6.0 ENVIRONMENTAL MEASUREMENT AND MONITORING PROGRAMS

6.1 Thermal Monitoring

This section describes the thermal monitoring program for a new facility at the GGNS ESP Site. The program would be divided into three phases: pre-application monitoring (combined construction and operating license (COL) application), pre-operational monitoring, and operational monitoring.

6.1.1 Pre-Application Monitoring

This program primarily utilized the data being collected by the ongoing GGNS Unit 1 thermal monitoring program, and baseline data collected prior to and during construction of GGNS Unit 1.

As part of the environmental field measurements programs documented in Reference 3, water temperature measurements were carried out for the Mississippi River near the Grand Gulf site and for Gin and Hamilton Lakes for the period November 1972 to November 1973. During this period, the river temperature values at the site were found to be almost identical to those recorded at Vicksburg, Mississippi, where long-term data exist. The Mississippi River water temperatures at Vicksburg are, therefore, useful for assessing long-term impacts on the river. Water temperature and discharge measurements recorded at the USGS station at Vicksburg are available (e.g., data from 1973 to 1999 is shown in Table 2.3-3).

Thermal monitoring in the Mississippi River conducted as part of the GGNS Unit 1 2002 National Pollutant Discharge Elimination System (NPDES) monitoring program is documented in the associated permit renewal application for GGNS Unit 1 (Reference 1). This same monitoring is part of an on-going NPDES monitoring program implemented at GGNS Unit 1 by Reference 2. The thermal monitoring points include Point 1 located upriver approximately 400 feet north of the mouth of the barge slip and not more than 60 feet from the eastern shoreline. The down-river location (Point 7) is located approximately 100 feet south of the mouth of the barge slip in the mixing zone, not more than 60 feet from the eastern shoreline. In addition, temperature and flow rate are measured continuously at Outfall 1, where cooling tower blowdown and service water return are combined for subsequent discharge into the Mississippi River. Sampling equipment and procedures are detailed in Reference 2.

The monitoring data collected as described above adequately established baseline data in the Mississippi River to support the potential environmental impacts discussed in this report, and the thermal discharge descriptions and evaluations provided in Section 5.3.

6.1.2 Pre-Operational Monitoring

The pre-operational monitoring program is a continuation of the pre-application monitoring program, which would be conducted during the construction stages of a new facility. This monitoring program would begin at least one year prior to anticipated operation, and would be continued until the new facility became operational. Data from this monitoring program would be utilized to establish baseline temperature data for subsequently identifying and assessing any environmental impacts resulting from plant operations. The program would address the Mississippi River temperature data requirements, with respect to expected isotherm size and extent, as established by the NPDES permitting agency, depths and characteristics of the expected mixing zones, and time-temperature relationships at any required biological monitoring stations (Section 6.5).

A discharge outfall would be utilized for the combined discharge from both GGNS Unit 1 and a new facility, as described in Section 5.3.2.1. The predicted far-field thermal plume resulting from the proposed discharge system was modeled for the new facility discharge, combined with that from GGNS Unit 1, using the CORMIX (Cornell Mixing Zone Expert System) software as discussed in Section 5.3.2.1. Results of this model run are given in Table 5.3-2. Sampling locations would be defined to ensure the maximum predicted thermal plume area is bounded by the data collected.

Temperature measurements would be collected at the surface and at depth intervals and at the frequency as required by the NPDES permit.

Monitoring equipment and associated data analysis methods are not defined, since the equipment and its capabilities, as they are known today will likely change between this permit application and the time when a pre-operational program will actually be needed.

6.1.3 Operational Monitoring

The operational monitoring program a is continuation of the pre-operational monitoring program, would be utilized to identify actual changes in water temperature as a result of plant operation, and would conform to applicable NPDES permit requirements at the time of operation.

6.1.4 References

1. Entergy Operations, Inc., 2002 NPDES Permit Renewal Application, Attachment C, 2001 Winter and Summer Thermal Monitoring Reports, 2002.
2. GGNS Unit 1 Plant Operations Manual, Environmental Instruction – NPDES Sampling, 08-S-09-4, Revision 8, January 14, 2002.
3. Mississippi Power and Light Company, Grand Gulf Nuclear Station Units 1 and 2 Final Environmental Report (FER), as amended through Amendment No. 8.

6.2 Radiological Monitoring

6.2.1 Introduction

This section provides a description of the existing GGNS Unit 1 Annual Radiological Operating Report required by GGNS Unit 1 Technical Specification 5.6.2. The GGNS Unit 1 radiological monitoring program adequately characterizes the radiological environment of the biosphere in the vicinity of a new facility on the GGNS site. It provides data on measurable levels of radiation and radioactive materials in the site environs, and provides baseline data on surveillance of principal pathways of exposure to the public. This section summarizes the findings from the 2001 Annual Radiological Environmental Operating Report for GGNS Unit 1 (Reference 1).

The following description of the GGNS Unit 1 radiological environmental monitoring program includes: (1) number and location of sample collection points and measuring devices and the pathway sampled or measured; (2) sample size, sample collection frequency, and sampling duration; (3) type and frequency of analysis; (4) general types of sample collection and measuring equipment; and (5) lower limit of detection for each analysis.

A similar type program would be utilized to support the pre-operational and operational monitoring needs of a new facility. Any unique characteristics required of the program for a new facility (e.g., those brought on by a new or different reactor design) would be incorporated into the program sufficiently in advance of operation of a new facility, to provide adequate baseline information prior to plant operation.

6.2.2 GGNS Unit 1 Radiological Environmental Monitoring Program

The GGNS Unit 1 Radiological Environmental Monitoring Program (REMP) was established in 1978 prior to the station becoming operational (in 1985) to provide data on background radiation and radioactivity normally present in the area. GGNS has continued to monitor the environment by sampling air, water, sediment, fish and food products, as well as measuring radiation directly. GGNS also samples milk, if milk-producing animals are present within five miles of the plant.

The REMP includes sampling indicator and control locations within an 18-mile radius of the plant. The REMP utilizes indicator locations near the site to show any increases or buildup of radioactivity that might occur due to station operation, and control locations farther away from the site to indicate the level of only naturally occurring radioactivity. Indicator results are compared with control and pre-operational results to assess any impact GGNS operation might have had on the surrounding environment.

In the year 2001, environmental samples for radiological analysis were collected. Results of indicator locations were compared with control locations and previous studies, and it was concluded that, overall, no significant relationship exists between GGNS plant operation and radiological effects on the plant environs. The review of year 2001 data, in many cases, showed undetectable radiation levels in the environment, and near background radiation levels in significant pathways associated with GGNS Unit 1.

6.2.2.1 Pathways Monitored

The airborne, direct radiation, waterborne and ingestion pathways, as seen in Figure 6.2-1, are monitored as required by the GGNS Offsite Dose Calculation Manual (ODCM) Table 6.12.1-1. A description of the GGNS REMP utilized to monitor the exposure pathways is described in Table 6.2-1 and shown in Figures 6.2-2 and 6.2-3.

6.2.2.2 Land Use Census

A land use census is conducted biannually, as required by ODCM Specification 6.12.2. The purpose of this census is to identify changes in land use within five miles of the GGNS site that would require modifications to the REMP or the ODCM. The most important criteria during this census is to determine location in each sector of the nearest: 1) residence, 2) animal milked for human consumption, and 3) garden of greater than 50 m^2 (500 ft^2) producing broadleaf vegetation.

The land use census is conducted by:

- Field surveys in each meteorological sector out to five miles in order to confirm
  - ✓ Nearest permanent residence
  - ✓ Nearest unoccupied residence
  - ✓ Nearest garden and approximate size
  - ✓ Nearest milking animal, if any
- Identifying locations on a map, measuring distances to GGNS and recording results on surveillance data sheets
- Comparing current census results to previous results, and
- Contacting the County Agent for Claiborne County for verification of nearest dairy animals.

6.2.2.3 GGNS Unit 1 2001 REMP Summary

Table 6.2-2 is a summary of the GGNS Unit 1 REMP results for 2001.

6.2.3 References

1. GNRO-2002/00034, Letter dated April 25, 2001, from Charles Bottemiller to U.S. NRC, Subject 2001 Grand Gulf Nuclear Station (GGNS) Annual Radiological Environmental Operating Report (AREOR).
2. GGNS Offsite Dose Calculation Manual (ODCM), Revision 25, January 2003.

6.3 Hydrological Monitoring

This section provides a description of the various hydrological monitoring programs, including:

- Pre-application monitoring used to support the descriptions of existing hydrologic conditions in Section 2.3;
- Site preparation and construction monitoring to control anticipated impacts from site preparation and construction, and to detect any unexpected impacts arising from these activities;
- Pre-operational monitoring to establish a baseline for identifying and assessing environmental impacts resulting from plant operation; and
- Operational monitoring programs to establish the impacts of operation of the plant, and to detect any unexpected impacts arising from plant operation.

