MLM-2483

Stability of Plutonium Contaminated Sediments in the Miami-Erie Canal

Billy M. Farmer and Daniel G. Carfagno

March 1, 1978

MOUND FACILITY
Miamisburg, Ohio

operated by
MONSANTO RESEARCH CORPORATION
a subsidiary of Monsanto Company

for the
U. S. DEPARTMENT OF ENERGY

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Contents

Summary

This study was conducted to evaluate the stability of plutonium-contaminated sediment in the Miami-Erie Canal. Because the plutonium is strongly sorbed to silt particles and is highly insoluble and, furthermore, because the canal water is not used as a source of drinking water, the inhalation pathway to man was considered the only potential hazard. Therefore the main thrust of the investigation was the magnitude of airborne plutonium-238 that may be released from this sediment and the impact on the population of this airborne plutonium.

Correlations were sought to relate concentrations at air sampling stations to plutonium-238 concentrations in air and stack emissions, wind direction, particulate loading, rainfall, and construction activities.

There appears to be some impact on airborne concentrations at air sampling stations 122 and 123 from the contaminated sediment in the canal and ponds area. For purposes of this evaluation, it was assumed that the plutonium-238 found in the air samples came from the contaminated sediment in the canal/ponds area.

To complete the evaluation of the inhalation pathway, dose calculations were performed using actual airborne concentrations of plutonium-238 measured at sampler 123. The dose equivalent to an individual in that area was calculated for 1 yr and 70 yr. Dose calculations were also performed on potential uptake of contaminated vegetation from that area for 1 yr and 70 yr.

This study indicates that, although the contaminated sediments in the canal and pond area appear to contribute to airborne plutonium-238, the observed maximum monthly concentration of plutonium-238 in air is a small fraction of the DoE Radioactivity Concentration Guide (RCG) and the nine-month average concentration of plutonium-238 in air observed thus far during 1977 is less than 1% of the RCG. Dose equivalents, conservatively calculated from these actual data, are well within existing DoE standards and proposed EPA guidance.

Surveillance of the area, i.e., continued air sampling, will be maintained to assure that radiation exposure of the public will remain well within existing and proposed guidance.

It was concluded that the contaminated sediment present in the abandoned Miami-Erie Canal is quite stable, even though it is not covered with water and has been disturbed by construction activities, and further action such as removal or covering up is apparently not warranted.

Introduction

Mound Facility is situated on 180 acres of land in Miamisburg, Ohio. This location is approximately 16 km (10 mi) southwest of Dayton, Ohio. The predominant geographical feature in the five-county region surrounding the Facility is the Great Miami River which flows from the northeast to the southwest through Miamisburg and west of the Facility. This river valley area is generally highly industrialized. The remainder of the region is predominantly agricultural with some light industry and scattered residential communities.

Mound Facility began operations in 1949. Its mission currently includes research, development, engineering, and production of components for the DoE Weapons Program; research, development, and production of explosive components; separation, purification, and sale of stable isotopes of the noble gases; and development, design, and fabrication of radioisotopic heat sources for thermoelectric generators. The radionuclides of primary concern currently being handled are plutonium-238 and tritium.

Previous studies

In 1974, Mound Facility Environmental Monitoring program established plutonium concentration in the sediment of certain waterways adjacent to Mound Facility (including the abandoned Miami-Erie Canal and adjacent ponds in the Miamisburg Community Park shown in Figure 1) above the expected baseline levels of less than 0.0004 nanocuries per gram (nCi/g) [1]. Air and water monitoring in the area at that time indicated there was no immediate hazard to the public.

Mound Facility, however, initiated the Environmental Plutonium Study to investigate fully the extent of the contamination, the source of plutonium, and potential hazards these deposits might present then or in the future. This study involved over 5,000 soil and sediment samples taken from the waterways and nearby land [2].

The findings of the Environmental Plutonium Study were presented to appropriate local, state, and federal government officials and to health and environmental agencies prior to a press conference held at Mound Facility on October 2, 1974. These findings and the conclusions drawn from them were that the plutonium-238 deposited in waterways near Mound Facility, as related to standards or RCG's, does not present a hazard to people living in this area or to the public at large.

