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FEED MATERIALS PRODUCTION CENTER ENVIRONMENTAL MONITORING SEMI-ANNUAL REPORT FOR SECOND HALF OF 1970 SUMMARY REPORT FOR 1970

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ENVIRONMENTAL MONITORING SEMI-ANNUAL REPORT

FOR
SECOND HALF
OF 1970
SUMMARY REPORT FOR 1970

Prepared by

HEALTH AND SAFETY DIVISION

NATIONAL LEAD COMPANY OF OHIO
P. O. Box 39158
Cincinnati, Ohio 45239

Contract No. AT(30-1)-1156

Date of Issuance: March, 1971

UNITED STATES ATOMIC ENERGY COMMISSION
CINCINNATI AREA

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FEED MATERIALS PRODUCTION CENTER
ENVIRONMENTAL MONITORING SEMI-ANNUAL REPORT
FOR
SECOND HALF OF 1970
SUMMARY REPORT FOR 1970

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CONTENTS

ABSTRACT

The environmental monitoring program for the sampling of air and water during the second half of 1970 and a summary report for 1970, in the vicinity of the Feed Materials Production Center, Fernald, Ohio is presented. The concentration of materials released to the environment was small in comparison with criteria set by the State of Ohio, and Radiation Protection Guides recommended in AEC Manual Chapter 0524.

INTRODUCTION

ENVIRONMENTAL MONITORING DATA

The following report concerns the environmental monitoring data collected 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 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 away, respectively. (For relative locations see Figure 1).