6.3.1 Pre-application Monitoring

This section addresses data collected from the ongoing GGNS Unit 1 National Pollutant Discharge Elimination System (NPDES) monitoring program (Reference 2), baseline data collected prior to construction of the existing GGNS facility, and data available from ongoing monitoring programs conducted by the U. S. Geological Survey (USGS) and the U. S. Army Corps of Engineers (Corps of Engineers). The data was used to document existing hydrologic conditions to support the hydrologic descriptions in Section 2.3.

The following describes baseline data collected at the GGNS site prior to and during construction activities for GGNS Units 1 and 2[1].

The GGNS Unit 1 hydrology field measurements program was initiated in 1972 and continued through August 1973. Incomplete parameter sampling was also conducted in September 1973. (Reference 1) A summary of the surface water physical measurements program is presented in Table 6.1-1 of Reference 1.

Preliminary sampling for the GGNS Unit 1 surface water quality measurements program was instituted in June 1972 with additional parameter determinations added throughout the summer and fall of 1972 as equipment became available. Essentially full sampling capabilities of the surface water quality program were attained by December 1972. (Reference 1) A summary of the surface water quality measurements program is presented in Table 6.1-2 of Reference 1.

Hydrologic features studied in the GGNS Unit 1 program included the Mississippi and Big Black Rivers, Hamilton and Gin Lakes, and streams in the plant site drainage basins. The parameters studied for the Mississippi and Big Black Rivers included stage, velocity, temperature, and channel bed characteristics. Hamilton and Gin Lakes were monitored for water level and temperature; a bathymetric survey was conducted in each lake. The site drainage basin streams were monitored for flow velocity, flow duration, and stage. The locations of sampling stations in the Mississippi River and Big Black River are shown in Figure 2.3-10. Sampling locations for the site drainage basin streams are shown in Figure 2.3-7. Details of the sampling program are provided in Reference 1.

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[1] GGNS Unit 2 construction was not completed, although many of the buildings for the second unit were constructed. Unit 2 was officially cancelled in 1991. References to GGNS Unit 1 include any work in support of the two-unit site preparation and construction.

A comparison of the GGNS Unit 1 environmental field measurements program temperature measurements showed that the temperature values at the site were found to be almost identical to those recorded at Vicksburg, Mississippi, where long-term data exist. (Reference 4) The Mississippi River water temperatures at Vicksburg are, therefore, useful for assessing long-term behavior of the water temperature. Water temperature and discharge measurements recorded at the USGS station at Vicksburg are available from 1973 to 1999[2]. Water quality information for the USGS station at Vicksburg is available from 1961 to 1999.

GGNS Unit 1 is required to conduct surface water sampling and flow measurements in accordance with existing water pollution control permit. Sampling data for a recent two-year period are shown in Table 2.3-10. This data shows the water quality of Stream A and Stream B, and the quality of water entering Hamilton Lake and the Mississippi River. Sampling equipment and procedures are detailed in Reference 2. Sampling at various outfall locations (Figure 2.3-12) is conducted as follows:

- Outfall 001 discharges into the Mississippi River via a pipeline from the discharge basin located near the GGNS Unit 1 power block. Temperature and flow rate just downstream of the discharge basin are measured continuously. Once per week grab samples are monitored for pH.
- Outfall 007 includes miscellaneous wastewater discharged into Basin B, prior to entering or mixing with the waters in Basin B. The flow rate, total suspended solids, oil and grease, total residual chlorine, and pH are sampled twice per month.
- Outfall 010 includes treated sanitary wastewater discharged to Basin A. Flow rate is measured continuously. Biological oxygen demand, total suspended solids, pH, total residual chlorine, and fecal coliform bacteria are sampled twice per month.
- Outfall 013 includes effluent from sediment Basin A that enters an unnamed tributary then flows into Hamilton Lake. The flow rate, pH, and total suspended solids (TSS) are measured quarterly.
- Outfall 014 includes effluent from sediment Basin B that enters an unnamed tributary then flows into Hamilton Lake. The flow rate, pH, and total suspended solids (TSS) are measured quarterly.

Thermal monitoring in the Mississippi River, conducted as part of the 2002 NPDES monitoring program, is documented in the associated permit renewal application for GGNS Unit 1 (Reference 3). Thermal monitoring is part of an on-going NPDES monitoring program implemented at GGNS Unit 1 by Reference 2 as discussed in Section 6.1.

Ground water levels were initially measured from 1972 to mid-1979; observation well and piezometer locations are shown on Figure 2.3-20. Ground water studies were completed in 1990 and 1992 to define sources of ground water recharge and ground water flow patterns across the site. (Reference 4) Water levels in monitoring wells and dewatering wells in the terrace deposits around the GGNS Unit 1 power block continue to be measured monthly.

Recent ground water sampling data was obtained from published sources and from results of ongoing monitoring programs at GGNS. Water quality sampling was conducted for the Mississippi River and for radial wells completed in the alluvial aquifer in 1988 as part of an

[2] 1999 was the latest complete data set from the USGS source.

evaluation of GGNS Unit 1 radial well performance. The site potable water wells located on the western boundary of the proposed power block area for a new facility, have pre-treatment sampling conducted on a routine basis in accordance with Mississippi Department of Health requirements.

The available hydrologic data was determined to be adequate to describe baseline conditions in the Mississippi River, local streams, local lakes, and ground water at the GGNS site as discussed in Section 2.3.

6.3.2 Construction Monitoring

Hydrological monitoring would be done to control anticipated impacts from site preparation and construction and to detect any unexpected impacts arising from these activities.

Potential increases in turbidity in the local lakes and streams from construction on the site, and in the Mississippi River from construction of the embayment and intake would be monitored for unanticipated impacts from these activities.

When the facility layout is determined, additional ground water monitoring wells may be required to estimate dewatering requirements for construction. Ground water levels would be monitored during construction to measure perched water levels, and to evaluate potential impacts to local ground water levels.

Construction impacts would be reduced by development and implementation of a site-specific construction Storm Water Pollution Prevention Plan (SWPPP). SWPPPs typically address regular inspections for erosion control measures and visual inspections for discharges that may be detrimental to water quality. Water quality sampling and flow measurements would be conducted as required to meet construction NPDES permit criteria.

6.3.3 Pre-Operational Monitoring

Pre-operational hydrological monitoring would be conducted to establish a baseline for identifying and assessing hydrologic changes resulting from future plant operation.

The program would consist of reconnaissance, field sampling, laboratory analysis, and data reduction and evaluation. This monitoring would include at least one year of data collection to ensure that temporal variations such as seasonal changes have been adequately monitored. Monitoring would focus on physical, chemical, and microbial components of the hydrologic systems on the site and in the Mississippi River as required. Data from ongoing monitoring programs for GGNS Unit 1 would be evaluated and used as appropriate to support this program. The monitoring would be used to evaluate:

- Alteration of surface water flow fields;
- Alteration of ground water flow;
- Impact of sanitary and chemical waste retention methods on water quality;
- Alteration of sediment transport; and
- Alteration of floodplains or wetlands.

Additional monitoring may be required as the design for a new facility, and the associated embayment and intake are finalized. Bathymetric characteristics of the Mississippi River would be evaluated to establish conditions in the vicinity of the embayment. When the final facility layout is determined, additional monitoring wells may be required to estimate dewatering

requirements for operation. These activities would provide additional hydrologic baseline data for the site against which to evaluate potential impacts from operation.

6.3.4 Operational Monitoring

Operational hydrological monitoring would be used to establish the impacts of operation of a new facility and to detect any unexpected impacts arising from plant operation. The monitoring would comply with applicable permitting agency requirements.

6.3.5 References

1. Mississippi Power and Light Company, Grand Gulf Nuclear Station Units 1 and 2 Final Environmental Report (FER), as amended through Amendment No. 8.
2. GGNS Unit 1 Plant Operations Manual, Environmental Instruction – NPDES Sampling, 08-S-09-4, Revision 8, January 14, 2002.
3. Entergy Operations, Inc., 2002 NPDES Permit Renewal Application, Attachment C, 2001 Winter and Summer Thermal Monitoring Reports, 2002.
4. Grand Gulf Nuclear Station Updated Final Safety Analysis Report, UFSAR.

6.4 Meteorological Monitoring

The meteorological monitoring program will be the same throughout the pre-construction and operational phases of the project. The monitoring program will simply be a continuation of the ongoing meteorological monitoring program for the GGNS Unit 1 facility. A description of the GGNS Unit 1 meteorological monitoring program, and the associated instrumentation and data analysis capability is provided in Section 2.7.5.

