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FEED MATERIALS PRODUCTION CENTER ENVIRONMENTAL MONITORING QUARTERLY REPORT OCTOBER - NOVEMBER - DECEMBER 1960 & SUMMARY REPORT FOR 1960

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FEED MATERIALS PRODUCTION CENTER
ENVIRONMENTAL MONITORING QUARTERLY REPORT

OCTOBER - NOVEMBER - DECEMBER

1960

and

SUMMARY REPORT FOR 1960

Prepared by

HEALTH AND SAFETY DIVISION

NATIONAL LEAD COMPANY OF OHIO
P. O. Box 158
Cincinnati 39, Ohio

Contract No. AT(30-1)-1156

Date of Report: January 10, 1961
Date of Issuance: February 1, 1961

UNITED STATES ATOMIC ENERGY COMMISSION
FERNALD AREA

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ABSTRACT

The environmental monitoring program for the sampling of air and water during the fourth quarter of 1960 and the annual summary report for the year 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 performed 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).

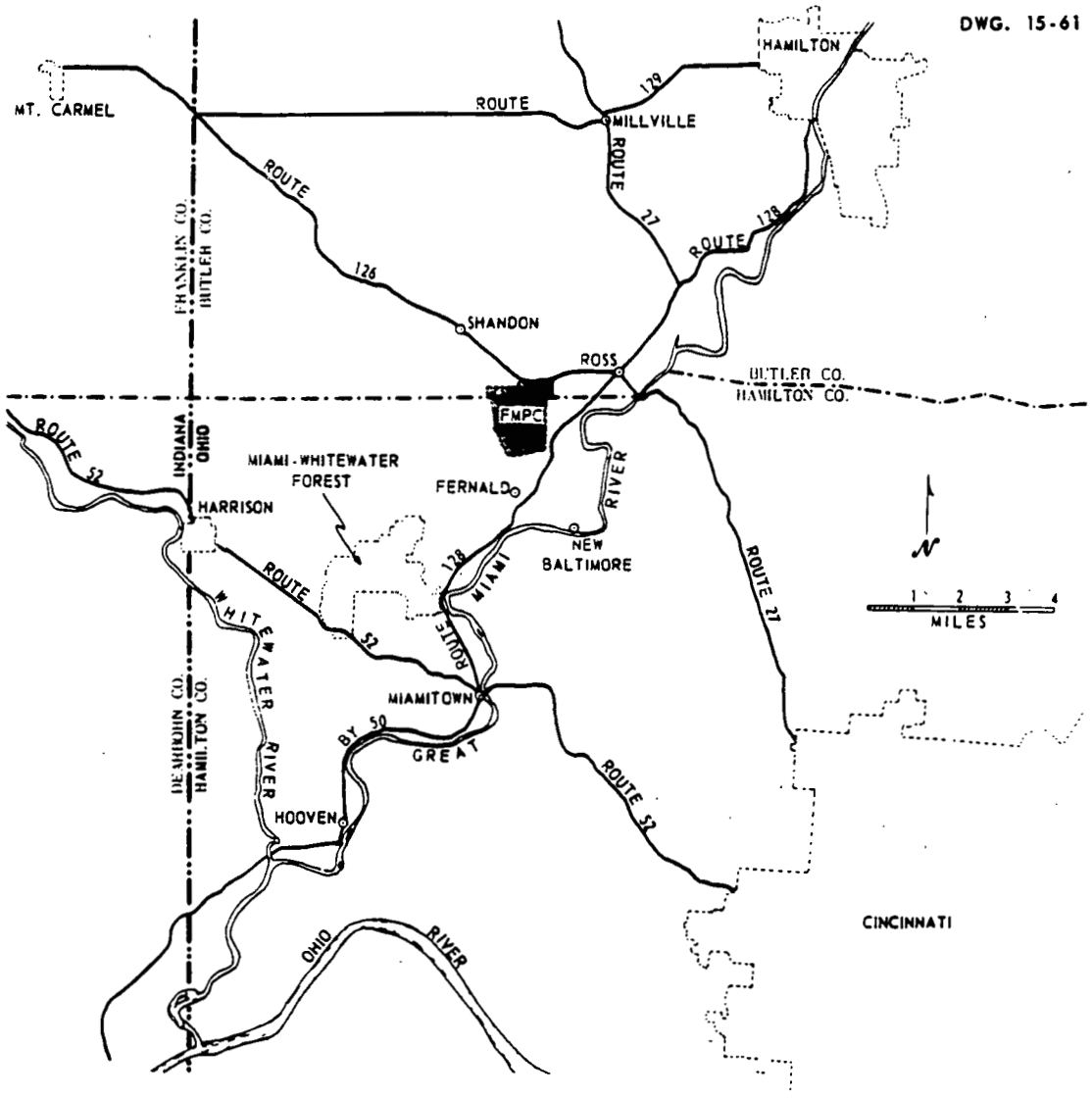

FIGURE 1 Area Map of Relative Locations

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 establish 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 released material from the plants. The results of this program in past years and to the present report indicated that the control of 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 fourth quarter sampling and the annual summary report for 1960.

Part I - Monitoring of Water

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.

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 central point for equalization. The water passes to a chemical waste pit, as seen in Figure 2, which serves as a settling basin for removal of any remaining settleable solids from the water. 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.