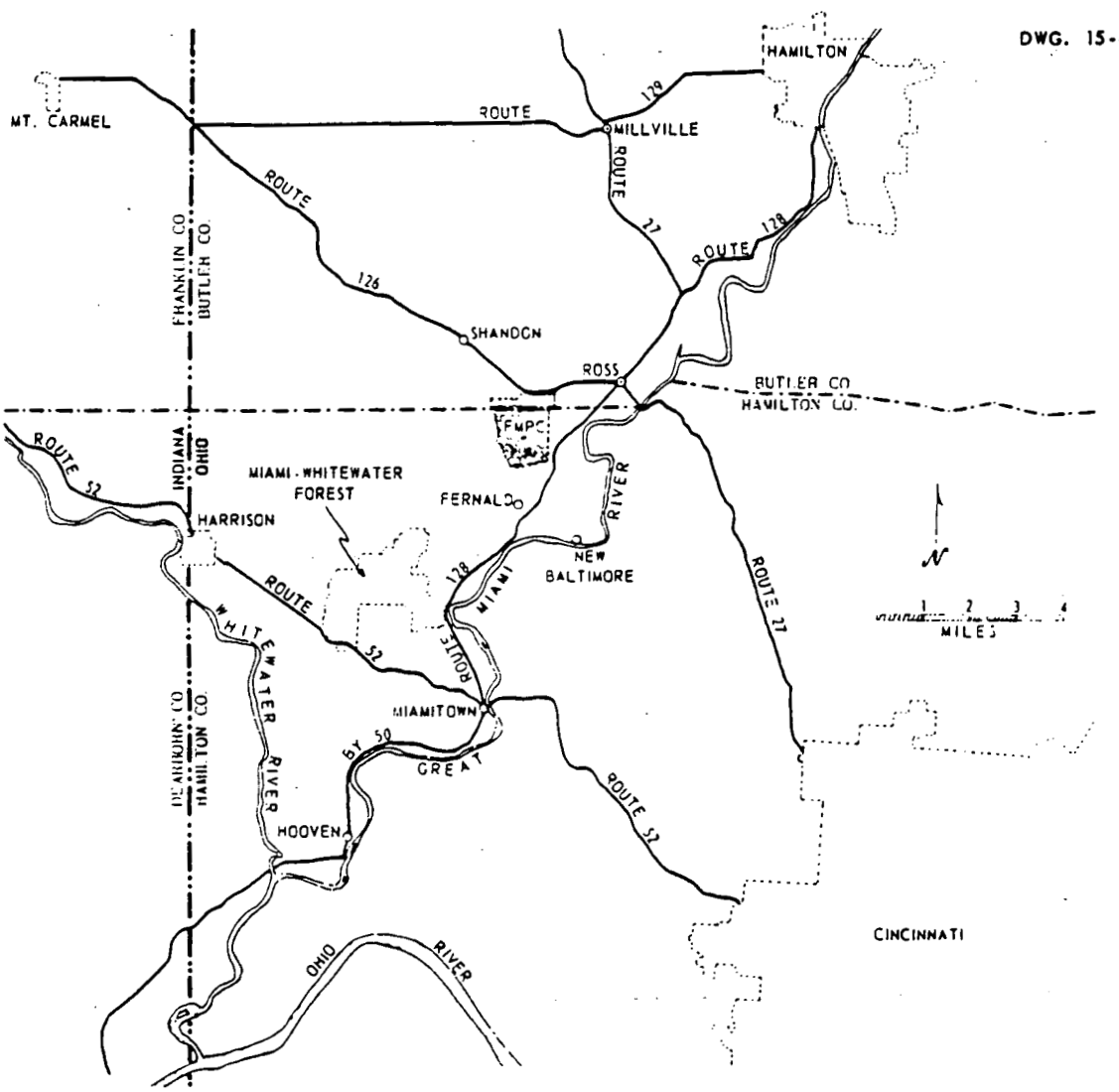

FIGURE 1 Area Map of Relative Locations

Operations at this project deal with the processing of high-grade uranium concentrates to produce metallic uranium. These processes include: acid digestion of the 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 concentrates and recovery of uranium from various residues. The final product is used in the nation's production reactors.

The project also produces some purified thorium compounds and the thorium metal. Production methods are similar to those used for producing uranium.

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 and thorium. Various in-plant methods are used to curtail their release to the environment. Almost complete removal of the materials is accomplished by using dust collectors and waste treatment processes. An environmental monitoring program has been established to determine the concentration of plant materials in the water and air outside the project. 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 AEC and the State of Ohio regulations. 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 uranium from the process wastewater. The effluents from the plants are collected at a general sump for additional treatment and settling. Clear water from the sump is pumped to the river. The solid portion is pumped to a chemical waste pit for further settling. The clear effluent from the pit is then combined with three other types of wastewater 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.

