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FEED MATERIALS PRODUCTION CENTER ENVIRONMENTAL MONITORING SEMI-ANNUAL REPORT FOR FIRST HALF OF 1965

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FEED MATERIALS PRODUCTION CENTER
ENVIRONMENTAL MONITORING SEMI-ANNUAL REPORT
FOR
FIRST HALF
OF 1965

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NATIONAL LEAD COMPANY OF OHIO

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Special

FEED MATERIALS PRODUCTION CENTER
ENVIRONMENTAL MONITORING SEMI-ANNUAL REPORT
FOR
FIRST HALF
OF 1965

Prepared by

HEALTH AND SAFETY DIVISION

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UNITED STATES ATOMIC ENERGY COMMISSION
CINCINNATI AREA

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ABSTRACT

The environmental monitoring program for the sampling of air and water during the first half of 1965 in the vicinity of the Feed Materials Production Center, Fernald, Ohio is presented. The amount of material released to the environment was small in comparison to the maximum permissible levels recommended by the National Committee on Radiation Protection and Measurements and the State of Ohio.

INTRODUCTION

ENVIRONMENTAL MONITORING DATA

The following report concerns the environmental monitoring data gathered in the Fernald Area by the Feed Materials Production Center (FMPC). The FMPC is operated by the National Lead Company of Ohio (NLO) for the United States Atomic Energy Commission. The project is located in a valley near Fernald in southwestern Ohio. The production area of FMPC covers an area of 136 acres, and is located approximately in the center of a 1050 acre government-owned site. Most of the site, including the entire production area, is located within Hamilton County, Ohio, but approximately 200 acres are situated in southern Butler County. Adjacent to the site are the small villages of Fernald, New Baltimore, Ross, and Shandon, all being located one mile or more from the project. The larger nearby communities of Cincinnati and Hamilton are 20 and 10 air miles respectively. (For relative locations see Figure 1).