6.5 Ecological Monitoring

Environmental measurements and monitoring of terrestrial and aquatic ecology at the Grand Gulf Nuclear Station (GGNS) site will be divided into four phases:

- Pre-application (CP/COL) Monitoring
- Site Preparation and Construction Monitoring
- Pre-operational Monitoring
- Operational Monitoring

6.5.1 Pre-Application Monitoring

6.5.1.1 Early Site Permit Phase Monitoring

Ecological monitoring conducted in support of construction of the existing GGNS facility, augmented by site reconnaissance and field survey in support of this ESP application were used to support the ecological descriptions provided in Section 2.4. Studies conducted for the existing GGNS facility Construction Phase Environmental Report and the Final Environmental Report (Reference 1) in large part contributed information used in this phase of the ecological monitoring program. These GGNS Unit 1 studies were designed and conducted to collect approximately one (1) year of baseline information in the following categories:

a. Aquatic Ecology - fishes, larval fishes, benthic macroinvertebrates, drifting benthic macroinvertebrates, river shrimp, crayfish, zooplankton, phytoplankton, periphyton and macrophyton, including observations of threatened and endangered species and disease and pest infestations in biota.

b. Terrestrial Ecology - vegetation, birds, mammals, amphibians and reptiles, including observations of rare and endangered species and disease and pest infestations in biota.

Supplementary environmental field measurements programs were also conducted as follows:

a. Impingement Study - conducted at MP&L's Baxter Wilson Steam Electric Station at Vicksburg, Mississippi to assess the impingement of aquatic organisms on the traveling screens of the condenser cooling water intake structures.

b. Environmental Photography Survey - conducted over the site and surrounding areas to document pre-construction site conditions, to assist in the identification of vegetation assemblages, to delineate areas of suspected existing stressed or diseased vegetation, to delineate existing drainage patterns, and to delineate areas of suspected high soil moisture. (Reference 1)

The terrestrial environmental field measurements programs for the existing GGNS facility construction were begun in June and July of 1972 and conducted by a full-time field staff. Reconnaissance and preliminary sampling were conducted in June and July 1972. Systematic sampling for ecologic parameters was initiated in July through August and September 1972 (Reference 1). The environmental field measurements programs were conducted through August 1973 to provide approximately one year of baseline data.

The existing GGNS facility was constructed in accordance with the Environmental Protection Program Respecting Construction of Grand Gulf Nuclear Station Units 1 and 2[1]. The objective of this program was to assure that construction was accomplished with practices which cause minimum impact (Reference 1).

The environmental field measurements programs conducted on and adjacent to the Grand Gulf site consisted of reconnaissance, observation, field sampling, laboratory analyses and data reduction and evaluation activities (Reference 1). Summaries of the environmental field measurements programs conducted at Grand Gulf are listed by major discipline in Tables 6.5-1 through 6.5-4. These tables include the parameters measured, the method of measurement, and the frequency of sampling. Detailed descriptions of the terrestrial ecology sampling procedures and methods of analysis used during the pre-construction environmental field measurements programs can be found in the GGNS Unit 1 FER (Reference 1).

In 2002, two reconnaissance surveys were made to the GGNS site, the first during the week of August 19 - 24 and the second October 29 - November 1. These surveys were used in part to qualitatively assess the ecological resources at the GGNS site to assist in determining if the ecological conditions had significantly changed during the intervening years since the GGNS Unit 1 FER surveys were done. The surveys consisted of qualitative assessments of the habitat types with comparison to the conditions described in the FER. Some general observations were also made during the site visits regarding the types of animals present on the site. The conclusion from these qualitative assessments is that the descriptions in the FER adequately describe the condition at the GGNS site, for the purposes of this ESP application. It was evident that there was little additional development on the site in previously undisturbed areas, and that the vast majority of the site has been left undisturbed in the intervening years (Figure 2.4-2).

6.5.1.2 CP/COL Phase Monitoring

Additional pre-application monitoring program would be implemented as required at the CP/COL phase for a new facility. This program would begin at least a year prior to clearing and grubbing of the ESP site. This CP/COL monitoring program would consist of two phases. The first phase would include site surveys for plants and animals of special interest identified through consultations with various State and Federal wildlife agencies. Information obtained from these agencies for this ESP application (Section 2.4) would form the basis for this phase of this CP/COL pre-application monitoring program consultations. The agencies would be contacted to identify any changes in the lists of species of special interest, and their recommendations concerning the potential presence and need for protection of these species. A survey of existing literature for information on critical life history information such as spawning areas, nursery grounds, food habits, feeding and wintering areas and migration routes would be done to help assess the extent of potential impacts on these species. The specific methods used for this survey would depend on the specific plants and animals identified during the consultation process.

This phase would also include a general survey of habitat types in the final areas designated construction of a new facility, to determine if the conclusions reached in this ESP application remain valid regarding the environment of the ESP Site. This general survey would be designed

[1] Initial construction on the GGNS site was for two identical units; only one was completed and is operating. Construction of the second unit was cancelled in 1991; most of the buildings were completed for the second unit.

to include all four seasons and would include a continuation of the environmental photography survey conducted over the site and surrounding areas prior to the initial construction of GGNS Unit 1. Photographic documentation would help identify changes in the type and extent of both aquatic and terrestrial habitats. The general survey of habitat types would provide ground truth information for aerial photographs of the site.

Monitoring during the first phase would be prioritized according to the severity of the potential impacts identified in this ESP ER. For example, a limited sampling of aquatic habitat may be necessary to better describe the population of fish, and particularly larval fish, in the Mississippi River in vicinity of the GGNS site, specifically in the areas surrounding a location of the embayment and intake.

The second phase of this CP/COL pre-application monitoring program would only be implemented if the screening survey identified significant differences in the habitat types from those presented in the FER. The design of this monitoring program would depend on the results of the screening phase. This phase would include monitoring only those habitat types and species of interest identified in the first phase. The second phase would also include monitoring of physical and chemical parameters as necessary to fully assess the potential impacts on the ecological resources in the vicinity of the GGNS site from a new facility.

If, during the first phase of this CP/COL pre-application monitoring program, evidence is found indicating the presence of terrestrial or aquatic species of special interest, this second phase may include more extensive investigations into the seasonal distribution and life history of these species.

6.5.2 Site Preparation and Construction Monitoring

Site Preparation and Construction Monitoring is used when specific adverse impacts from site preparation and construction are predicted. Specific monitoring would be done, for example, if it is determined that significant adverse impacts would occur to aquatic species in the area proposed for construction of an embayment on the shoreline of the Mississippi River.

The program developed for construction of a new facility would allow for periodic modification as monitoring results become available and as station design parameters change to ensure that the monitoring effort is sufficient when compared to the effects that site preparation and construction are having on the environment.

6.5.3 Pre-operational Monitoring

A program to monitor the terrestrial and aquatic ecology of the GGNS site may be necessary to establish baseline information for identifying and assessing the potential environmental impacts resulting from operation of a new facility. An evaluation would be made at during the construction phase of the project, based on monitoring and evaluations conducted previously, to determine the necessity of a pre-operational monitoring program. Should a pre-operational monitoring program be required, full advantage would be taken of any environmental monitoring programs conducted on and in the vicinity of the GGNS site prior to and during construction of a new facility. And, if possible, two or more consecutive years of monitoring would be conducted to provide a baseline against which future operational impacts may be judged.

If previous monitoring programs identified the presence of terrestrial or aquatic threatened or endangered species or other species of special importance that have a potential of being impacted by operation of a new facility, the pre-operational monitoring program would thus be designed to obtain additional information on the spawning areas, nursery and feeding areas,

wintering areas and migration routes of these species. This information would be particularly important in assessing potential impacts to aquatic species, because of the potential for impingement and entrainment of the individuals, including larvae and juveniles, in the intake water. These organisms may also be impacted by the release of heated water. Physical, chemical, and biological factors known to influence the distribution and relative abundance of these “important” species would be investigated as part of this monitoring program.

Potential impacts to commercial and sport fishing in the vicinity from intake and discharges from a new facility would be evaluated and appropriate monitoring conducted. And potential impacts from operation of cooling towers on the terrestrial habitat and vegetative growth would be considered in development of this program. Any required NPDES permit monitoring provisions would be included in this program.

6.5.4 Operational Monitoring

A program to monitor the terrestrial ecology of the GGNS site may be necessary to establish baseline information for use and evaluation of the environmental impacts resulting from continued operation of a new facility. An evaluation would be made, based on results of the pre-operational monitoring program (if such program was required) and final design of a new facility, to determine the necessity of such an operational monitoring program. Full advantage would be taken of any environmental monitoring programs conducted on and in the vicinity of the GGNS site prior to design and implementation of an operational monitoring program.

6.5.5 References

1. Mississippi Power and Light Company, Grand Gulf Nuclear Station Units 1 and 2 Final Environmental Report (FER), as amended through Amendment No. 8.

6.6 Chemical Monitoring

This section describes a chemical monitoring program for a new facility at the GGNS ESP Site. The monitoring program would be divided into three phases: construction monitoring, pre-operational monitoring, and operational monitoring programs, each program building upon the methodology and data from the previous program(s). Data collection requirements in each successive program will be based on changes in parameters from the previous, and the perceived need to continue monitoring.

