different directional sectors) with the highest calculated annual average ground-level D/Q (NNE, N, NNW)	Continuous air sampler operation with filter collection weekly or as required by dust loading, whichever is more frequent	Radioiodine cannister: analysis weekly for I-131
	1 sample from the vicinity of station meteorological tower (approximately 1 km W)		Particulate sampler: gross beta activity following filter change[2], composite (by location) for gamma isotopic[3] quarterly
	1 sample from between the station and the river (near intake embayment) (2.8 km SSW) 1 sample from the community having the highest calculated annual average ground-level D/Q (St. Francisville, 5 km WNW) 2 samples from major communities 17 km ESE (Zachary) and 40 km SSE (Baton Rouge) 1 sample from a control location 20 km SW, in the least prevalent wind direction (Parlange Substation)		
DIRECT RADIATION	Measurements from 45 locations: 32 stations with two or more dosimeters to be placed in an inner ring near the restricted area boundary (in each of 16 directional sectors) and an outer ring in the 6- to 10-km range (16 sectors)	Thermoluminescent dosimeters (TLDs) changed monthly or quarterly	Gamma dose monthly or quarterly

TABLE 6.2-1 (Cont)

Exposure Pathway and/or Sample	Number of Samples and Locations[1]	Sampling and Collection Frequency[1]	Type, Frequency, and Analysis
	3 stations to serve as control locations, 16, 18, and 20 km distant in the E, N, and SW sectors, respectively		
	10 special interest locations designated in Table 6.2-2		
WATERBORNE			
Surface[4]	1 sample from about 4 km upstream of the plant liquid discharge outfall, near LA Hwy. 10 ferry crossing[5]	Weekly grabs composited over 1-month periods	Gross beta and gamma isotopic analyses monthly; composite for tritium analysis quarterly
	1 sample from about 4 km downstream of the plant liquid discharge outfall, near Crown-Zellerbach paper mill		
Drinking	1 sample from nearest downstream water supply (People's Water Service Co., River Mile 175.5)[5]	Weekly grabs composited over 1-month periods	Gross beta and gamma isotopic analyses monthly; composite for tritium analysis quarterly
Ground	1 sample from Upland Terrace Aquifer well upgradient from site	Quarterly grab	Gross beta, gamma isotopic, and tritium analyses quarterly
	1 sample from Upland Terrace Aquifer well downgradient on site property		
Sediment from River Shoreline	1 sample from along east shore of river near Crown-Zellerbach papermill	Semi-annual grabs (spring and autumn quarters)	Gamma isotopic analysis semi-annually
INGESTION			
Milk	1 sample from McKowen Dairy, 6 km ESE (nearest source of milk for consumption)[6]	Semi-monthly when animals are on pasture monthly at other times	Gamma isotopic and I-131 analyses semi-monthly when animals are on pasture; monthly at other times
	1 sample from animals at a control location (Louisiana State Penitentiary at Angola), 35 km NW		

TABLE 6.2-1 (Cont)

Exposure Pathway and/or Sample	Number of Samples and Locations[1]	Sampling and Collection Frequency[1]	Type, Frequency, and Analysis
Produce	1 sample of leafy vegetables grown in onsite garden near the site of the highest calculated annual average ground-level D/Q (1 km WNW)	Monthly when available	Gamma isotopic and I-131 analysis on edible portions monthly when available
	2 samples of leafy vegetables grown in offsite gardens in areas of high dose potential (N, NW, WNW sectors)[6]		
	1 sample of leafy vegetables grown at a control location (Louisiana State Penitentiary at Angola), 35 km NW		
Fish and Shellfish	1 sample from downstream of plant liquid discharge outfall, near River Mile 260.8, of each of the following: river shrimp, blue catfish, freshwater drum	Seasonally (e.g., summer for shrimp) when available or semi-annually	Gamma isotopic analysis on edible portions seasonally or semi-annually
	1 sample of the same species from an upstream control location		

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(1) The number, medium, frequency, and location of sampling may vary. At times it may not be possible or practical to obtain samples of the medium of choice at the desired location or time. In such cases, suitable alternative media and/or locations will be chosen for the particular pathway in question.

(2) Particulate sample filters will be analyzed for gross beta activity 24 hrs or more after sampling to allow for radon and thoran daughter decay. If gross beta activity in air or water is greater than 10 times the yearly mean of control samples for any medium, gamma isotopic analysis will be performed on the individual samples.

(3) Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility or from weapons testing fallout.

(4) The upstream sample will be taken at a distance beyond influence of the plant discharge. The downstream sample will be taken in an area beyond but near the mixing zone.

(5) The upstream surface water sampling location (near LA Hwy. 10 ferry crossing) will be used as a control for drinking water sampling.

(6) If milk-producing animals become available within a 5-km radius of the plant, up to 3 samples from these animals will be analyzed in lieu of the leafy vegetable samples from offsite gardens in high dose-potential areas.

