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RESPONSE TO ITEMS A1 - A3 OF RADIATION DISCHARGE INFORMATION SECTION FEDERAL FACILITIES COMPLIANCE AGREEMENT

08/17/86

WMCO
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REPORT

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FEED MATERIALS PRODUCTION CENTER

RESPONSE TO ITEMS A1-A3 OF

RADIATION DISCHARGE INFORMATION SECTION

FEDERAL FACILITIES COMPLIANCE AGREEMENT

30 Day Deliverable

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ENVIRONMENTAL MONITORING PROGRAM AT THE FMPC

1.0 INTRODUCTION

1.1 Purpose of Report

The Environmental Monitoring Program (EMP) at the Feed Materials Production Center (FMPC) is designed to assess any possible effects of FMPC operations on the quality of the environment.

The purpose of this document is to provide an overall outline of the requirements and procedures which comprise environmental monitoring at the FMPC. The responsibility of ensuring adherence to the guidance set forth in this document lies with the Environment, Safety and Health (ES&H) Department of Westinghouse Materials Company of Ohio (WMCO). It is the policy of WMCO to promote environmental awareness and further enhance levels of air and water quality which will protect environmental quality and public health. The responsibility for limiting the release of potential pollutants into the environment to as low as reasonably achievable (ALARA) rests with all personnel, both management and operators.

1.2 Site Background

The FMPC is an industrial facility owned by the United States Department of Energy (DOE), and was managed by NLO, Inc. until December 31, 1985. Current management of the facility has been under the direction of Westinghouse Materials Company of Ohio (WMCO) since January 1, 1986. Located approximately 32 km (20 mi) northwest of downtown Cincinnati, Ohio, production

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operations cover approximately 55 hectares (136) in the center of a 425 hectare (1050 acres) site. Several rural communities lie within a 1-5 km radius of the plant (Figure 1).

The primary function of the FMPC is the production of metallic uranium fuel elements, target cores and other uranium compounds for use at other DOE facilities. The isotopic content of the final product may be depleted, normal, or slightly enriched in ^{235}U. However, the average ^{235}U content is close to that of uranium found in nature (0.71 percent).

The production of fuel elements and target cores may begin with ore concentrates, recycled uranium, or with other uranium compounds. Some of the material is first dissolved in nitric acid to extract uranium from most of the impurities. A solution of uranyl nitrate is then produced. The recycled uranium feed material received at the FMPC contains residual quantities of some fission products.

Evaporation and heating convert the nitrate solution to uranium trioxide powder. This trioxide is reduced to uranium dioxide and subsequently reacted with anhydrous hydrogen fluoride to produce uranium tetrafluoride. Uranium tetrafluoride is then reacted with magnesium metal to produce metallic uranium. This metallic uranium is then combined with scrap uranium metal and remelted to yield a purified uranium ingot. Ingots are then extruded to form rods or tubes and machined to the dimensions specified by other DOE sites. A process diagram is shown in Figure 2.

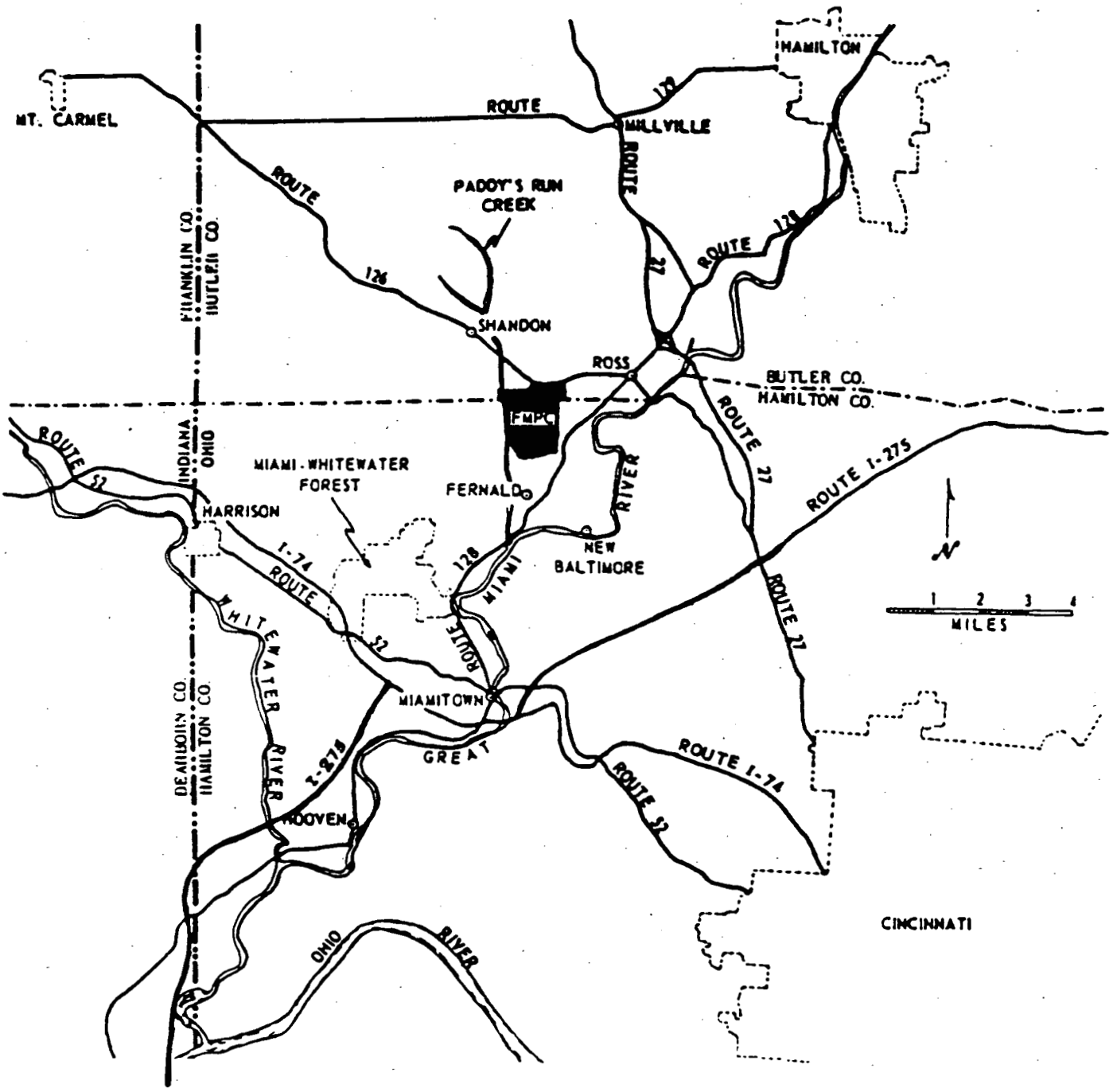
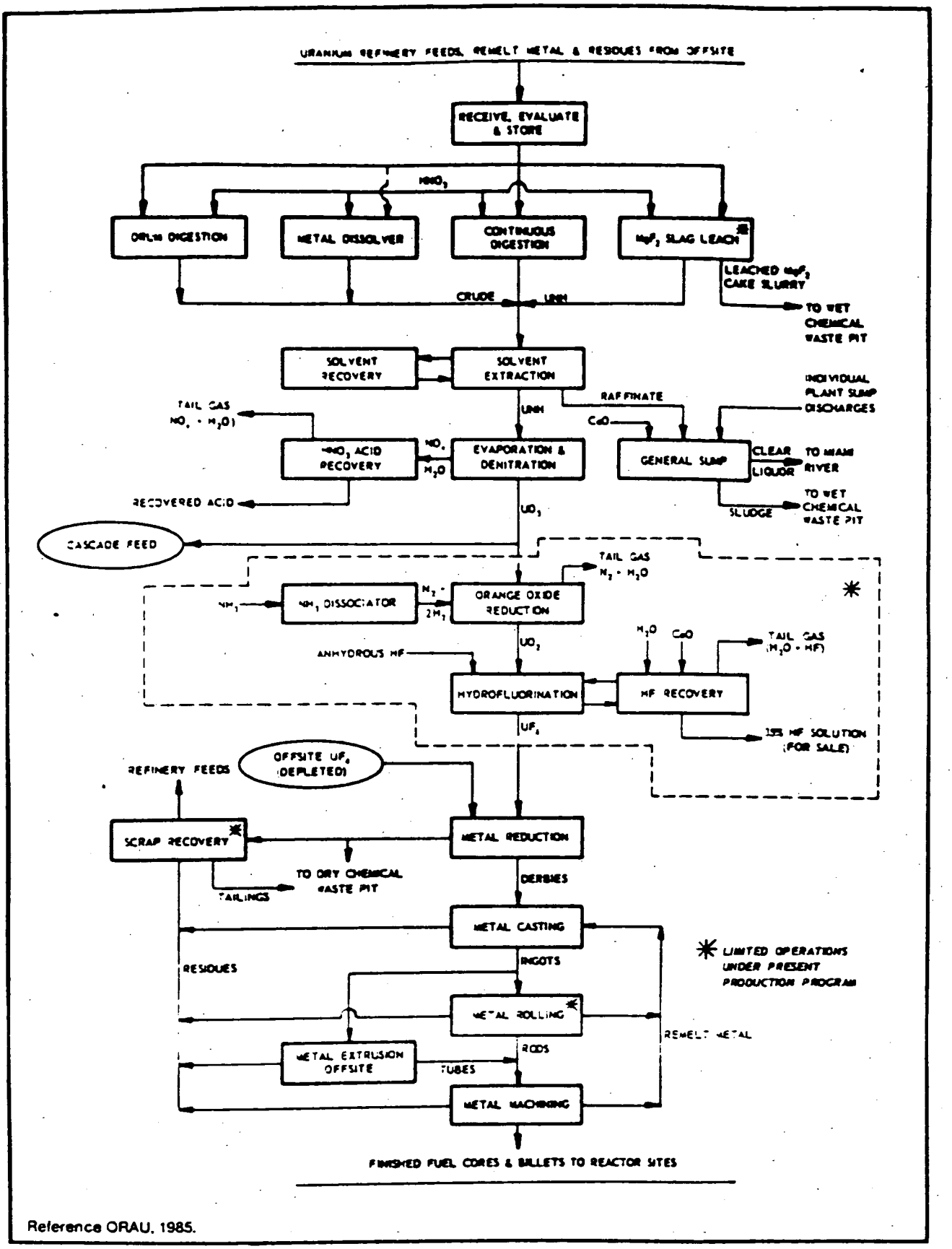


FIGURE 1 AREA MAP



Reference ORAU, 1985.

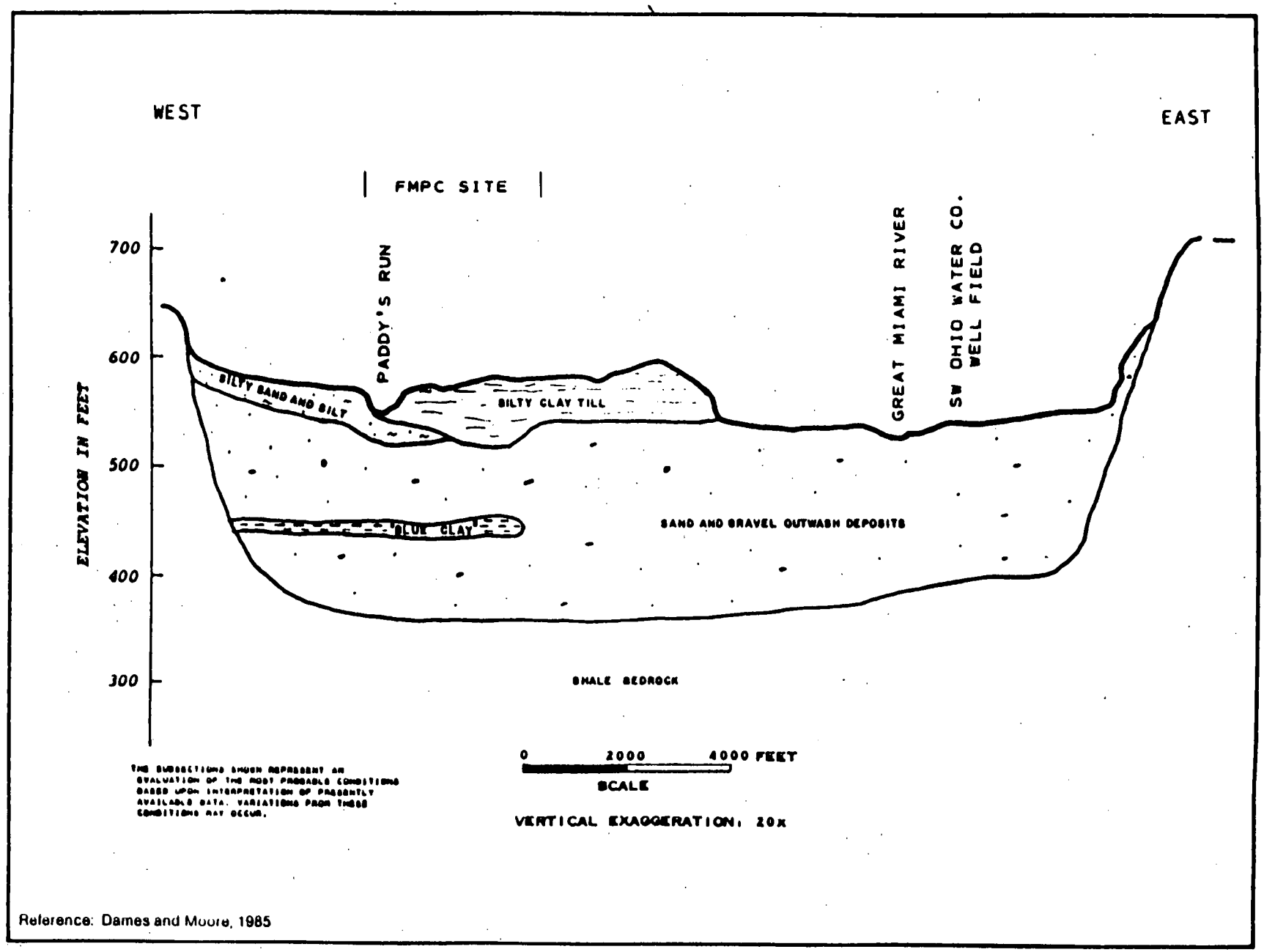
FIGURE 2 SCHEMATIC DIAGRAM OF THE FMPC PROCESS

In the past, small amounts of thorium have been processed at the FMPC. Thorium production is similar to uranium production; however, the final product may be in the form of thorium nitrate solution, solid thorium compounds, or metallic thorium. In addition, uranium and radium bearing residues resulting from the processing of pitchblende ores are presently stored in concrete silos at the FMPC.

1.3 Environmental Features

Glacial action during the time of the Illinoian and Wisconsin ice sheets left the area in much the same geological form as it is today. In the immediate area, outwash from retreating glaciers filled the remains of an ancient river valley (see Figure 3). The Great Miami River, which runs in a southerly direction about 1 km east of the FMPC, cut its present course through this fill. The present river bed lies approximately 18 m below the original surface level of the glacial deposit. Nearly 15 m of clay-rich till underlies the FMPC and is probably the remnant of a large glacial moraine. Beneath this till is a wide (approximately 5 km) and deep (about 46 m) bed of sand and gravel.

The FMPC site topography is a relatively level elevated plain, some 177 m (580 ft) above sea level. The land rises slightly to the north (213 m elevation at the northern boundary) and, on the west, slopes downward to Paddy's Run (168 m elevation). Soils at the FMPC are generally characterized as Fincastle-Xenia silt loams grading into Fox-Gennessee and Russell-Xenia silt loams at the western edge and northeast corner of the site, respectively.



Reference: Dames and Moore, 1985

FIGURE 3 GENERALIZED GEOLOGIC CROSS SECTION OF NEW HAVEN TROUGH

On-site vegetation is typical of that occurring elsewhere in the region under similar land use practices. The on-site areas north and west of the production area are moderately wooded with a variety of deciduous hardwoods. Along the west of the site and to some extent on the south, these wooded portions are found mainly along the natural watersheds. Several acres immediately north of the production area were planted with white pine (Pinus strobus) and Austrian Pine (Pinus nigra). The major planting was done in 1973 as part of an environmental improvement project. The remainder of the site is covered with a variety pasture grasses typical of the area and most of this is leased to local dairy producers for grazing purposes.

