

**ENGINEERING EVALUATION/COST ANALYSIS
(EE/CA) APPROVAL MEMORANDUM
CONTAMINATED GROUND WATER SOUTH OF
PLANT SITE (SOUTH PLUME)**

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**DOE-FMPC/DOE-ORO
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REPORT**

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**FEED MATERIALS PRODUCTION CENTER
U. S. DEPARTMENT OF ENERGY**

1.0 INTRODUCTION

On July 18, 1986, a Federal Facilities Compliance Agreement (FFCA) was jointly signed by the U. S. Department of Energy (DOE) and the U. S. Environmental Protection Agency (U. S. EPA) pertaining to environmental impacts associated with DOE's Feed Materials Production Center (FMPC) in Fernald, Ohio. The FFCA is intended to ensure that environmental impacts associated with past and present activities at the FMPC are thoroughly and adequately investigated so that appropriate remedial response actions can be formulated, assessed, and implemented.

In response to the FFCA, a Remedial Investigation and Feasibility Study (RI/FS) is in progress pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA). The technical strategy adopted for the RI/FS is to issue distinct RI/FS reports for each of five operable units at the FMPC. By accommodating separate schedules for each operable unit, the remedial action decision process is proceeding to completion for the most problematical units while data collection and analysis continue for other operable units.

One of the identified operable units of the FMPC includes those environmental media that serve as migration pathways and/or environmental receptors of radiological or chemical releases from the FMPC. Important elements of this operable unit are the on- and off-site area of the regionally important buried valley aquifer of the Great Miami River Basin (Great Miami Aquifer) that exhibit elevated levels of uranium. Because of the off-site location of portions of the uranium plume within developed areas south of the FMPC and the associated potential threat to human health, the DOE is planning a removal action for this off-site area or "south plume" consistent with the implementation of a final remedial action for the regional aquifer.

Removal actions, as described in the National Contingency Plan (NCP) of July 1988 (40 Code of Federal Regulations (CFR) 300.65), are primarily intended to abate, minimize, stabilize, mitigate, or eliminate a release or threat of release prior to a final action if there is a threat to public health, welfare or the environment. A second reason for implementing a removal action is to mitigate contaminant migration pending final action if site conditions permit a straightforward mitigative action and significant migration would occur in the interim if no action is taken. Additionally, based on the proposed revisions to this portion of the NCP, removal actions are to be consistent with the anticipated long-term remedial action and to contribute to the efficient performance of the

long-term remedy to the extent practicable.

Once a non-time critical removal action is deemed appropriate, an engineering evaluation/cost analysis (EE/CA) is performed to analyze removal action alternatives and to support the selection of a preferred alternative. The EE/CA will be prepared and used by DOE as the basis for remedy selection and implementation.

2.0 SITE DESCRIPTION

The FMPC site is located on 1,050 acres in a rural area approximately 20 miles northwest of downtown Cincinnati, Ohio. The production area is limited to an approximate 136-acre tract near the center of the FMPC site. The villages of Fernald, New Baltimore, Ross, New Haven, and Shandon are all located within a few miles of the plant. There is an estimated population of over 14,000 within a five-mile radius of the site.

The area surrounding the FMPC is mainly agricultural, with dairy, beef, corn, and soy bean production. Several industries, including Delta Steel, Albright & Wilson Chemical Company, Rutgers-Nease Chemical Company, two commercial gravel operations, and a cement plant are located south of the site. The Miami Whitewater Forest, a Hamilton County park, is located five miles to the southwest of the FMPC.

The area surrounding the FMPC contains several sites of historical interest, but none are within the immediate study area of the south plume. The National Register of Historic Places lists four prehistoric Indian sites within a 3-mile radius. They include the Adena Circle, the Demoret Mound, the Colerain Work, and the Dunlap Work. The closest site, the Colerain Work, is situated approximately one mile east of the FMPC. The State Historical Preservation Officer reports that there are no known sites of archaeological significance on the FMPC site. There are also no known archaeological sites in the area of the south plume removal action being considered.

The FMPC is located within the Great Miami River Basin drainage, but above the river's present day floodplain. The Great Miami River is the receiving stream for the FMPC effluent discharge and represents the main surface water feature in the vicinity of the FMPC (Figure 1). The river flows generally to the southwest.