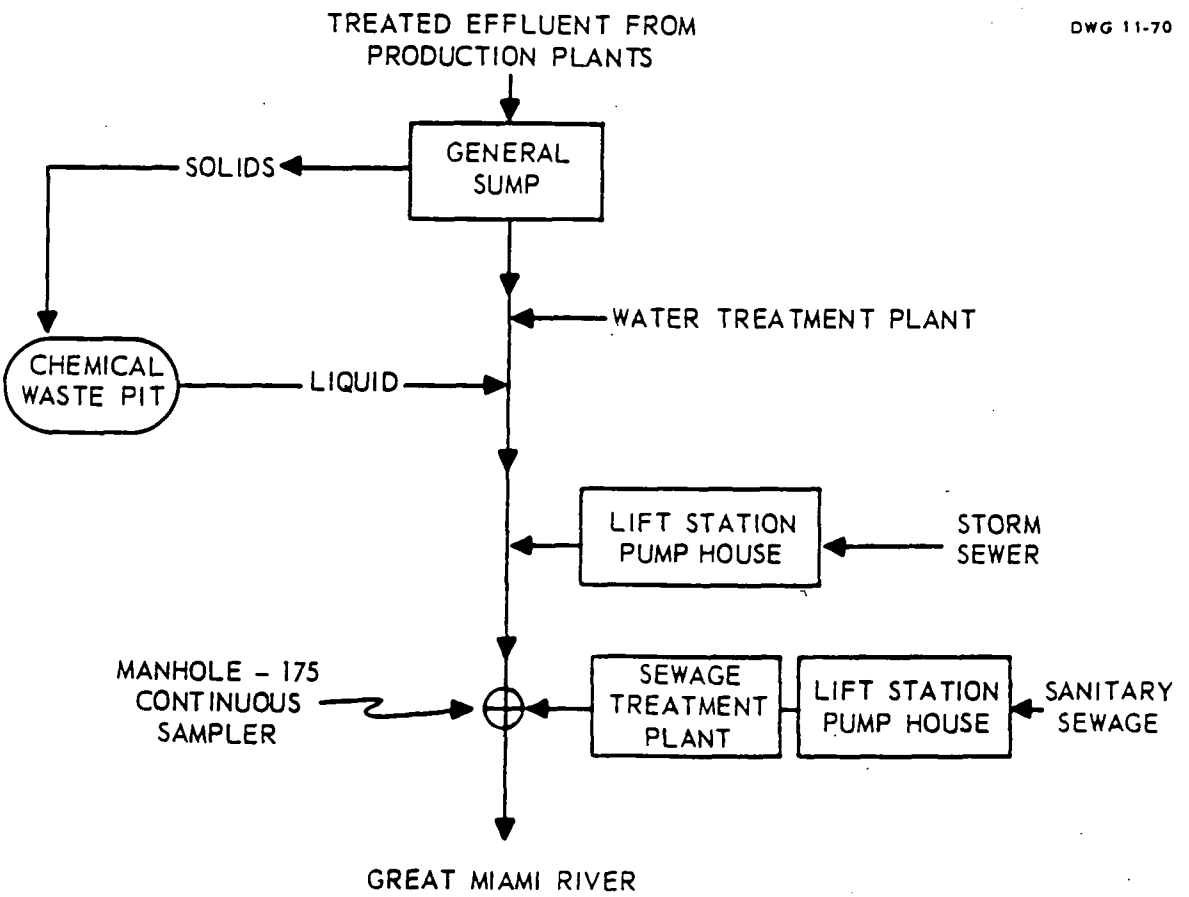

FIGURE 2 Flow Diagram of Chemical Waste and Disposal Process

The locations of the principal effluent and water sampling points are shown in Figure 3. A Parshal Flume type water sampler collects (at point B) samples of the combined effluent stream (see also Figure 2). This sample is collected and analyzed on a daily basis. Results of this analysis utilized with daily measurement of the river flow are the basis for calculating the contaminant concentration added to the river. At point A, upstream from the effluent discharge point, a weekly spot sample is taken for background analysis. At point C, downstream, a continuous sample is taken for a 24-hour period and at least one sample is analyzed each week.

All of these samples are analyzed for uranium, alpha and beta radioactivity, chloride, fluoride, and nitrate. Samples taken at all sampling points are also analyzed for Ra ^{228}, daughter of Th ^{232}. This is the controlling nuclide in the thorium decay chain. Control of this nuclide and gross alpha and beta radioactivity insure that all MPC's for the thorium decay chain are not exceeded.