Although there are several small industries nearby, the major economic activities in the area are farming, dairying, and the raising of beef cattle. Major farm crops include sweet corn, field corn, soybeans, and wheat. Several nearby farms are also involved in the production of garden produce which is sold either at local roadside stands or trucked to nearby urban markets.

Due to the nature of the geology underlying the area, groundwater and gravel are important area products which are sold commercially. A nearby water company (approximately 2 km upstream of the FMPC outfall) began operations just prior to construction of the FMPC and pumps nearly 20 million gallons of water per day. This is sold chiefly to industries in and near Cincinnati. This aquifer, from which the FMPC also obtains its water supply, is recharged in part by the Great Miami River. Many gravel pit operations exist in the

Great Miami Valley. These are found both along the river and in the flood plain some distance inland.

Substantial amounts of industrial and municipal wastes from the upstream communities of Dayton, Middletown, Hamilton, and Fairfield are discharged into the Great Miami River; therefore, little recreational use is made of the river.

Downstream areas of the river are sparsely settled and industries are small and scattered. The confluence of the Great Miami with the Ohio River is located approximately 29 km (18 mi) to the south of the FMPC.

The climate in the region of the FMPC is continental with temperatures ranging from an average of -1.7^{o}C in January to 24.2^{o}C in July[1]. The highest temperature recorded from 1950 through 1984 was 38.9^{o}C in August, 1962, and the lowest was -31.7^{o}C in January, 1977. There was an average of 110 days per year with a minimum temperature of 0°F or less and an average of 20 days with a maximum temperature of 32.2^{o}C or above. Frost depth ranges from 11.8 to 14.2 cm[1].

The average annual precipitation for the period 1955 through 1984 was 14.9 cm and ranged from 11.5 to 16.0 cm per year[1]. The highest precipitation occurred during the spring and early summer; precipitation was lowest in late summer and fall. The average annual snowfall for the same period was 9.4 cm with heaviest snowfall in January.

Heavy precipitation events, defined as 0.6 cm per 24 hours, have occurred several times since 1955[1]. The maximum recorded 24-hour precipitation event occurred in March, 1964 when 2.1 cm fell.

Windflow data for the period 1948 through 1978 indicate that the winds blow 86.5 percent of the time[1]. The prevailing winds were from the south-southwest (11.2%) and southwest (9.9%) as shown in Figure 4.

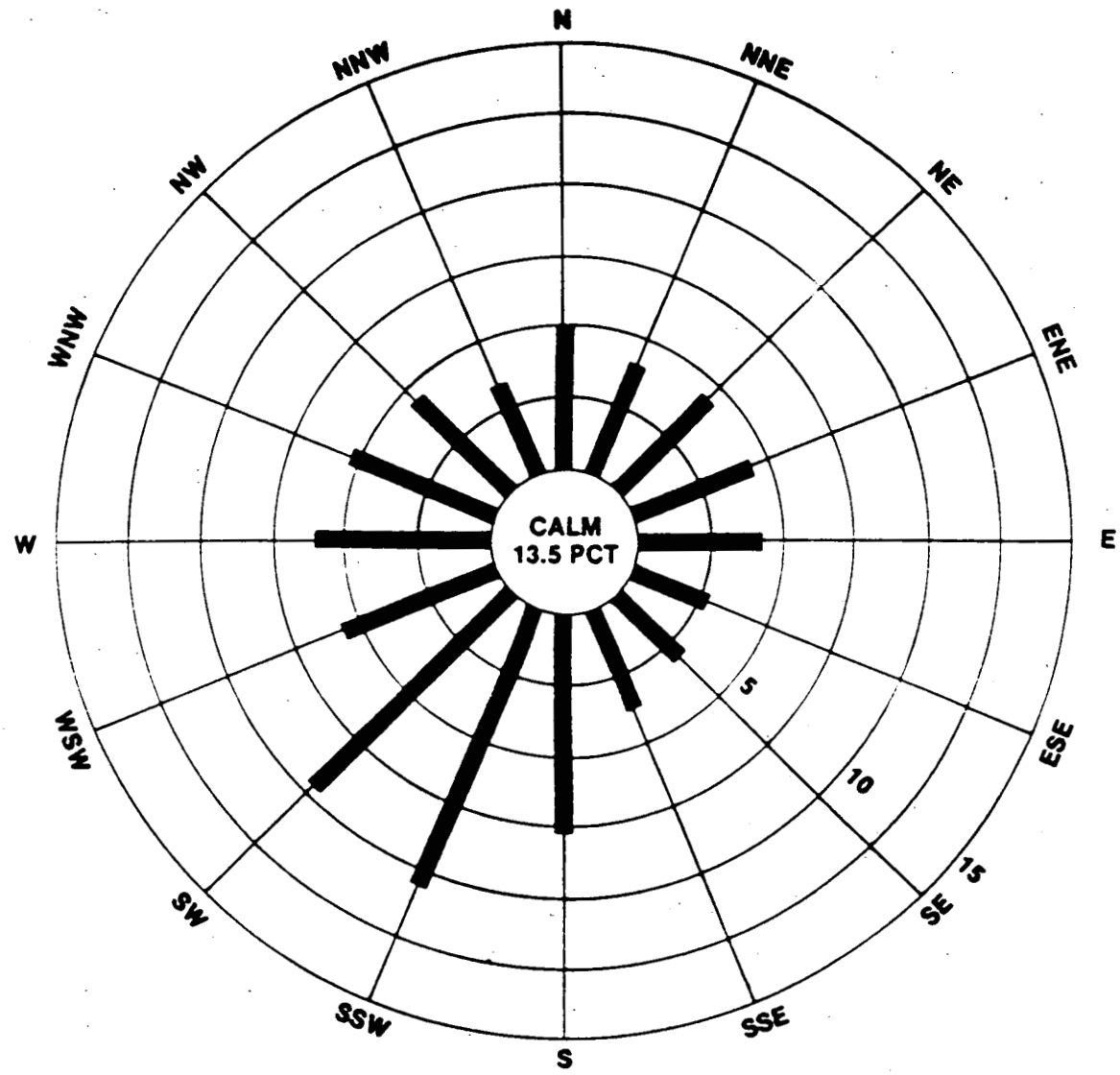
2.0 ENVIRONMENTAL STANDARDS

Several sets of guidelines and standards are applicable to environmental sampling performed in connection with FMPC operations. These regulations have been established by the DOE, the United States Environmental Protection Agency (EPA) and the State of Ohio Environmental Protection Agency (OEPA).

2.1 Radiological Parameters

Radiation exposures to the public resulting from effluent discharges of air and water from the FMPC are required to meet Federal standards for radiation protection. These standards are defined in "Radiation Standards For The Protection of the Public In The vicinity of DOE Facilities." The National Emission Standards for Hazardous Air Pollutants (NESHAP)[3] which became effective in February, 1985, are also used for evaluating air emissions from the FMPC.

No DOE or EPA standards have been established for soil radionuclide levels. The FMPC presently used 34 picouries of uranium per gram (50 ppm) of soils as a reference point, this being more conservative



Reference: NOAA, 1984.

FIGURE 4 PERCENT FREQUENCY OF WIND DIRECTION FOR THE PERIOD 1948 THROUGH 1978 AT THE GREATER CINCINNATI METROPOLITAN AIRPORT

than the level generally used in the DOE's remedial action programs for acceptance of decontaminated areas. Whole body dose equivalents are reported solely for comparison with the NESHAP guideline. The term "whole body" refers to all human organs or tissue exclusive of the skin and the cornea and results from radionuclides that are not deposited throughout the body. The effective dose equivalent represents a weighted average ofcommitted dose equivalents to specific organs defined by ICRP 26[4]. Critical organ doses are also reported for verificationof compliance with with NESHAP. Limits for exposure from airborne emissions (25 mrem whole body dose, 75 mrem to a critical organ) are set forth in NESHP.

2.2 Non-radiological Parameters

Criteria used for nonradioactive contaminants in water from the Great Miami River and Paddy's Run, and ambient air are taken from standards adopted by the OEPA[5, 6]. In the State of Ohio, water quality standards for rivers and streams apply only beyond a specified zone permitted for mixing and dilution of industrial and municipal effluents[6].

Results of groundwater sampling are compared to National Primary and Secondary Drinking Water Regulations as well as the Federal guidelines for radiation protection. Non-radiological liquid effluent discharged from the FMPC is regulated by Ohio EPA as part of the National Pollutant Discharge Elimination System (NPDES).

2.3 Estimation of Radiation Dose Equivalent

The AIRDOS-EPA and DARTAB computer programs are used by the Oak Ridge National Laboratory (ORNL) to calculate committed dose

equivalent to the maximally exposed individual and the 80 km population dose equivalent due to FMPC operations. These programs compute dose equivalent commitments due to airborne releases of uranium through all inhalation, ingestion and direct radiation pathways. Calculations adhere to the methodology of the International Commission on Radiological Protection (ICRP) 26/30[4], with EPA modifications. EPA approved organ dose weighting factors are used for effective dose commitments. The AIRDOS/DARTAB program considers pulmonary tissue as the critical target organ, whereas the ICRP uses the lung as the target organ. The pulmonary tissue incorporates some of the lymph system and results in a slightly higher "lung" dose conversion factor.

The AIRDOS/DARTAB program is used to calculate the 50-year dose equivalent commitment to pulmonary tissue and the 50-year committed whole body dose equivalent due to airborne emissions, based on the concentration at the point of maximum exposure to an off-site individual. The population whole body 50-year dose equivalent commitment due to uranium emissions is estimated using AIRDOS/DARTAB and an estimate of 2.5 million for the human population within 80 km (48 miles) of the FMPC. The meteorological data used in the modeling is collected at the Greater Cincinnati Airport and is supplied to ORNL by the National Oceanographic and Atmospheric Admiminstration (NOAA). Data from the Dayton Airport was used in 1985 (see Figure 5). A new meteorological system for the FMPC will become operational by the end of 1986 in order to provide site specific meteorological data.

Exposure from direct gamma radiation is measured with the thermoluminescent detectors placed at seven air monitoring stations on the FMPC boundary and three off-site air monitoring stations. These TLD's are changed and processed quarterly. A pressurized ionization chamber (PIC) is used to measure the ambient external exposure at the residence nearest the FMPC.

3.0 QUALITY ASSURANCE AND DATA ANALYSIS

Various environmental data are collected by FMPC personnel in preparation of the Annual Environmental Monitoring Report. The collection and analysis of these data are part of an ongoing FMPC program designed to insure that plant operations fall within the scope of governmental guidelines and to assure the continued integrity of the environment.

An essential part of the verification of environmental data is the implementation of a comprehensive quality assurance program. The analytical laboratories at the FMPC maintain such a program. The FMPC laboratories calibrate their instruments daily, analyze standards with each set of samples, and frequently analyze blanks and spiked samples. With each set of samples sent to independent laboratories for analysis, certified quality assurance and control blanks are also included. Depending on the constituent to be analyzed, the results must occur within a specified performance limit or within the routine limit set by each laboratory for a standard level comparable to the specified true value.

In order to assure adequate and consistent compliance with the environmental requirements at the FMPC, a Quality Assurance (QA) program

is required. The description of such a program for environmental monitoring at the FMPC is provided in Appendix III.

A very important program in which the FMPC participates is the Quality Assurance Program administered by the DOE Environmental Measurements Laboratory (EML) in New York. EML provides radiological samples to be analyzed by FMPC laboratories and the results of these analyses are compared to the respective standards.

In cooperation with U.S. EPA, the FMPC laboratories participate in the NPDES laboratory performance evaluation program. Samples containing constituents regulated under the NPDES permit for the FMPC are submitted for analysis and checked with the standard results.

Sampling the air, water, vegetation, soil and other media requires careful planning and design. When a sample is taken from the environment, it exhibits a natural variation from all other samples collected. While samples vary, most samples will have only slight differences in one another and they cluster around the "most probable" value. This is considered to be a normal distribution.

Samples may not be distributed normally; however adjustments in the analysis can correct the techniques designed for normal populations. Some sampling programs are recognized to produce non-normally distributed samples (fish sampling and radiological air monitoring, for instance). This is accounted for in the data analysis.

The actual evaluation of data involves comparing sample variation to standard population distributions. Each comparison is adjusted by the number of samples that were collected and how demanding a test is

required. The tests can compare averages to see if they are different from one another, and establish limits around the most probable calculated value. All information gathered as part of the EMP is treated in this manner, and all tests are designed to be 95% certain that the results obtained in each respective test capture the true value.

4.0 STRATEGY FOR ENVIRONMENTAL SAMPLING AND ANALYSIS

4.1 Air Monitoring

The conversion of impure uranium compounds to reactor-grade feed materials can generate radioactive particulates in the air. Ventilation and air cleaning systems are used to reduce the exposure of employees to these particles and to reduce the emission of particles to the atmosphere. As part of the reclamation program at the FMPC, the more valuable of these materials are returned to the production process.

Seven high volume air samplers (Figure 5) are located along the FMPC boundary to continuously collect samples of airborne particles. Samples are collected and analyzed at weekly intervals. At each sampler, air is drawn through a 20 cm by 25 cm filter at a rate of approximately 1 m^3/min. Filters used during the week are accurately weighed before installation and after collection to obtain the weight of the particulate matter collected. The filter is then dissolved in acid and the solutions are analyzed for uranium content and beta activity. Analysis for uranium and beta activity are done nine days after collection. A portion of each of these solutions is retained to provide a long-term composite, which is used to detect the presence of trace radionuclides (e.g., ^{237}Np, ^{239}Pu, and ^{232}Th).

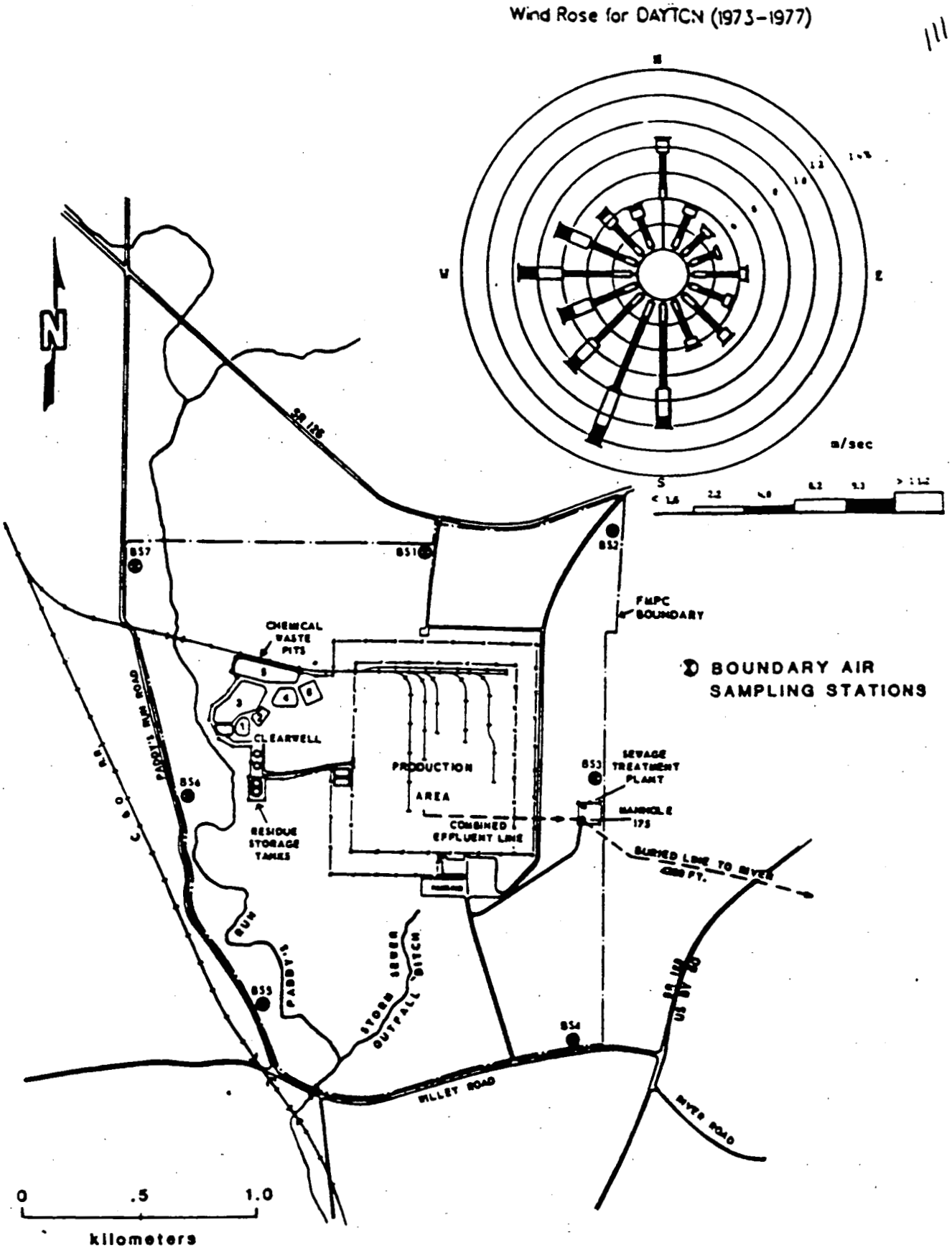


FIGURE 5 FMPC SITE MAP AND BOUNDARY AIR STATION LOCATIONS

More frequent analyses for these other radionuclides are not considered necessary since analyses of the sample solutions have shown extremely small amounts of these elements present in the airborne emissions from the site. Air monitoring procedures are detailed in Reference 7.