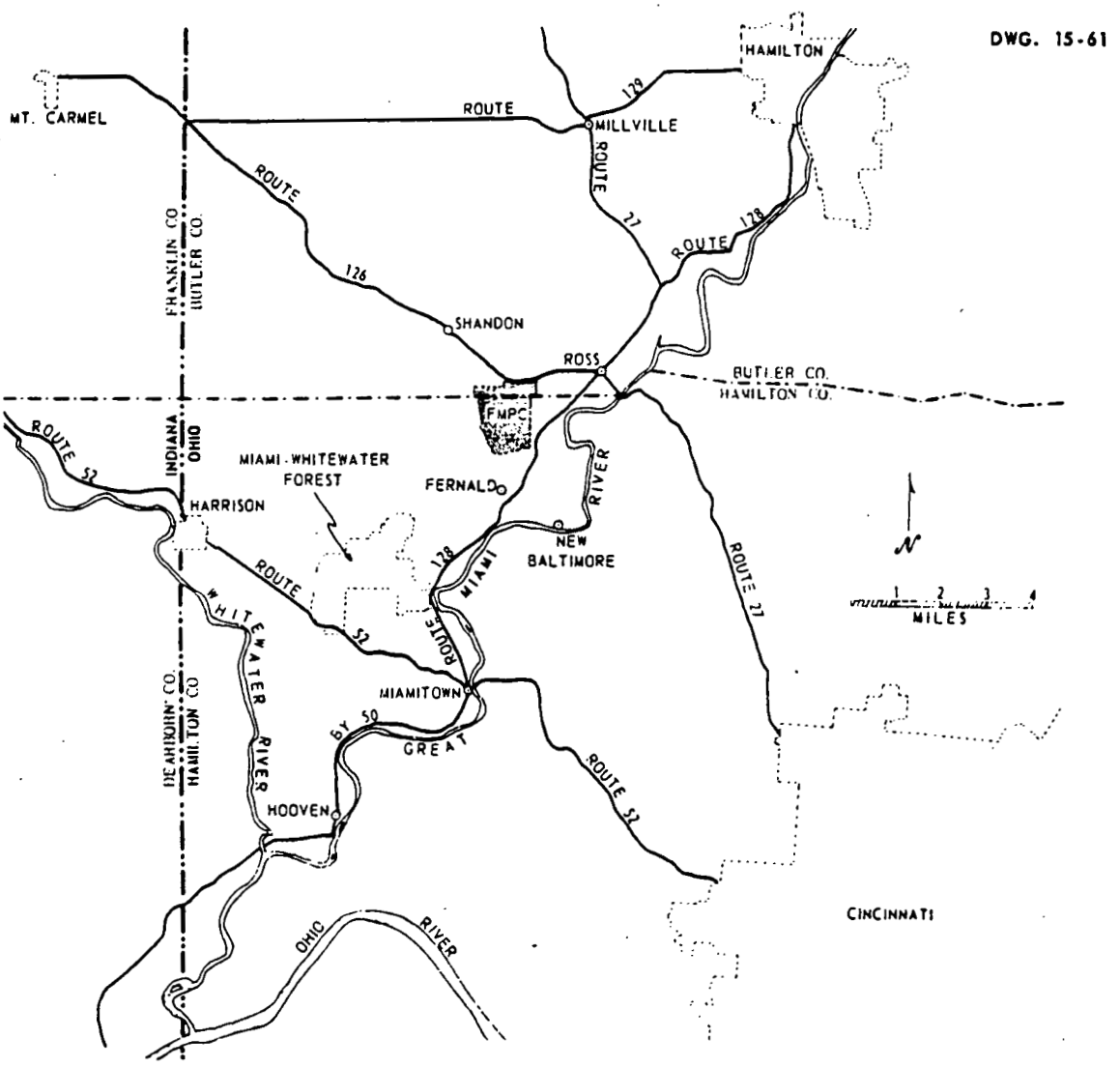

FIGURE 1 Area Map of Relative Locations

Operations at this project deal with the processing of high-grade uranium ores and ore concentrates to produce metallic uranium. These processes include: acid digestion of the ores and concentrates, organic phase extraction of uranyl nitrate, subsequent conversion of the uranyl nitrate to uranium oxides and tetrafluoride, reduction to uranium metal, and fabrication of the metal into fuel elements. The project also includes plants for sampling of the ores and concentrates and recovery of uranium from various residues. The final product is used throughout the United States as a fuel for nuclear reactors.

During the many involved reactions and processes that lead to the reactor fuels, various liquid and airborne wastes are generated. These wastes contain varying quantities of uranium. Various in-plant methods are used to curtail their release into the environment surrounding the plant. Almost complete removal of the materials is accomplished by using dust collectors and waste treatment processes. In order to determine what concentrations reach the area surrounding the project an environmental survey program has been established which consists of water, soil, and air sampling of the environs and performing those analyses on the samples that are indicative of material released from the plants. The results of this program in past years and the present report indicated that the material released to the environs at this site is well within the maximum permissible concentrations (MPC) as recommended by the National Committee on Radiation Protection and Measurements and the State of Ohio. The following pages contain results of the environmental sampling program during the period covered by this report.

Part I – Monitoring of Water

Each of the individual production plants on the project has collection sumps and treatment equipment to remove the uranium from the process waste water. The effluent from the plants are collected at a general sump for equalization and settling. The clear water from the sump is pumped to the river. The solid portion is pumped to a chemical waste pit for further settling. The flow which is decanted to the clear-well portion of the pit is virtually free of solids and radioactivity. The effluent is then combined with three other types of project waste water and discharged to the river.

Water samples are taken to determine the effect of the site's liquid wastes upon the Great Miami River, into which all of the plant's liquid effluents pass. The results of the monitoring of liquid effluent have been reported to the Ohio Department of Health on a monthly basis since 1954 and duplicate samples are taken by a State Engineer and a National Lead Company of Ohio Industrial Hygienist. One sample every month is exchanged in order that each group can evaluate the other's sampling procedure and analytical results.