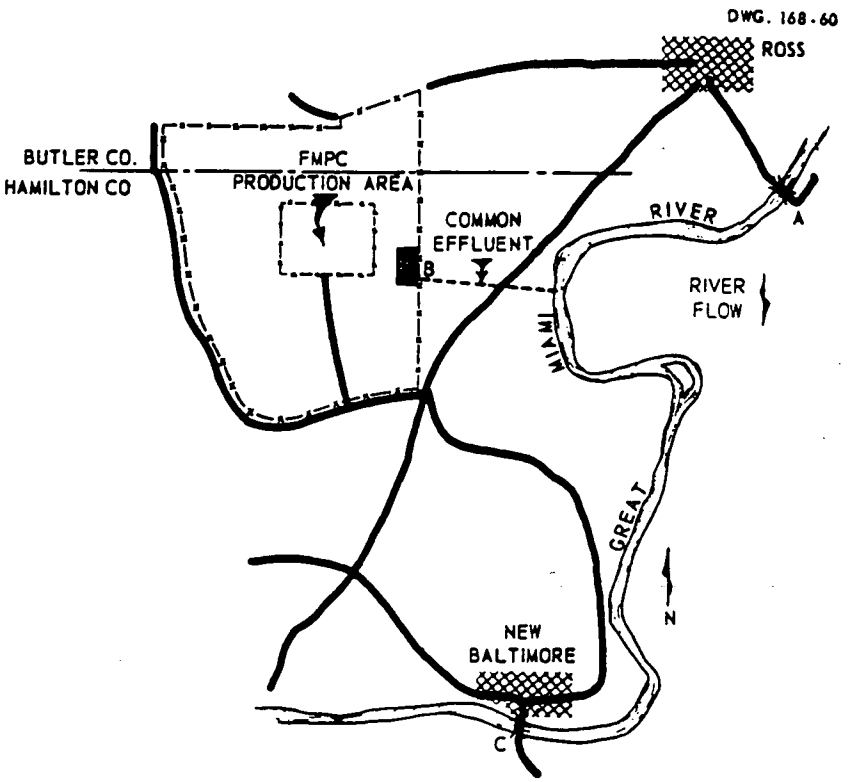

FIGURE 3 Water Sampling Locations (Fernald Area, Feed Materials Production Center and Surrounding Area)

A. Water Monitoring Results

Table I indicates the high, average, and low concentrations of the calculated and sampled contaminants during the second half of 1970. The applicable MPC's and the percent of each MPC are also indicated for comparison.

TABLE I Water Sampling Results for the Second Half of 1970

Location[1]	No. of Samples	Uranium ($\times 10^{-6}$ µCi/ml)[2]				Alpha Activity ($\times 10^{-6}$ µCi/ml)[2]				Beta Activity ($\times 10^{-6}$ µCi/ml)[2]			
		High	Low	Avg.	%MPC	High	Low	Avg.	%MPC	High	Low	Avg.	%MPC
B (FMPC Outfall - Calculated Addition to the River)	183	.007	<.001	.001	.05	.009	<.001	.001	.03	.024	<.001	.018	.60
A (Upstream Concentration)	25	.081	<.001	.007	.04	.105	<.001	.018	.60	.100	<.001	.023	.77
C (Downstream Concentration)	27	.016	<.001	.003	.02	.027	<.001	.007	.23	.027	<.001	.014	.47
	(3)MPC	20×10^{-6} µCi/ml				3×10^{-6} µCi/ml				3×10^{-6} µCi/ml			
		Nitrate (ppm)[5]				Chloride (ppm)[5]				Fluoride (ppm)[5]			
B	183	10	1	2	4.5	3	1	1	.4	.02	.01	.01	.8
A	25	18	4	8	18.2	70	27	55	22.0	.86	.24	.53	44.2
C	27	20	6	13	29.5	70	30	56	22.4	1.70	.28	.62	51.7
	(4)MPC	44 ppm				250 ppm				1.2 ppm			
		$Ra^{228} \times 10^{-9}$ µCi/ml[2]											
B	7	.02	<.01	.01	0.33								
A	6	.05	.05	.05	1.67								
C	6	.23	.05	.10	3.33								
	(3)MPC	3×10^{-8} µCi/ml											

(1) See Figure 3.

(2) µCi/ml – Microcuries per milliliter.

(3) AEC Manual Chapter 0524, Concentration Guides: 20×10^{-6} µCi/ml for natural uranium; 3×10^{-6} µCi/ml for certain mixtures of alpha and beta emitters; 3×10^{-8} µCi/ml for radium-228, the isotope of greatest concern in the thorium-232 decay chain.