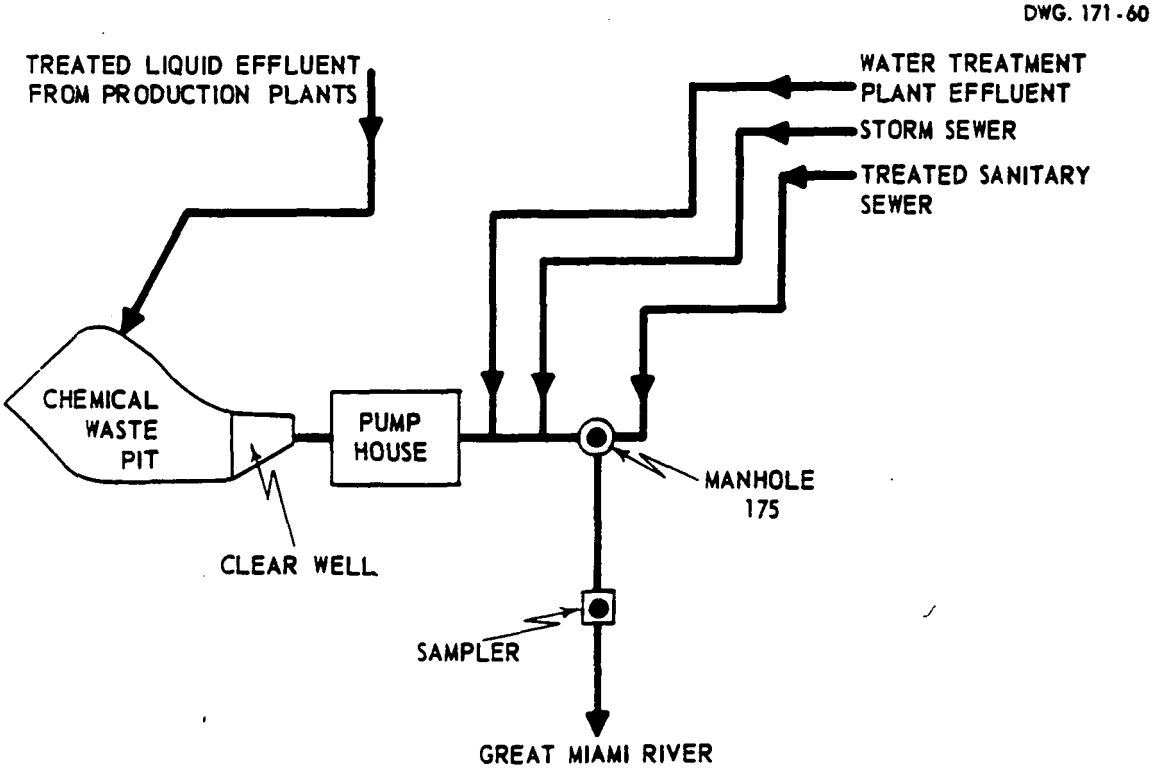

FIGURE 2 Flow Diagram of Chemical Waste and Disposal Process

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.