The results of these studies were discussed in two reports: (1) The Report of the Ad Hoc Committee to Evaluate the Health and Safety Aspects of Plutonium-238 in the Environment Adjacent to Mound Laboratory dated February 1976, [3] and (2) Mound Laboratory Environmental Plutonium Study, 1974 dated September, 1975 [1]. Neither study found any health and safety problems associated with the plutonium contamination, although the Ad Hoc Committee report indicated that if there were any future disturbance of the soil in the contaminated area, the hazards should be reevaluated.

FIGURE 1 - Aerial view (from the north) of offsite abandoned canal and pond system.

In early 1977, the City of Miamisburg made plans to modify two existing small ponds just west of Mound Facility in the Community Park. The north pond was to be deepened and made into a solar energy pond to heat a bath house and a swimming pool, and the south pond was to be deepened and made into a fishing pond. Since this effort would involve disturbance of soil in a portion of the contaminated area, an additional evaluation was performed. This evaluation also found no health or safety problem from the plutonium contamination in the sediment associated with the modification and construction efforts of the Miamisburg Park Improvement Project [4].

Objective

This study was conducted to evaluate the stability of plutonium-contaminated sediment in the Miami-Erie Canal so that the need for stabilization of the contaminated sediment by water or other means can be determined. Because the plutonium is strongly sorbed to silt particles and is highly insoluble and, furthermore, because the canal water is not used as a source of drinking water, the inhalation pathway to man was considered the only potential hazard. Therefore the main thrust of the investigation was the magnitude of airborne plutonium-238 that may be released from this sediment and the impact on the population of this airborne plutonium.

Discussion

Description of data and data tables are given in the Appendix.

The correlations discussed below were attempted so the impact, if any, of the plutonium-contaminated sediment in the canal/ponds on the permanent air samplers, located in the immediate area, could be determined.

Correlation of air sampler concentration to stack emissions and meteorological data

Correlation of plutonium-238 concentrations at various air samplers with meteorological data and stack emissions was investigated by preparing scatter plots, e.g., stack emission vs plutonium-238 concentrations at air sampling stations. Locations of these air samplers are shown in Figures 2 and 3. No statistically based conclusions could be drawn from these plots; however, certain inferences were made from trends in the data. For example, air sampler data in the 0°-90° or northeast quadrant indicated some linearity as shown in Figure 4. Data in the remaining three quadrants exhibited almost no linearity.

Of the four samplers located in the northeast quadrant, sampler 101 correlated best with monthly stack emissions (Figure 5).

Since air samplers 122 and 123 (southwestern quadrant) had plutonium-238 concentrations similar to the samplers in the 0°-90° quadrant, scatter diagrams were prepared, but no correlation with stack emissions was apparent even though these sampler locations are close to the Mound Facility site boundary, 0.285 and 0.333 miles, respectively.

Scatter diagrams were also prepared to compare the deviation of the monthly resultant

