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FEED MATERIALS PRODUCTION CENTER ENVIRONMENTAL MONITORING SEMI-ANNUAL REPORT FOR SECOND HALF OF 1968 SUMMARY REPORT FOR 1968

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FEED MATERIALS PRODUCTION CENTER

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ENVIRONMENTAL MONITORING SEMI-ANNUAL REPORT

FOR
SECOND HALF
OF 1968
SUMMARY REPORT FOR 1968

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: February, 1969

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 second half of 1968 and a summary report for 1968, in the vicinity of the Feed Materials Production Center, Fernald, Ohio is presented. The amount of materials 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).

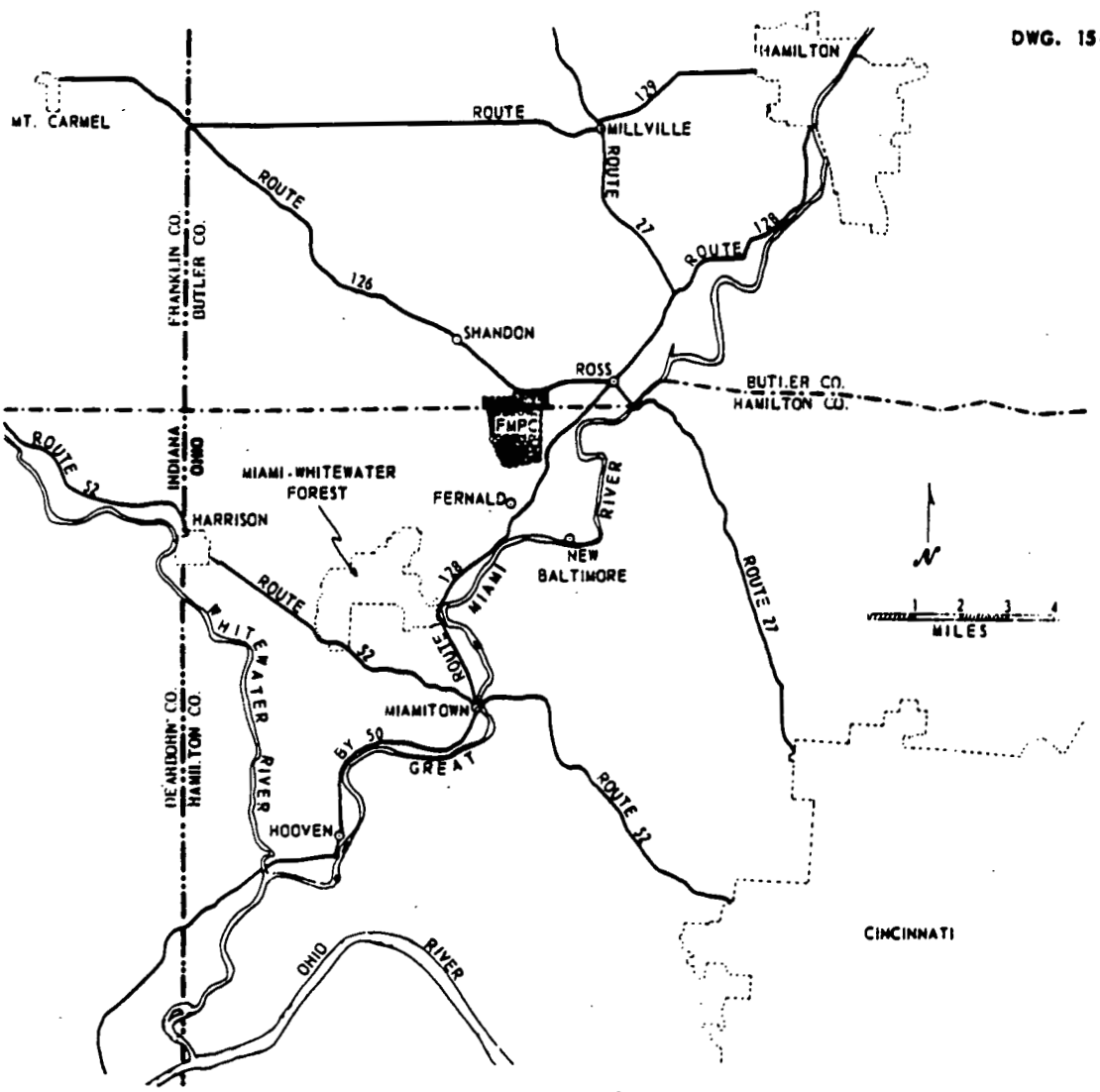

FIGURE 1 Area Map of Relative Locations

Operations at this project deal with the processing of high-grade uranium 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 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 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 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.