6.6.1 Pre-Application Monitoring

Pre-application monitoring primarily utilized data from ongoing GGNS Unit 1 monitoring programs, USGS and Corps of Engineers data collected at various locations on the Mississippi River in the vicinity of the GGNS site (refer to Section 2.3 tables for recent data), and baseline data collected prior to construction of the existing GGNS facility. Data from these monitoring programs was used to document existing water quality conditions, and to support water quality descriptions provided in Section 2.3 demonstrating site suitability for this ESP application.

The following describes the baseline data collected prior to the construction of GGNS Unit 1 as documented in Reference 1.

The GGNS Unit 1 hydrology field measurements program was initiated in 1972 and continued through August 1973. Incomplete parameter sampling was also conducted in September 1973. (Reference 1) A summary of the surface water physical measurements program is presented in Table 6.1-1 of Reference 1.

Preliminary sampling for GGNS Unit 1 surface water quality measurements program was instituted in June 1972, with additional parameter determinations added throughout the summer and fall of 1972 as equipment became available. Essentially full sampling capabilities of the surface water quality program were attained by December 1972. (Reference 1) A summary of the surface water quality measurements program is presented in Table 6.1-2 of Reference 1.

Hydrologic features studied in the GGNS Unit 1 program included the Mississippi and Big Black Rivers, Hamilton and Gin Lakes, and streams in the plant site drainage basins. The parameters studied for the Mississippi and Big Black Rivers included stage, velocity, temperature, and channel bed characteristics. Hamilton and Gin Lakes were monitored for water level and temperature; a bathymetric survey was conducted in each lake. The site drainage basin streams were monitored for flow velocity, flow duration, and stage. The locations of sampling stations in the Mississippi River and Big Black River are shown in Figure 2.3-10. Sampling locations for the site drainage basin streams are shown in Figure 2.3-7. Details of the sampling program are provided in Reference 1.

GGNS Unit 1 is required to conduct surface water sampling and flow measurements in accordance with their NPDES permit. Sampling data for a recent two-year period are shown in Table 2.3-10. This data shows the water quality of Stream A and Stream B, and of water entering Hamilton Lake and the Mississippi River. Sampling equipment and procedures are detailed in Reference 2. Sampling at various outfall locations (Figure 2.3-12) is conducted as follows:

- Outfall 001 discharges into the Mississippi River via a pipeline from the discharge basin located near the GGNS Unit 1 power block. Temperature and flow rate just downstream of the discharge basin are measured continuously. Once per week grab samples are monitored for pH.

- Outfall 007 includes miscellaneous wastewater discharged into Basin B, prior to entering or mixing with the waters in Basin B. The flow rate, total suspended solids, oil and grease, total residual chlorine, and pH are sampled twice per month.
- Outfall 010 includes treated sanitary wastewater discharged to Basin A. Flow rate is measured continuously. Biological oxygen demand, total suspended solids, pH, total residual chlorine, and fecal coliform bacteria are sampled twice per month.
- Outfall 013 includes effluent from sediment Basin A that enters an unnamed tributary then into Hamilton Lake. The flow rate, pH, and total suspended solids (TSS) are measured quarterly.
- Outfall 014 includes effluent from sediment Basin B that enters an unnamed tributary then into Hamilton Lake. The flow rate, pH, and total suspended solids (TSS) are measured quarterly.

The available water quality data is adequate to describe and establish the baseline conditions in the Mississippi River water, and for the local streams, local lakes, and ground water on the site, with respect to chemical parameters monitored.

6.6.2 Construction Monitoring

If required by the Mississippi Environmental Quality Permit Board, MDEQ, the administrative agency responsible for the approval and enforcement of the site NPDES permit, a construction monitoring program would be instituted at the site in order to assess water quality changes resulting from construction of the proposed project. This data collected would be analyzed and compared with historical data collected in the pre-application monitoring program. Analysis of water quality data would provide a means to control anticipated impacts resulting from site preparation and construction, and would support detection of any unexpected impacts arising from these activities.

Any construction impacts could be reduced through development and implementation of a site-specific construction Storm Water Pollution Prevention Plan (SWPPP). SWPPPs typically address regular inspections for erosion control measures and visual inspections for discharges that may be detrimental to water quality. Water quality sampling and flow measurements would be conducted as required to meet NPDES permit criteria during construction.

6.6.3 Pre-Operational Monitoring

Pre-operational hydrological monitoring would be conducted to establish a baseline for identifying and assessing environmental impacts resulting from plant operation. Data from ongoing monitoring programs for the GGNS Unit 1 facility, and data collected during any pre-application and construction monitoring done, would be evaluated and used as appropriate. The pre-operational monitoring program would be an extension of the previous water quality monitoring programs.

The program would consist of reconnaissance, field sampling, laboratory analysis, and data reduction and evaluation. This monitoring would include at least one year of data collection to ensure that temporal variations such as seasonal changes have been adequately monitored. Monitoring would focus on physical, chemical and microbial components of the hydrologic systems on and adjacent to the site as required.

6.6.4 Operational Monitoring

Operational monitoring would be used to establish the impacts of operation of the plant and detect any unexpected impacts arising from plant operation. This monitoring would be utilized to evaluate the impact of sanitary and chemical waste retention methods on water quality, and to assess the impact associated with alteration of sediment transport during operation of a new facility. The effectiveness of effluent treatment and control systems would be assessed as a part of the monitoring program, providing the ability to predict failures in or reductions of effectiveness of these systems.

Sampling locations, frequency, and parameter analysis would meet NPDES permit criteria applicable at the time of operation.

6.6.5 References

1. Mississippi Power and Light Company, Grand Gulf Nuclear Station Units 1 and 2, Final Environmental Report (FER), as Amended through Amendment No. 8.
2. GGNS Unit 1 Plant Operations Manual, Environmental Instruction-NPDES Sampling, 09-S-08-4, Revision 8, January 14, 2002.

6.7 Summary of Monitoring Programs

This section summarizes the monitoring programs requirements. Sections 6.1 through 6.6 discuss these programs for each of six specific areas of monitoring to be conducted as follows:

Section 6.1 Thermal Monitoring Program

Section 6.2 Radiological Monitoring Program

Section 6.3 Hydrological Monitoring Program

Section 6.4 Meteorological Monitoring Program

Section 6.5 Ecological Monitoring Program

Section 6.6 Chemical Monitoring Program

6.7.1 Pre-Application Monitoring

This program provided baseline data for the site in support environmental descriptions in this environmental report, and assessment of site environmental suitability. Pre-application monitoring for COL activities may be required for ecological issues, as discussed in Section 6.5.

6.7.2 Site Preparation and Construction Monitoring

Site preparation and construction monitoring is used when specific adverse impacts from site preparation and construction are predicted. The purpose of this monitoring program is to provide data necessary to assess impacts resulting from the construction of the proposed project. This monitoring would include additional pre-application monitoring when necessary to establish a baseline. The time-frame for sampling each parameter would be appropriate for the period of expected change and data would be collected at defined locations, times, and frequencies such that subsequent data collected during construction can be compared, and construction impacts assessed and mitigated as required.

6.7.3 Pre-Operational Monitoring

The purpose of this monitoring program is to provide baseline data such that the operational monitoring program can detect impacts resulting from the continued operation of a new facility. It is anticipated that this monitoring would be consistent with existing GGNS Unit 1 monitoring programs, and would include a logical extension of the pre-application, and the site preparation and construction monitoring programs as appropriate.

6.7.4 Operational Monitoring

The purpose of the operational monitoring program would be to identify and assess the magnitude of impacts resulting from continued plant operation. This information would also be used to assess the effectiveness of waste treatment systems and the quality of plant effluents, and to provide real time warnings of any failures in effluent treatment systems. Operational monitoring programs would be prescribed, primarily, by the requirements of the various permits required for operation of a new facility, such as the air permit and NPDES permit.