TABLE 6.2-2

SPECIAL INTEREST THERMOLUMINESCENT DOSIMETER LOCATIONS

Map ID No.*	Location	Distance (km)	Direction
1	River Bend Station Meteorological Station	1.0	W
2	River Bend Station River Access Road	2.8	SSW
3	West Feliciana Parish Hospital	4.0	NW
4	St. Francis Substation	5.0	WNW
5	Bains School Complex	9.5	NNW
6	Edge of New Roads Population Center	10.0	SW
7	East Louisiana State Hospital, near Jackson	12.0	ENE
8	Edge of Zachary Population Center	17.0	ESE
9	State Penitentiary, Angola	35.0	NW
10	Downtown Baton Rouge	40.0	SSE

5

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*See Figures 6.2-1 and 6.2-2.

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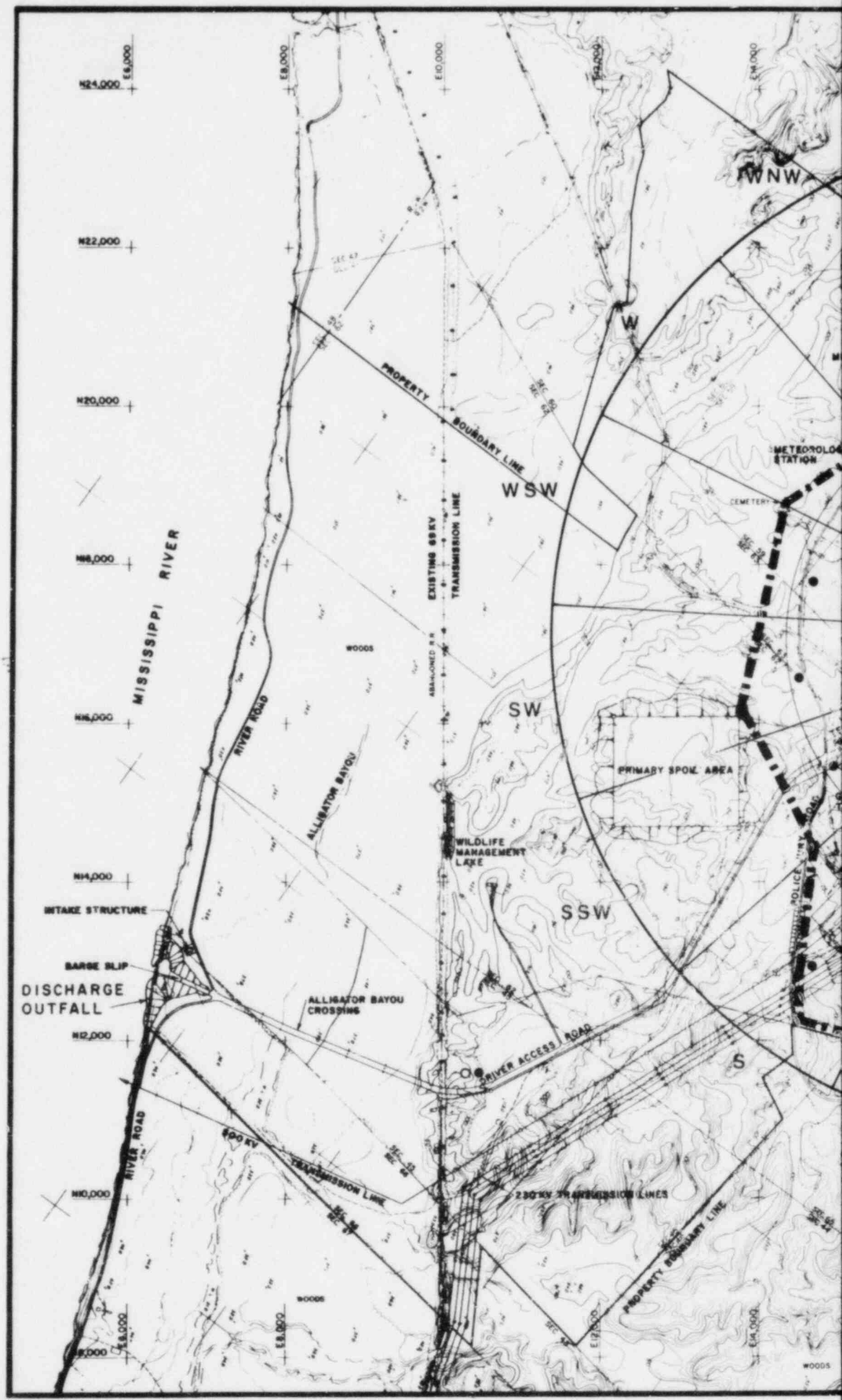
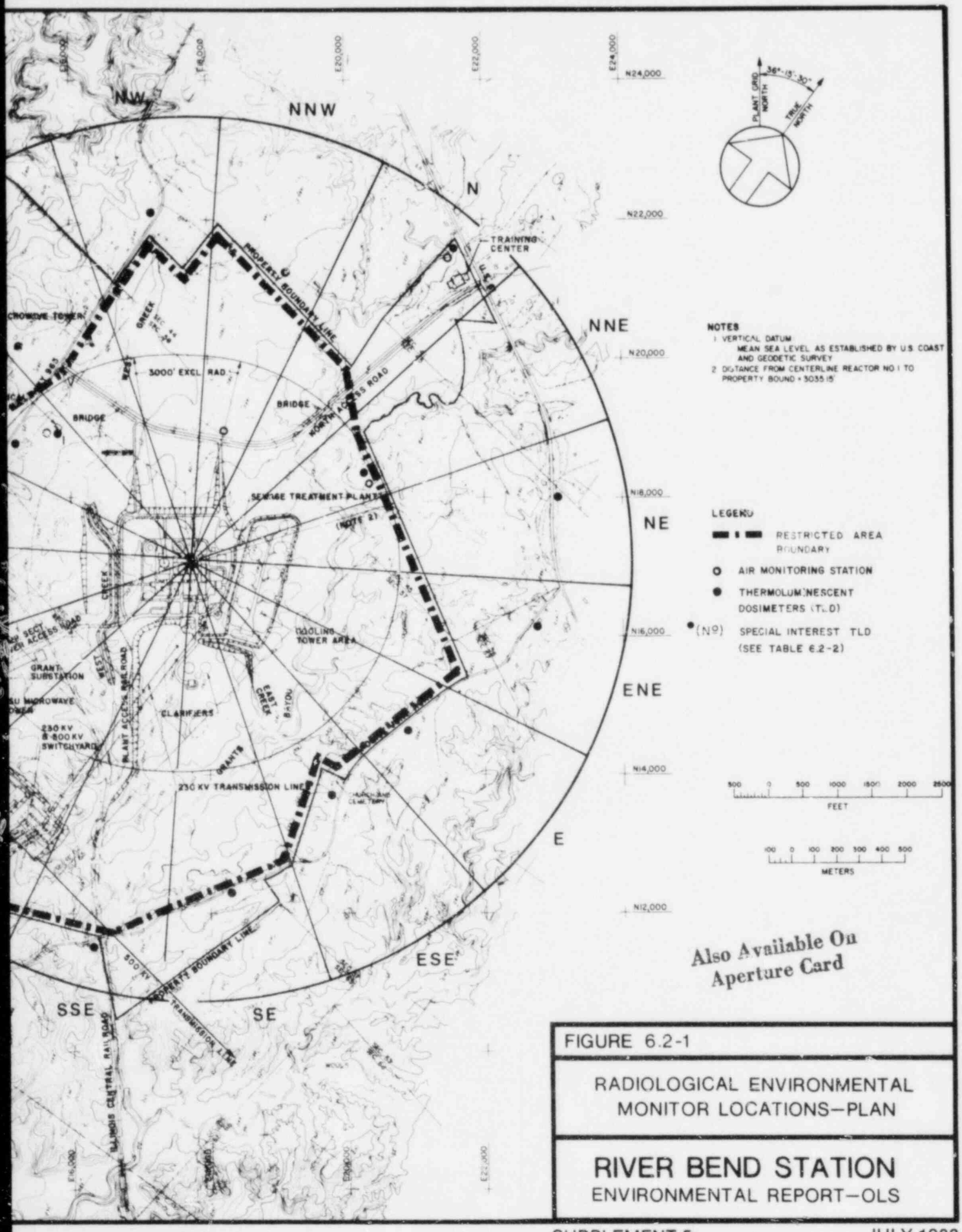