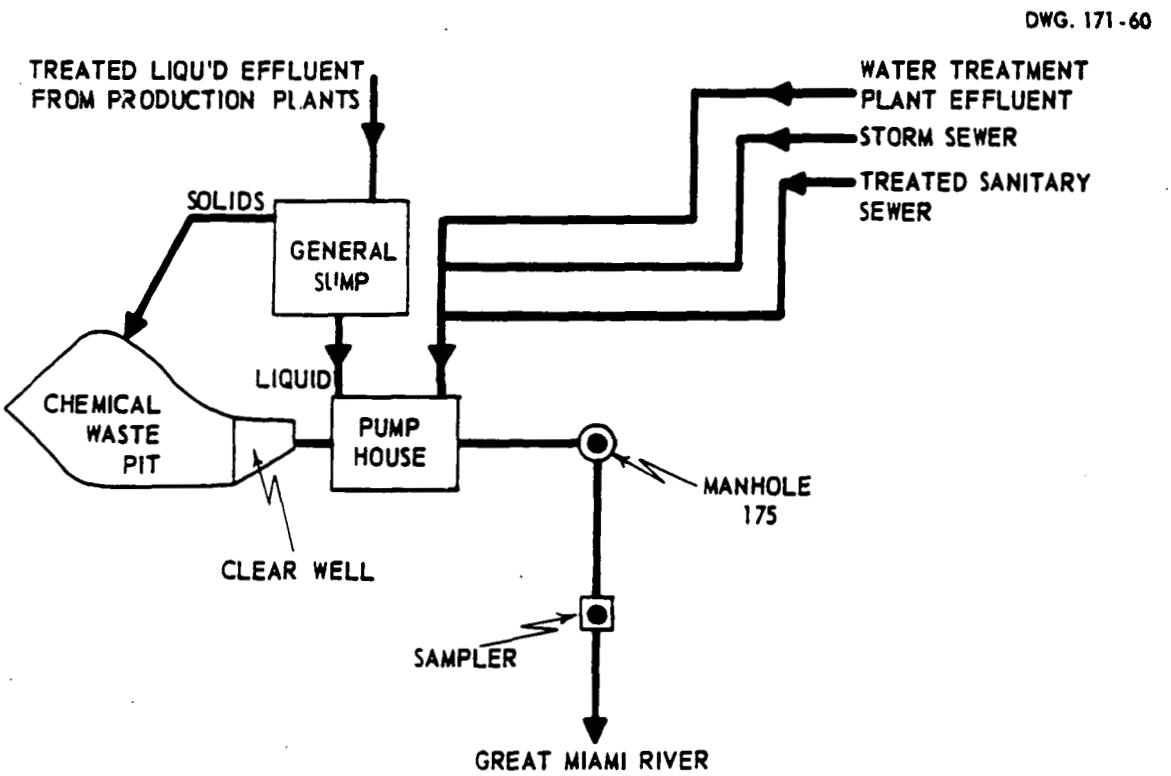

FIGURE 2 Flow Diagram of Chemical Waste and Disposal Process

The locations of 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 random samples are analyzed each week. Samples of the storm sewer overflow are collected in an automatic flow integrated sampler when overflow occurs.

All of these samples are analyzed for uranium, total activity, chloride, fluoride, and nitrate.