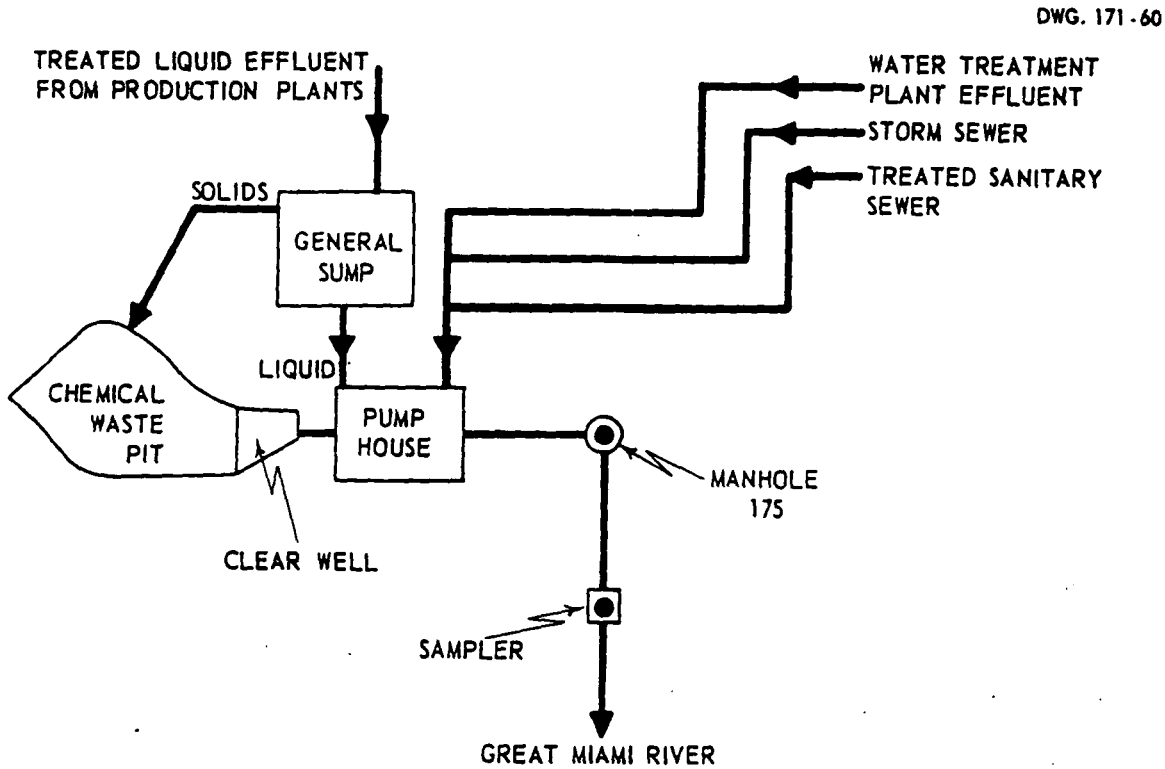

FIGURE 2 Flow Diagram of Chemical Waste and Disposal Process

The locations of all sampling points are shown in Figure 3. A weir-type water sampler collects (at point B) samples of the combined stream (see also Figure 2). The collected sample is removed and analyzed daily. These results when utilized with measurements of river flow are the basis for calculated outfall river concentrations. Since it is difficult to have this type of sampler in an upstream (point A) and downstream (point C) location, weekly spot samples are taken at these points. The collected samples at all points are analyzed for uranium, total activity, chlorides, fluorides, and nitrates.