TABLE 6.2-1

RADIOLOGICAL ENVIRONMENTAL SAMPLING PROGRAM

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Airborne	Radioiodine and Particulates 1 sample close to the SITE BOUNDARY having the highest calculated annual average groundlevel D/Q.	AS-7 UH (Sector H, Radius 0.5 Miles) – South-southeast of GGNS at the IBEW Union Hall.	Continuous sampler operation with sample collection per 7 days or as required by dust loading, whichever is more frequent.	Radioiodine Cannister – 1-131; 7 days Particulate Sampler – Gross beta radioactivity following filter change, composite (by location) for gamma isotopic; 92 days
	Radioiodine and Particulates 1 sample from the vicinity of a community having the highest calculated annual average groundlevel D/Q.	AS-1 PG (Sector G, Radius 5.5 Miles) – Southeast of GGNS at the Port Gibson City Barn.		
	Radioiodine and Particulates 1 sample from a control location 15 – 30 km (10 – 20 miles) distance.	AS-3 61VA (Sector B, Radius 18 Miles) – North-northeast of GGNS on Hwy 61, North of the Vicksburg Airport.		
Direct Radiation	TLDs An inner ring of stations in the general areas of the SITE BOUNDARY	M-16 (Sector A, Radius 0.9 Miles) – Meteorological Tower. M-17 (Sector C, Radius 0.5 Miles) – South Side, Grand Gulf Road. M-19 (Sector E, Radius 0.5 Miles) – Eastern SITE BOUNDARY Property line, North-northeast of HWSA	92 days	Gamma dose; 92 days

TABLE 6.2-1 (Continued)

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Direct Radiation	TLDs An inner ring of stations in the general areas of the SITE BOUNDARY.	M-21 (Sector J, Radius 0.4 Miles) – Near Former Training Center Building on Bald Hill Road M-22 (Sector G, Radius 0.5 Miles) – Former RR Entrance Crossing on Bald Hill Road. M-23 (Sector Q, Radius 0.5 Miles) – Gin Lake Road 50 yards North of Heavy Haul Road on Power Pole. M-25 (Sector N, Radius 1.6 Miles) – Radial Well Number 1. M-28 (Sector L, Radius 0.9 Miles) – Former Glodjo Residence. M-94 (Sector R, Radius 0.8 Miles) – Sector R Near Meteorological Tower.	92 days	Gamma dose; 92 days
	TLDs An outer ring approximately 3 to 5 miles from the site	M-36 (Sector P, Radius 5.0 Miles) – Curve on HW 608, Point Nearest GGNS at Power Pole. M-40 (Sector M, Radius 2.3 Miles) – Headly Drive, Near River Port Entrance.		

TABLE 6.2-1 (Continued)

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Direct Radiation	TLDs An outer ring approximately 3 to 5 miles from the site.	M-48 (Sector K, Radius 4.8 Miles) – 0.4 Miles South on Mont Gomer Road on West Side. M-49 (Sector H, Radius 4.5 Miles) – Fork in Bessie Weathers Road/Shaifer Road. M-50 (Sector B, Radius 5.3 Miles) – Panola Hunting Club Entrance. M-55 (Sector D, Radius 5.0 Miles) – Near Ingelside Karnac Ferry Road/Ashland Road intersection. M-57 (Sector F, Radius 4.5 Miles) – Hwy 61, Behind the Welcome to Port Gibson Sign at Glensdale Subdivision.	92 days	Gamma dose; 92 days
	TLDs 8 stations in special interest areas such as population centers, nearby residences, schools, and in 1 or 2 areas to serve as controls stations.	M-01 (Sector E, Radius 3.5 Miles) – Across the road from Lake Claiborne Entry Gate. (Special Interest) M-07 (Sector G, Radius 5.5 Miles) – AS-1 PG, Port Gibson City Barn. (Special Interest) M-09 (Sector D, Radius 3.5 Miles) – Warner Tully Y-Camp. (Special Interest) M-10 (Sector A, Radius 1.5 Miles) – Grand Gulf Military Park. (Special Interest)		

TABLE 6.2-1 (Continued)

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Direct Radiation	TLDs 8 Stations in special interest areas such as population centers, nearby residences, schools, and in 1 or 2 areas to serve as control stations	M-14 (Sector B, Radius 18.0 Miles) – AS-3-61VA, Hwy 61, North of Vicksburg Airport. (Control) M-33 (Sector P, Radius 12.5 Miles) – Newellton, Louisiana Water Tower. (Special Interest) M-38 (Sector M, Radius 9.5 Miles) – Lake Bruin State Park, Entrance Road. (Special Interest) M-39 (Sector M, Radius 13.0 Miles) – St. Joseph, Louisiana, Auxiliary Water Tank. (Special Interest)	92 days	Gamma dose; 92 days
	TLDs Sixteen permanent TLD stations at the protected area boundary (these are in addition to ODCM requirements).	M-61 (Sector D, Onsite) – Protected Area Fence. M-62 (Sector E, Onsite) – Protected Area Fence. M63 (Sector N, Onsite) – Protected Area Fence. M64 (Sector M, Onsite) – Protected Area Fence.		

TABLE 6.2-1 (Continued)

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Direct Radiation	TLDs Sixteen permanent TLD stations at the protected area boundary.	M-65 (Sector L, Onsite) – Protected Area Fence. M-66 (Sector K, Onsite) – Protected Area Fence. M-67 (Sector J, Onsite) – Protected Area Fence. M-68 (Sector H, Onsite) – Protected Area Fence. M-69 (Sector G, Onsite) – Protected Area Fence. M-70 (Sector F, Onsite) – Protected Area Fence. M-71 (Sector C, Onsite) – Protected Area Fence. M-72 (Sector B, Onsite) – Protected Area Fence. M-74 (Sector Q, Onsite) – Protected Area Fence. M-76 (Sector A, Onsite) – Protected Area Fence.	92 days	Gamma dose; 92 days

TABLE 6.2-1 (Continued)

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Direct Radiation	TLDs Sixteen permanent TLD stations at the protected area boundary.	M-77 (Sector R, Onsite) – Protected Area Fence. M-81 (Sector P, Onsite) – Protected Area Fence.	92 Days	Gamma dose; 92 days
	TLDs Three TLDs utilized as duplicates at varying locations (these are in addition to ODCM requirements).	M-31 (Sector Varies, Radius Varies) – Duplicate TLD Installed Quarterly at Varying Locations. M-32 (Sector Varies, Radius Varies) – Duplicate TLD Installed Quarterly At Varying Locations. M-60 (Sector Varies, Radius Varies) – Duplicate TLD Installed Quarterly At Varying Locations.		

TABLE 6.2-1 (Continued)

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Waterborne	Surface Water 1 sample upstream.	MRUP (Sector Q – R, Radius 1.8 Miles) – At least 4500 ft upstream of the GGNS discharge point into the Mississippi River to allow adequate mixing of the Mississippi and Big Black Rivers.	92 days	Gamma isotropic and tritium analyses; 92 days
	1 sample downstream.	MRDOWN (Sector N, Radius 1.6 Miles) – At least 5000 ft downstream of the GGNS discharge point into the Mississippi River near Radial Well No. 1.		
	1 sample downstream during a Liquid Radwaste Discharge.	MRDOWN (Sector Q – P, Radius 1.3 Miles) – Downstream of the GGNS discharge point into the Mississippi River near Radial Well No. 5.	366 days	Gamma isotropic and tritium analyses; 366 days
Waterborne	Groundwater Samples from 2 sources.	PGWELL (Sector G, Radius 5.0 Miles) – Port Gibson Wells – Take from distribution system or one of the five wells. CONSTWELL (Sector P, Radius 0.4 Miles) – GGNS Construction Water Well – Taken from distribution system or the well.	366 days	Gamma isotopic and tritium analyses; 366 days

TABLE 6.2-1 (Continued)

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
	Sediment From Shoreline			
	1 sample from downstream area.	SEDHAM (Sector N, Radius 1.6 Miles) – Downstream of the GGNS discharge point in the Mississippi River near Hamilton Lake outlet.	366 days	Gamma isotopic; 366 days
	1 sample from upstream area.	SEDCONT (Minimum of 100 yds) – Upstream of the GGNS discharge point in the Mississippi River.		
Ingestion	Milk			
	1 sample from milking animals within 8 km if milk is available commercially	Currently, no available milking animals within 8 km of GGNS.	92 days when required	Gamma isotopic and I-131; 92 days
	1 control sample (only if indicator exists) >8 km if milk is available.	ALCONT (Sector K, Radius 10.5 Miles) – Located South-southwest of GGNS at Alcorn State University.		

TABLE 6.2-1 (Continued)

Exposure Pathway	Requirement	Sample Point Description, Distance and Direction	Sampling and Collection Frequency	Type and Frequency Of Analyses
Ingestion	Fish			
	1 sample in vicinity of GGNS discharge point.	FISHDOWN – Downstream of the GGNS discharge point into the Mississippi River.	366 days	Gamma isotopic on edible portion; 366 days.
	1 sample uninfluenced by GGNS discharge.	FISHUP – Upstream of the GGNS discharge point in the Mississippi River uninfluenced by plant operations.		
	Food Products			
	1 sample of broadleaf vegetation grown in one of two different offsite locations with highest anticipated annual average ground level D/Q if milk sampling is not performed.	VEG-J (Sector J, Radius 0.4 Miles) – South of GGNS near former Training Center on Bald Hill Road.	92 days when available	Gamma isotopic and I-131; 92 days
	1 sample of similar vegetation grown 15 – 30 km distant if milk sampling is not performed.	VEG-CONT (Sector K, Radius 10.5 Miles) – Alcorn State University south-southwest of GGNS when available, otherwise a location 15-30 km distant.		