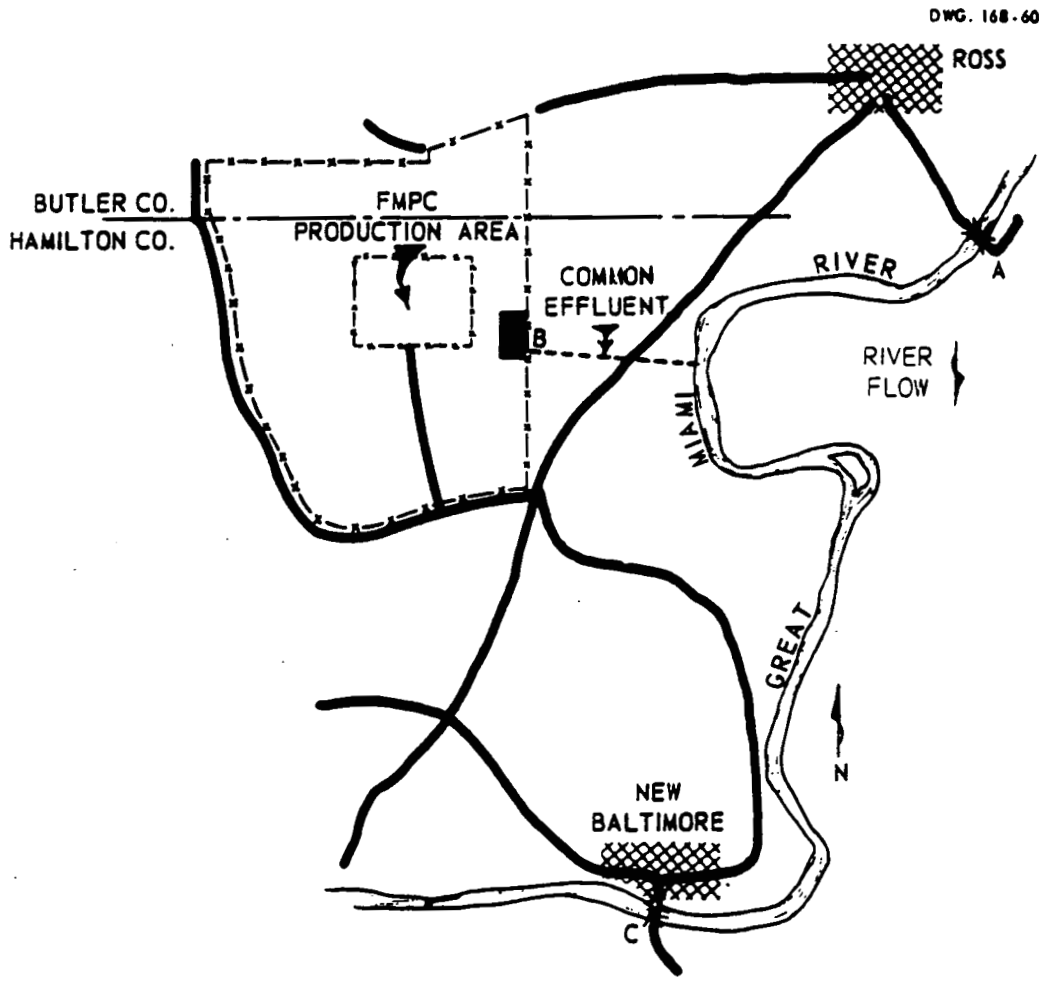

FIGURE 3 Water Sampling Locations (Fernald Area, Feed Materials Production Center and Surrounding Area)

A. Water Monitoring Results

Table I indicates the high, average, and low concentrations of the calculated and sampled contaminants during the second half of 1968. 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 1968

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)	184	.02	<.01	<.01	<.1	.07	<.01	.01	0.3
A (Upstream Concentration)	21	.01	<.01	.007	<.1	.06	<.01	.02	0.7
C (Downstream Concentration)	25	.05	<.01	.010	<.1	.09	.01	.03	1.0
C - A Difference	–	NA	NA	.003	0	NA	NA	.01	0.3
	(1) MPC	20×10^{-6} µc/cc*				3×10^{-6} µc/cc*			
		Nitrate (ppm)				Chloride (ppm)			
B	184	15	<1	3	7	3	<1	<1	<1
A	21	17	6	9	20	56	18	39	16
C	25	23	8	14	32	56	15	39	16
C - A	–	NA	NA	5	12	NA	NA	0	0
	(2) MPC	44 ppm				250 ppm			
		Fluoride (ppm)							
B	184	.1	<.1	<.1	8				
A	21	.8	.3	.5	42				
C	25	.8	.3	.5	42				
C - A	–	NA	NA	0	0				
	(2) MPC	1.2 ppm							
		$Ra^{228} \times 10^{-10}$ µc/cc*							
B	7	35.0	.2	7.1	2.4				
A	No Analysis Performed								
C	3	0.00002	0.00001	0.00001	<0.01				
	(1) MPC	300×10^{-10} µc/cc*							

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 indicates 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 averaged 12% 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 1968