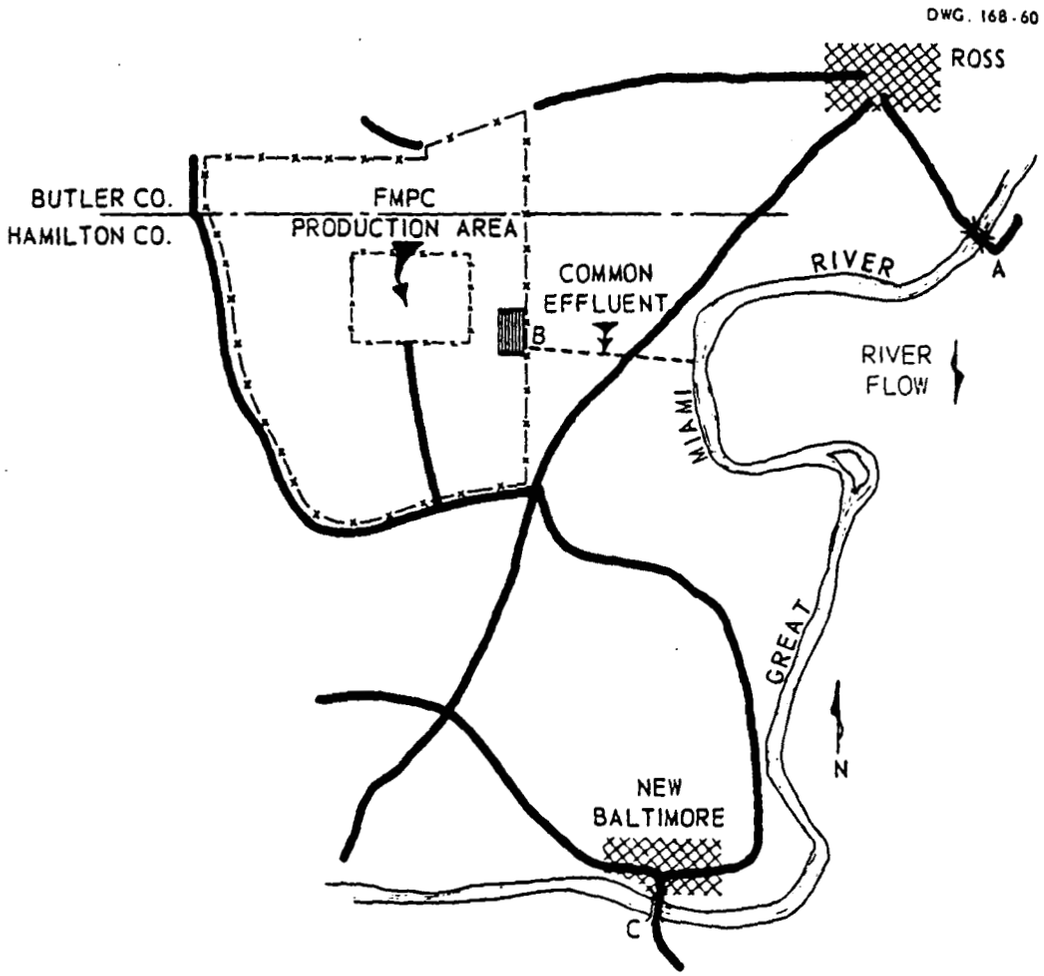

FIGURE 3 Water Sampling Locations (Fernald Area, Feed Materials Production Center and Surrounding Area)

A. Water Monitoring Results

Table I indicates the high, average, and low concentrations of the sampled contaminants during this period of this year. The applicable MPC's and the percent of each MPC are also indicated for comparison.

TABLE I Water Sampling Results for the First Half of 1965

Location†	No. of Samples	Uranium ($\times 10^{-6}$ µc/cc)				Total Activity ($\times 10^{-6}$ µc/cc)			
		High	Low	Avg.	%MPC	High	Low	Avg.	%MPC
B (FMPC Outfall - Calculation Concentration in River)	181	.01	<.01	.002	<.1	.36	<.01	.02	.6
A (Upstream Concentration)	26	.03	<.01	.006	<.1	.38	<.01	.07	2.3
C (Downstream Concentration)	30	.04	<.01	.009	<.1	.32	<.01	.06	2.0
C - A Difference	–	NA	NA	.003	<.1	NA	NA	NA	NA
	(1) MPC	20 $\times 10^{-6}$ µc/cc				3 $\times 10^{-6}$ µc/cc			
		Nitrate (ppm)				Chloride (ppm)			
B	181	14	<1	2	5	17	<1	1	.4
A	26	26	2	14	32	69	10	31	12.4
C	30	27	2	14	32	67	10	32	12.8
C - A	–	NA	NA	0	0	NA	NA	1	.4
	(2) MPC	44 ppm				250 ppm			
		Fluoride (ppm)							
B	181	.4	<.1	<.1	8				
A	26	.8	<.1	.3	25				
C	30	.7	<.1	.4	33				
C - A	–	NA	NA	.1	8				
	(2) MPC	1.2 ppm							

NA – Not Applicable
µc/cc – Microcuries per cubic centimeter
ppm – parts per million
(1) – AEC Manual, Chapter 0524
(2) – NLO - State
† – See Figure 3.
NOTE: Figures marked < are taken as the whole figure in averaging.