Natural surface drainage from the FMPC is primarily to Paddy's Run. Paddy's Run originates north of the site, drains southward along the west side of the FMPC, and eventually enters the Great Miami River approximately 1.5 miles south of the FMPC (Figure 1). This stream loses flow to the ground

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water along most of its course due to its highly permeable channel bottom and limited elevation above the regional ground water table. Paddy's Run is an ungaged, intermittent stream that flows primarily between January and May.

A principal drainage feature of the FMPC is a tributary to Paddy's Run known as the storm sewer outfall ditch. This drainage course originates south of the Production Area, flows southwest across the southern portion of the site, and enters Paddy's Run near the southwest corner of the property (Figure 1). Much of the stream bottom of this drainage course, which also collects runoff from an area east of the plant, is composed of sand and gravel. Vertical seepage rates through the stream bottom may be high. This drainage course is generally dry throughout most of the year with flows occurring during and immediately after precipitation.

The regionally important Great Miami Aquifer underlies the site. This aquifer serves as a principal source of domestic, municipal, and industrial water throughout the region.

The United States Atomic Energy Commission (AEC), predecessor to the DOE, established the FMPC for processing uranium and its compounds from uranium ore concentrates for U.S. Government needs. This integrated production complex began operations in the early 1950s. In 1951, NLO Inc. (formerly National Lead Company of Ohio) entered into contract with the AEC as Operations and Maintenance (O&M) Contractor. This contractual relationship lasted until January 1, 1986. Westinghouse Materials Company of Ohio (WMCO), a wholly-owned subsidiary of Westinghouse Electric Corporation, then assumed management responsibilities of the site operations and facilities for the following five-year period.

A variety of chemical and metallurgical processes are utilized at the FMPC for the manufacture of uranium products. During the manufacturing process, high quality uranium compounds are introduced into the FMPC processes at several points. Impure starting materials are dissolved in nitric acid and the uranium is removed through solvent extraction to yield a solution of uranyl nitrate. Evaporation and heating convert the nitrate solution to uranium trioxide (UO_3) powder. This compound is reduced with hydrogen to uranium dioxide (UO_2) and then converted to uranium tetrafluoride (UF_4) by reaction with anhydrous hydrogen fluoride. Uranium metal is produced by reacting UF_4 and magnesium metal in a refractory-lined reduction vessel. This primary uranium metal is then remelted with scrap uranium metal to yield a purified uranium ingot. Various uranium metal working processes also exist.

3.0 INCIDENT CHARACTERISTICS

Ground water in the regional aquifer beneath the FMPC and to the south of the plant boundary is contaminated with uranium. The extent and concentration of the uranium contamination is being defined under the RI/FS program, through ground water monitoring and the development of a ground water flow model.

In late 1981, the State of Ohio and FMPC sampled several wells in the Fernald area to determine the cause of elevated beta activity found in one well. The FMPC reported to the State of Ohio in November 1981 that the site had discovered uranium in two offsite wells. As a result of the report to the state, the FMPC expanded its ground water sampling program to include existing offsite wells owned by residents and businesses near the site. Year-by-year, additional wells have been added to the ground water monitoring program.

The source of the contamination is still under investigation. Based on the current understanding of plant operations and records, site hydrology, and results of the ground water modeling study, the principal source of the off-site plume is believed to be historical releases of uranium contaminated water into Paddy's Run and the storm sewer outfall ditch. Because the sediments of these water sources are highly permeable in the reaches north and west of the south plume, the uranium contaminated water directly entered the regional aquifer in these areas. The ground water flow component is toward the south plume area. The uranium in Paddy's Run and the storm sewer outfall ditch had its source in storm water runoff. Historic pumping of ground water from the Waste Storage Area to Paddy's Run may also have been a source of uranium contamination.

The on-site portion of the plume may be caused by a slower and more recent infiltration of uranium into the underlying aquifer from the Southfield area and possibly the fly ash piles. Infiltration along Paddy's Run also continues, but the associated uranium levels have been reduced. Another possible explanation of the dual concentration distribution is that the current recharge of water containing much lower levels of uranium along the storm water outfall ditch dilutes the more recent, southerly migrating ground water plume.

The area of the south plume study is indicated on Figure 1.