Two additional high volume air samplers are located at nearby elementary schools approximately 2.3 and 2.9 km from the FMPC. Another off-site air sampler has been installed at a local industry (approximately 1.4 km from the FMPC), and plans are ongoing to install a fourth off-site sampler at another elementary school located 2.3 km from the FMPC. Also, two on-site air samplers were installed in the prevailing wind direction at the FMPC. All of these high volume air samplers have been or will be incorporated into the FMPC air monitoring program and sampled and analyzed as previously outlined for the existing samplers. The filters taken from the high volume air samplers are analyzed for particulates, uranium, gross beta activity, ^{137}Cs, ^{237}Np, ^{238}Pu, $^{239/240}Pu$, ^{241}Pu, ^{226}Ra, ^{228}Ra, ^{106}Ru, ^{90}Sr, ^{99}Tc, ^{228}Th, ^{230}Th, and ^{232}Th. This data is presented in the FMPC Environmental Monitoring Annual Reports.

Radon (^{222}Rn) is a naturally occurring isotope which is produced from the decay of radium (^{226}Ra), also a natural isotope found in various geologic formations. Concentrations of ^{222}Rn have been monitored at the seven on-site boundary air stations and two local residences located 3 and 5 kms from the FMPC. These concentrations are measured using commercially available track-etch radon detectors. By using two detectors with one having a slight filter modification, these detectors can be used to monitor thoron (^{220}Rn)

separately from ^{222}Rn. As of July, 1986, both radon and thoron monitoring is in place at all on-site and off-site high volume air samplers plus the two local residences. The two local residence locations are used for background purposes.

External radiation exposure is also measured at all of the previously mentioned locations through the use of environmental thermoluminescent dosimeters (TLD's). With careful handling and annealing procedures, the precision of measurement of a pre-sorted batch of dosimeters should fall within $\pm$ 5% at the 95% confidence level in the range of 1 to 100 mR[8]. Continuous monitoring is provided with the environmental TLD's being processed quarterly.

4.2 Surface Water Monitoring

Daily grab samples are collected at river sampling points W1 (upstream) and W3 downstream (see Figure 6). These samples are composited monthly for radium analyses. A weekly grab sample is collected at point W4 (Miamitown) 7.5 km downstream from the confluence of Paddy's Run with the Great Miami River. At least one sample per week from each of the three river sampling points is analyzed for uranium, alpha and beta activity, chloride, fluoride, nitrate, non-filterable solids and pH. In addition, semi-annual composites of samples collected from W1, W3, and W4 are analyzed for ^{90}Sr, ^{99}Tc, ^{234}U, ^{235}U, ^{236}U, and ^{238}U.

Paddy's Run is a small intermittent stream on the west side boundary. It joins the Great Miami River a little more than 3 km south of the FMPC. During periods of heavy runoff, excess water in the storm sewer system overflows at point W6 to a natural drainage

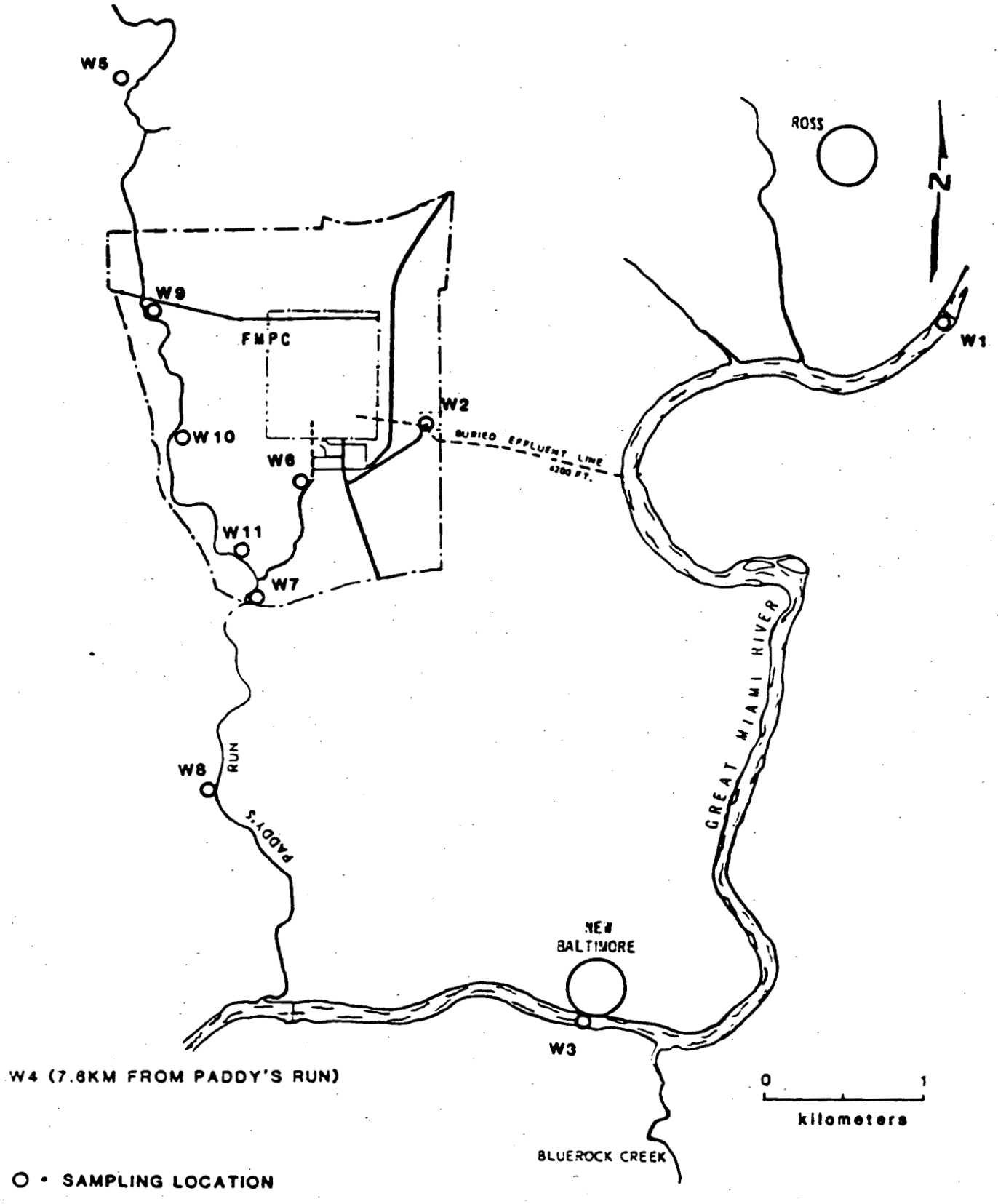


FIGURE 6 SURFACE WATER SAMPLING LOCATIONS

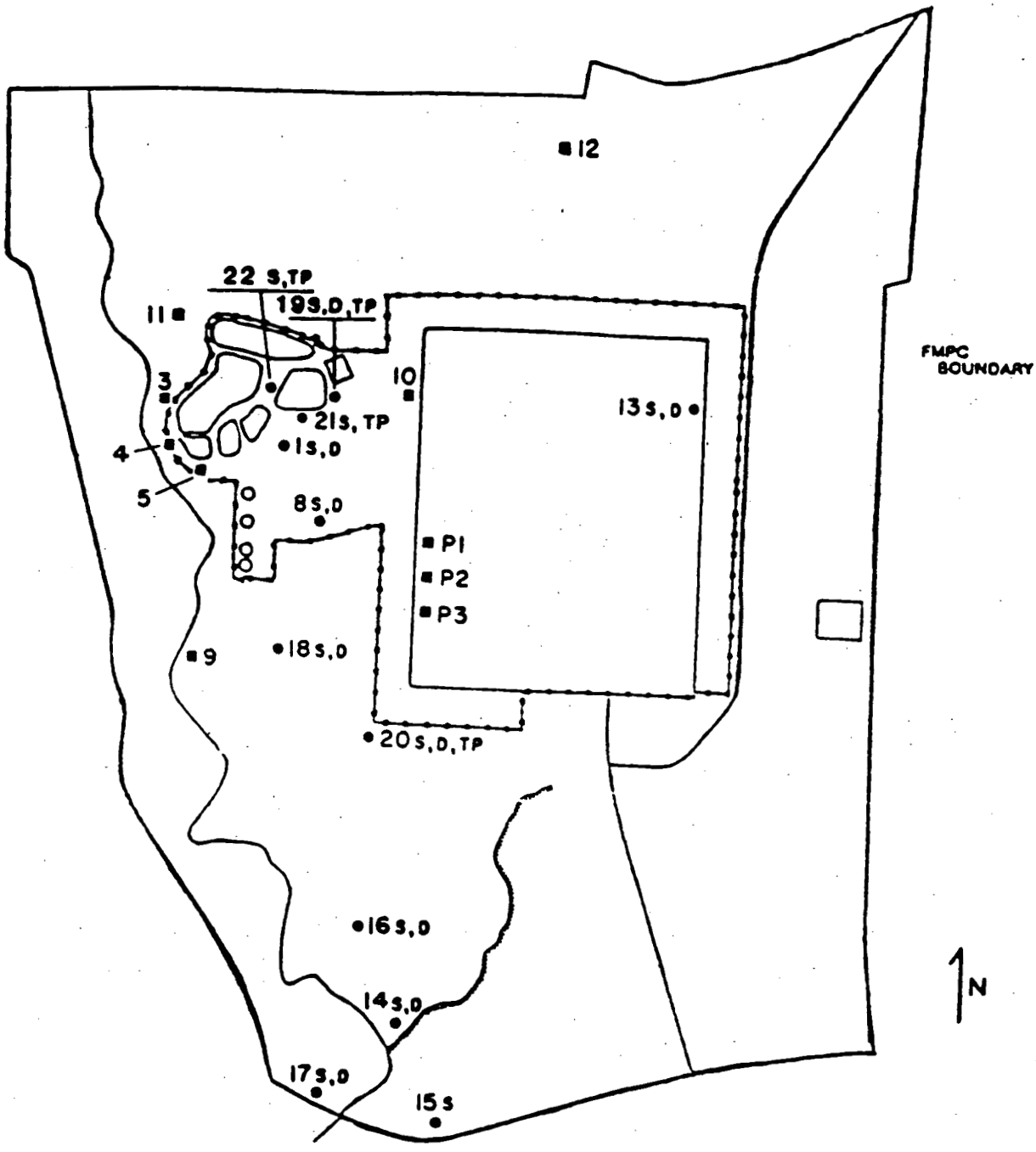
ditch which discharges into Paddy's Run at a point just above point W7.

Grab samples are collected weekly from each Paddy's Run sampling location (points W5, W7, W8, W9, W10, and W11, depending on the availability of water at each location) as shown in Figure 6. These samples are analyzed for uranium, alpha and beta activity and pH. Chloride, fluoride and nitrate analyses are performed on one sample each month. ^{226}Ra and ^{228}Ra analyses are performed on bimonthly composites of water collected at W5, and, when available, on monthly composites collected at W7.

4.3 Groundwater Monitoring

Groundwater samples are presently collected monthly from 13 on-site wells and 26 off-site wells for uranium content determinations. (see Figures 7 and 8). Quarterly samples taken from 13 on-site wells are also analyzed for various water quality and radiological parameters such as chlorides, sulfates, pH, and gross alpha and beta activities. Sampling procedures are outlined in References 9 and 10.

An integral part of the FMPC groundwater monitoring program is incorporated into the site's Resource Conversation and Recovery Act (RCRA) detection monitoring efforts which entail the quarterly sampling of 35 on-site and 6 off-site wells for 95 pollutant parameters. These parameters assess the general water quality, drinking water suitability, and the potential presence of metals, organics, or other pollutants in the groundwater underlying the FMPC and vicinity (see Appendix I). Subsequent to each round of



■ - SINGLE WELL LOCATIONS

● - CLUSTER WELL LOCATIONS
(S-shallow)
(D-deep)
(TP-test pit)

FIGURE 7 FMPC ON-SITE PRODUCTION AND TEST WELL LOCATIONS

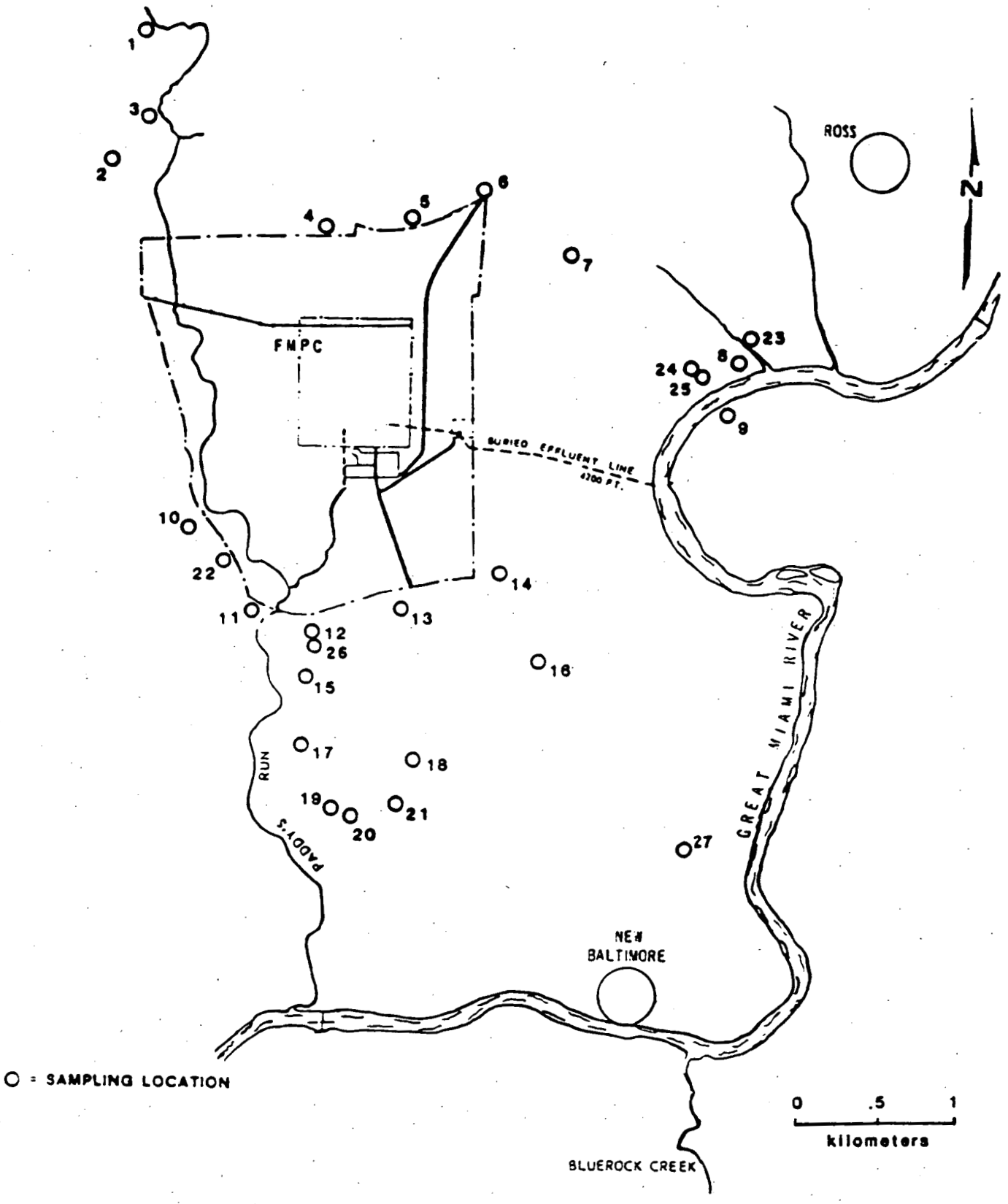


FIGURE 8 OFF-SITE MONITORING WELL LOCATIONS

sampling, a report is prepared to summarize the groundwater data and outline sampling protocol[11].