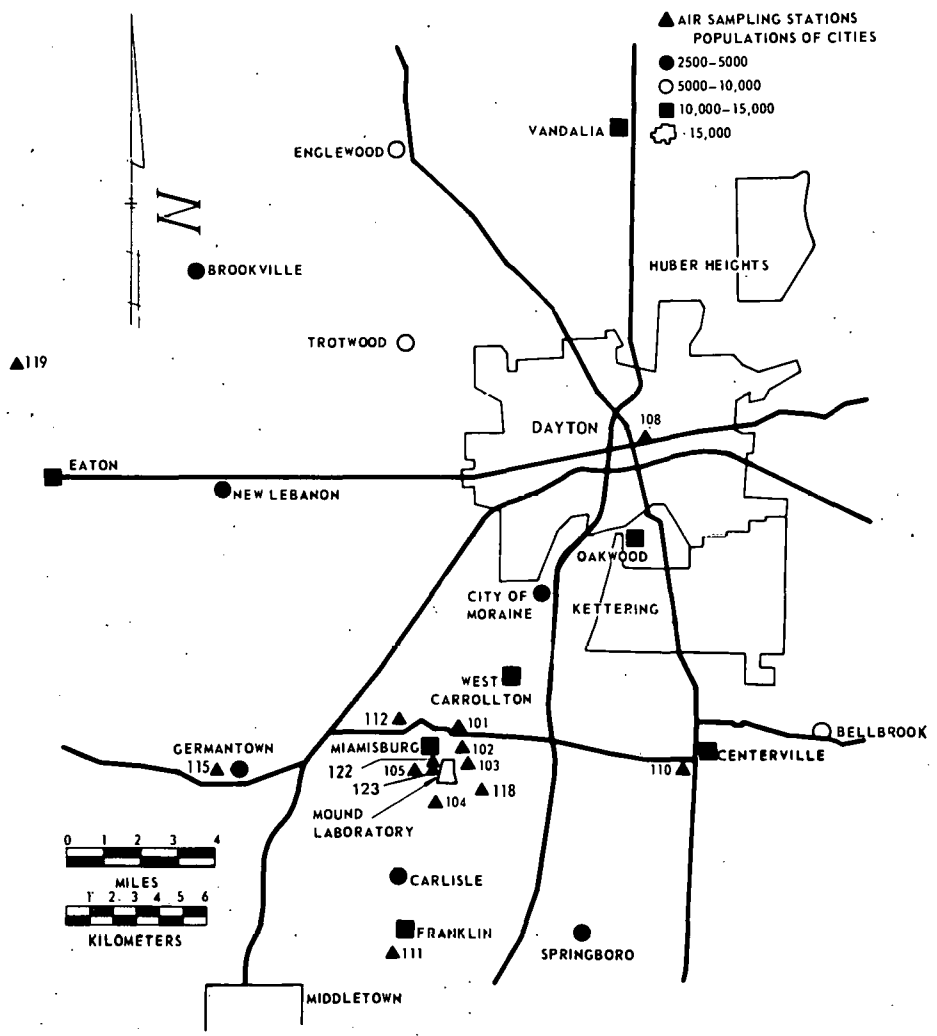

FIGURE 2 - Offsite air sampling locations.