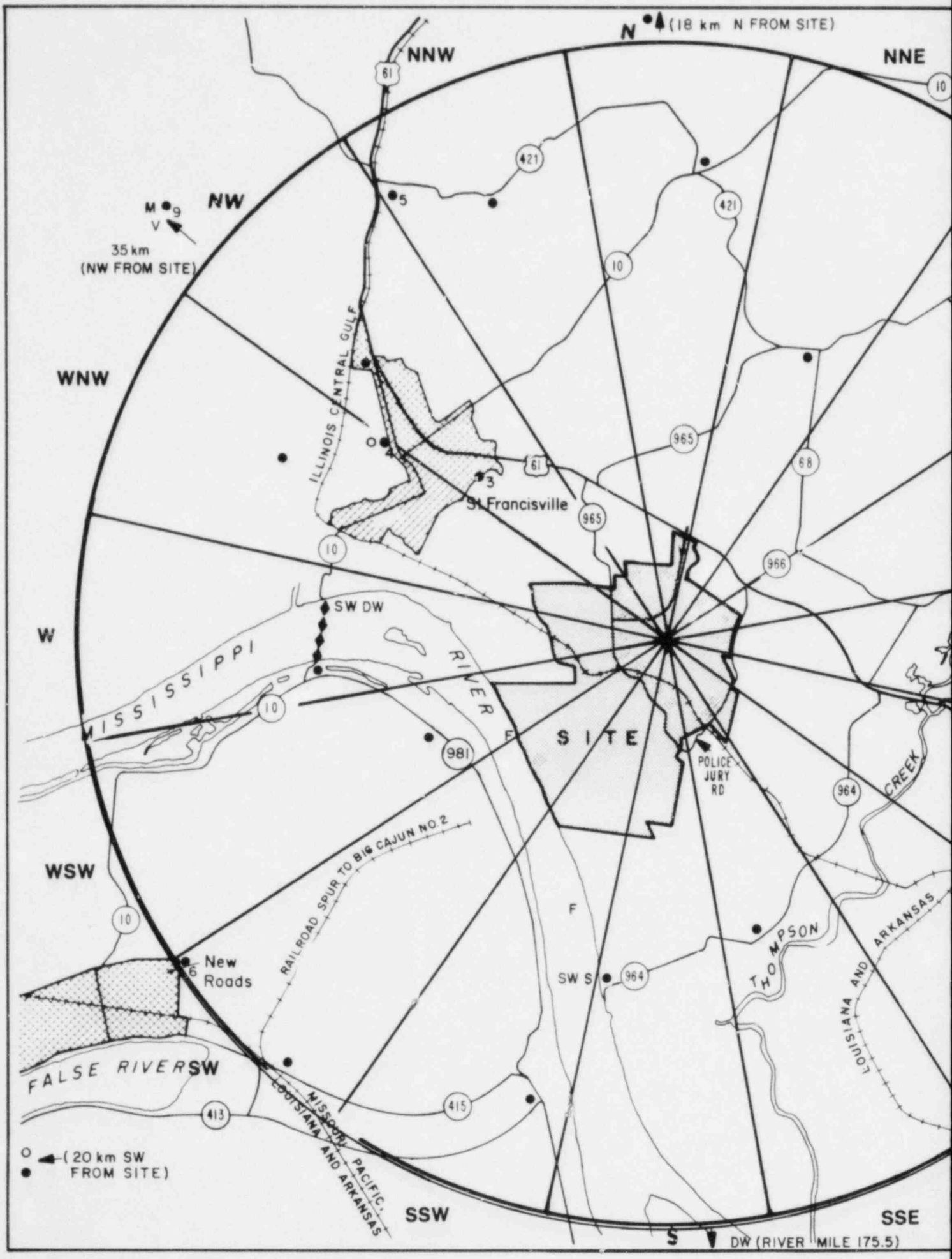
Also Available On Aperture Card

FIGURE 6.2-1

RADIOLOGICAL ENVIRONMENTAL MONITOR LOCATIONS—PLAN

RIVER BEND STATION

ENVIRONMENTAL REPORT—OLS


N
(18 km N FROM SITE)
NNW
NNE
NW
M
V
9
35 km
(NW FROM SITE)
WNW
ILLINOIS CENTRAL GULF
St Francisville
SW DW
W
MISSISSIPPI
RIVER
SITE
POLICE JURY RD
CREEK
WSW
RAILROAD SPUR TO BIG CAJUN NO. 2
New Roads
SW S
THOMPSON
LOUISIANA AND ARKANSAS
FALSE RIVER
SW
MISSOURI PACIFIC
LOUISIANA AND ARKANSAS
(20 km SW
FROM SITE)
SSW
SSE
S
DW (RIVER MILE 175.5)
61
421
10
965
68
966
981
964
415
413