NOTES:
1. Data taken from the Grand Gulf Nuclear Station Annual Radiological Environmental Monitoring Program Summary for the reporting period of January – December 2001

TABLE 6.2-2

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM SUMMARY – GGNS UNIT 1

Sample Type (Units)	Type & Number of Analyses [a]	LLD [b]	Indicator Locations Mean (F) [c] [Range]	Location with Highest Annual Mean Location [d]	Location with Highest Annual Mean Mean (F) [c] [Range]	Control Locations Mean (F) [c] [Range]	Number of Non-routine Results [e]
Air Particulates (pCi/m³)	GB 153	0.01	0.022 (102 / 102) [0.010 – 0.059]	AS-7 UH (Sector H, 0.5 mi.)	0.022 (51 / 51) [0.010 – 0.059]	0.021 (51 / 51) [0.009 – 0.050]	0
	GS 12						
	Cs-134	0.05	<LLD	N/A	N/A	<LLD	0
	Cs-137	0.06	<LLD	N/A	N/A	<LLD	0
Airborne Iodine (pCi/m³)	I-131 153	0.07	<LLD	N/A	N/A	<LLD	0
Inner Ring TLDs (mR/Qtr)	Gamma 36	(f)	9.9 (36 / 36) [6.8 – 12.5]	M-21 (Sector J, 0.4 mi.)	11.9 (4 / 4) [11.3 – 12.5]	N/A	0
Outer Ring TLDs (mR/Qtr)	Gamma 28	(f)	10.6 (28 / 28) [8.6 – 12.3]	M-49 (Sector H, 4.5 mi.)	11.6 (4 / 4) [11.2 – 12.2]	N/A	0
Special Interest TLDs (mR/Qtr)	Gamma 28	(f)	9.4 (28 / 28) [7.4 – 11.6]	M-01 (Sector E, 3.5 mi.)	11.0 (4 / 4) [10.1 – 11.6]	N/A	0
Control TLDs (mR/Qtr)	Gamma 4	(f)	N/A	N/A	N/A	10.9 (4 / 4) [10.0 – 11.3]	0
Protected Area TLDs (mR/Qtr)	Gamma 64	(f)	37.3 (64 / 64) [8.2 – 126.0]	M-69 (Sector G, Onsite)	106.1 (4 / 4) [80.7 – 126.0]	N/A	0

TABLE 6.2-2 (Continued)

Sample Type (Units)	Type & Number of Analyses [a]	LLD [b]	Indicator Locations Mean (F) [c] [Range]	Location with Highest Annual Mean Location [d]	Mean (F) [c] [Range]	Control Locations Mean (F) [c] [Range]	Number of Non-routine Results [e]
Surface Water (pCi/l)	H-3 11	3000	<LLD	N/A	N/A	<LLD	0
	GS 11						
	I-131	15	<LLD	N/A	N/A	<LLD	0
	Mn-54	15	<LLD	N/A	N/A	<LLD	0
	Fe-59	30	<LLD	N/A	N/A	<LLD	0
	Co-58	15	<LLD	N/A	N/A	<LLD	0
	Co-60	15	<LLD	N/A	N/A	<LLD	0
	Zn-65	30	<LLD	N/A	N/A	<LLD	0
	Zr-95	30	<LLD	N/A	N/A	<LLD	0
	Nb-95	15	<LLD	N/A	N/A	<LLD	0
	Cs-134	15	<LLD	N/A	N/A	<LLD	0
	Cs-137	18	<LLD	N/A	N/A	<LLD	0
	Ba-140	60	<LLD	N/A	N/A	<LLD	0
	La-140	15	<LLD	N/A	N/A	<LLD	0

TABLE 6.2-2 (Continued)

Sample Type (Units)	Type & Number of Analyses [a]		LLD [b]	Indicator Locations Mean (F) [c] [Range]	Location with Highest Annual Mean Location [d]	Mean (F) [c] [Range]	Control Locations Mean (F) [c] [Range]	Number of Non-routine Results [e]
Groundwater (pCi/1)	H-3	3	2000	<LLD	N/A	N/A	<LLD	0
	I-131	2	1	<LLD	N/A	N/A	<LLD	0
	GS	3						
	Mn-54		15	<LLD	N/A	N/A	<LLD	0
	Fe-59		30	<LLD	N/A	N/A	<LLD	0
	Co-58		15	<LLD	N/A	N/A	<LLD	0
	Co-60		15	<LLD	N/A	N/A	<LLD	0
	Zn-65		30	<LLD	N/A	N/A	<LLD	0
	Zr-95		30	<LLD	N/A	N/A	<LLD	0
	Nb-95		15	<LLD	N/A	N/A	<LLD	0
	Cs-134		15	<LLD	N/A	N/A	<LLD	0
	Cs-137		18	<LLD	N/A	N/A	<LLD	0
	Ba-140		60	<LLD	N/A	N/A	<LLD	0
	La-140		15	<LLD	N/A	N/A	<LLD	0
Bottom Sediment (pCi/kg)	GS	2						
	Cs-134		150	<LLD	N/A	N/A	<LLD	0
	Cs-137		180	<LLD	N/A	N/A	<LLD	0

TABLE 6.2-2 (Continued)

Sample Type (Units)	Type & Number of Analyses [a]	LLD [b]	Indicator Locations Mean (F) [c] [Range]	Location with Highest Annual Mean Location [d]	Location with Highest Annual Mean Mean (F) [c] [Range]	Control Locations Mean (F) [c] [Range]	Number of Non-routine Results [e]
Fish	GS 3						
(pCi/kg)	Mn-54	130	<LLD	N/A	N/A	<LLD	0
	Fe-59	260	<LLD	N/A	N/A	<LLD	0
	Co-58	130	<LLD	N/A	N/A	<LLD	0
	Co-60	130	<LLD	N/A	N/A	<LLD	0
	Zn-65	260	<LLD	N/A	N/A	<LLD	0
	Cs-134	130	<LLD	N/A	N/A	<LLD	0
	Cs-137	150	<LLD	N/A	N/A	<LLD	0
Food Products (pCi/kg)	I-131 8	60	<LLD	N/A	N/A	<LLD	0
	GS 8						
	Cs-134	60	<LLD	N/A	N/A	<LLD	0
	Cs-137	80	<LLD	N/A	N/A	<LLD	0
Sediment (Special)	GS 2						0
(pCi/kg)	Mn-54	(f)	39.07 (2 / 2) [37.20 – 40.94]	SEDBAR (Sector Q, 1.5 mi.)	39.07 (2 / 2) [37.20 – 40.94]	N/A	
	Co-60	(f)	51.34 (2 / 2) [42.07 – 60.60]	SEDBAR (Sector Q, 1.5 mi.)	51.34 (2 / 2) [42.07 – 60.60]	N/A	0
	Cs-134	150	<LLD	N/A	N/A	N/A	0
	Cs-137	180	28.77 (2 / 2) [23.24 – 34.30]	SEDBAR (Sector Q, 1.5 mi.)	28.77 (2 / 2) [23.24 – 34.30]	N/A	0

TABLE 6.2-2 (Continued)

Sample Type (Units)	Type & Number of Analyses [a]	LLD [b]	Indicator Locations Mean (F) [c] [Range]	Location with Highest Annual Mean Location [d]	Mean (F) [c] [Range]	Control Locations Mean (F) [c] [Range]	Number of Non-routine Results [e]
Venison (Special)	GS 1						
(pCi/kg)	Mn-54	130	<LLD	N/A	N/A	N/A	0
	Fe-59	260	<LLD	N/A	N/A	N/A	0
	Co-58	130	<LLD	N/A	N/A	N/A	0
	Co-60	130	<LLD	N/A	N/A	N/A	0
	Zn-65	260	<LLD	N/A	N/A	N/A	0
	Cs-134	130	<LLD	N/A	N/A	N/A	0
	Cs-137	150	<LLD	N/A	N/A	N/A	0

[a] GB = Gross beta; I-131 = Iodine-131; H-3 = Tritium; GS = Gamma scan.
[b] LLD = Required lower limit of detection based on GGNS ODCM Table 6.12.1-3.
[c] Mean and range based upon detectable measurements only. Fraction of detectable measurements at specified locations is indicated in parenthesis (F).
[d] Locations are specified (1) by name and (2) degrees relative to reactor site.
[e] Non-routine results are those which exceed ten times the control station value. If no control station value is available, the result is considered non-routine if it exceeds ten times the preoperational value for the location.
[f] LLD is not defined in GGNS ODCM Table 6.12.1-3

NOTES:

1. Data taken from the Grand Gulf Nuclear Station Annual Radiological Environmental Monitoring Program Summary for the reporting period of January – December 2001

TABLE 6.5-1

SUMMARY OF TERRESTRIAL ECOLOGICAL MEASUREMENTS PROGRAM[1] – 1972-1973

Task	Method	Frequency
Type-map overstory vegetation	0.1-acre plots	Once
Type-map understory vegetation	0.001-acre plots	Summer, Winter and Spring
Determination of bird populations:		
a. Species composition and relative abundance	Belt transect and field-edge census	Bimonthly
b. Passerine populations	Observation plots in major forest habitats	Bimonthly
c. Nocturnal raptors	Evening observation census	Monthly in spring
d. Diurnal raptors	Tower observation census	Monthly
e. Waterbird populations	Lake census	Monthly
f. Blackbirds	Roost census	Monthly
g. Abundance of upland game birds	Hunter census	Periodic during hunting season
h. Importance of Gin and Hamilton Lakes to wood ducks	Live trapping	Once in late summer and fall
i. Bird impaction on cooling towers	Interviews; evaluation of local avian populations	Once
Determination of abundance and population status of deer	a. Hunt club records b. Nightlight census c. Correlation with State records d. Discussions with local experts	Daily during hunting season Biweekly Once Once
Determination of medium- sized mammal populations:	Hunt club records plus:	
a. rabbits	a. Live trapping[2]	Once
b. squirrels	b. Nest census[2]	Once
c. beaver	c. Lodge census	Once
d. other mammals	d. Nightlight census	Biweekly
Evaluation of populations of small mammals	Trapping in major habitats	Quarterly
Determination of species and relative abundance of reptiles and amphibians	Searching selected habitats	Periodic; increased intensity during spring
Determination of plants and animals in the area eaten by man	a. Literature b. Interviews	Once

NOTES:
1. Including observations for rare and endangered species.
2. Augmented with hunter bag census periodically during hunting season.
3. Reptile and amphibian collection activities were also conducted in conjunction with and at the locations of the aquatic field sampling programs (see Reference 1 Figures 2.2-9, 2.2-10 and 2.2-12).