4.4 Soil Monitoring

As part of the routine soil monitoring program, samples are collected from each of the 15 annual on-site and off-site locations (Figure 9). Other samples are collected at 20 locations which correspond to grass sampling sites (Figure 13). Each soil sample is made up of a composite of ten cores 2 cm in diameter and 10 cm deep, but exclusive of vegetation insofar as this is posible. The cores are taken from the top layer of the soil profile with one being obtained from each coordinate of two adjacent 1 m^2 grids. The 10 cm cores are split at a 5 cm depth with each 5 cm sample composited separately for analysis. Detailed procedures are outlined in Reference 12 and are currently being revised.

Soils are routinely analyzed for uranium concentration only, since analyses for other radionuclides in 1984 revealed small or undetectable concentrations of those radionuclides; however,additional radionuclide analyses will be performed in 1986 for parameters such as isotopic U, isotopic Th, isotpic Pu, and isotopic Ra. A map showing estimated uranium levels in soil near the FMPC was developed based on extensive soil sampling performed in 1984 (Figure 10). Uranium concentrations up to 6.5 ppm are typical in southwestern Ohio soils. No standards have been established for radionuclide levels in soils other than guidelines relative to burial of radioactive contaminants. The FMPC presently uses 34 pCi/g (50 ppm) of uranium content in soil as a reference point. This level is slightly lower than the level generally used in DOE's

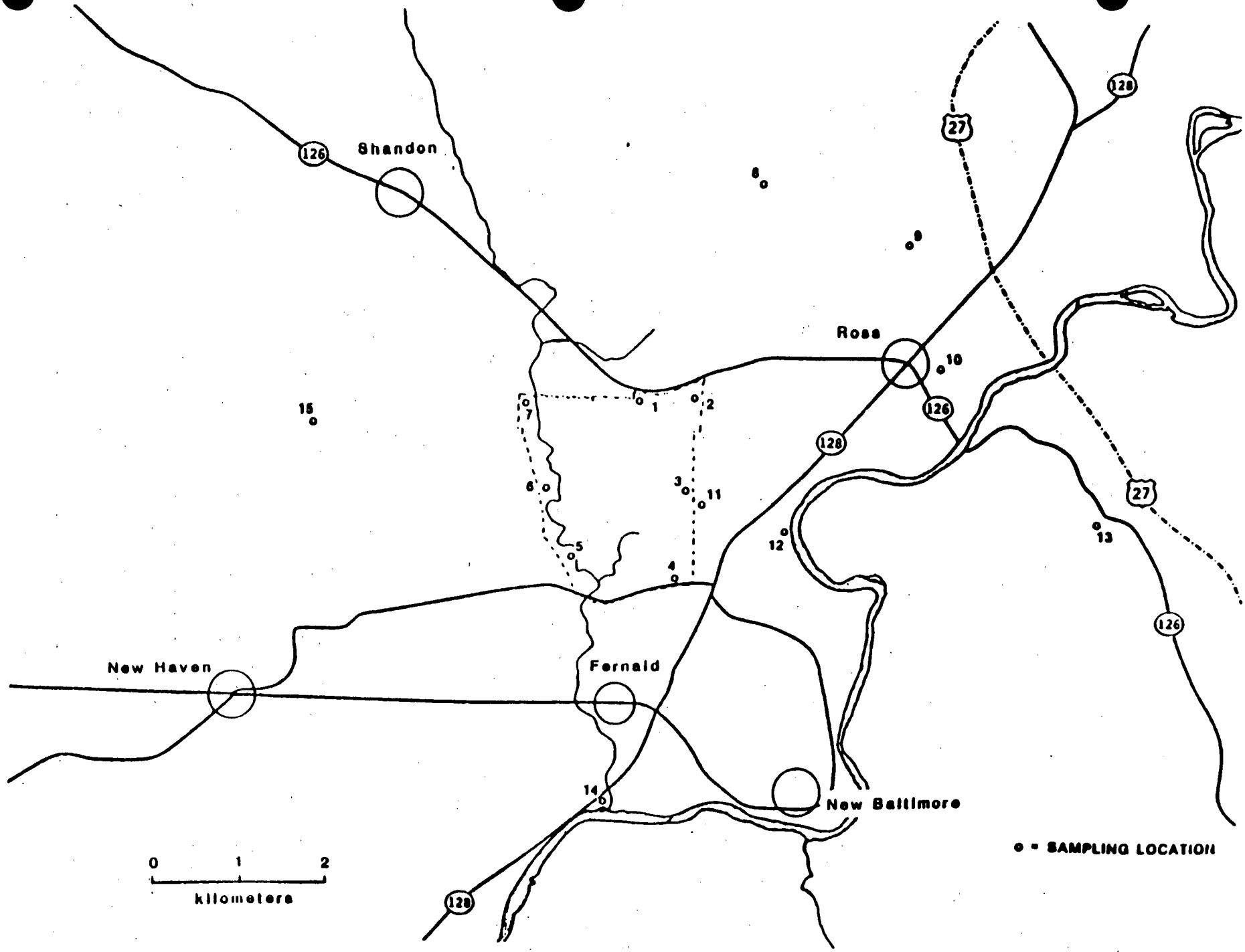


FIGURE 9 ROUTINE SOIL SAMPLING LOCATIONS

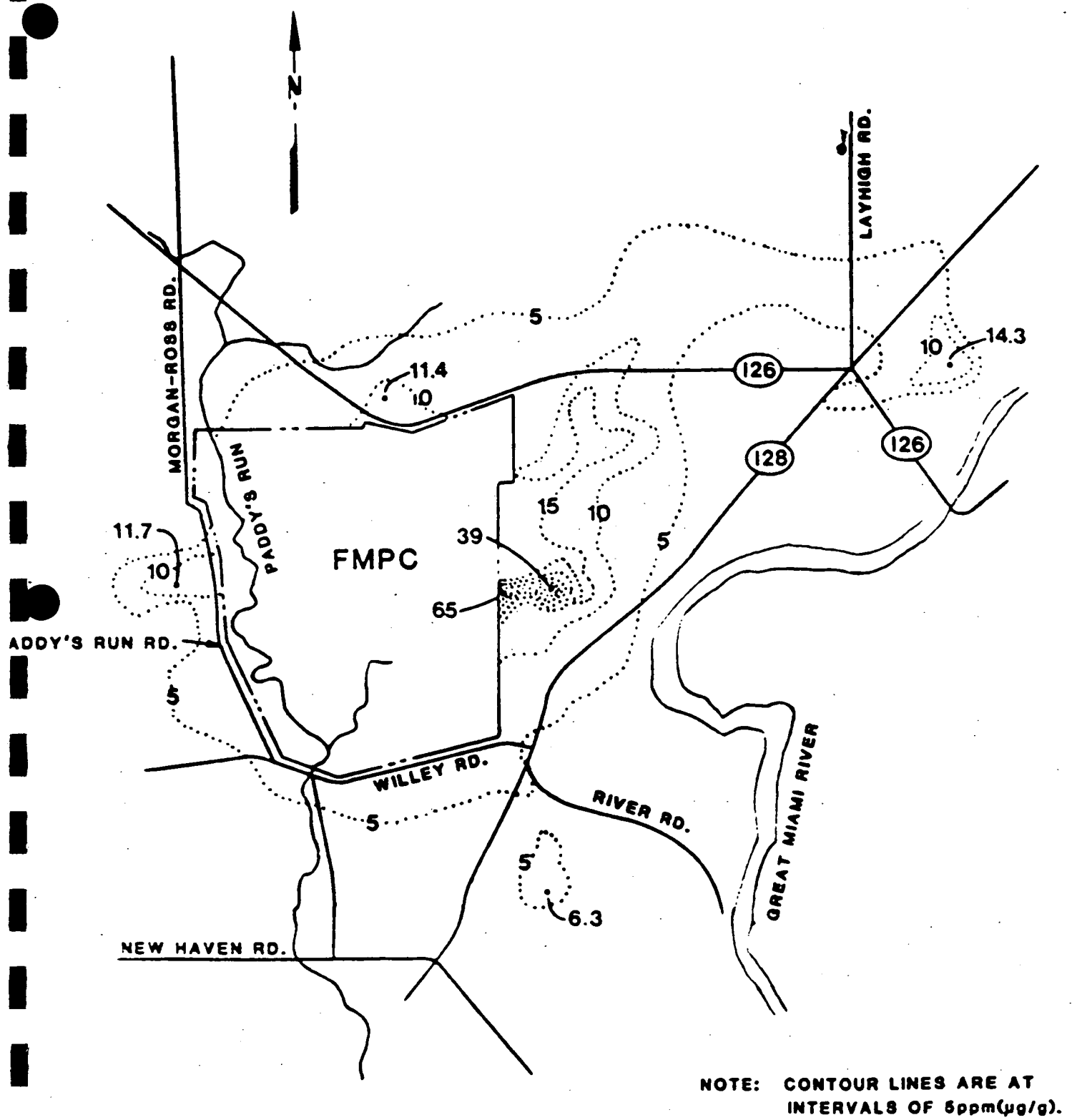


FIGURE 10 Uranium Levels in Soils Adjacent to the FMPC

remedial action programs for acceptance of decontaminated areas. A soil pathway analysis to determine site specific guide-lines was initiated by the University of Cincinnati in 1986 and is expected to be completed by early 1987.

4.5 Sediment Monitoring

Sediment samples are currently collected annually at nine locations on the Great Miami River and at 100 m intervals on Paddy's Run north of the confluence with the Storm Sewer Outfall Ditch (SSOD) and at 100 m intervals on the SSOD (Figure 11). On Paddy's Run south of the SSOD confluence, samples are collected at 200 m intervals. Three samples are collected cross-sectionally (1 at each bank and midstream location) at the end of a 100 or 200 m interval. All sediment samples are analyzed for ^{234}U, ^{235}U, ^{236}U, ^{238}U, ^{99}Tc, ^{228}Th, ^{230}Th, ^{232}Th, ^{238}Pu, $^{239/240}Pu$, $^{223/224/226}Ra$, and ^{228}Ra. This extensive sediment sampling and analysis program was initiated in 1986. Sediment sampling procedures are outlined in Reference 13 and 14.

5.0 STRATEGY FOR FOODSTUFF SAMPLING AND ANALYSIS

5.1 Vegetation Monitoring

Samples of grass and other available vegetation are collected, along with parallel soil samples, from sites selected in 1984 (Figures 12 and 13). The majority of samples are collected to the northwest of the site which is in the direction of prevailing winds. Each vegetation sample is a composite of a number of subsamples in order to provide approximately 500g (wet weight) total. Each subsample consists of all above ground plant material (material is clipped