Ground water flow velocities along the south plume path are estimated to be about 1,300 feet per year. The migration rate of the uranium contaminated plume would be less than the estimated ground water flow velocities as a result of the retardation effects caused by the physicochemical interchange

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of the dissolved uranium with the solid matrix through which it is flowing. Results of the ground water flow/solute transport model indicate a calculated plume movement of approximately 150 feet per year.

4.0 QUANTITIES AND TYPES OF SUBSTANCES PRESENT

Ground water data collected to date from the sand and gravel aquifer indicate the presence of radionuclides and inorganic metals in the south plume. Most of the radionuclides are found at natural background concentrations. None of the radionuclides or metals exceed established or derived drinking water limits with the exception of uranium. Certain organic chemicals have been observed in some samples, but these observations have not been persistent for the same monitoring wells and are far below allowable maximum concentration levels for all organics detected. For this reason, uranium has been designated as the contaminant of concern for the south plume.

Uranium concentrations in the south plume (both on and off-site) range from 1 microgram per liter (ug/l) to approximately 850 ug/l. A data package documenting these results can be found as an attachment to the preliminary assessment prepared for the south plume. The highest uranium concentrations are located in the upper layer of the aquifer (2000 - series wells located approximately 60-90 feet in depth), with a substantial reduction in concentrations with depth (3000 and 4000 - series wells located approximately 125-150 feet and 220-225 feet in depth, respectively). The 4000 - series wells have had uranium concentrations consistently less than 1 ug/l.

The ground water sampling methodology, as well as procedures for maintaining consistency, reliability and quality control are fully described in the Quality Assurance Project Plan (QAPP), volume 5 of the Remedial Investigation /Feasibility Study (RI/FS) Work Plan, Revision 3 (March 1988). The sample collection and analysis are conducted by International Technology Corp., a subcontractor on the RI/FS project. The IT Laboratories used for analysis are Contract Laboratory Program (CLP) certified.

5.0 STATE AND LOCAL AUTHORITIES ROLES

Executive Order 12580 delegates Section 104 response authority to DOE for DOE sites. The state and local roles have been one of participation in the negotiations of the CERCLA Consent Agreement, in technical information exchanges, and identification of state and local ARARs.

6.0 ACTIONS TO DATE

Construction was completed on the second of two storm water

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retention basins in December of 1988 at a cost of approximately \$1.2 million dollars. Stormwater runoff from the Production Area is now conveyed to these retention basins. The basins, designed to retain the runoff from a 10-year, 24-hour rainfall event, essentially eliminate the contribution of storm water from the Production Area to the outfall ditch.

The additional following actions have been taken to date:

- The public has been notified of the south plume contamination and well and cistern sampling has been performed by the Ohio Department of Health and on the behalf of DOE.
- An alternate water supply has been provided to a private residence located along Willey Road to the north of the plume center.
- An on-going ground water monitoring program is conducted for a number of wells in the South Plume area. The results of the ground water analysis are reported to the public.

Runoff from the FMPC Waste Storage Area flows west and southwest to Paddy's Run. A separate removal action is currently underway by the DOE to capture and divert the majority of this runoff to the Great Miami River following treatment. The schedule and costs for the removal action covering the storm water runoff from the waste pit area will be determined as this removal action proceeds.

7.0 THREAT TO PUBLIC HEALTH OR ENVIRONMENT

The site conditions meet certain criteria listed in the NCP for categorization of specific cleanup efforts as removal actions. The eight factors to be considered in determining the appropriateness of a removal action, as listed in section 300.65 of the NCP, are:

1. Actual or potential exposure to hazardous substances or pollutants or contaminants by nearby populations, animals, or food chains.
2. Actual or potential contamination of drinking water supplies or sensitive ecosystems.
3. Hazardous substances or pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers that may pose a threat of release.
4. High levels of hazardous substances or pollutants or contaminants in soils, largely at or near the surface,

that may migrate.

- 5. Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released.
- 6. Threat of fire or explosion.
- 7. Availability of other appropriate federal or state response mechanisms to respond to the release.
- 8. Other situations or factors that may pose threats to public health or welfare and the environment.