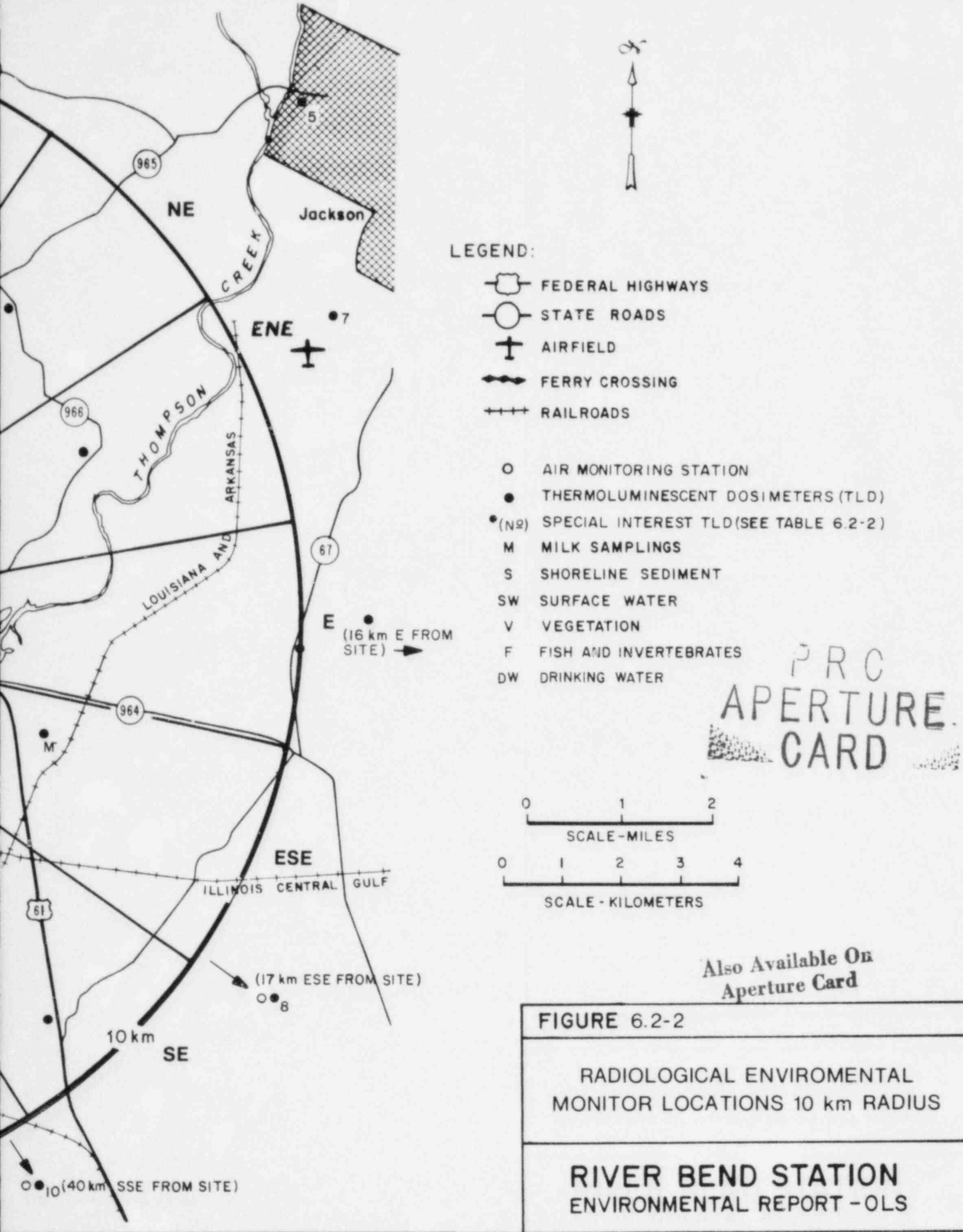


FIGURE 6.2-2

RADIOLOGICAL ENVIROMENTAL MONITOR LOCATIONS 10 km RADIUS

RIVER BEND STATION
ENVIRONMENTAL REPORT - OLS

6.5 BIOLOGICAL

6.5.1 Terrestrial Monitoring

6.5.1.1 Baseline Monitoring Program

Baseline studies of the terrestrial ecosystems of the River Bend property were performed by Louisiana State University from 1972 through 1977. The results of these studies are included in Section 2.4.1.

6.5.1.2 Preoperational and Operational Monitoring Program

The preoperational and operational monitoring program is based on the results of baseline studies coupled with an assessment of potential plant impacts on terrestrial ecosystems.

The primary impact of station operation on terrestrial biota may result from the operation of the cooling towers (see Section 5.3.3.2). Onsite, there is a potential for some limited foliar damage to sensitive plant species due to salt deposition. There is essentially no potential for this type of impact offsite. Therefore, the preoperational and operational monitoring programs are designed to address the onsite impacts of salt drift.

A preoperational data base will be obtained from a series of stereo false color infrared aerial photographs of the site taken in September or early October (the period of maximum theoretical susceptibility to salt-induced stress, due to relatively arid conditions) for two years preceding the initiation of cooling tower operation. A second series of aerial photographs will be taken during the first and third early-autumn periods after initiation of cooling tower operation. Detailed comparisons of the two series of photographs will be used to determine the existence of any changes in the structure or vigor of forest communities attributable to cooling tower operation. 5

The need for ground verification of any evidence of vegetation stress will be determined when the photographs are evaluated. Such ground verification could include direct inspection of individual trees and analyses of foliar salt content from trees in areas of high deposition potential and control areas.

6.5.2 Aquatic Ecology

An extensive program that monitors aquatic life in the vicinity of the River Bend site has been conducted by Louisiana State University personnel since 1972. The past, present, and future aquatic ecology sampling program can be divided into several phases:

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- Initial Baseline Study
- Interim Study
- Preoperational Study
- Operational Study.