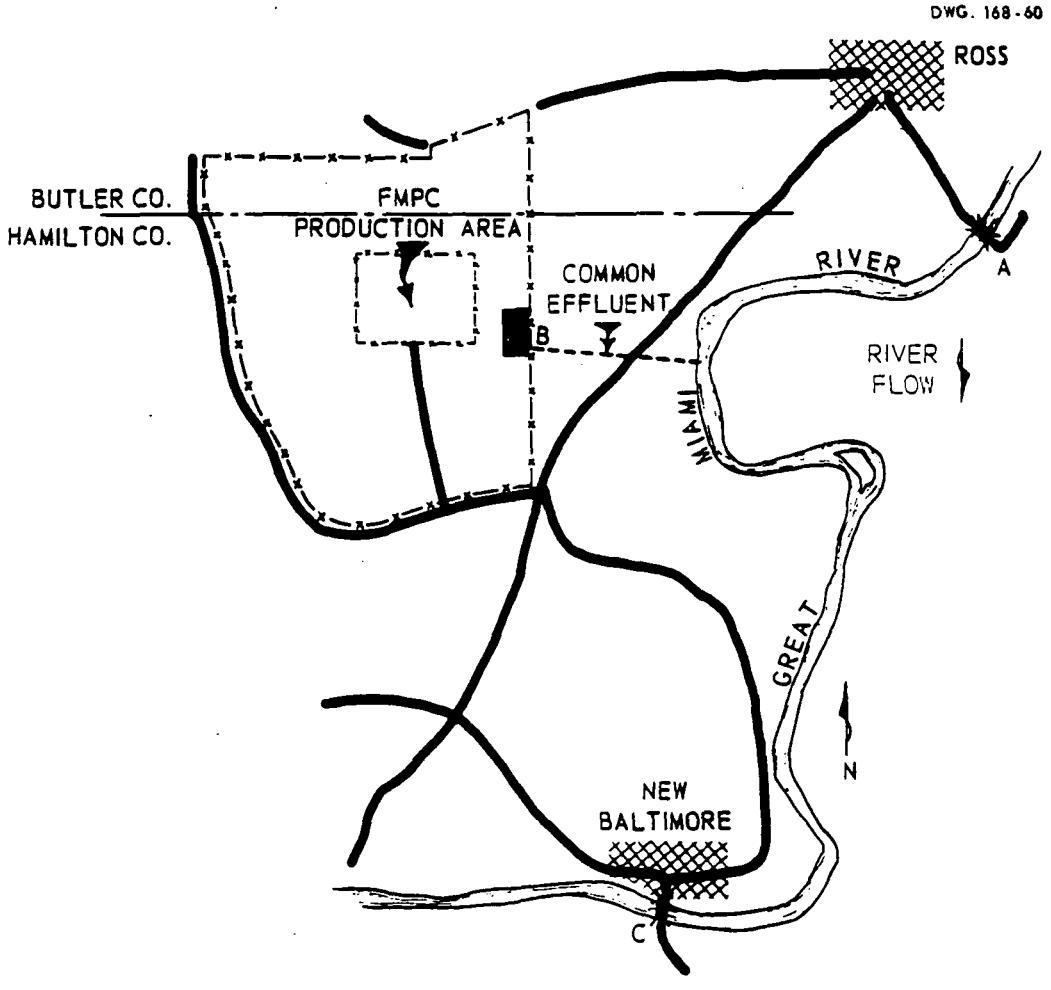

FIGURE 3 Water Sampling Locations (Fernald Area, Feed Materials Production Center and Surrounding Area)