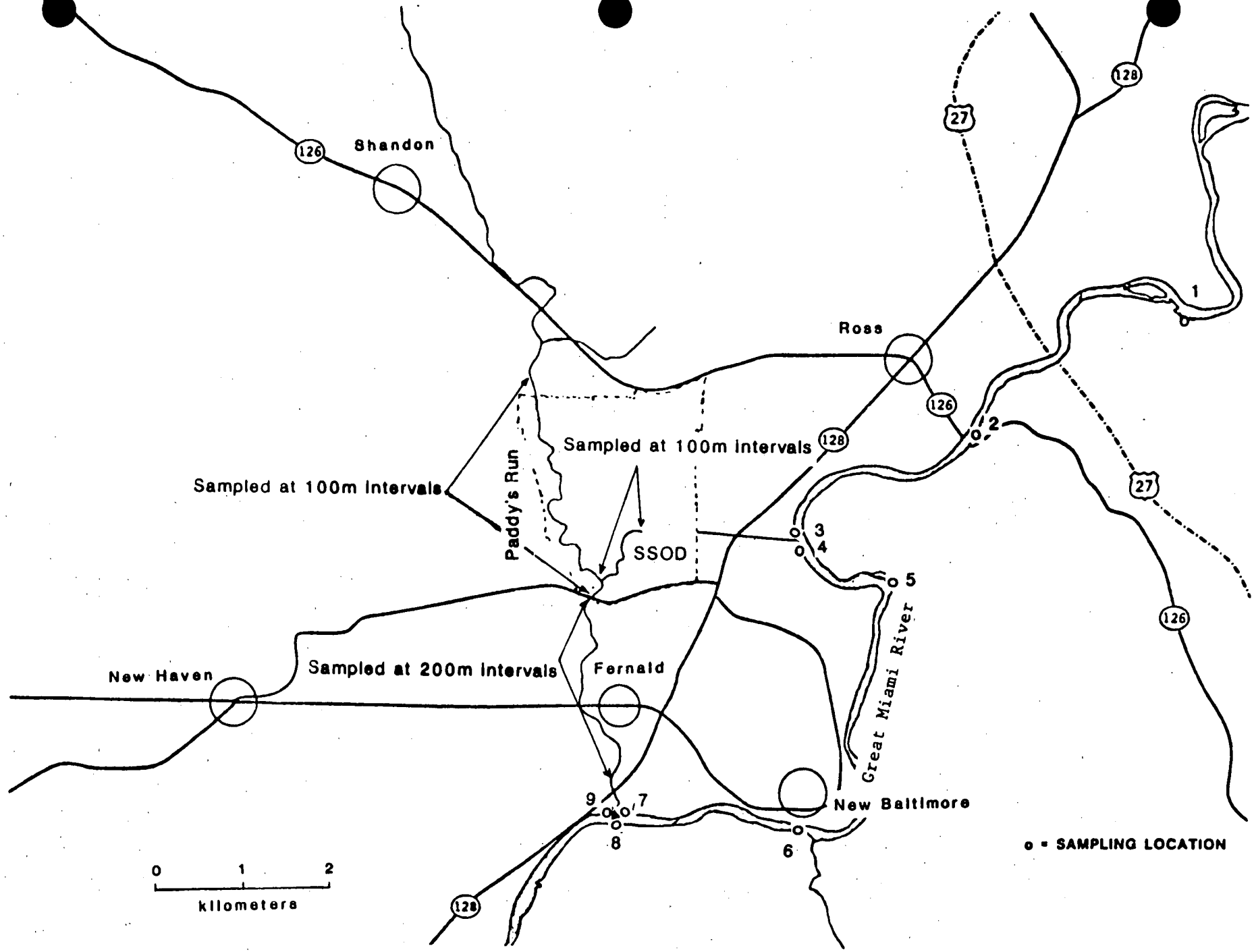


FIGURE 11 SEDIMENT SAMPLING LOCATIONS

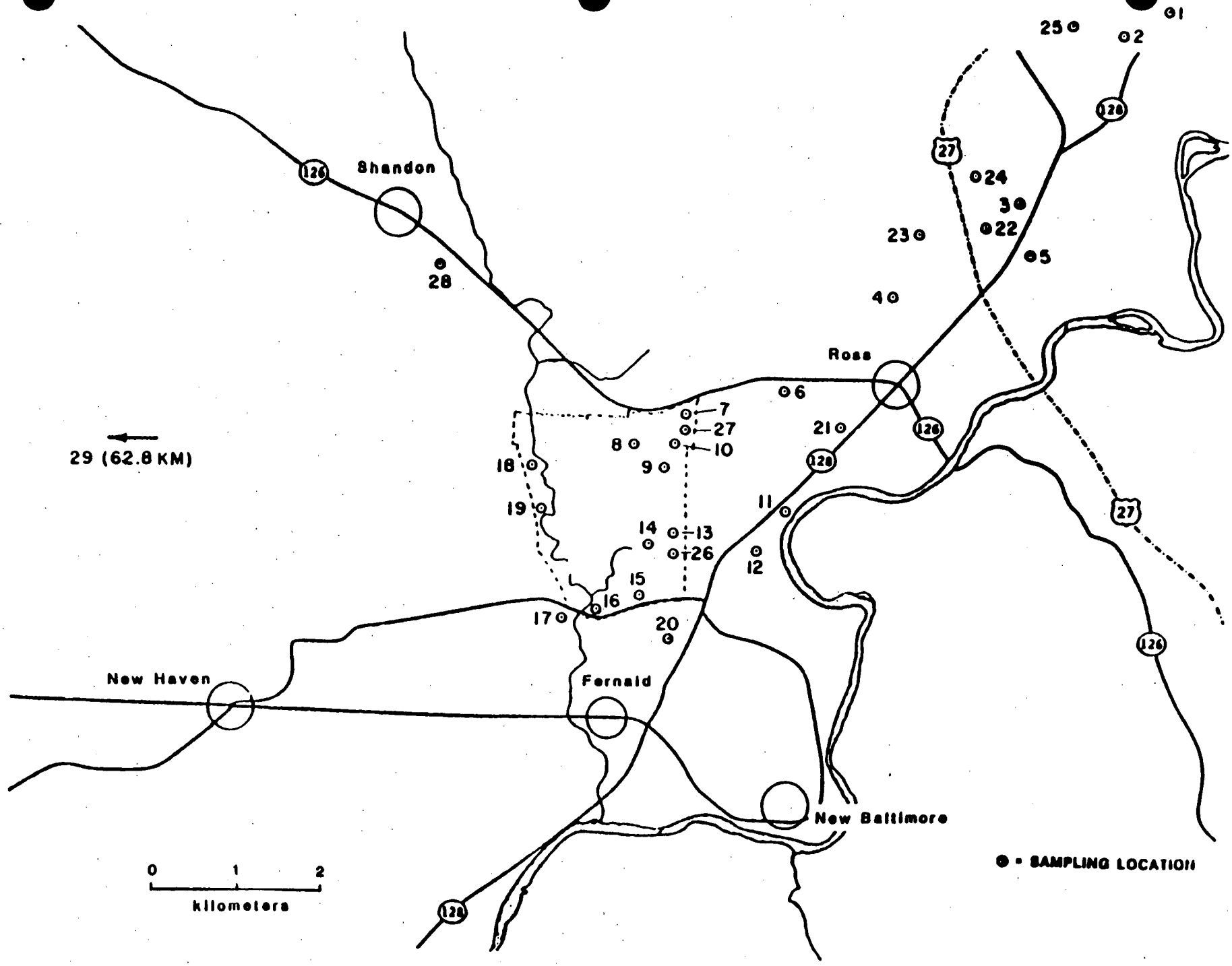


FIGURE 12 GRASS AND FORAGE SAMPLING LOCATIONS

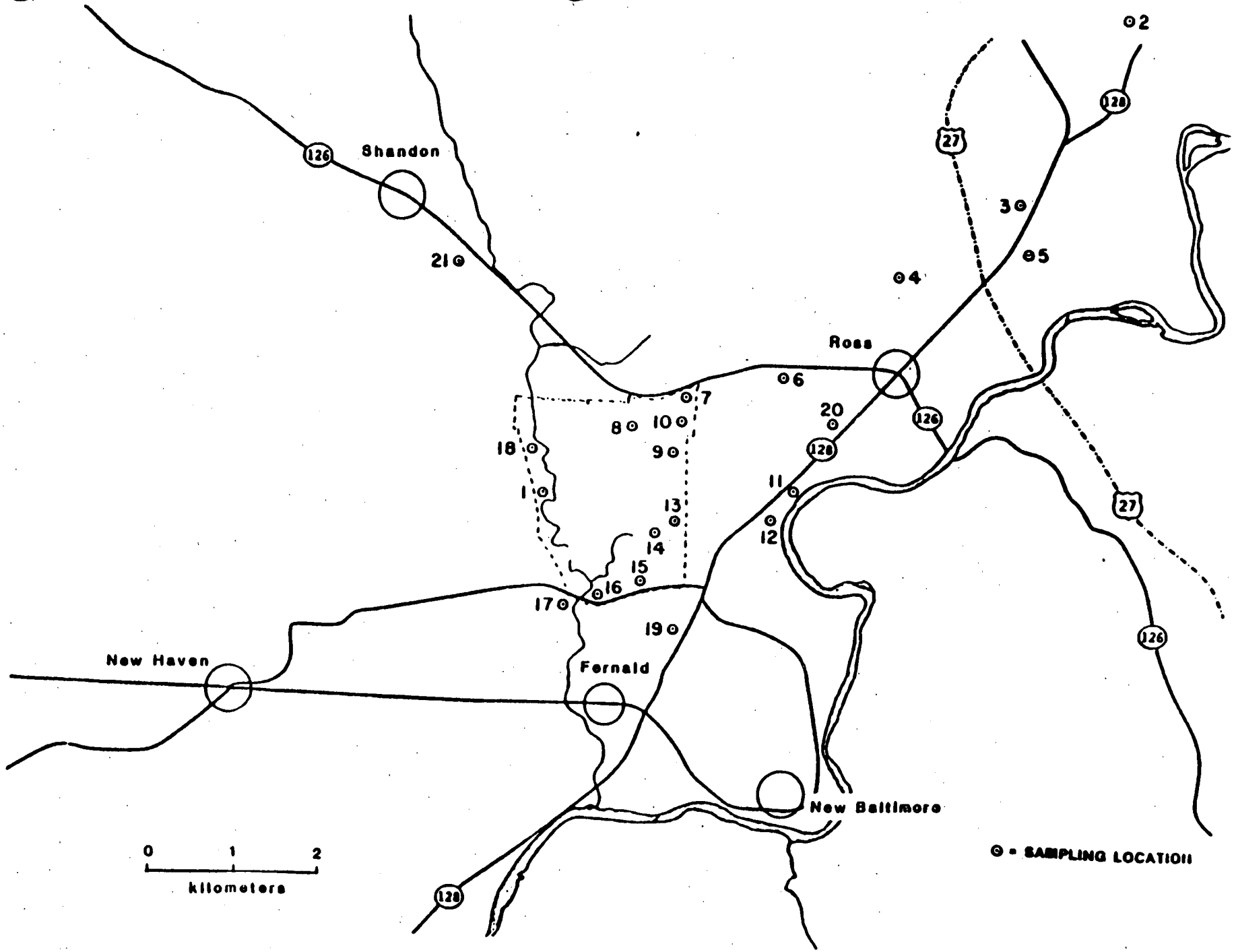


FIGURE 13 LOCATIONS OF PARALLEL SOIL AND GRASS SAMPLING

near ground level using grass shears) from a 0.5 m diameter circular quadrant (5 such subsamples = 1 m^2 of ground cover). Soil samples are collected in the same manner as they were for routine monitoring purposes (Section 4.4). After collection, the vegetation samples are air dried before analysis for uranium and fluoride. Fluoride is analyzed due to the presence of anhydrous hydrogen fluoride and uranium tetrafluoride at the FMPC and the potential to emit fluorides via an air pathway. Soils have been analyzed for uranium content only. In 1986, the list of analytical parameters to be measured in soils has been expanded to include the radionuclides previously mentioned under Sections 4.4 and 4.5. This routine will be performed at least two times during the growing season to assess the impact FMPC operations may have on the pasture-cow-milk food chain.

Ohio standards have not been set for either uranium or fluoride levels in grass and other forage. However, Kentucky Air Pollution Regulations allow up to 80 ppm (one-month average) fluoride (as fluoride ion) in and on forage for consumption by grazing ruminants. When measured over the 6-month growing period, a 40 ppm comparison is performed. The analysis results of samples from the FMPC environs are compared to these guidelines. A procedure for grass sampling is provided in Reference 15 and is currently being revised.

5.2 Garden Produce Monitoring

The methodology for collection and sampling of locally grown produce was improved in 1984. Upon a review of the literature on plant uptake and bio-accumulation of uranium in vegetables, potatoes were determined to be the best locally available source for measuring the

possible introduction of uranium into the food chain via vegetable matter[16]. Consequently, replicate potato samples of one pound each are collected from area farms and gardens (see Figure 14 for sample locations). Six replicates collected from Indiana, Kentucky and Michigan locations are used as a control (background) sample. Peels are analyzed separately from the flesh, but both are analyzed for uranium content. Analysis of variance is performed to identify any significant difference in the uranium content between samples. These analyses are done to verify that FMPC operations have no apparent affect on uranium concentrations in potatoes. As of July, 1986, all garden produce (e.g. corn, tomatoes, leafy vegetables, etc.) were included into the garden produce monitoring program at the FMPC. A procedure for garden produce sampling is presently being prepared (Reference 17).

5.3 Fish Monitoring

A comprehensive fish sampling and analysis project was initiated in 1984. With the aid of a fisheries research team and electroshocking equipment from the University of Cincinnati, fish are collected from three areas of the Great Miami River (Figure 15) on an annual basis. The fish from each location are placed in plastic bags, packed in ice and subsequently scaled and prepared as for human consumption (heads and entrails removed). The fish are filleted if total weight was above 800-900 grams. They are then frozen, packed in dry ice and shipped to an independent testing lab for analysis. The uranium concentration in the biomass was analyzed in 1984 and in 1985. Due to the physiological differences between species and concomitant relative differences in bone content, the amount of uranium per gram

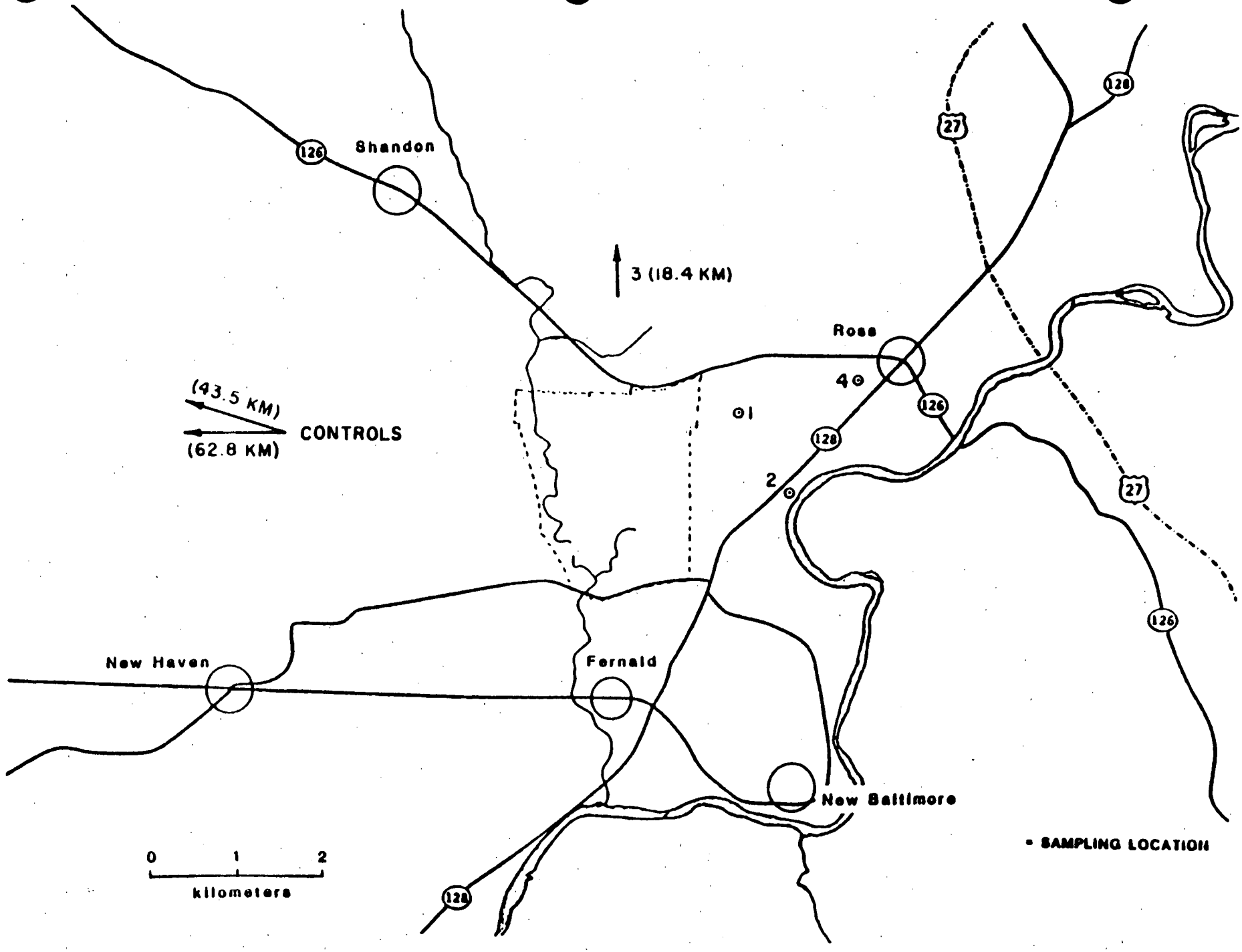


FIGURE 14 SAMPLING LOCATIONS FOR GARDEN PRODUCE

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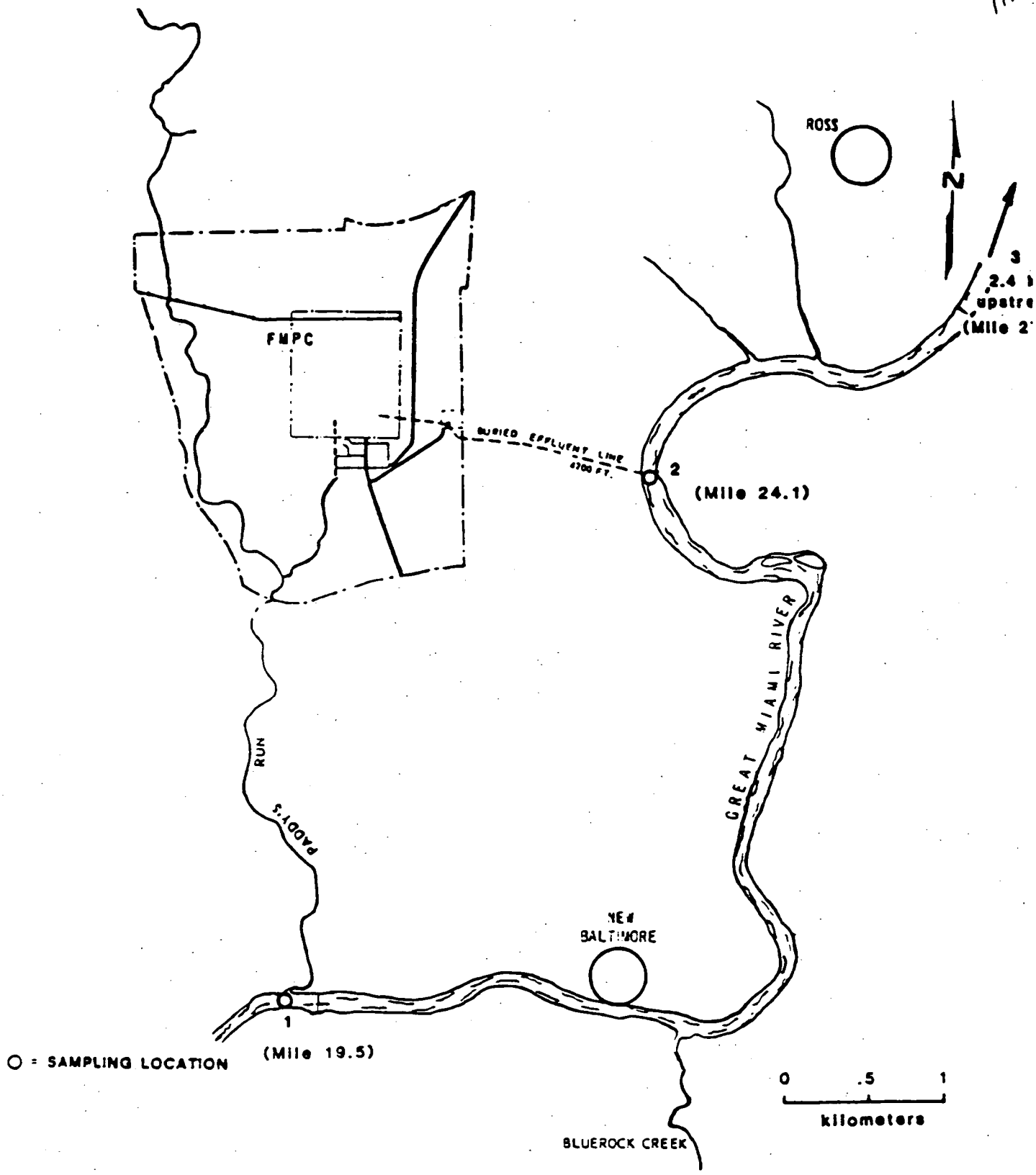


FIGURE 15 FISH SAMPLING LOCATIONS

of ash in each sample is used for statistical analysis purposes. This program will be continued on an annual basis. There are no significant differences to date between sites or species, and all fish, relative to uranium concentration, appeared to be from a single population.