The initial baseline study lasted for 2 yr from spring 1972 to spring 1974. The study established baseline conditions and provided input for the evaluation of potential impact and site suitability in the preparation of the Environmental Report - Construction Permit Stage.

The interim study was designed to monitor selected biological characteristics of the aquatic ecosystem in the site area. This phase began at the end of the baseline survey (spring 1974) and extends to the beginning of the preoperational studies.

The preoperational study is designed to collect data that will add to the information already acquired and allow direct comparison with data collected after the Unit 1 startup. This study will begin 2 yr before the start of Unit 1 operation and will continue until the unit goes into operation.

The operational study is designed to detect changes in the aquatic ecosystems due to the operation of the station. This phase will begin with the startup of Unit 1 and continue for up to 2 yr after the unit goes into operation. A similar schedule would be followed for Unit 2.

6.5.2.1 Initial Baseline Study

The 1972-1974 Baseline Study is summarized in Section 2.4.2. Sampling stations established during the baseline study are shown in Fig. 6.5-1.

6.5.2.2 Interim Study

The interim study, which began in the spring of 1974, was designed to continue the monitoring from the baseline study at reduced spatial intensity but, in most cases, at an increased temporal frequency. Sampling was concentrated on fewer biotic communities than in the baseline study. Also included were special studies of the floodplain.

Physicochemical

The following characteristics were studied:

Water temperature	Total residue
Dissolved oxygen	Total nonfilterable residue
pH	Alkalinity
Oxidation-Reduction Potential	Phosphates
Transmissivity	Nitrates

In situ water quality parameters were sampled in conjunction with biological sampling. Transmissivity, total residue, total nonfilterable residue, alkalinity, phosphates, and nitrates were sampled monthly.

6.5.2.2.3 Grants Bayou

Phytoplankton

Phytoplankton were collected in 2-liter whole water samples taken quarterly at two stations. Sampling began in 1974, but was discontinued during the dry period from spring 1976 to winter 1977. In 1977, Station 2 (Fig. 6.5-2) was moved 500 ft upstream.

Laboratory analysis was conducted in the same manner as the river samples.

Benthos

The benthic invertebrates were collected by taking three replicate Ekman grab samples at Stations 1 and 2 (Fig. 6.5-2). The samples were taken quarterly, except when Grants Bayou was dry from spring 1976 to winter 1977. Monthly samples were taken from 1978 to 1980. The benthic organisms were identified and counted using the same procedures described for river benthos.

Fish

Fish were collected in seines and dip nets on a quarterly schedule from 1974 to 1977. All fish captured were identified, counted, weighed, and measured.

Physicochemical

The following characteristics were studied:

Temperature	Total residue
Dissolved oxygen	Total nonfilterable residue

Conductivity	Alkalinity
pH	Phosphates
Oxidation-Reduction Potential	Nitrates

Water quality was sampled in conjunction with regular biological sampling.

6.5.2.3 Preoperational and Operational Monitoring

Plant operation is not expected to have significant impacts on aquatic biota. To verify this, 2 yrs each of preoperational and operational monitoring will be performed as described in the following outline. The operational program will be a continuation of the preoperational monitoring and will begin at the start of Unit 1 operation. Results will be reviewed following the first year and if no unexpected impacts have been detected, the same level of effort will take place during the second year. Unless the first 2 yrs of operational study show that continued monitoring is required, all sampling could then be terminated. A similar schedule would be followed for Unit 2. Because no plant discharges will enter Alligator Bayou directly during operation, preoperational and operational monitoring will be performed only in the Mississippi River and Grants Bayou.

Mississippi River

General - Because even near-field effects will be difficult to measure (if detectable) sampling will be conducted along the eastern shore only, at the three stations used during previous LSU studies and a station recently established in the intake embayment (Figure 6.5-3). Station V-A is representative of the area of natural shoreline above the plant discharge, IV-A is in the immediate vicinity of the discharge, and III-A is below the influence of the discharge. The embayment (Station 101) is a unique situation that may attract distinctive biotic communities. Inclusion of the embayment in the monitoring program will afford an evaluation of its relationship to the natural shoreline habitats.

Benthic Macroinvertebrates - Monthly samples will be taken in triplicate at each station with a fully-weighted Petersen grab. Invertebrate animals retained by a U.S. Standard No. 30 sieve will be identified and counted in order to estimate mean densities/station/visit.

Ichthyoplankton - Eggs, larvae, and early juveniles of fishes will be sampled by means of surface pushes with flowmeter-equipped, 0.5 in diameter, 0.5-mm mesh conical plankton nets. Samples will be taken semi-monthly in triplicate at each station from March through September, when spawning of river fishes occurs in the vicinity of the plant.

Nekton - Adult and larger juvenile fishes and shrimp will be sampled monthly at each station by means of boat-mounted, pulsed dc electrofishing equipment.