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 1968

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	366	.02	<.01	<.01	<.1	.08	<.01	.02	0.7
A	45	.01	<.01	.006	<.1	.08	<.01	.03	1.0
C	56	.05	<.01	.007	<.1	.09	<.01	.03	1.0
C-A	–	NA	NA	.001	0	NA	NA	0	0
	(1) MPC	20×10^{-6} µc/cc*				3×10^{-6} µc/cc*			
		Nitrate (ppm)				Chloride (ppm)			
B	366	15	<1	3	7	3	<1	<1	<1
A	45	20	5	11	25	71	8	37	15
C	56	23	8	15	34	75	9	37	15
C-A	–	NA	NA	4	9	NA	NA	0	0
	(2) MPC	44 ppm				250 ppm			
		Fluoride (ppm)							
B	366	.1	<1	<.1	<8				
A	45	.8	.2	.4	33				
C	56	.8	.2	.4	33				
C-A	–	NA	NA	0	0				
	(2) MPC	1.2 ppm							
		$Ra^{228} \times 10^{-10}$ µc/cc*							
B	12	35.0	.1	5.9	2.0				
A	No Analysis Performed								
C	7	0.00003	0.00001	0.00002	<0.01				
	(1) MPC	300×10^{-10} µc/cc*							

NA – Not Applicable

*µc/cc – Microcuries per cubic centimeter

ppm – parts per million

(1) – AEC Manual, Chapter 0524.

(2) – NLO-State

† – See Figure 3.

The MPC's for nitrate, chloride, and fluoride were established by the National Lead Company of Ohio and the State of Ohio as a guide for waste effluent operations. The NLO-State values refer to a time-weighted average concentration and not to daily outputs. The sampled average concentrations downstream for nitrates was 15 ppm, 37 ppm for chlorides and 0.4 ppm for fluorides, all of which are well below their respective MPC's.

Two methods of measuring the FMPC contributions in the Great Miami River (Lines B and C-A in Table II) are employed and the results obtained from the two methods compare with each other quite favorably. All effluent additions to the river by these two methods averaged 9% MPC or less. This is an indication of the small quantity of waste effluent that was added in relation to the applicable MPC's.

The results of the monitoring of liquid effluents in 1968 indicate they averaged well below the maximum permissible concentrations for uranium, radium-228, total radioactivity, chlorides, fluorides and nitrates. The results for 1968 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. 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.

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 20% of all samples are taken upwind of the plant. Replicate samples are taken at each sampling point and averaged to obtain a representative concentration for that location.