(4) NLO – State.

(5) ppm – parts per million.

NOTE: Figures marked < are taken as whole figure in averaging.

The above table indicates that the average calculated concentrations (B) of all liquid waste discharged to the river were 4.5% 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.

B. Annual Water Monitoring Data for 1970

Table II is a summary of both semi-annual reports in regard to effluent concentrations at the FMPC site.

TABLE II Water Sampling Results for 1970

Location(1)	No. of Samples	Uranium ($\times 10^{-6}$ µCi/ml)(2)				Alpha Activity ($\times 10^{-6}$ µCi/ml)(2)				Beta Activity ($\times 10^{-6}$ µCi/ml)(2)			
		High	Low	Avg.	%MPC	High	Low	Avg.	%MPC	High	Low	Avg.	%MPC
B	364	.007	<.001	.001	.05	.009	< 001	.001	.03	.024	<.001	.006	.20
A	52	.081	<.001	.008	.04	.105	<.001	.016	.53	.100	<.001	.022	.73
C	54	.041	<.001	.005	.03	.055	<.001	.009	.30	.064	<.001	.018	.60
	(3)MPC	20×10^{-6} µCi/ml				3×10^{-6} µCi/ml				3×10^{-6} µCi/ml			
		Nitrate (ppm)(5)				Chloride (ppm)(5)				Fluoride (ppm)(5)			
B	364	10	1	2	4.5	3	1	1	.4	.03	.01	.01	.8
A	52	38	3	14	31.8	89	19	46	18.4	1.50	.24	.58	48.3
C	54	44	6	16	36.4	93	19	47	18.8	1.70	.28	.60	50.0
	(4)MPC	44 ppm				250 ppm				1.2 ppm			
		$Ra^{228} \times 10^{-6}$ µCi/ml (2)											
B	16	.10	<.01	.03	1.00								
A	12	.91	.05	.17	5.67								
C	12	.23	.05	.10	3.33								
	(3)MPC	3×10^{-6} µCi/ml											

(1) See Figure 3.

(2) µCi/ml – Microcuries per milliliter.

(3) AEC Manual Chapter 0524, Concentration Guides: 20×10^{-6} µCi/ml for natural uranium; 3×10^{-6} µCi/ml for certain mixtures of alpha and beta emitters; 3×10^{-6} µCi/ml for radium-228, the isotope of greatest concern in the thorium-232 decay chain.

(4) NLO – State

(5) ppm – parts per million.

NOTE: Figures marked < are taken as whole figure in averaging.

The MPC's for nitrate, chloride, and fluoride were established by the National Lead Company of Ohio and the State of Ohio as a quide for waste effluent operations. The NLO-State values refer to a time-weighted average concentration and not to daily outputs. The average concentrations found downstream were 16 ppm nitrate, 47 ppm chloride, and 0.6 ppm fluoride, all of which are well below the respective MPC's.

The results of the monitoring of liquid effluents in 1970 indicate they averaged well below the maximum permissible concentrations for uranium, radium-228, total radioactivity, chloride, fluoride, and nitrate. The results for 1970 are of the same magnitude as they have been in past years.

Part II – Monitoring 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. The 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 are collected around the 1000-acre plant 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. A known quantity of air is drawn through a filter medium which is then analyzed for uranium and radioactivity. An analysis for thorium is not considered necessary because of the small amount of thorium handled on the project.

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 meteorological conditions on the day of sampling. Approximately 80% of all samples are taken downwind of the plant. Replicate samples are taken at each sampling point and averaged to obtain a representative concentration for that location.