The above table indicated that the average calculated concentrations (B) of all liquid waste discharged to the river were 8% MPC or less. The difference between upstream and downstream concentration (C - A), essentially the same figure as B arrived at by river sampling, revealed that liquid discharged for all contaminants also averaged 8% MPC or less.

The average concentrations of all sampled contaminants at the downstream position (C) indicates each contaminant was well below the applicable MPC's. It may be concluded from sampling and calculations that the FMPC effluent produced little change in the river's quality.

Part II – Moniroting of Air

During the many involved processes performed at this project various airborne dusts are generated. In order to collect the valuable material, the project uses dust collectors which remove almost all of the generated airborne material. These dust collectors, such as bag collectors, electrostatic precipitators and scrubbing towers are specially designed for each operation and precede all stacks. Air sampling of these exhaust stacks is maintained on a continuous schedule.

An environmental air sampling program has been established to determine the amount of material which is in the air surrounding the project. Air samples, rainwater, and gumpapers from fallout stations are collected around the 1000-acre plant site and at points as far away as 10 miles. The sampling of airborne particulate matter provides a good indication of the amount of material released into the atmosphere by the project. The amount of particulates in the air is calculated by drawing a known quantity of air through a filter medium and analyzing the filter for uranium and radioactivity.

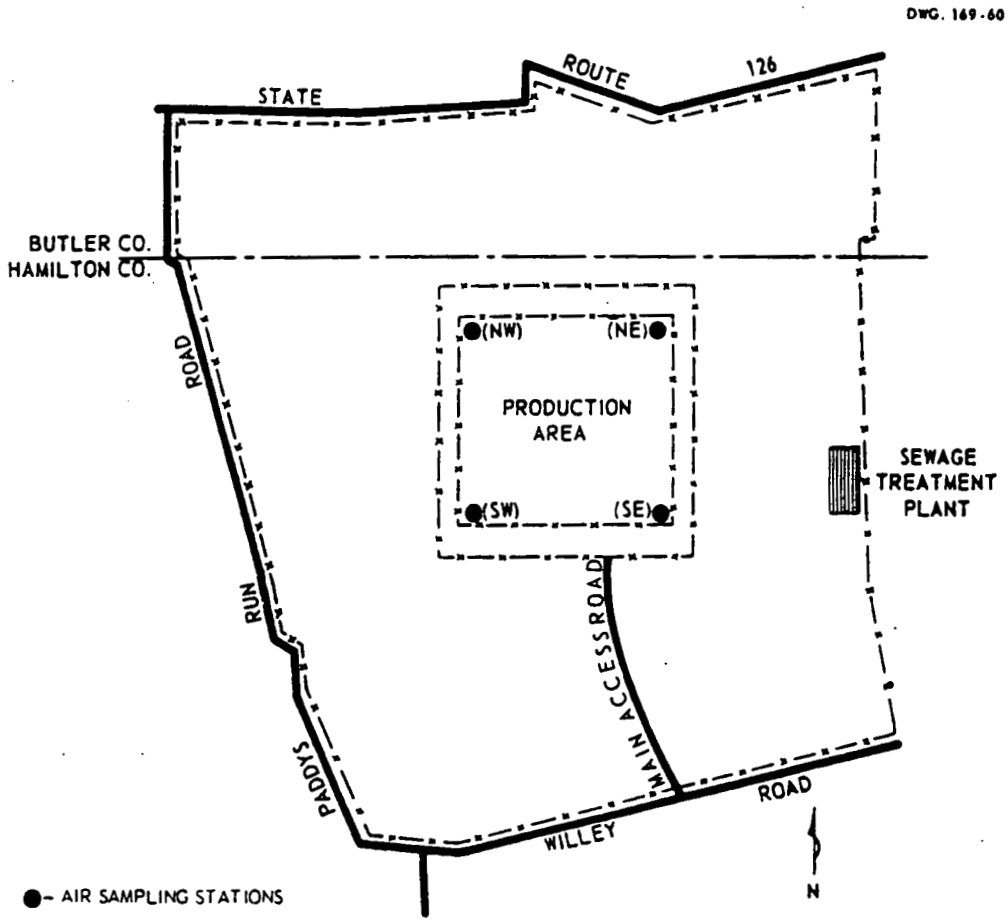

FIGURE 4 Air Sampling Locations (Fernald Area, Feed Materials Production Center and Surrounding Area)