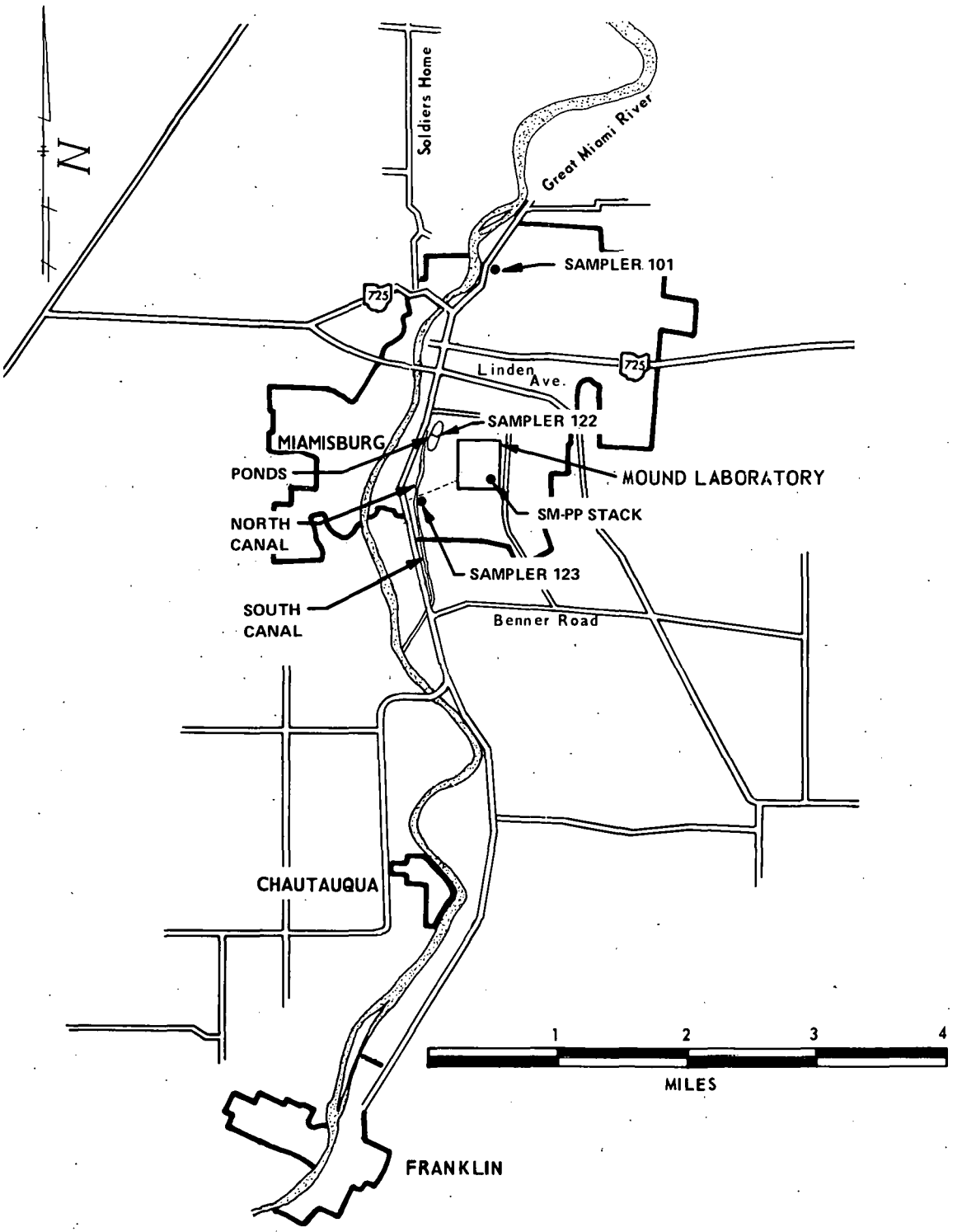

FIGURE 3 - Locations of samplers 101, 122, and 123.

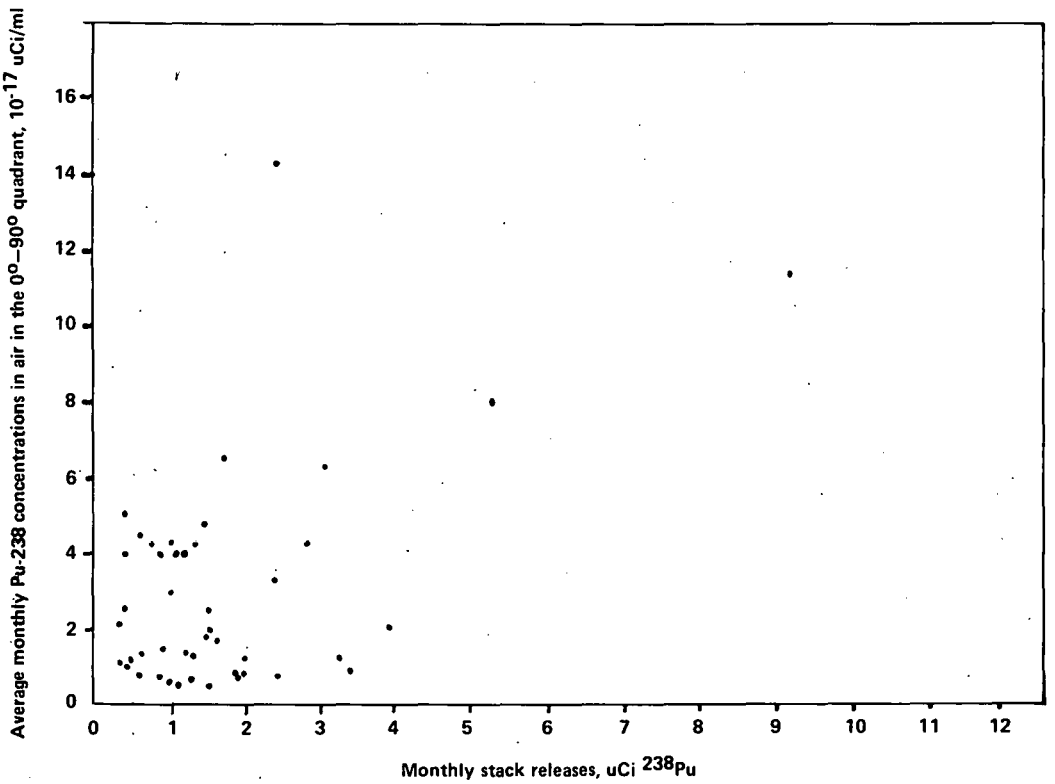

FIGURE 4 - ^{238}Pu concentrations in air in the 0°-90° quadrant vs. stack releases.