Physicochemical - Water temperature, dissolved oxygen concentration, specific conductance, and pH will be measured by means of in situ instruments at the time of each biological collection. These and other observations such as depth, surface current velocity, relative light penetration, and weather will serve to document conditions at the time of collection. Quarterly analyses of texture and organic content of sediment at each station will be performed to aid in evaluation of benthic macroinvertebrate data.

Grants Bayou

General - Sampling will be conducted at stations above and below the plant outfalls in Grants Bayou (Figure 6.5-3). Because of the small size and seasonal intermittency of the bayou, only one biotic community will be monitored routinely.

Benthic Macroinvertebrates - Monthly samples will be taken in triplicate at each station (if flow exists) with an Ekman grab.

Physicochemical - The same in situ water quality characteristics will be measured as in the river at the time of each benthic collection. Quarterly analyses of texture and organic content of sediments will also be performed.

References - 6.5

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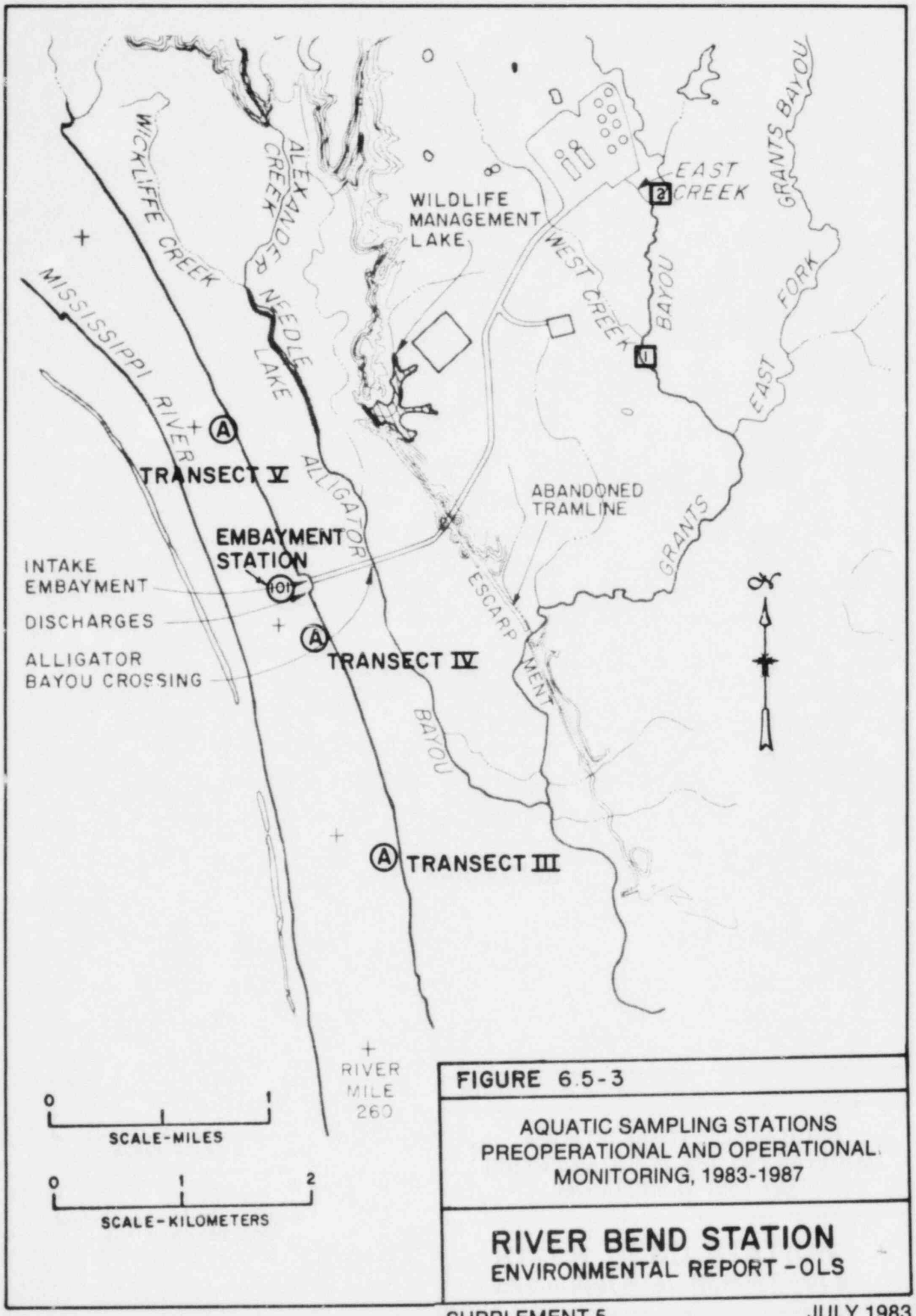

FIGURE 6.5-3

AQUATIC SAMPLING STATIONS
PREOPERATIONAL AND OPERATIONAL
MONITORING, 1983-1987

RIVER BEND STATION
ENVIRONMENTAL REPORT - OLS

In addition, flow and temperature instrumentation is provided for the continuous monitoring and recording of those parameters where required by NPDES permit.