A. Fourth Quarter Monitoring Results

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

TABLE I Water Sampling Results for Fourth Quarter of 1960

Location†	No. of Samples	Uranium ($\times 10^{-8}$ $\mu c/cc$)				Total Activity ($\times 10^{-8}$ $\mu c/cc$)			
		High	Low	Avg.	% MPC	High	Low	Avg.	% MPC
B (FMPC Outfall-Calculated Concentration in River)	92	.059	.005	.013	.07	.090	.004	.018	.60
A (Upstream Concentration)	19	.143	.002	.015	.08	.137	.005	.038	1.30
C (Downstream Concentration)	19	.102	.001	.021	.10	.146	.009	.045	1.50
C-A (Difference)	–	NA	NA	.006	.03	NA	NA	.007	.23
	(1) MPC	20×10^{-8} $\mu c/cc$*				3×10^{-8} $\mu c/cc$**			
		Nitrate (ppm)				Chloride (ppm)			
B	92	50.75	3.60	14.16	32.2	21.25	4.80	10.14	8.5
A	19	18.00	1.00	4.75	10.8	75.00	29.00	42.84	17.1
C	19	29.00	1.00	9.86	22.4	82.00	34.00	49.31	19.7
C-A	–	NA	NA	5.11	10.6	NA	NA	6.47	2.6
	(2) MPC	44 ppm				250 ppm			
		Fluoride (ppm)							
B	92	.57	.07	.24	20.0				
A	19	1.35	<.01	.58	48.3				
C	19	1.70	<.01	.69	57.5				
C-A	–	NA	NA	.11	9.2				
	(2) MPC	1.2 ppm							

NA - Not Applicable
$\mu c/cc$ - Microcuries per cubic centimeter
ppm - parts per million
(1) - U. S. Department of Commerce, National Bureau of Standards Handbook 69, Pages 86*, 93**.
(2) - NLO - State
† - See Figure 3

The above table indicates that the average calculated concentrations (B) of all liquid waste discharged to the river were 32.2% 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 discharges for all contaminants averaged 10.6% MPC or less. Fifty percent of the average concentrations were 2.6% MPC or less.

During the fourth quarter there were two days when the calculated nitrate concentration (B) in the river exceeded the average permissible level of 44 ppm. There were four days when the sampled fluoride concentration downstream (C) were above the average permissible level of 1.2 ppm. The "over" concentrations upstream (B) indicates discharges by some upstream sources. The sampled average concentrations downstream for nitrates were 9.86 ppm and 0.69 ppm for fluorides, both of which are well below their respective MPC's.

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 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 the fourth quarter sampling and calculations that the FMPC effluent produced little change in the river's quality.

B. Annual Monitoring Data for 1960

Table II indicates the summary of the four quarterly reports in regard to effluent concentrations at the FMPC site.

TABLE II Water Sampling Results for 1960

Location†	No. of Samples	Uranium ($\times 10^{-6}$ $\mu c/cc$)				Total Activity ($\times 10^{-6}$ $\mu c/cc$)			
		High	Low	Avg.	% MPC	High	Low	Avg.	% MPC
B	364	.059	<.001	.006	.03	.090	<.001	.009	.30
A	76	.143	.001	.012	.06	.241	.005	.034	1.13
C	76	.102	.001	.018	.09	.146	<.001	.041	1.36
C-A	NA	NA	NA	.006	.03	NA	NA	.007	.23
	(1) MPC	20×10^{-6} $\mu c/cc$				3×10^{-6} $\mu c/cc$			
		Nitrate (ppm)				Chloride (ppm)			
B	364	50.75	.01	5.89	13.4	21.26	.11	4.55	1.8
A	76	18.00	<.01	5.27	12.0	75.00	12.00	32.47	12.9
C	76	29.00	.30	7.93	18.0	82.00	12.00	37.49	15.0
C-A	—	NA	NA	1.66	6.0	NA	NA	5.02	2.0
	(2) MPC	44 ppm				250 ppm			
		Fluoride (ppm)							
B	364	.57	.002	.100	8.3				
A	76	1.35	<.001	.407	33.9				
C	76	1.70	<.001	.413	34.4				
C-A	—	NA	NA	.006	.5				
	(2) MPC	1.2 ppm							