SOURCE: Reference 1, Table 6.1-4

TABLE 6.5-2
(FER TABLE 6.1-5)

CENSUS TECHNIQUES EMPLOYED TO DETERMINE SEASONAL AVIAN SPECIES COMPOSITION AND RELATIVE ABUNDANCE AT THE GRAND GULF SITE - 1972-1973

Census Type	Census Unit	Frequency	Location
Plot census	40 Acres	Bimonthly	Bluff forest Bottomland forest
Field-edge census	8000' x 100'	Bimonthly	Bluff fields Bottomland fields
Waterbird census	Hamilton and Gin Lakes	Monthly	Lakes
Soaring bird census	Range of vision[1]	Monthly	Entire site
Belt transect census	5000' x 300'	Bimonthly	Bluffs Bottomlands
Blackbird roost census	Middle Ground Island[2]	Monthly	Bottomland forest
Nocturnal raptor	Entire site	Monthly during spring	Entire site
Wood duck trapping	Hamilton and Gin Lakes	Late summer and fall	Lakes

NOTES:
1. Census conducted from Grand Gulf Military Park observation tower.
2. Roost is on Middle Ground Island in Mississippi River, west of site.

SOURCE: Reference 1

TABLE 6.5-3
(FER TABLE 6.1-7)

SUMMARY OF SUPPLEMENTARY SAMPLING ACTIVITIES

Task	Method	Frequency	Location
Determination of aquatic biota impingement on intake water screens	Wire mesh baskets in screen wash discharge	Daily Semiweekly[1]	Baxter Wilson Steam Electric Station, Vicksburg, Mississippi
Lake periphyton and macrophyton a. periphyton b. macrophyton	Sample analyses and observations during aquatic sampling	 Twice Periodically	 FER Figure 2.2-10 Hamilton and Gin Lakes
Diseases and pest infestations in biota a. fish b. vegetation c. wildlife	Observations during regular sampling	 Periodically[2] Periodically[2] Periodically[2]	 FER Figures 2.2-9, 2.2-10 and 2.2-12 Site area Site area
Environmental photography	Thermal and color infrared and color aerial photography	Once	Grand Gulf site and adjacent areas
Ambient noise survey	Sound analysis system	Once	Grand Gulf site and adjacent areas
Transmission line corridor survey	Reconnaissance surveys by terrestrial biologists and construction specialist	Once	All proposed transmission line routes and alternate alignments

NOTES:
1. Sampled daily from March through May 1973 and semiweekly from June through August 1973.
2. Observations for diseases and pest infestations in biota were conducted during scheduled field sampling activities.

SOURCE: Reference 1

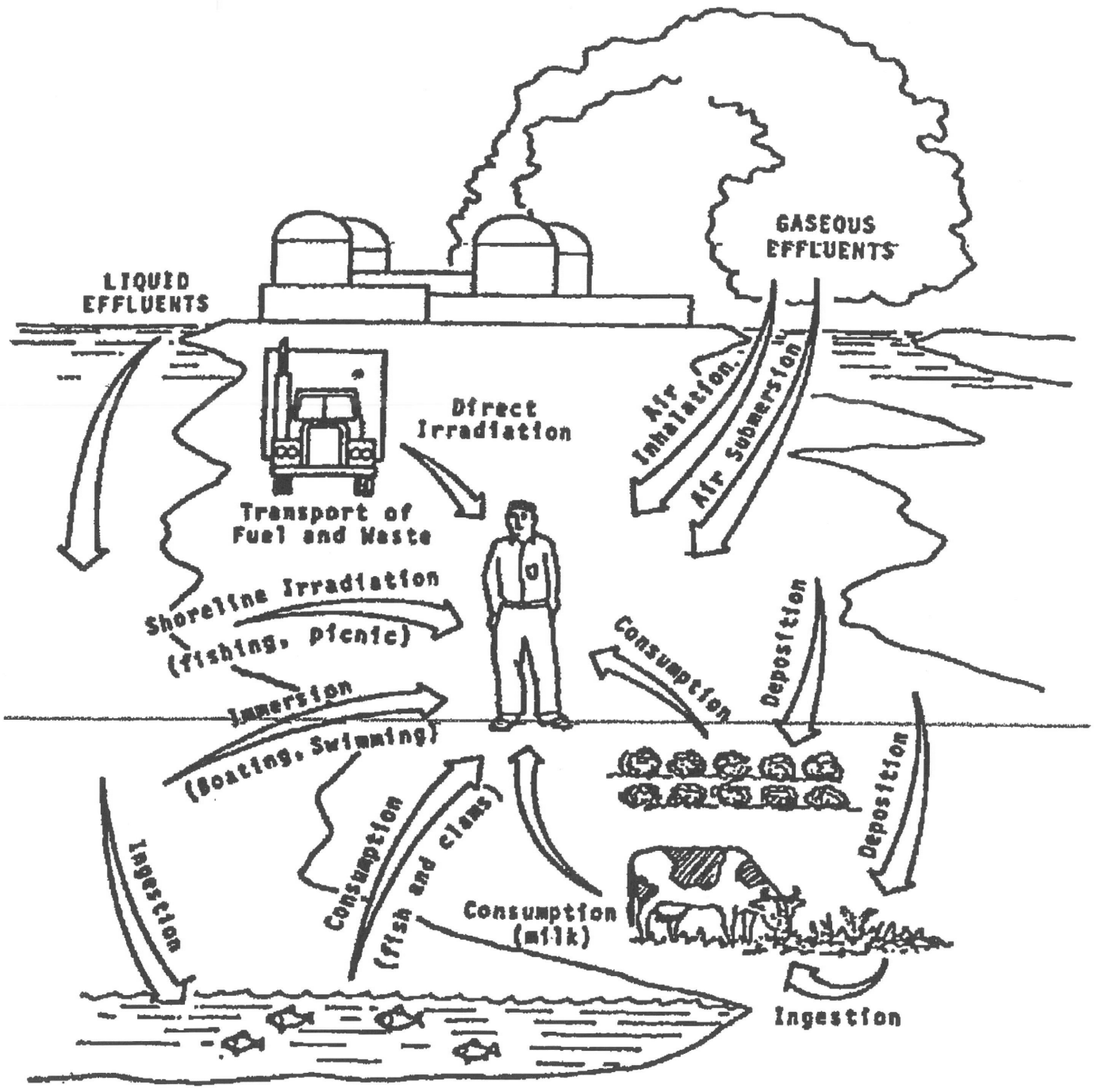
TABLE 6.5-4

SUMMARY OF AQUATIC ECOLOGICAL MEASUREMENTS PROGRAM[1] 1972-1973

Task	Method	Frequency
Determination of adult fish assemblage in the river	a. Nets	Monthly[2]
	b. Trawl	Monthly[2]
	c. Seine	Monthly[2]
Determination of adult fish assemblage in the lakes	a. Nets	Bimonthly[2]
	b. Electrofishing	Quarterly[2]
Determination of adult fish assemblage in stream A	a. Electrofishing	Semiannually
	b. Seine	Once
Determination of adult fish population in two bluff ponds	Electrofishing	Once per pond
Determination of larval and juvenile fish assemblage in river	a. Meter net	Monthly[4]
	b. Seine	Monthly[2]
Commercial and recreational uses of lakes and river	Creel census and interviews	As required
Determination of benthic communities of river	a. Shipek grab	Monthly
	b. Shrimp traps	Monthly
Determination of drifting macroinvertebrates assemblage in river	Meter net	Monthly[4]
Determination of plankton populations in river	Net (zoo.) and whole water samples (phyto.)	Monthly to Semimonthly
Determination of plankton populations in lakes	Net (zoo.) and whole water samples (phyto.)	Monthly to Semimonthly

NOTES:
1. Including observations for rare and endangered species.
2. As river stage conditions permitted.
3. See Figure 3.2-1 for sampling locations in the lakes during flood conditions; electrofishing, only, conducted during flood conditions.
4. Semimonthly during peak spawning period.