Analysis parameters were selected on the basis of complying with NPDES Permit Nos. LA0042731 issued August 4, 1978, for River Bend Station, discharge limitations of current federal new-source effluent standards for the steam electric power generating point source category (40CFR423, dated October 8, 1974), and federal standards for secondary treatment (40CFR133, dated September 2, 1976).

The sampling program takes into account the intermittent nature of some of the chemical waste sources and the sampling frequencies required by the present NPDES permit. For example, sampling for residual chlorine in the cooling tower blowdown will be representative of periods of chlorination. Average and maximum free available chlorine will not exceed 0.2 mg/l and 0.5 mg/l, respectively, and discharge duration of either free available or total residual chlorine will not exceed 2 hr per unit per day. Also, only one unit will discharge at any given time. One cycle per week will be sampled for free available residual chlorine in compliance with the NPDES permit. The sample will be obtained when the injection cycle is complete, adding allowance for system residence time from the application points to the sampling point. The concentration of residual chlorine will be determined by analysis using approved methods. The daily average concentration during a calendar month will be computed by mathematically averaging the weekly determinations of concentration, weighted by flow value for each of the parameters having a measurement frequency of once per week.

The data for continuously measured flow and temperature will be time weighted and averaged to arrive at a daily average value. The daily average temperature will be computed and recorded on a daily basis as the average in a 24-hr period of temperatures at intervals not greater than 2 hr. The daily average flow during a calendar month will be computed by averaging the total flow recorded for each 24-hr period.

A composite (flow-weighted) sample from individual sources will be used for analysis and reporting of nonradioactive floor drains.

5

References - 6.6

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2. Standard Methods for the Examination of Water and Wastewater. American Public Health Association, American Water Works Association, Water Pollution Control Federation, 13th edition, 1971.

CHAPTER 7

ENVIRONMENTAL IMPACTS OF POSTULATED ACCIDENTS INVOLVING RADIOACTIVE MATERIALS

7.1 PLANT ACCIDENTS

This section discusses the radiological environmental impact of River Bend Station as required by 10CFR51, and as based on the accident assumptions provided in Environmental Standard Review Plan, Section 7.1 [1,2]. For each accident the following is provided:

1. A description of a representative type of accident appropriate for each accident class together with its basic assumptions

2. A determination of the radiological doses for each classification accident as it applies to River Bend Station.

Table 7.1-1 identifies the accidents considered.

Table 7.1-2 gives a summary of the radiological doses of each accident to a hypothetical maximum exposed individual at the exclusion area boundary, as defined in 10CFR100[3].

Table 7.1-3 summarizes the population doses for each accident at an 80-km radius utilizing the projected demography for the year 2000.

The demographic data and CHI/Q values at the 50 percent probability level that were used in these analyses can be found in Sections 2.5.1 and 2.7, respectively. Both the demographic data and CHI/Q values were based on the most recently available information at the time of analyses performance, thus providing more representative individual and population doses. 4

Calculations of doses to individuals and population are performed in accordance with the methods of NRC Regulatory Guide 1.3 and Regulatory Guide 1.145[4,5]. Population doses result from adjusting the individual dose by a factor incorporating population density and CHI/Q values for each specific sector.

7.1.1 Design Basis Accidents

7.1.1.1 Trivial Incidents Class

These incidents are included and evaluated under routine release in accordance with Appendix I to 10CFR50 in Section 5.4. 2

7.1.1.2 Small Releases Outside Containment Class

These releases include releases from small spills or leaks of radioactive materials outside the containment. These releases are included and evaluated under routine releases in accordance with Appendix I to 10CFR50 in Section 5.4. 2

7.1.1.3 Radwaste System Failures Class

7.1.1.3.1 Equipment Leakage or Malfunction

The source for this event is the largest radioactive storage tank which would be a rupture of an off gas system charcoal delay bed. This would cause the release of 25 percent of the average inventory on the bed. The source of activity for a bed is based upon the expected reactor coolant steam activities. The effective charcoal delay bed holdup time for krypton is 9.2 hr and for xenon is 211 hr. The duration of the accident is assumed to be 2 hr.

The calculated dose at the exclusion area boundary is given in Table 7.1-2. The integrated dose to the population is given in Table 7.1-3.

7.1.1.3.2 Release of Waste Gas Storage Tank Contents

This event is similar to the previous accident with the exception that 100 percent of the bed inventory is released to the atmosphere.

The calculated dose at the exclusion area boundary is given in Table 7.1-2. The integrated dose to the population is given in Table 7.1-3.