NA - Not Applicable
$\mu c/cc$ - Microcuries per cubic centimeter
ppm - parts per million
(1) - U. S. Department of Commerce, National Bureau of Standards Handbook 69, Pages 86*, 93**.
(2) - NLO-State
† - See Figure 3

Two methods of measuring the FMPC contributions to 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 13.4% 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 1960 indicate they averaged well below the maximum permissible concentrations for uranium, total radioactivity, chlorides, fluorides and nitrates. The results for 1960 are of the same magnitude as they have been in past years.

Part II – Monitoring of Air

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 medium for material indicative of the operation.

During the many involved processes various airborne dusts are generated. Appropriate type dust collectors, such as bag collectors, electrostatic precipitators, and scrubbing towers are specially designed for each operation and are attached to stacks that would have emissions of significant quantities of material. Exhaust stack sampling is maintained on a continuous sampling schedule.

The determination of the actual amount of material which is in the air surrounding the project is accomplished by the use of air sampling equipment. The samples are analyzed for uranium and total activity. The air sampling stations are shown in Figure 4.

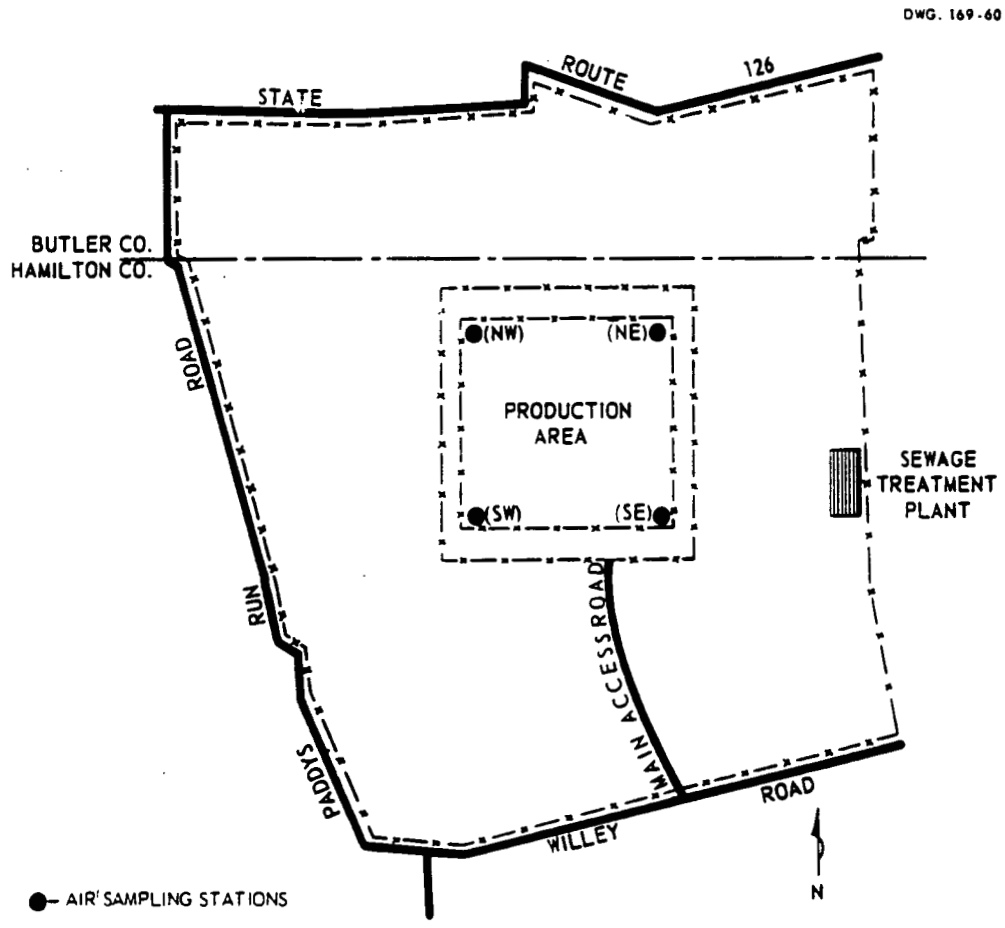

FIGURE 4 Air Sampling Locations (Fernald Area, Feed Materials Production Center and Surrounding Area)

A. Fourth Quarter Monitoring Results

Table III indicates the high, average, and low concentrations for air sampling during the fourth quarter. 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 15% of the MPC for uranium and 0.44% of the MPC for total radioactivity.

TABLE III Air Sampling Results for the Fourth Quarter of 1960

Location†	No. of Samples	Uranium ($\times 10^{-12}$ $\mu c/cc$)				Total Activity($\times 10^{-12} \mu c/cc$)			