Of the eight factors to be considered, the actual contamination of potential drinking water supplies and the associated potential for exposure reflected in the first two factors are relevant to the south plume removal action. Ground water containing uranium at concentration levels exceeding the DOE derived concentration guideline (DCG) of 33 ug/l for uranium in drinking water is present at off-site locations south of the FMPC. Potential ground water users are located in and adjacent to the study area.

There is no known use of ground water for drinking water, feedstock watering, or crop irrigation from the south plume area with uranium levels exceeding the derived concentration limit of 33 ug/l. Only two of these potential ground water users currently remove ground water at locations known to contain elevated levels of uranium and the use of this water is limited to industrial/commercial purposes. Therefore, it has been determined that the threat to public health and the environment is not time critical. Coupled with the fact that there is a planning period of more than six months available before on-site removal activities must begin, it has been determined that a non-time critical response is appropriate. Therefore, DOE will prepare an EE/CA document.

The impacted aquifer is within the buried valley aquifer of the Great Miami River Basin, which has been designated as a Sole-Source Aquifer by the U.S. EPA under Section 1424(e) of the Safe Drinking Water Act (Federal Register, Vol. 53, No. 131, Friday, July 8, 1988). Under the designation, the Administrator of Region V of the U.S. EPA has determined that this aquifer is the sole or principal source of drinking water for this area and that if contaminated would create a significant hazard to public health.

The state of Ohio is the only potential Natural Resource Trustee party. Other potential Federal Trustees (Dept. of Interior, Dept. of Commerce, etc.) do not have jurisdiction since the natural resources under evaluation are DOE owned land, never in the public domain, and state controlled surface

and ground water.

As demonstrated in the state of Ohio's complaint and subsequent Consent Decree, Ohio is aware of the potential threat to natural resources. In the Consent Decree signed in December 1988, Ohio Environmental Protection Agency (OEPA) deferred action on the complaint dealing with potential damage to natural resources. Ohio agreed that activity under the RI/FS was the appropriate mechanism for assessing any natural resource damage.

8.0 ENFORCEMENT

Executive Order 12580 delegates Section 104 response authority to DOE for DOE sites. Therefore, enforcement issues as they relate to PRP's are not applicable.

9.0 PROPOSED PROJECT AND COST

The objective of the EE/CA is to evaluate possible removal actions and associated costs, select a response, and document the decision. Adequate information from the RI/FS process exists to prepare the EE/CA. As new information becomes available, it will be incorporated into the decision making process, as appropriate.

The preparation of the EE/CA will involve compilation of the data, providing a description of the site background and removal action alternatives, evaluating the alternatives with respect to effectiveness of protecting public health and the environment, and selection of a preferred alternative.

The estimated cost for preparation of the EE/CA is \$147,000. Work on preparation of the EE/CA report began in August 1989. A draft of the EE/CA was completed for internal review in September. The final EE/CA will be submitted to EPA for review and approval and released for public review and comment by April 15, 1990. By no later than that date, the Administrative Record will be made available for public inspection.

The removal action could involve a cost of as much of \$25.9 million dollars (present worth value) and continue until the final remedial action is initiated, if pumping and treatment of the contaminated ground water is the chosen alternative.

10.0 RESULTS IF NO ACTION IS TAKEN

If left unattended, the plume of elevated uranium

concentrations in ground water south of the FMPC would be expected to continue to migrate south-southeast along the regional ground water flow path in the buried channel aquifer. This could potentially extend the area of contamination to new potential users. The no-action alternative is not effective in preventing potential risk to public health via the drinking water pathway. For the no-action alternative, it is possible that the two industrial users of ground water from the south plume would continue to use this water.

Under the no-action alternative, the amount of uranium crossing the FMPC boundary would continue at the currently projected level until an on-site removal or remedial action was implemented as part of another operable unit. No lessening of environmental concentrations would occur except for the continued dispersion of the plume as it migrates, uncontrolled, toward the south-southeast. The potential also exists for mixing with another plume of contamination in the south plume area.

The no-action alternative would have no impact on sensitive habitats or the historical resources in the area. There would be no noise or air quality impacts related to this alternative and no change in existing land use practices or waste management requirements.

11.0 IMPORTANT POLICY ISSUES

There are no important policy issues associated with this EE/CA request.