The environmental air samples are divided into two classifications: Perimeter air samples; and "off-site" air samples. There are four permanent air sampling stations at the corners of the production area. These air sampling stations are shown in Figure 4. Samples from these perimeter stations are collected each week and analyzed for uranium and total activity. The off-site samples are collected by air sampling equipment which has been installed in a motor vehicle. These samples are also analyzed for uranium and total activity. The location at which the air samples will be taken is determined by local meterological conditions on the day of sampling. Approximately 20% of all samples are taken upwing of the plant. Replicate samples are taken at each sampling point and averaged to obtain a representative concentration for that location.

A. Air Monitoring Results

Table II indicates the high, average, and low concentrations for perimeter air sampling during the first half of 1965. The MPC's and the percent of the MPC are listed for comparison. The results of sampling indicate that even well within the project area controlled by the AEC, the concentrations averaged only 5% of the MPC for uranium and only 0.4% of the MPC for total radioactivity in uncontrolled areas.

TABLE II Perimeter Air Sampling Results for the First Half of 1965

Location†	No. of Samples	Uranium ($\times 10^{-12}$ μc/cc)				Total Activity ($\times 10^{-12}$ μc/cc)			
		High	Low	Avg.	%MPC	High	Low	Avg.	%MPC
SW	25	.3	<.1	.1	5	2.5	.2	.5	.5
NW	25	.3	<.1	.1	5	.7	.1	.3	.3
NE	26	.4	<.1	.1	5	1.3	.1	.5	.5
SE	26	.2	<.1	.1	5	.5	.1	.3	.3
Average Concentration	–	NA	NA	.1	5	NA	NA	.4	.4
(1) MPC		2×10^{-12} μc/cc				100×10^{-12} μc/cc			

NA – Not Applicable

μc/cc – Microcuries per cubic centimeter

(1) – AEC Manual, Chapter 0524

† – See Figure 4

All of the off-site air samples taken during the first half of 1965 are tabulated in groups depending upon the sampling distance from the project. Table III indicates the high, low and average concentration for the off-site samples in each of the four groups. The MPC's and the percent of the MPC are listed for comparison. The results of sampling indicate that the off-site concentrations averaged only 8% of the MPC for uranium and 0.7% for total radioactivity.

TABLE III Off-Site Air Sampling Results for the First Half of 1965

Group	Distance from FMPC	No. of Samples	Uranium × 10^{-12} μc/cc				Total Activity × 10^{-12} μc/cc			
			High	Low	Avg.	%MPC	High	Low	Avg.	%MPC
I	0 – 2 mi.	26	1.3	<.1	.3	15	10.9	.1	1.5	1.5
II	2 – 4 mi.	26	.1	<.1	<.1	<5	.7	.1	.3	.3
III	4 – 8 mi.	22	.1	<.1	<.1	<5	.6	.2	.33	.3
IV	8 – 12 mi.	8	<.1	<.1	<.1	<5	.2	.2	.2	.2
Average Concentration		NA	NA	NA	.16	8	NA	NA	.7	.7
(1) MPC		–	2×10^{-12} μc/cc*				100×10^{-12} μc/cc **			

NA – Not Applicable

μc/cc – Microcuries per cubic centimeter

(1) – AEC Manual, Chapter 0524

CONCLUSIONS

During the first half of 1965, the amount of material released to the air and water remained at the low level that it had during previous years. The average concentrations of material present in the air and water environ surrounding the FMPC project are well below their respective MPC's. It therefore may be concluded from this report that the Fernald Area Operations added insignificant amounts of material to the surrounding community environment.