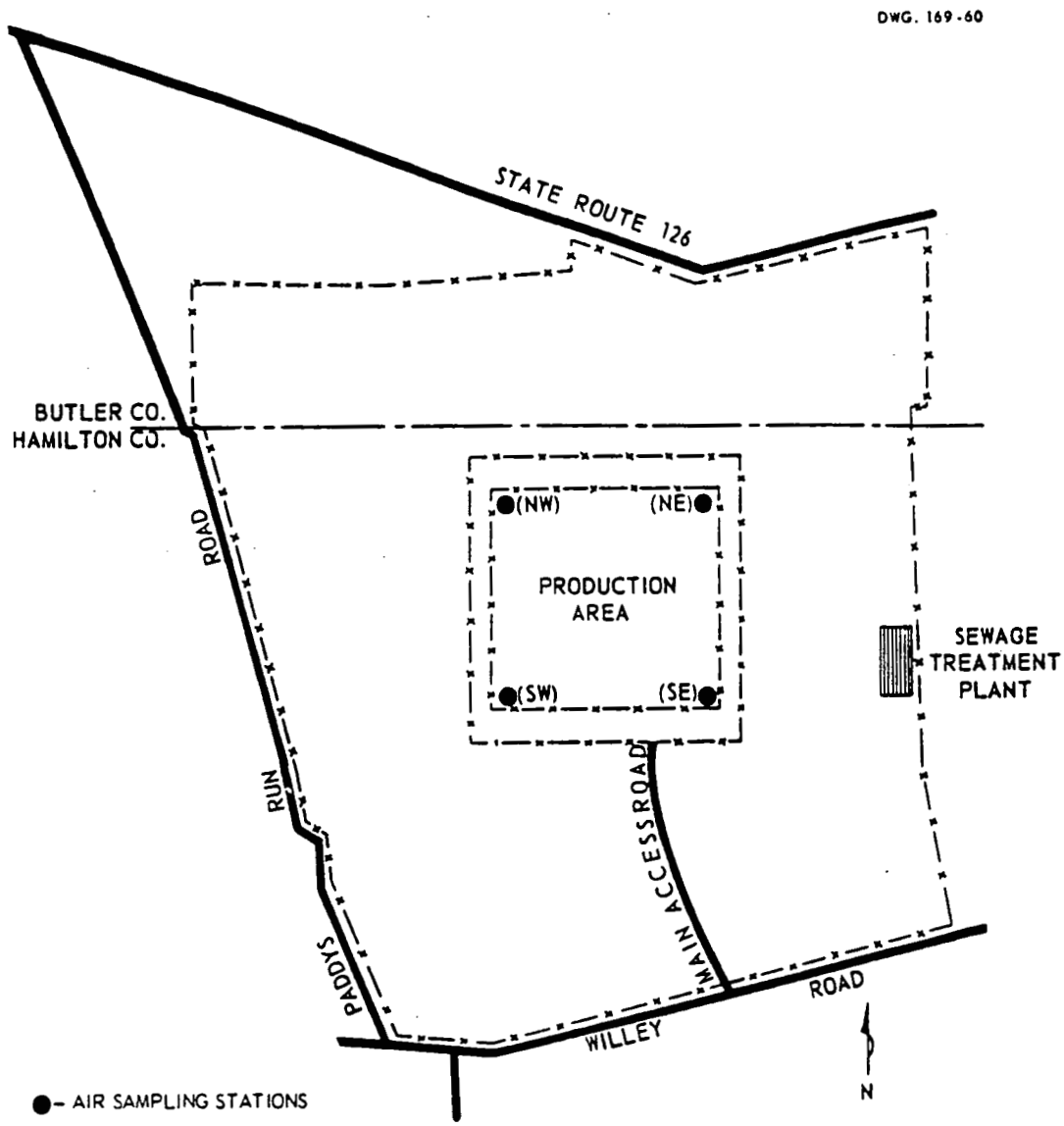

FIGURE 4 Air Sampling Locations (Fernald Area, Feed Materials Production Center and Surrounding Area)

A. Air Monitoring Results

Table III shows the high, average, and low concentrations for perimeter air sampling during the second half of 1970. The MPC's and the per cent of 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 1.6% of the MPC for uranium and 2.1% of the MPC for alpha radioactivity, and .01% of the MPC for beta radioactivity.