12.0 APPROVAL

Because conditions at the FMPC meet the NCP Section 300.65 criteria for a removal action, approval to prepare an engineering evaluation/ cost analysis (EE/CA) is requested. The estimated total costs of performing the EE/CA are \$147,000. Please indicate your approval by signing below.

Approve: _____ Date: _____

Title: _____

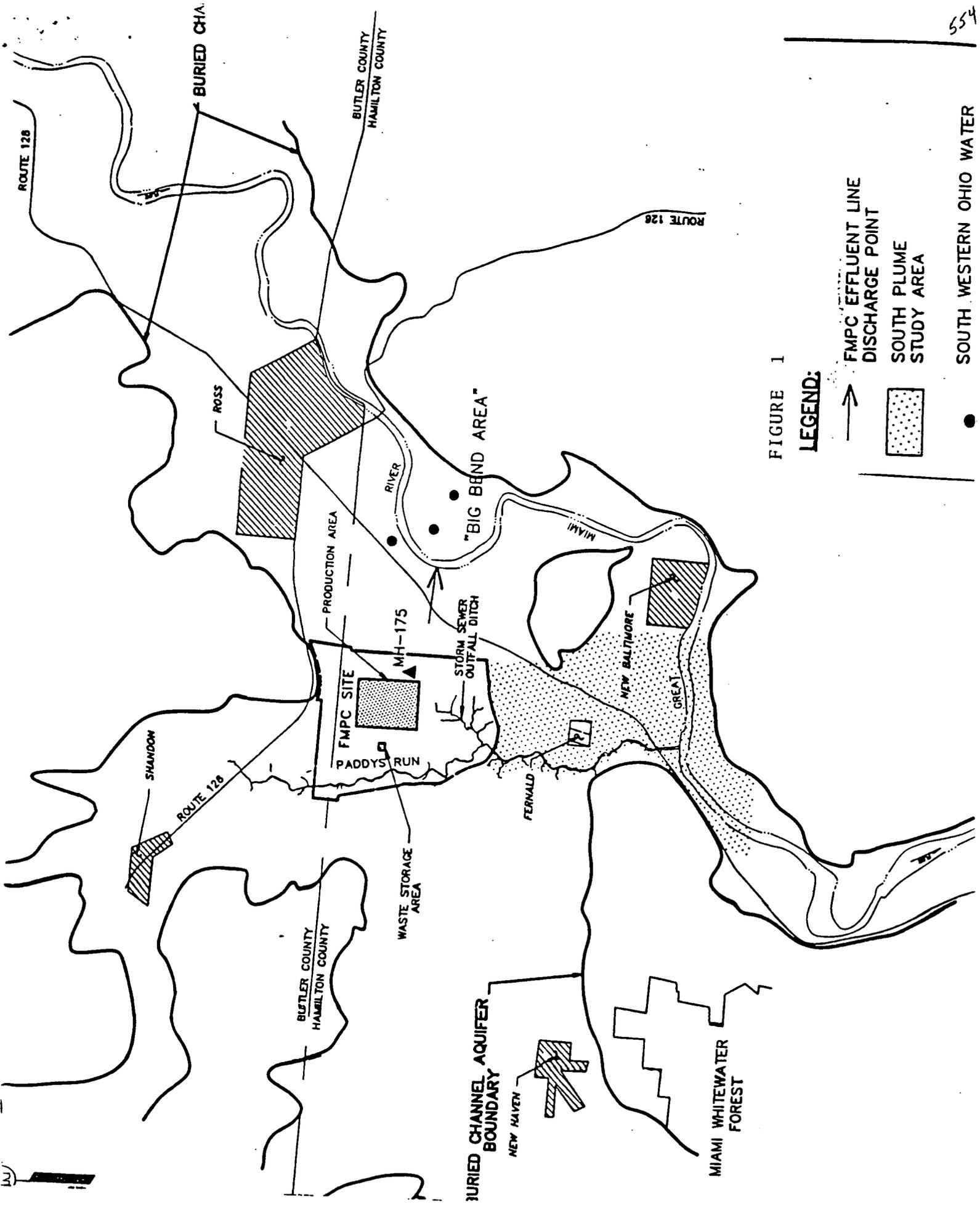


FIGURE 1

LEGEND:

- FMPC EFFLUENT LINE DISCHARGE POINT
- SOUTH PLUME STUDY AREA