SOURCE: Reference 1, Table 6.1-3.

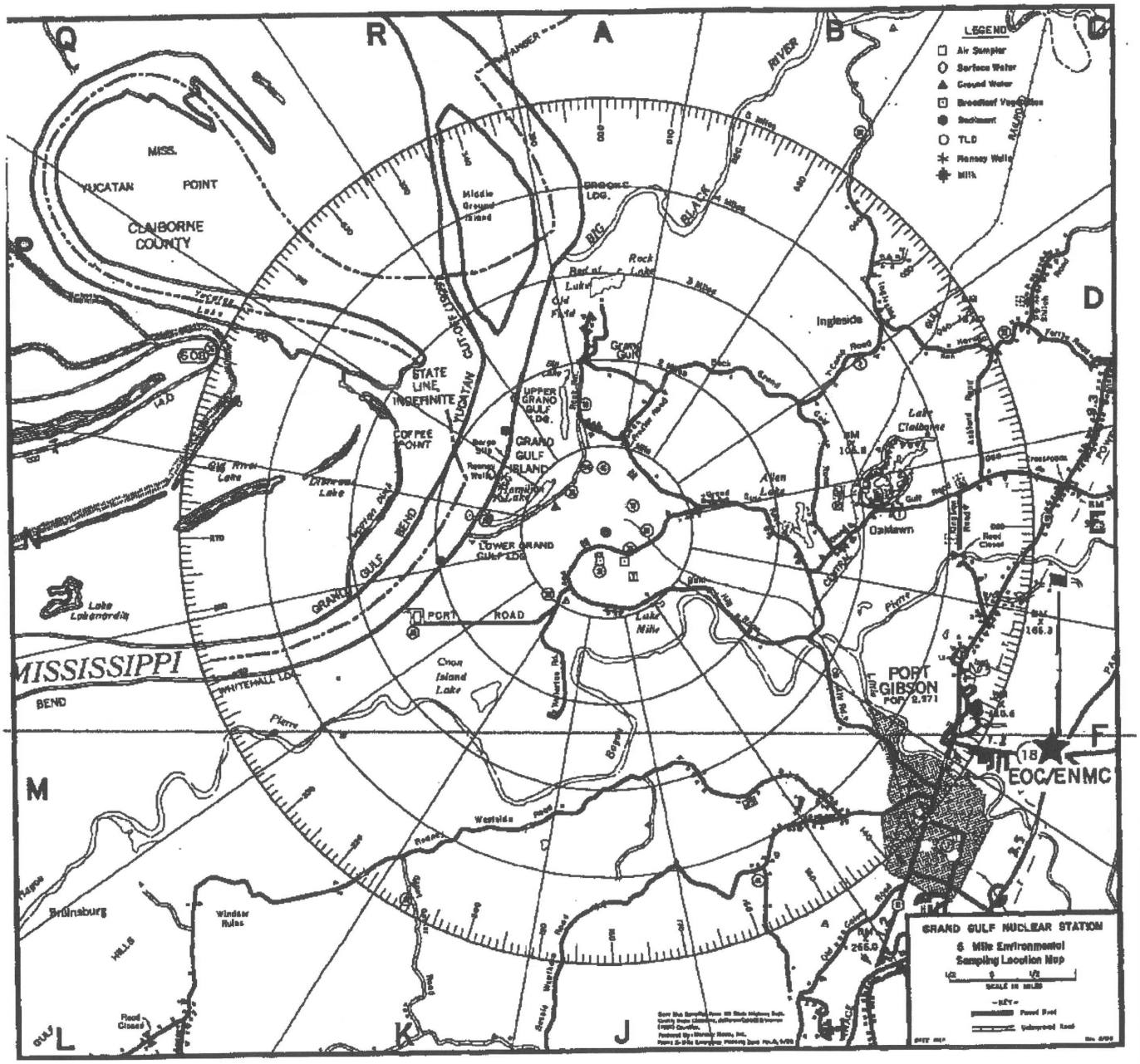


SOURCE:
GGNS UNIT 1 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT FOR YEAR 2001.

SERI
GRAND GULF NUCLEAR STATION SITE
EARLY SITE PERMIT APPLICATION
ENVIRONMENTAL REPORT

EXPOSURE PATHWAYS

FIGURE 6.2-1 REV. 1

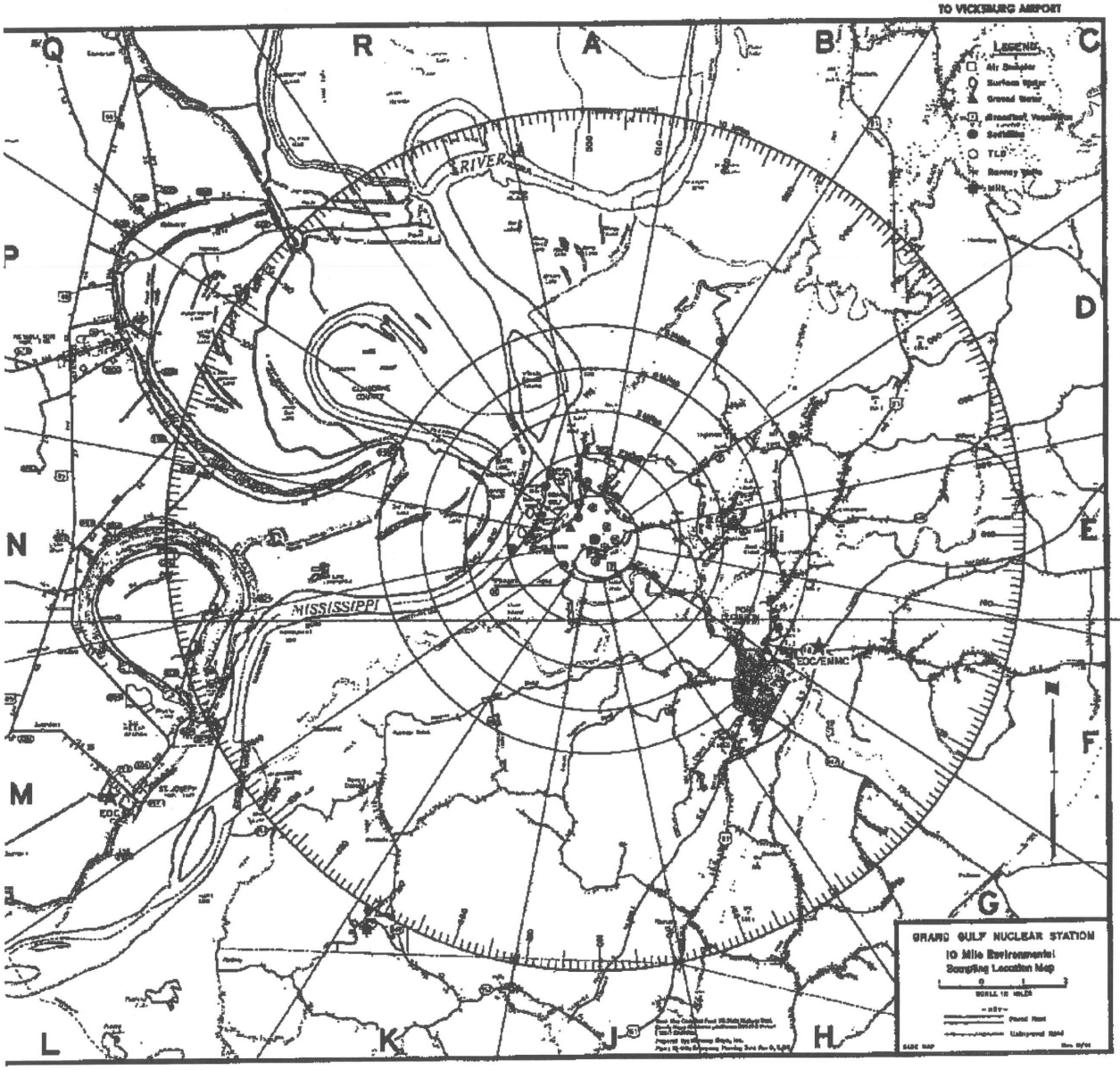


SOURCE:
GGNS UNIT 1 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT FOR YEAR 2001.

SERI
GRAND GULF NUCLEAR STATION SITE
EARLY SITE PERMIT APPLICATION
ENVIRONMENTAL REPORT

SAMPLE COLLECTION SITES-
NEAR FIELD

FIGURE 6.2-2 REV. 1



SOURCE:
GGNS UNIT 1 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT FOR YEAR 2001.

SERI
GRAND GULF NUCLEAR STATION SITE
EARLY SITE PERMIT APPLICATION
ENVIRONMENTAL REPORT

SAMPLE COLLECTION SITES-
FAR FIELD

FIGURE 6.2-3 REV. 1