The University of Cincinnati determined that species diversity was highest at the FMPC effluent outfall location in 1985. The length to weight ratios are similar at each location. These determinations suggest that populations throughout the river are healthy. A fish sampling procedure is currently being developed (Reference 18).

5.4 Milk Monitoring

Milk produced by cows grazing on the FMPC and adjacent pasture land is collected and analyzed on a quarterly basis. A similar sample is collected concurrently from a remote site 29-30 km southeast of the FMPC for comparison purposes. Samples are analyzed for uranium content by an independent laboratory. Analysis performed in 1986 has also included parameters such as gross alpha, gross beta, ^{90}Sr, ^{99}Tc, ^{226}Ra, ^{228}Ra, ^{228}Th, ^{230}Th, ^{232}Th, ^{234}U, ^{235}U, and ^{238}U. A procedure for milk sampling is presently being developed (Reference 19).

6.0 STRATEGY FOR EFFLUENT SAMPLING AND ANALYSIS

6.1 Water Pollution Control Monitoring

Each of the major production plants at the FMPC has the capability to collect and pretreat process wastewater. Uranium is collected for recycling as part of these pretreatment systems. Effluent from each plant sump system is collected at a centralized facility, the

General Sump, for additional treatment. Treated wastewater is allowed to settle and clear prior to being routed to a lagoon and clearwell system for further solids removal. Effluent from the Clearwell and non-contaminated supernatant from the General Sump are combined with sewage treatment effluent and a portion of stormwater runoff prior to discharge to the Great Miami River. Excessive stormwater runoff from the site overflows at the Storm Sewer Lift Station to an outfall ditch which drains to Paddy's Run (see Figure 16).

A total of six sampling locations, two of which are discharge outfalls, are defined and regulated by a National Pollutant Discharge Elimination System (NPDES) permit. This permit, issued by Region V of the U.S. EPA, is administered by the Ohio EPA and requires the FMPC to characterize their effluent stream by analyzing samples collected at the aforementioned locations. Schedules for sampling are specified in the permit and results are reported to the U.S. EPA and the Ohio EPA on a monthly basis. Sample collection and analysis are conducted according to procedures outlined in References 20 and 21.

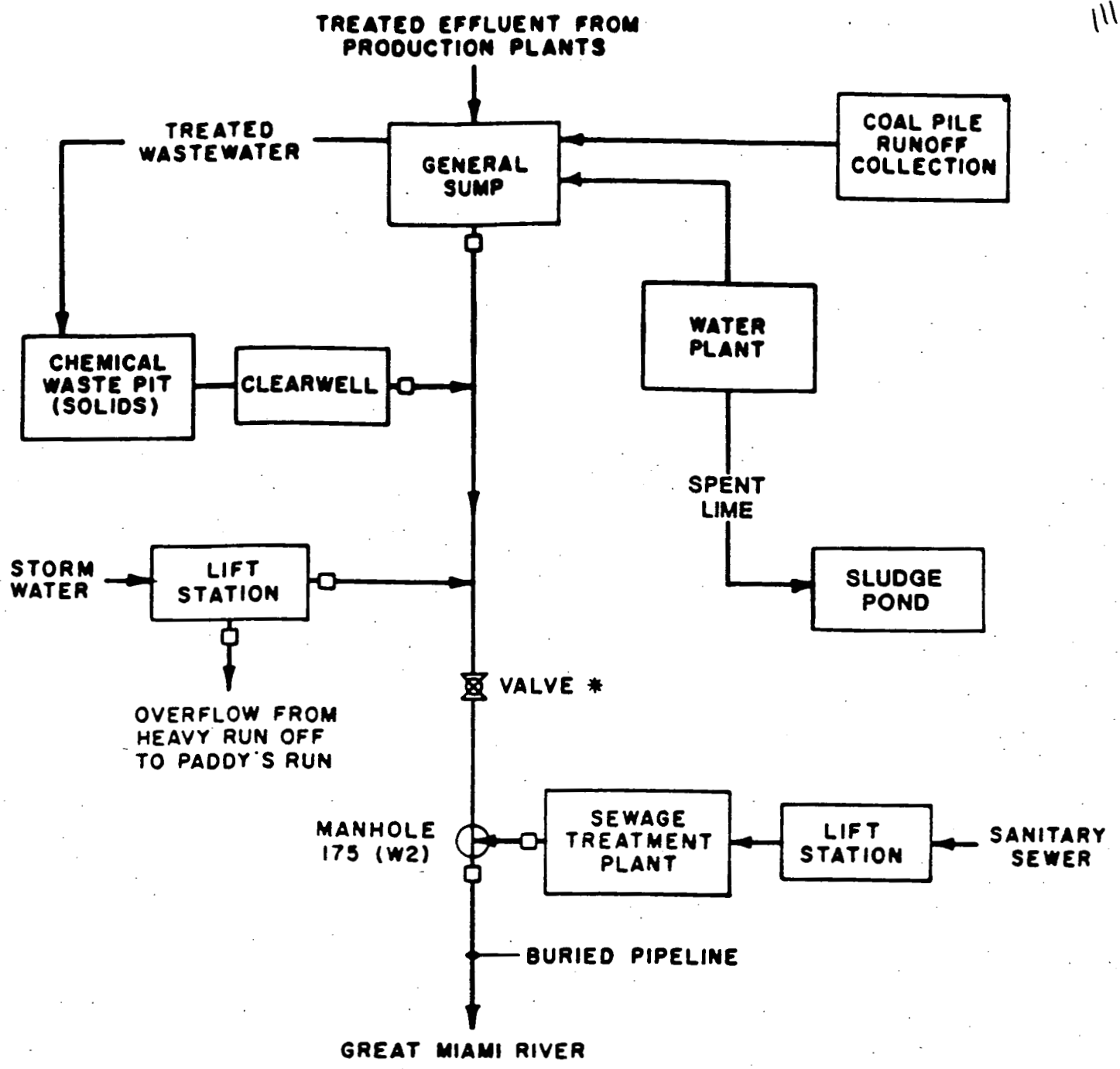
Approximately 150 analyses per month are performed on the water samples taken at the NPDES sampling locations. From these analyses, the results are studied to determine whether or not the effluent parameters exceed either their daily maximum or monthly average limits as specified by the permit. Any measurements above these limits must be immediately reported to DOE/ORO for their submittal to the Ohio EPA. In addition, monthly and quarterly reports summarizing wastewater quality and NPDES sampling data are submitted

to DOE/ORO for their review and submittal to the appropriate authority.

At the final access point on the effluent line, W2, a Parshall Flume type water sampler continuously collects a sample which is proportional to the total flow. Samples (24 hour composites) are collected daily and analyzed for uranium, alpha and beta activity and pH. Analyses for chlorides, fluorides and nitrates are conducted on one sample each week. One-month composites of the daily samples are analyzed for ^{226}Ra, ^{228}Ra, ^{106}Ru and thorium. Semi-annual composites are analyzed for other radionuclides of interest such as ^{90}Sr, ^{99}Tc, ^{137}Cs, ^{237}Np, and ^{238}Pu, etc. From sampling point W2 the plant effluent is discharged into the river through a buried pipeline (see Figure 6).

An NPDES Permit Renewal Application was submitted in late 1984 as required by the U.S. EPA. This application incorporated the results of sampling for all of the NPDES locations as defined under the secondary industry category; however, additional sampling will be required by the U.S. EPA subsequent to promulgation of the proposed regulation regarding "Non-ferrous Metals Manufacturing - Uranium Subcategory". This sampling is scheduled to be completed in 1986.

The current Water Pollution Control Project at the FMPC is designed to improve the quality of liquid effluent and consists of four subprojects: Biodenitrification System, Stormwater Retention Basin, Coal Pile Runoff Collection System, and Ultraviolet Disinfection of Sewage Effluent. The Biodenitrification project is designed to lower nitrate loadings discharged to the Great Miami River. In



* STORM SEWER WATER CAN BE DIVERTED TO THE CHEMICAL WASTE PIT OR THE GENERAL SUMP.

□ NPDES SAMPLING LOCATIONS

FIGURE 16 LIQUID WASTE STREAM FLOW DIAGRAM

order to eliminate stormwater discharges to Paddy's Run, the Stormwater Retention project will be instaalled to collect production area runoff and divert this flow to the Great Miami River. The Coal Pile Runoff and Ultraviolet Disinfection projects are currently operational. The Coal Pile project provides for the collection and transport of runoff from the coal storage area for treatment and the Ultraviolet Disinfection project involves the replacement of chlorine as the disinfectant at the Sewage Treatment Plant.

6.2 Air Pollution Control Monitoring

As previously mentioned, ventilation and air cleaning systems are used to reduce the exposure of the employees to these particles and to reduce the emission of the particles to the atmosphere. The FMPC utilizes high efficiency dust collection and scrubber equipment and tight operational and maintenance procedures to effectively minimize gaseous and particulate discharges to the atmosphere.

Air emissions from the FMPC are generally limited to criteria pollutants of the Clean Air Act, as amended, radionuclides and trace amounts of hydrogen fluoride and kerosene fumes. The strategy for air pollution control is based on an Air Emission Control Master Plan to provide the direction for facility improvements to achieve full compliance with the Clean Air Act of 1970.

Other integral parts of the strategy are to operate under all applicable permits and to perform the necessary monitoring. Permits define the conditions under which the air emission sources must operate in order to be in compliance with regulatory requirements.

The conditions to operate, determinations of allowable emission levels for each source, and particulate monitoring, sampling or reporting requirements must be established.

The steam generation plant at the FMPC utilizes two boilers with a total design capacity of 150,000 pounds of steam per hour. Electrostatic precipitators keep the particulate discharge below the Ohio EPA particulate limit of 0.19 pounds per million BTU input. Compliance testing, as required by the OEPA, was performed on the steam plant in the early part of 1985 and subsequently permitted by the Ohio EPA. Discharge from the steam generation plant is in full compliance with OEPA standards. The process of compliance testing occurs once every three years in order for the permit to be renewed.

Sulfur dioxide (SO_2) emission limits for stationary facilities have been adopted by the OEPA. Under these rules, the limit for the FMPC steamplant is less than 1 kg (2.2 pounds) of SO_2 per million BTU input from each boiler. This limit is equivalent to the use of coal containing only one percent or less sulfur is purchased in order to meet the states SO_2 emission requirement.

Maximum rates of emission of particulates from industrial processes are described by OEPA Rule 37450-17-11, Restrictions on Particulate Emissions from Industrial Processes. Through the use of numerous dust collectors, scrubbers, electrostatic precipitators and various other types of air cleaning equipment, non-radioactive particulate emissions from FMPC process operations are well below the established OEPA limits. Permits for all air emission points were submitted to OEPA in 1985 and all emission points identified as

well as the total amount of product processed through each operation. A NESHAPS source report was also prepared in 1985 and report pertains to hazardous air pollutants and addresses uranium as submitted to OEPA. This report pertains to hazardous air pollutants and addresses uranium as the site specific parameter for the FMPC. The NESHAPS regulation became effective in February, 1985.

The State of Ohio currently has no emission limit for NO_x for sources in existance prior to January 1, 1974. The FMPC, in keeping within its commitment to worker protection and environmental improvement, maintains NO_x emissions at levels as low as practicably achievable. The major sources of potential NO_x emission at the FMPC are ventilated to a bubble cap tower for scrubbing prior to release to the atmosphere. Emissions from this tower are limited to 100 parts per million NO_x as indicated in an FMPC standard operating procedure. Other smaller sources of potention NO_x emissions do exist at the FMPC which are not ventilated through scrubber systems. Emissions from these facilities are kept as low as achievable through administrative controls. Engineering efforts are underway to examine the application of control systems to reduce emissions from these facilities.

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7.0 REFERENCES

(1) Roy F. Weston, Inc., Site Characterization Of The Waste Storage Areas, Part 1, (Review Draft), June, 1986.

(2) Letter, dated November 14, 1985, Richard L. Egli to Distribution, "Radiation Standards for the Protection of the Public in the Vicinity at DOE Facilities."

(3) Code of Federal Regulations, Title 40, Parts 61.93 and 61.94, "National Emission Standards for Hazardous Air Pollutants," Vol. 50, No. 25, February, 1985.

(4) International Commission on Radiological Protection, Annals of the ICRP, Recommendations of the International Commission on Radiological Protection, ICRP Publication Nos. 26/30, Pergamon Press, Oxford, NY, 1977.

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(6) Ohio Environmental Protection Agency, "Water Quality Standards," Regulation No. 3745-1, Laws and Regulations, February, 1978.

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(9) WMCO Procedure, ESH-P-01-002, Off-site Groundwater Monitoring, Draft, 1986.

(10) WMCO Procedure, ESH-P-01-003, On-site Groundwater Monitoring, Draft, 1986.

(11) RCRA Groundwater Monitoring Report: 1985-1986, Vol. 1 - Round 1 Sampling, Dames & Moore, Pearl River, NY, June, 1986.

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(12) WMCO Procedure, ESH-P-01-008, Off-site Soil Surface Sampling, Draft, 1986.

(13) WMCO Procedure, ESH-P-01-009, River Sediment Sampling, Draft, 1986.

(14) WMCO Procedure, ESH-P-01-010, Paddy's Run and Storm Sewer Outfall Sampling, Draft, 1986.

(15) WMCO Procedure, ESH-P-01-011, Grass Sampling, Draft, 1986.

(16) Tracy, B. L., F. A. Prantl, and J. M. Quinn, "Transfer of ^{226}Ra, ^{210}Pb and Uranium from Soil to Garden Produce: Assessment of Risk," Health Physics, Vol. 44 (1983), pp. 469-477.

(17) WMCO Procedure, ESH-P-01-013, Sampling Farm and Garden Produce, Draft, 1986.

(18) WMCO Procedure, ESH-P-01-012, Fish Sampling From the Great Miami River, Draft, 1986.

(19) WMCO Procedure, ESH-P-01-014, Milk Sampling, Draft, 1986.

(20) WMCO Procedure, 43-C-301, Operation of Water Treatment Plant, Revised September, 1983.

(21) WMCO Procedure, 43-C-305, Water Plant Laboratory Procedures, Revised May, 1985.