TABLE III Perimeter Air Sampling Results for the Second Half of 1970

Location(1)	No. of Samples	Uranium $\times 10^{-12}$ µCi/ml (2)				Alpha Activity $\times 10^{-12}$ µCi/ml (2)				Beta Activity $\times 10^{-12}$ µCi/ml(2)			
		High	Low	Avg.	%MPC	High	Low	Avg.	%MPC	High	Low	Avg.	%MPC
SW	25	.08	.01	.03	1.50	.10	.01	.04	2.00	.31	.01	.13	.01
NW	25	.08	.01	.03	1.50	.16	.01	.04	2.00	.21	.04	.10	.01
NE	25	.13	.01	.04	2.00	.18	.01	.05	2.50	.24	.02	.11	.01
SE	25	.10	.01	.03	1.50	.16	.01	.04	2.00	.24	.01	.11	.01
Average Concentration	–	NA	NA	.03	1.60	NA	NA	.04	2.10	NA	NA	.11	.01
(4) MPC		2×10^{-12} µCi/ml				2×10^{-12} µCi/ml				1000×10^{-12} µCi/ml			

(1) See Figure 4.

(2) µCi/ml – Microcuries per milliliter.

(3) NA – Not Applicable.

(4) AEC Manual Chapter 0524, Concentration Guides: 2×10^{-12} µCi/ml for natural uranium, alpha radioactivity; 1000×10^{-12} µCi/ml for Th^{234}, a beta emitting daughter product of U^{238}.

All of the off-site air samples taken during the second half of 1970 are tabulated in groups depending upon the sampling distance from the project. Table IV indicates the high, low, and average concentration for the off-site samples in each of the four groups. The MPC's and the per cent of the MPC are listed for comparison. The results of sampling indicate that the off-site concentrations averaged only 1.77% of the MPC for uranium and 1.77% of the MPC for alpha radioactivity, and .02% of the MPC for beta radioactivity.

TABLE IV Off-Site Air Sampling Results for the Second Half of 1970

Group	Distance from FMPC	No. of Samples	Uranium $\times 10^{-12}$ µCi/ml(1)				Alpha Activity $\times 10^{-12}$ µCi/ml(1)				Beta Activity $\times 10^{-12}$ µCi/ml(1)			
			High	Low	Avg.	%MPC	High	Low	Avg.	%MPC	High	Low	Avg.	%MPC
I	0 – 2 mi.	20	.11	.01	.05	2.50	.13	.01	.05	2.50	1.51	.05	.26	.03
II	2 – 4 mi.	18	.08	.01	.03	1.50	.07	.01	.03	1.50	.21	.05	.13	.01
III	4 – 8 mi.	28	.12	.01	.03	1.50	.12	.01	.03	1.50	.54	.01	.22	.02
IV	8 – 12 mi..	8	.04	.01	.03	1.50	.04	.01	.03	1.50	.15	.07	.10	.01
Average Concentration		–	NA	NA	.04	1.77	NA	NA	.04	1.77	NA	NA	.20	.02
(3) MPC			2×10^{-12} µCi/ml				2×10^{-12} µCi/ml				1000×10^{-12} µCi/ml			

(1) µCi/ml – Microcuries per milliliter.

(2) NA – Not Applicable.

(3) AEC Manual Chapter 0524, Concentration Guides: 2×10^{-12} µCi/ml for natural uranium, alpha radioactivity; 1000×10^{-12} µCi/ml for Th^{234}, a beta emitting daughter product of U^{238}.

B. Annual Air Monitoring Data for 1970

Table V indicated the high, average, and low concentrations for perimeter air sampling during 1970. 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 owned and controlled by the AEC, the concentrations averaged only 2.75% of the MPC for uranium and 3.13% of the MPC for alpha radioactivity, and .02% of the MPC for beta radioactivity.