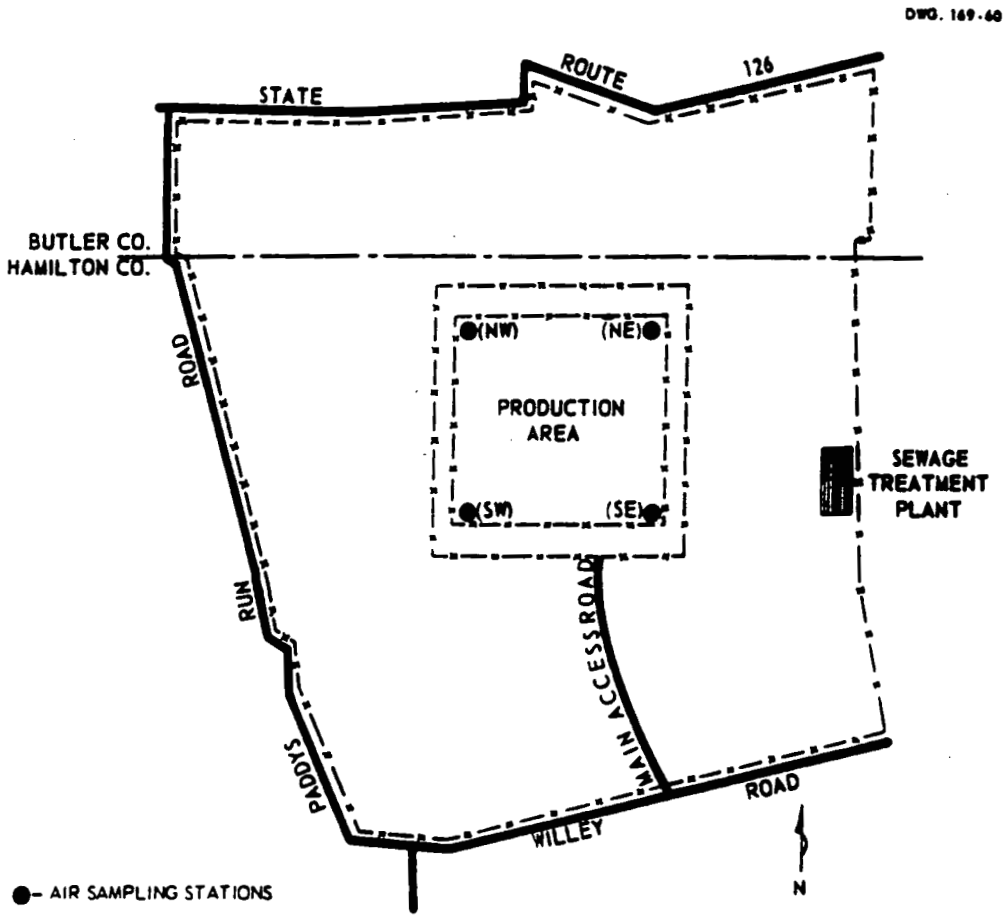

FIGURE 4 Air Sampling Locations (Fernald Area, Feed Materials Production Center and Surrounding Area)

A. Air Monitoring Results

Table III shows the high, average, and low concentrations for perimeter air sampling during the second half of 1968. The MPC's and the per cent 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 8% of the MPC for uranium and 0.4% of the MPC for total radioactivity.

TABLE III Perimeter Air Sampling Results for the Second Half of 1968

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 ††	5	.1	<.1	<.1	<5	.2	<.1	.1	.1
NW	26	1.0	<.1	.1	5	2.1	<.1	.3	.3
NE	26	.5	<.1	.2	10	.9	.1	.4	.4
SE	26	1.0	<.1	.2	10	1.9	<.1	.4	.4
Average Concentration	–	NA	NA	.2	8	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

†† – Number of samples limited to 5 was due to electric power cable becoming defective July, 1968 and repaired the latter part of November, 1968

All of the off-site air samples taken during the second half of 1968 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 5% of the MPC for uranium and 0.2% for total radioactivity.

TABLE IV Off-Site Air Sampling Results for the Second Half of 1968

Group	Distance from FMPC	No. of Samples	Uranium $\times 10^{-12}$ µc/cc *				Total Activity $\times 10^{-12}$ µc/cc *			
			High	Low	Avg.	%MPC	High	Low	Avg.	%MPC
I	0 – 2 mi.	26	.3	<.1	<.1	<5	.8	<.1	.2	.2
II	2 – 4 mi.	32	.2	<.1	<.1	<5	.5	<.1	.2	.2
III	4 – 8 mi.	33	.4	<.1	<.1	<5	.6	<.1	.1	.1
IV	8 – 12 mi.	16	.1	<.1	<.1	<5	.3	<.1	.2	.2
Average Concentration		–	NA	NA	.1	5	NA	NA	.2	.2
(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.

B. Annual Air Monitoring Data For 1968

Table V indicates the high, average, and low concentrations for perimeter air sampling during 1968. The MPC's and the per cent 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 6% of the MPC for uranium and 0.3% of the MPC for total radioactivity.

TABLE V Perimeter Air Sampling Results for 1968

Location†	No. of Samples	Uranium × 10^{-12} μc/cc*				Total Activity × 10^{-12} μc/cc*			
		High	Low	Avg.	%MPC	High	Low	Avg.	%MPC
SW	32	.7	<.1	.2	10	1.3	<.1	.4	.4
NW	53	1.0	<.1	.1	5	2.1	<.1	.2	.2
NE	53	.5	<.1	.1	5	.9	.1	.4	.4
SE	53	1.0	<.1	.1	5	1.9	<.1	.4	.4
Average Concentration	–	NA	NA	.1	6	NA	NA	.3	.3
(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 1968 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 5% of the MPC for uranium and 0.3% for total radioactivity during 1968.

TABLE VI Off-Site Air Sampling Results for 1968

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.	62	.5	<.1	.1	5	1.4	<.1	.5	.5
II	2 – 4 mi.	70	.2	<.1	<.1	<5	.9	<.1	.3	.3
III	4 – 8 mi.	55	.4	<.1	<.1	<5	.6	<.1	.2	.2
IV	8 – 12 mi.	32	.1	<.1	<.1	<5	.5	<.1	.2	.2
Average Concentration		–	NA	NA	.1	5	NA	NA	.3	.3
(1) MPC			2 × 10^{-12} μc/cc*				100 × 10^{-12} μc/cc*			

NA – Not Applicable

*μc/cc – Microcuries per cubic centimeters

(1) – AEC Manual, Chapter 0524.

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CONCLUSIONS

During the second half of 1968, 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 1968 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 Fernald Area Operations added insignificant amounts of material to the surrounding community environment.