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APPENDIX I

PARAMETERS TO BE ANALYZED FOR RCRA GROUNDWATER SAMPLING

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A. For General Water Quality[1]

1. Chloride
2. Iron
3. Manganese
4. Phenols (total)
5. Sodium
6. Sulfate

B. For Indicators of Contamination (Quadruplicate Analysis)[1]

1. pH
2. Specific Conductance
3. Total Organic Carbon (TOC)
4. Total Organic Halogen (TOX)

C. For Drinking Water Suitability [1]

1. Arsenic
2. Barium
3. Cadmium
4. Chromium - Hexavalent
   - Total
5. Fluoride
6. Lead
7. Mercury
8. Nitrate (as N)
9. Selenium
10. Silver
11. Gross alpha
12. Gross beta
13. Radium
14. Endrin
15. Lindane
16. Methoxychlor
17. Toxaphene
18. 2, 4-D
19. 2, 4, 5-TP Silvex
20. Coliform Bacteria

D. Other Metals, Organics, and Site Specific Parameters[2]

1. Nickel
2. Cyanide
3. Copper
4. Zinc
5. Magnesium
6. Calcium
7. Phosphorus
8. Chlorobenzene
9. Chlorodibromomethane
10. Chloroethane
11. 2-chloroethylvinyl Ether
12. Chloroform
13. Dichlorobromomethane
14. Dichlorodifluoromethane
15. Total Dissolved Solids (TDS)
16. Total Potassium
17. Chemical Oxygen Demand (COD)
18. per Chloroethylene
19. cis 1, 2 Dichloroethylene
20. Tributylphosphate

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21. Acrolein
22. Acrylonitrile
23. Benzene
24. bis(chloromethyl) Ether
25. Bromoform
26. Bromodichloromethane
27. Bromomethane
28. Carbontetrachloride
29. Chloromethane
30. 1.2 Dichlorobenzene
31. 1,3 Dichlorobenzene
32. 1,4 Dichlorobenzene
33. 1,1 Dichloroethane
34. 1,2 Dichloroethane
35. 1,1 Dichloroethylene
36. 1,2 Dichloropropane
37. 1,2 Dichloropropylene
38. Ethylbenzene
39. Methylbromide
40. Methylchloride
41. trans-1,2 Dichloroethylene
42. 1,3 Dichloropropene
43. 1,1,2,2 Tetrachloroethane
44. Tetrachloroethylene
45. Toulene
46. 1,1,1 Trichloroethane
47. 1,1,2 Trichloroethane
48. Trichloroethylene
49. Trichlorofluoromethane
50. Vinyl Chloride

E. Radionuclides(2)

1. Potassium 40
2. Total Uranium
3. Radium 226
4. Radium 228
5. Technetium 99
6. Thorium 228
7. Thorium 230
8. Thorium 232
9. Ces ium 137
10. Strontium 90
11. Ruthenium 106
12. Neptunium 237
13. Plutonium 238
14. Plutonium 239
15. Plutonium 240

F. Schedule - Quarterly for one (1) years, semiannual thereafter (or as necessary according to regulations).

(1) Required for RCRA and analyzed for each sample

(2) Not required for RCRA, but also analyzed for each sample

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APPENDIX II

DEFINITIONS, UNITS, PREFIXES, ABBREVIATIONS, AND ACRONYMS

Definitions

Activity - The number of spontaneous nuclear transformations, in a given quantity of material per unit time. Varies with each type of radioactive decay and with each radionuclide.

AIRDOS/DARTAB - A computerized methodology for estimating environmental concentration and dose to man from airborne releases of radionuclides.

Confidence limit (CL) - A confidence limit is a statement that the population parameter (usually the mean) has a value lying between two specified limits. It has the feature that, in repeated sampling, a known proportion (for instance, 95%) of the intervals computed by this method will include the population parameter. The 95% confidence limit for a sample can be estimated by the following: $t_{(\alpha=.05,df)}\ S_{\bar{x}}$ where "t" is the tabular "t" statistic, and $S_{\bar{x}}$ is the standard deviation of the mean.

Critical organ - A particular organ or tissue that is likely to be of greatest importance when more than one organ is exposed because of the dose it received, its sensitivity to radiation, or the importance to health of any damage that results.

Dose - Quantity of radiation absorbed by the body.

Geometric mean and standard deviation - When the variance of a population is related to the mean, a logarithmic transformation of the original data will sometimes help to stabilize the variance. A mean that is calculated on the logarithmic data and then transformed back (using the antilogarithm) to the original units is the geometric (or derived) mean.

To estimate the standard deviation about the geometric mean, the standard deviation of the logarithms is transformed back to the original data and the geometric mean is then multiplied and divided by the antilog of the standard deviation.

Weighting factor - The ratio of the stochastic risk arising from exposure of a tissue to the total risk when the whole body is irradiated uniformly.

W Solubility Class - That class of materials deposited in the lung that has a clearance half-time on the order of weeks. This material is considered to be moderately soluble.

Y Solubility Class - That class of materials deposited in the lung that has a clearance half-time on the order of years. This material is considered to be chemically insoluble.

Radiation units

Unit	Definition
Curie (Ci) and Becquerel (Bq)	Units of radioactivity which are a measure of those spontaneous, energy-emitting, atomic transformations that involve changes in the state of the nuclei of radioactive atoms. 1 Ci = 3.7 E+10 Bq
Roentgen (R) and coulombs per kilogram (C/kg)	Units of exposure to radioactivity. 1 R = 2.58 E-4 C/kg
Rad and Gray (Gy)	Units of absorbed dose in any medium. 1 rad = 1 E-2 Gy
Roentgen equivalent man (rem) and Sievert (Sv)	Units of dose equivalent which account for the relative biological effectiveness of a given absorbed dose. 1 rem = 1 E-2 Sv

Unit prefixes

Factor	Prefix	Symbol
10^{15}	peta	P
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{2}	hecto	h
10^{1}	deka	da
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	u
10^{-9}	nano	n
10^{-12}	pico	p
10^{-15}	femto	f

Elements and Compounds

Ag	silver	Na	sodium
Al	aluminum	Nb	niobium
As	arsenic	NH_3	ammonia
B	boron	Np	neptunium
Ba	barium	$NH_3(N)$	ammonia nitrogen
Be	beryllium	$NO_3(N)$	nitrate nitrogen
Br	bromine	NO_3^-	nitrate
Ca	calcium	Ni	nickel
Cd	cadmium	P	phosphorus
Ce	cerium	Pb	lead
Cl	chlorine	PO_4^{3-}	phosphate
Cl^-	chloride	Pu	plutonium
CN^-	cyanide	Ra	radium
Co	cobalt	Rn	radon
Cr	chromium	Ru	ruthenium
Cs	cesium	Sb	antimony
Cu	copper	Sc	scandium
F^-	fluoride	Se	selenium
Fe	iron	Si	silicon
Ga	gallium	SO_4^{2-}	sulfate
^3H	tritium	Sr	strontium
Hf	hafnium	Tc	technetium
Hg	mercury	Th	thorium
I	iodine	Ti	titanium
K	potassium	U	uranium
Kr	krypton	V	vanadium
La	lanthanum	Xe	xenon
Li	lithium	Y	yttrium
Mg	magnesium	Zn	zinc
Mn	manganese	Zr	zirconium
Mo	molybdenum		

Acronyms

ALARA	as low as reasonably achievable
BOD_5	five day biochemical oxygen demand
BTU	British thermal units
CFR	Code of Federal Regulations
DOE	Department of Energy
EML	Environmental Measurements Laboratory
EPA	Environmental Protection Agency
ICRP	International Commission on Radiological Protection
NESHAP	National Emission Standards for Hazardous Air Pollutants
NLO	National Lead Company of Ohio
NPDES	National Pollutant Discharge Elimination System
OAC	Ohio Administrative Code
ODH	Ohio Department of Health
RCRA	Resource Concervation and Recovery Act
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TOX	Total Organic Halogen
TSS	Total Suspendid Solids
WMCO	Westinghouse Materials Company of Ohio

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APPENDIX III

ENVIRONMENTAL COMPLIANCE QUALITY ASSURANCE PLAN

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ENVIRONMENTAL COMPLIANCE QUALITY ASSURANCE PLAN

1.0 Purpose and Scope

The purpose of the Environmental Compliance Quality Assurance Plan (QAP) is to identify the quality assurance requirements to be used for the environmental compliance program. The plan includes the functions necessary to assure proper compliance with environmental requirements. This plan applies to all environmental compliance activities conducted by the Westinghouse Materials Company of Ohio (WMCO). Environmental compliance activities include sampling, analysis and evaluations of environmental substances, processing hazardous materials, and facility operations which include environmental compliance.

2.0 Quality Assurance Program Elements

2.1 This plan has been structured to meet the requirements of the FMPC QA programs, DOE Order 5700.6A entitled "Quality Assurance", ANSI/ASME NQA-1, "Quality Assurance Program Requirements for Nuclear Facilities", and other applicable DOE orders and federal and state regulations.

2.2 Operations affecting environmental compliance will be subjected to a Quality Assurance Analysis (QAA) to establish risks and define preventative actions to be integrated into the overall QA plan. The QAA will be performed and documented in accordance with established procedures.

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2.3 The Applicable Quality Assurance Program elements contained in ANSI/ASME NQA-1, will be applied to environmental compliance activities as summarized below:

2.3.1 Organization

The WMCO organization chart is shown in Figure 2-1. The responsibility for environmental regulatory compliance is assigned to the Regulatory Compliance Section within the Environment, Safety and Health (ES&H) Department. The organization of the ES&H Department is shown in Figure 2-2. Figure 2-3 shows the administrative organization of the Regulatory Compliance Section.

While the Regulatory Compliance Section is the focal point for assuring and maintaining compliance with the rules, regulations, and guidelines cited in this document, other organizations within WMCO are responsible for implementing and complying with the environmental requirements imposed on the FMPC operations. The ES&H Department has the authority to stop work or to control further operations where significant conditions adverse to environmental compliance are identified.

The Quality Assurance Department is responsible to verify that the quality assurance requirements specified in this plan and other quality related documents are met. To this end, Quality Assurance performs review and approval actions, auditing, surveillance and inspection activities to a level commensurate with ensuring environmental compliance.

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The functional organization of the FMPC, with areas of responsibility clearly defined, is currently being developed. Functional relationships for all aspects of environmental compliance will be specified in this section at a later date.

2.3.2 Design Control

The FMPC Quality Assurance Program requires designs which affect environmental compliance be reviewed by the Environmental organization and verified. The extent of the verification, the requirement that shall be met, and the method used for verification shall be documented by the organization responsible for the design. Personnel performing design verifications shall have the knowledge, experience, and training to perform an adequate design verification but shall not have a direct responsibility for the original design. Design changes shall be documented and the approval shall be at a level equivalent to that required for the original design.

The environmental organization reviews designs affecting environmental compliance before they are considered acceptable for final release. This includes facility and equipment designs and changes and modifications thereto.

2.3.3 Procurement Control (Document and Purchased Services)

FMPC purchase requests pertaining to environmental compliance equipment shall be submitted to the Environmental organizations for review. All reviews will be documented.

When applicable, procurement documentation shall show environmental compliance quality requirements, either by reference or by specifications or drawings that are made a part of these documents. When additional requirements or parts of reference documents are used, they should be clearly stated on procurement documents. Changes to the procurement document shall be reviewed by the original reviewers.

Source inspections and audits required by the requisitioner, the environmental organization, or quality assurance shall be clearly stated on the procurement documents. Access to the supplier's plant facilities and appropriate records shall be requested in the procurement documents when such actions are deemed necessary.

Procurement documents shall define the environmental compliance records that are to be prepared, maintained, and submitted by the supplier.

2.3.4 Instructions, Procedures and Drawings

Environmental compliance activities shall be prescribed by written instructions, procedures, or drawings, and shall be accomplished in accordance with these documents. When drawings are required they shall be approved for use through drawing control procedures. When applicable, instructions, procedures, and drawings shall include appropriate quantitative or qualitative acceptance criteria for determining that environmental compliance activities (monitoring and sampling) have been satisfactorily

accomplished, including frequencies, analysis and logs and records to be maintained.

Operating procedures not currently controlled by SOPs will be performed according to an executive order. The ES&H Department Manager will issue an executive order that requires all environmental compliance activities be conducted in such a manner as to establish, implement, and achieve an environmental quality program consistent with protection of public health, safety and the environment. The program objective is to comply with standards, regulations, guidelines, and best management practices applicable to air and water quality, toxic substances, and waste management and is consistent with ALARA principles.

Preventative maintenance requirements criteria associated with environmental control processes, equipment, and piping and vents shall be documented. These procedures shall specify the type and frequency of preventative maintenance and the need for maintenance logs and records of maintenance. Prior to approval and final release, these documents shall be subject to the appropriate design verification and shall be reviewed for adequacy by the Environmental organization.

2.3.5 Document Control

Document control procedures shall be developed to specify the provisions for control of environmental compliance document preparation, review, approval, distribution, and revision. The preparation, issue, and change of documents shall be

controlled to assure that only the latest issue of a document is being employed. A listing of documents that are to be subject to review and approval shall be maintained current. Documentation shall exist of the individuals who are authorized and responsible for reviewing, approving, and issuing environmental compliance documents. Approval of changes to these documents shall be at a level equivalent to that required for the original document.

2.3.6 Identification and Control of Analyses Samples

Procedures shall be issued for the identification and control of environmental samples being processsed for laboratory analysis. Physical identification of the sample shall occur as soon as possible after the sample is taken. Identification markings and associated records shall be clear and indelible and shall provide traceability from the location and time the sample was taken through the laboratory analysis. Change-of-custody controls shall be established for transfer of samples. Samples shall be packaged, stored and handled in a manner to prevent damage, contamination, or deterioration. If samples are designated as hazardous materials, they shall be so marked and shall be packaged and shipped according to 49 CFR U. S. Department of Transportation Hazardous Materials Regulations. Samples having a limited life from the time the sample is taken until laboratory analysis is accomplished shall be so identified and controlled to preclude the expiration of the sample life.

2.3.7 Inspection

Inspections required for equipment and facilities based on environmental compliance considerations shall be performed in accordance with documented instructions, procedures, or drawings. Inspection procedures shall provide for:

- o identification of characteristics and activities to be inspected;
- o identification and certification of individuals responsible for inspection;
- o acceptance-rejection criteria;
- o description of the method of inspection;
- o listing of mandatory inspection hold points; and
- o identification of data records and/or method of reporting the results of the inspection.

2.3.8 Control of Measuring and Test Equipment

Measuring and test equipment used for monitoring, sampling, and analysis of environmental releases and which require periodic calibration shall be clearly identified in project documents. The measuring and test equipment shall be uniquely identified and calibrated at prescribed intervals using certified calibration equipment. Written procedures for calibrating measuring and test equipment shall be issued to assure calibration techniques uniformity. The method and interval of calibration for each item of measuring and test equipment shall be documented. Measuring and test equipment shall be stored, handled and maintained in an environment

controlled to the extent necessary to ensure the required accuracy. The reference standards used for calibration shall be traceable to the National Bureau of Standards or accepted values of natural physical constants. If no national standards exist, the basis for traceable calibration shall be documented. Calibration records shall provide for traceability between the measuring and test equipment and the measurement standards used.

When measuring and test equipment are found to be out of calibration, an evaluation shall be made and documented for the validity and acceptability of previous test results.

The procurement requirements for measuring, test, and calibration equipment used in environmental compliance shall be reviewed by the Environment organization before the purchase request is approved.

Records shall be maintained to assure that calibration schedules have been followed. Equipment shall be labeled to indicate the date of last calibration, by whom it was calibrated, and the date for the next calibration. Equipment that has exceeded the calibration dates shall not be used.

2.3.9 Handling, Storage, and Shipping

Requirements for handling, storage, and shipping of hazardous materials, substances, and wastes shall be described in formal procedures. The documents shall cover requirements for cleaning, packaging, marking, shipping, preservation, and

storage. Procedures shall identify the need for routine maintenance and inspection and, where necessary, retesting to assure that all reusable containers meet applicable design standards.

Criteria shall be established for the purpose of assuring that procured packages and containers meet the applicable specifications. Packages and containers fabricated by FMPC shall be built, inspected, and accepted in accordance with approved specifications.

2.3.10 Inspection, Test, and Operating Status

The status of inspection and analytical activities shall be identified on documents traceable to the sample. The status shall be maintained on the change-of-custody documentation.

2.3.11 Control of Nonconformances and Unusual Occurrences

Nonconforming items, processes, or conditions and unusual incidents that affect environmental compliance shall be identified, segregated, controlled, and reported in a timely manner in accordance with established procedures. The disposition of these nonconformances shall be concurred in by the Environmental organization.

2.3.12 Corrective Action

Unsatisfactory conditions adverse to environmental compliance shall be promptly identified, evaluated, and corrected. The cause of the unsatisfactory condition shall be determined and corrective action taken to preclude repetition.

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2.3.12 Corrective Action

Unsatisfactory conditions adverse to environmental compliance shall be promptly identified, evaluated, and corrected. The cause of the unsatisfactory condition shall be determined and corrective action taken to preclude repetition.

Corrective action shall include:

- o analysis of unsatisfactory condition to determine the extent and causes;
- o analysis of quality trends to provide a basis for improvements;
- o introduction of required improvements and corrections, an initial review of the adequacy of such measures, and monitor the adequacy of the corrective actions taken; and
- o follow-up action to verify implementation of corrective action.

2.3.13 Quality Records

Sufficient records shall be prepared as work is performed to furnish objective documentary evidence of the quality of items, processes, and operations affecting environmental compliance. Records shall be consistent with applicable codes, standards, drawings, specifications, project record lists, and contracts and shall provide for the verification of quality. Records shall include, but not be limited to log books, documentation of reviews, inspection and analysis data, material and equipment certifications, drawings and specifications, calibration data, and nonconformance, corrective action, and audit reports.