TABLE V Perimeter Air Sampling Results for 1970

Location(1)	No. of Samples	Uranium $\times 10^{-12}$ µCi/ml(2)				Alpha Activity $\times 10^{-12}$ µCi/ml (2)				Beta Activity $\times 10^{-12}$ µCi/ml(2)			
		High	Low	Avg.	%MPC	High	Low	Avg.	%MPC	High	Low	Avg.	%MPC
SW	51	.94	.01	.08	4.00	.94	.01	.10	5.00	1.42	.01	.18	.02
NW	51	.11	.01	.04	2.00	.16	.01	.04	2.00	.38	.02	.12	.01
NE	51	.31	.01	.06	3.00	.31	.01	.07	3.50	.68	.02	.16	.02
SE	51	.13	.01	.04	2.00	.16	.01	.04	2.00	.39	.01	.12	.01
Average Concentration	—	NA	NA	.06	2.75	NA	NA	.06	3.13	NA	NA	.15	.02
(4) MPC		2×10^{-12} µCi/ml				2×10^{-12} µCi/ml				1000×10^{-12} µCi/ml			

(1) See Figure 4.

(2) µCi/ml – Microcuries per milliliter.

(3) NA – Not Applicable.

(4) AEC Manual Chapter 0524, Concentration Guides: 2×10^{-12} µCi/ml for natural uranium, alpha radioactivity; 1000×10^{-12} µCi/ml for Th^{234}, a beta emitting daughter product of U^{238}.

All of the off-site air samples taken during 1970 are tabulated in groups depending upon the sampling distance from the project. Table VI indicates the high, low, and average concentration for the off-site samples in each of the four groups. The MPC's and the per cent of the MPC are listed for comparison. The results of sampling indicate that the off-site concentrations averaged only 1.82% of the MPC for uranium, 1.82% of the MPC for alpha radioactivity, and .03% of MPC for beta radioactivity.

TABLE VI Off-Site Air Sampling Results for 1970

Group	Distance from FMPC	No. of Samples	Uranium $\times 10^{-12}$ µCi/ml(1)				Alpha Activity $\times 10^{-12}$ µCi/ml (1)				Beta Activity $\times 10^{-12}$ µCi/ml(1)			
			High	Low	Avg.	%MPC	High	Low	Avg.	%MPC	High	Low	Avg.	%MPC
I	0 – 2 mi.	32	.11	.01	.04	2.50	.13	.01	.05	2.50	1.51	.03	.19	.02
II	2 – 4 mi.	30	.08	.01	.03	1.50	.07	.01	.03	1.50	.21	.03	.11	.01
III	4 – 8 mi.	45	.12	.01	.03	1.50	.12	.01	.03	1.50	.54	.02	.14	.01
IV	8 – 12 mi.	12	.11	.01	.04	2.00	.14	.01	.05	2.00	.61	.07	.27	.03
Average Concentration		–	NA	NA	.03	1.82	NA	NA	.04	1.82	NA	NA	.16	.01
(3) MPC			2×10^{-12} µCi/ml				2×10^{-12} µCi/ml				1000×10^{-12} µCi/ml			

(1) µCi/ml – Microcuries per milliliter.

(2) NA – Not Applicable.

(3) AEC Manual Chapter 0524, Concentration Guides: 2×10^{-12} µCi/ml for natural uranium, alpha radioactivity; 1000×10^{-12} µCi/ml for Th^{234}, a beta emitting daughter product of U^{238}.

CONCLUSIONS

During the second half of 1970, the amount of material released to the air and water remained at the low level that it had during previous years. The results of monitoring for 1970 are of the same magnitude as they have been in the past years. The average concentrations of material present in the air and water environ surrounding the FMPC project was well below their respective MPC's. It therefore may be concluded from this report that the Atomic Energy Commission operations added insignificant amounts of material to the surrounding community environment.

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