		High	Low	Avg.	% MPC	High	Low	Avg.	% MPC
SW	3	.77	.19	.51	25.5	1.02	.25	.76	.76
NW	8	.16	.03	.09	4.5	.30	.05	.15	.15
NE	10	.91	.03	.30	15.0	.98	.04	.45	.45
SE	9	.61	.03	.30	15.0	.73	.05	.38	.38
Average Concentration	—	NA	NA	.30	15.0	NA	NA	.44	.44
(1) MPC		2×10^{-12} $\mu c/cc$*				100×10^{-12} $\mu c/cc$**			

NA - Not Applicable
$\mu c/cc$ - Microcuries per cubic centimeter
(1) - U. S. Department of Commerce, National Bureau of Standards Handbook 69, Pages 86*, 94**.
† - See Figure 4

B. Annual Monitoring Data

Table IV represents the tabulation of results of environmental monitoring during 1960. Due to construction work being carried out mainly in April, May, and June, it was impossible to operate the SW and SE Stations during portions of this period. This accounts for the difference in number of samples taken at each of the perimeter stations. The average air-borne concentration of uranium and total activity for 1960 are well below their respective MPC's.

TABLE IV Air Sampling Results for 1960

Location†	No. of Samples	Uranium ($\times 10^{-12}$ $\mu c/cc$)				Total Activity($\times 10^{-12} \mu c/cc$)			
		High	Low	Avg.	% MPC	High	Low	Avg.	% MPC
SW	13	.77	.11	.35	17.5	1.02	.25	.59	.59
NW	30	1.09	.02	.16	8.0	1.74	.05	.28	.28
NE	31	.91	.01	.19	9.5	.98	.04	.33	.33
SE	19	.61	.03	.21	10.5	.73	.05	.30	.30
Average Concentration	—	NA	NA	.23	11.4	NA	NA	.38	.38
(1) MPC		2×10^{-12} $\mu c/cc$*				100×10^{-12} $\mu c/cc$**			

NA - Not Applicable
$\mu c/cc$ - Microcuries per cubic centimeter
(1) - U. S. Department of Commerce, National Bureau of Standards Handbook 69, Pages 86*, 94**.
† - See Figure

CONCLUSIONS

During the fourth quarter, the amount of airborne and water activity remained at the low level that it had during the rest of the year. The results submitted for this entire year are of the same magnitude as they have been in past 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.