Records shall be identified, indexed, filed, and maintained in a manner which will permit prompt retrieval and traceability to the specific item, process, or condition to

which they apply. Record retention time scales shall be specified.

Records shall be maintained in facilities that provide suitable protection against deterioration, damage, and loss.

2.3.14 Audits

Audits shall be planned, scheduled, and implemented to assure compliance with environmental and quality assurance requirements.

Audits shall be scheduled to ensure that an effective quality assurance and compliance program exists during the planning, designing, procuring, and operating activities and shall be coordinated in a manner to provide coverage of ongoing environmental program activities. Audits shall be conducted at a frequency commensurate with the states and importance of the activity. The audit schedule shall be reviewed periodically and revised as necessary. Audits may be conducted either periodically or on a random unscheduled basis.

Certification of QA auditors shall be documented and filed. Audits shall be performed in accordance with written procedures using audit checklists.

The results of the audit shall be documented and provided to management having responsibility in the area audited. The report shall include a summary of audit results with appropriate recommended actions.

Management of the audited organization or operation shall respond in writing to any audit finding. This response shall include results of the investigations and corrective actions planned or taken.

Follow-up to assure corrective actions are adequate and have been completed shall be documented.

2.3.15 Training

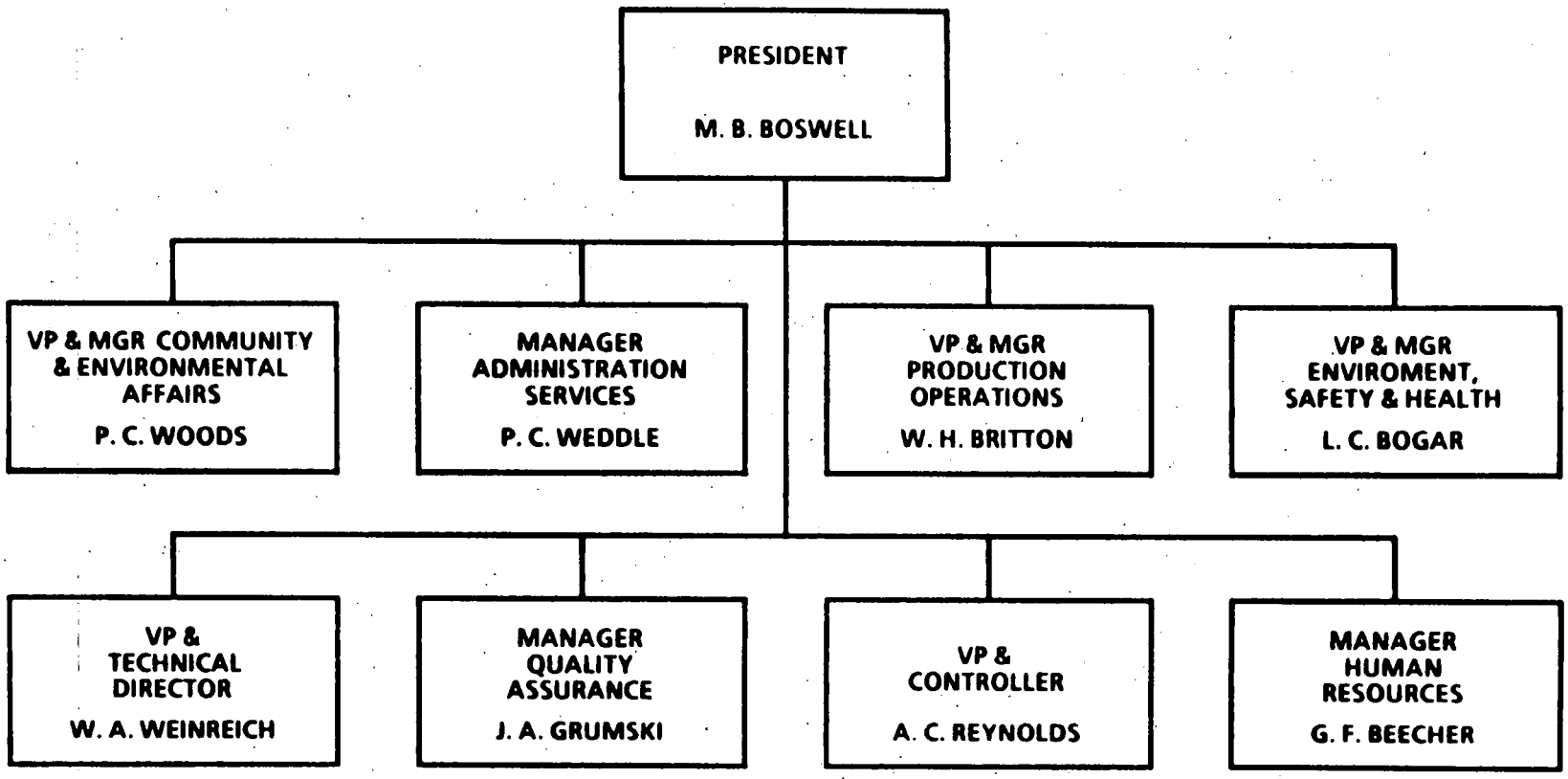
WMCO personnel performing activities that impact or affect environmental compliance shall receive indoctrination and training as required to assure that suitable proficiency is achieved and maintained such that personnel are able to fulfill their assigned tasks and they are knowledgeable of FMPC environmental compliance and associated quality assurance procedures.

3.0 Implementing Procedures

Environmental compliance activities are encompassed in a series of Standard Operations Procedures (SOP). A complete list of these implementing procedures will be furnished at a later date.

4.0 Other Regulatory Documents

A complete list of the regulatory documents and their associated implementary procedures will be furnished at a later date.



RESPONSIBLE FOR TOTAL PROJECT MANAGEMENT INCLUDING:

- CUSTOMERS SERVICE/INTERFACES
- COMMUNITY RELATIONS
- PRODUCTION
- OVERALL SAFETY AND SECURITY
- PERSONNEL MANAGEMENT
- EEO PROGAM
- QUALITY ASSURANCE
- COST AND SCHEDLUE CONTROL

Figure 2-1. WMCO Organization Chart

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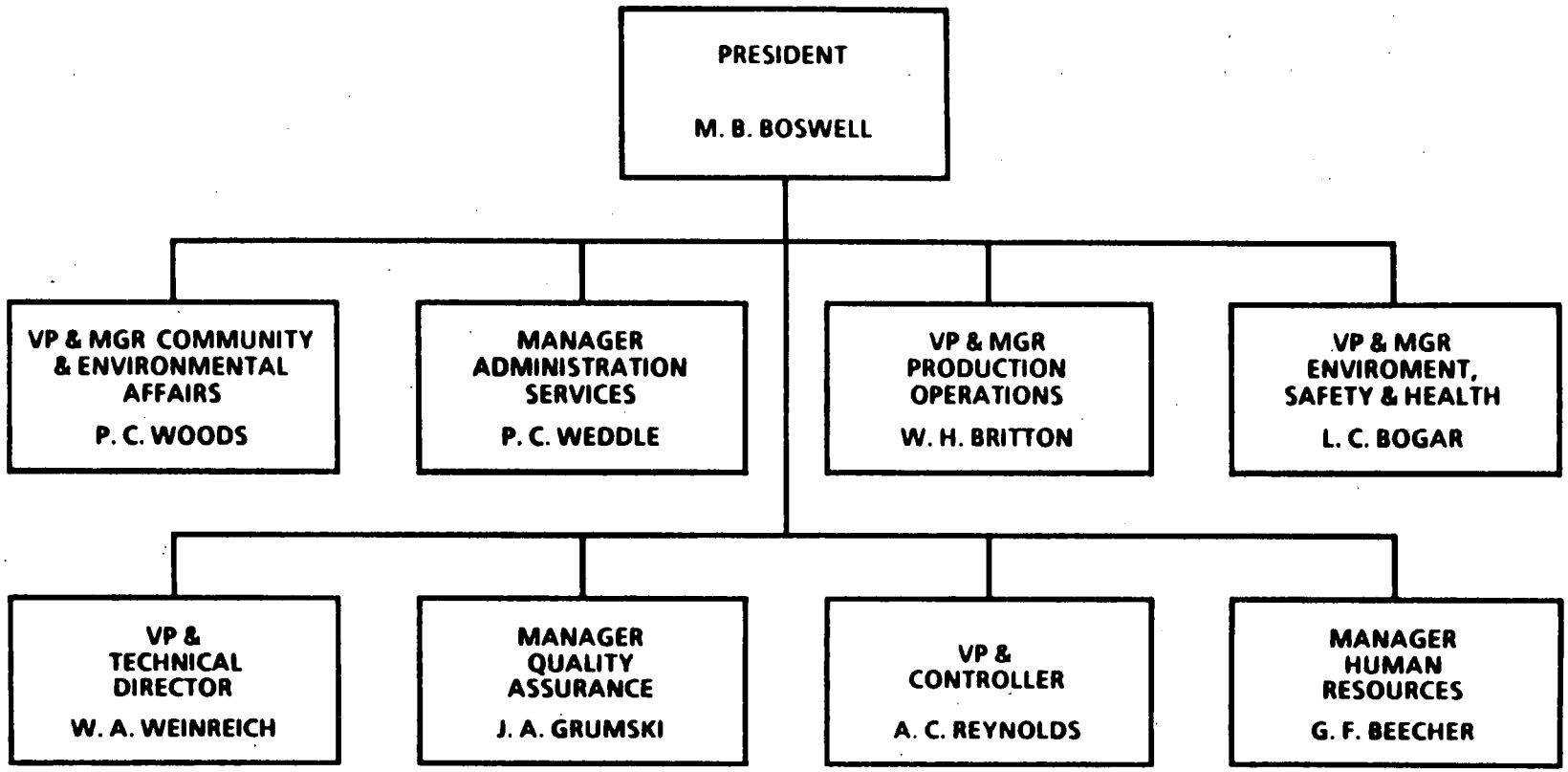

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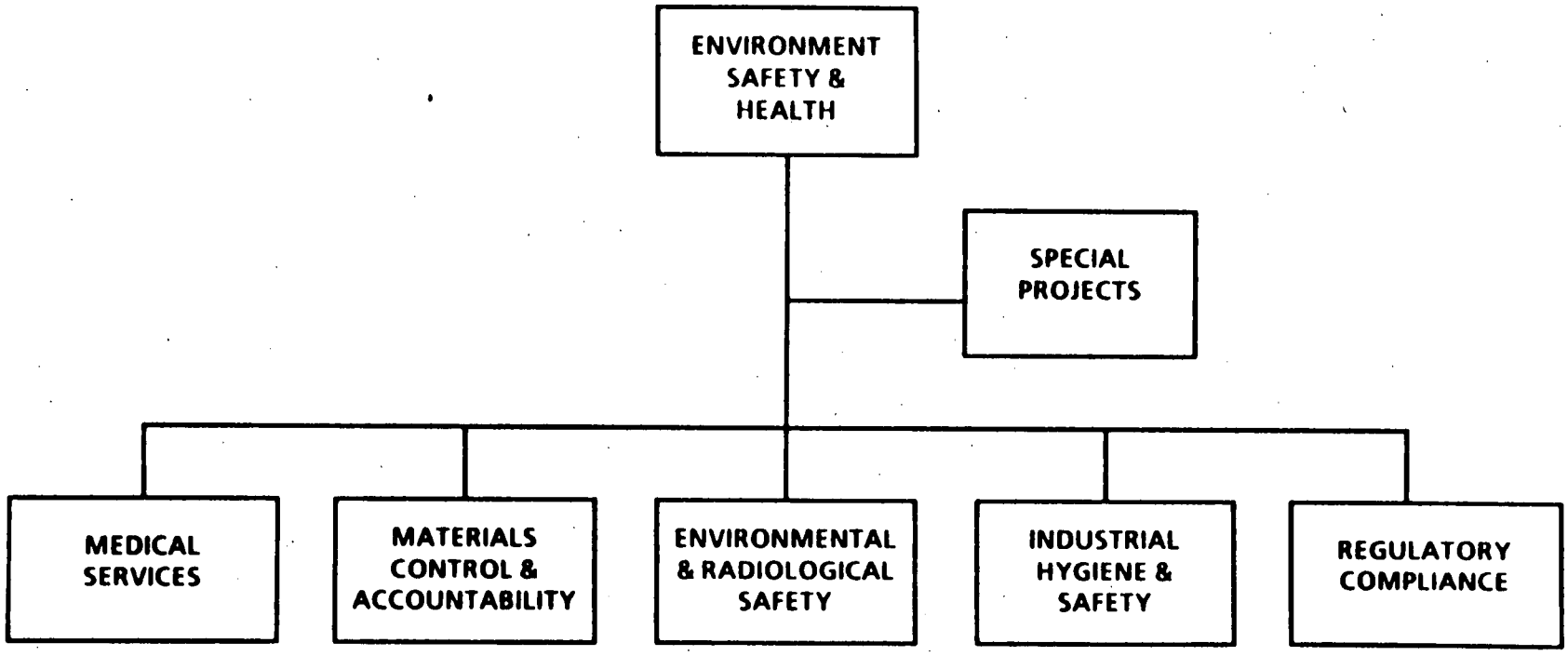
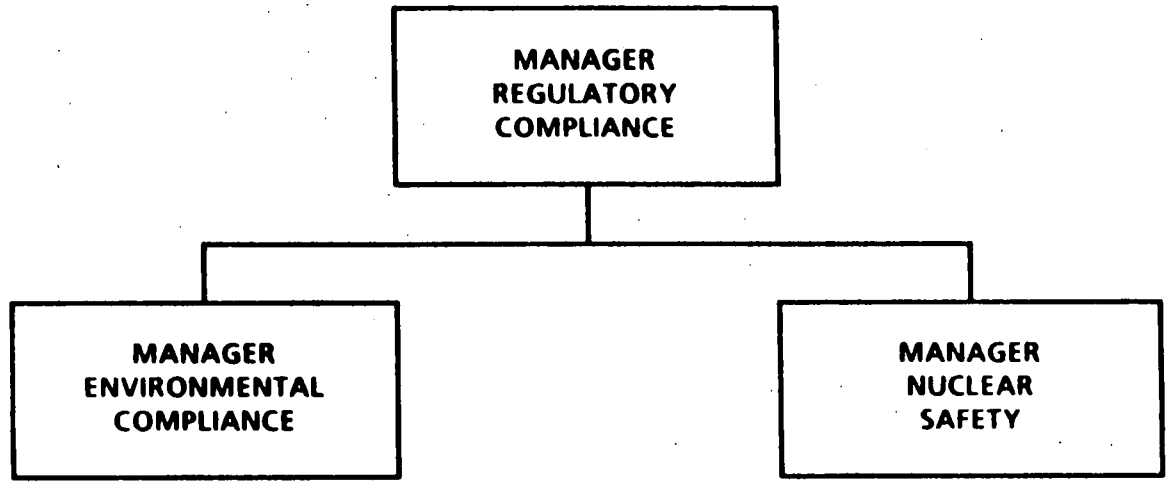


Figure 2-2. ES&H Department Organization Chart



- PREPARE PERMITTING
- ASSURE COMPLIANCE WITH ALL ENVIRONMENTAL REGULATIONS (USEPA, OEPA, DOE ORDERS)
- INTERFACE WITH OTHER FUNCTIONAL AREAS TO ASSURE COMPLIANCE AND TO ASSESS THE IMPACTS OF NEW REGULATIONS
- GENERATE ALL NEPA DOCUMENTATION
- DEVELOP AND PREPARE ALL REQUIRED ENVIRONMENTAL DOCUMENTATION
  - PROGRAM PLANS
  - MONITORING PROGRAMS
  - PROCEDURES
- INVESTIGATE ENVIRONMENTAL PROBLEMS

- PERFORM FAILURE MODES AND EFFECTS ANALYSIS
- DEVELOP SITEWIDE FINAL SAFETY ANALYSIS REPORTING
- GENERATE NEW FACILITIES SAFETY ANALYSIS DOCUMENTATION
- PERFORM NUCLEAR CRITICALITY SAFETY ANALYSIS
- DEVELOP AND PRESENT CRITICALITY SAFETY TRAINING
- ASSURE CONFIGURATION CONTROL
- ASSIST WITH TRANSPORTATION SAFETY AND PACKAGING

Figure 2-3. Regulatory Compliance Section Organization Chart