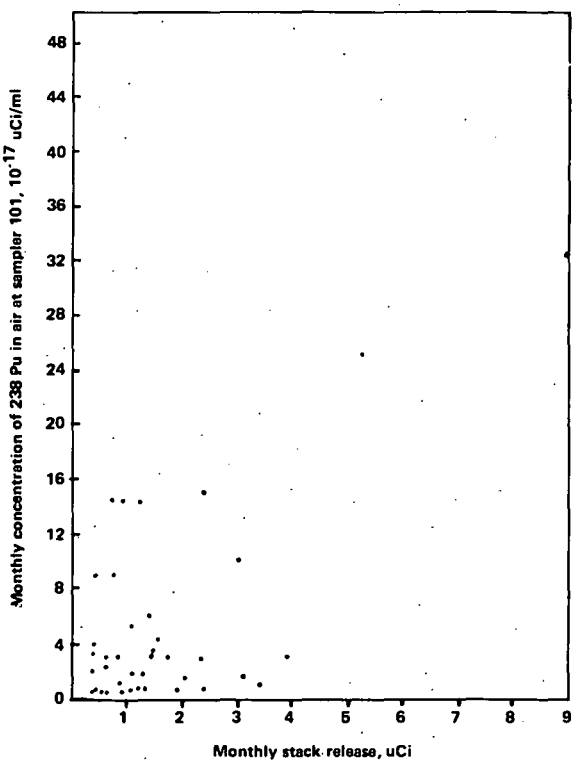

FIGURE 5 - ^{238}Pu concentrations in air at sampler 101 vs. stack releases.

wind direction from the optimum wind direction with the monthly plutonium-238 air concentration. The optimum wind direction is defined as the wind direction which would transport stack emissions or contamination from the source to the sampler of interest. It appeared from these diagrams, that there is better correlation of plutonium-238 air concentration at samplers 101, 122, and 123 with wind direction than with stack emissions.

Another correlation was then attempted. This approach involved relating quarterly average plutonium-238 air concentrations at air samplers in the 0°-90° quadrant with stack emissions and deviation from optimum wind direction. The average optimum wind direction for these samplers is 45° if stack emissions at Mound

Facility are assumed to be the source. Figures 6 and 7 show the relationship of samplers in the 0°-90° quadrant and samplers 122 and 123 respectively with stack emissions and deviation from optimum wind direction. There does appear to be some correlation of plutonium-238 in air concentrations in the 0°-90° quadrant with stack emission and wind direction. For samplers 122 and 123, however, there does not appear to be any observable correlation, thus supporting the supposition of a source other than stack emissions.

To further determine if the canal and/or pond area is causing some effect on the plutonium-238 concentrations at samplers 122 and 123, additional comparisons were made. The south canal was assumed in one case as the source of plutonium-238, and the north canal and/or ponds as the source in the second case. Optimum wind directions for each case and each sampler were determined. In both Figures 8 and 9, a better correlation between concentration of plutonium-238 and wind direction from the north can be observed. There does not appear to be any relationship between concentration and wind from the south. This strongly implies that any effect on these samplers from resuspension is from the north portion of the canal and/or the ponds.

Correlation of air sampler concentration and particulate loading

Particulate loading data were compared with plutonium-238 concentration at offsite sampling locations. The air samplers show relatively consistent values with samplers 101 and 108 having values outside the mean with error limits at the 95% confidence level for 1975, 1976, and 1977. There does not appear to be any general relationship between plutonium-238 concentration and particulate loading at air sampling locations. However, there did appear a slight increase in plutonium-238 concentrations with increasing particulate loading in samplers 122 and 123 as shown in Figures 10 and 11 respectively. This reaffirms the inference that these two samplers are being slightly affected by resuspension in the canal and pond area.

Correlation of air sampler concentration and rainfall

Data for correlating plutonium-238 concentrations at air samplers 122 and 123 with rainfall were somewhat limited since direct rainfall measurements are not available for winter, and resuspension will be affected by snow cover. However, available rainfall data was compared with plutonium-238 concentrations at air samplers 122 and 123 (Figures 12 and 13). There is no correlation, in general, observable from these data. Specifically, however, during 1976 higher plutonium-238 concentrations at both samplers 122 and 123 occurred in September which had a relatively low amount of rainfall. During 1976 sampler 122 had the highest monthly concentration of plutonium-238 in July which had less rainfall than did either June or August. In 1977, sampler 123 plutonium-238 concentrations increased in May which had less rainfall than April or June of 1977. In summary, it appears that there is some correlation between lack of rainfall and increases in plutonium-238 concentrations at these two sampling locations.

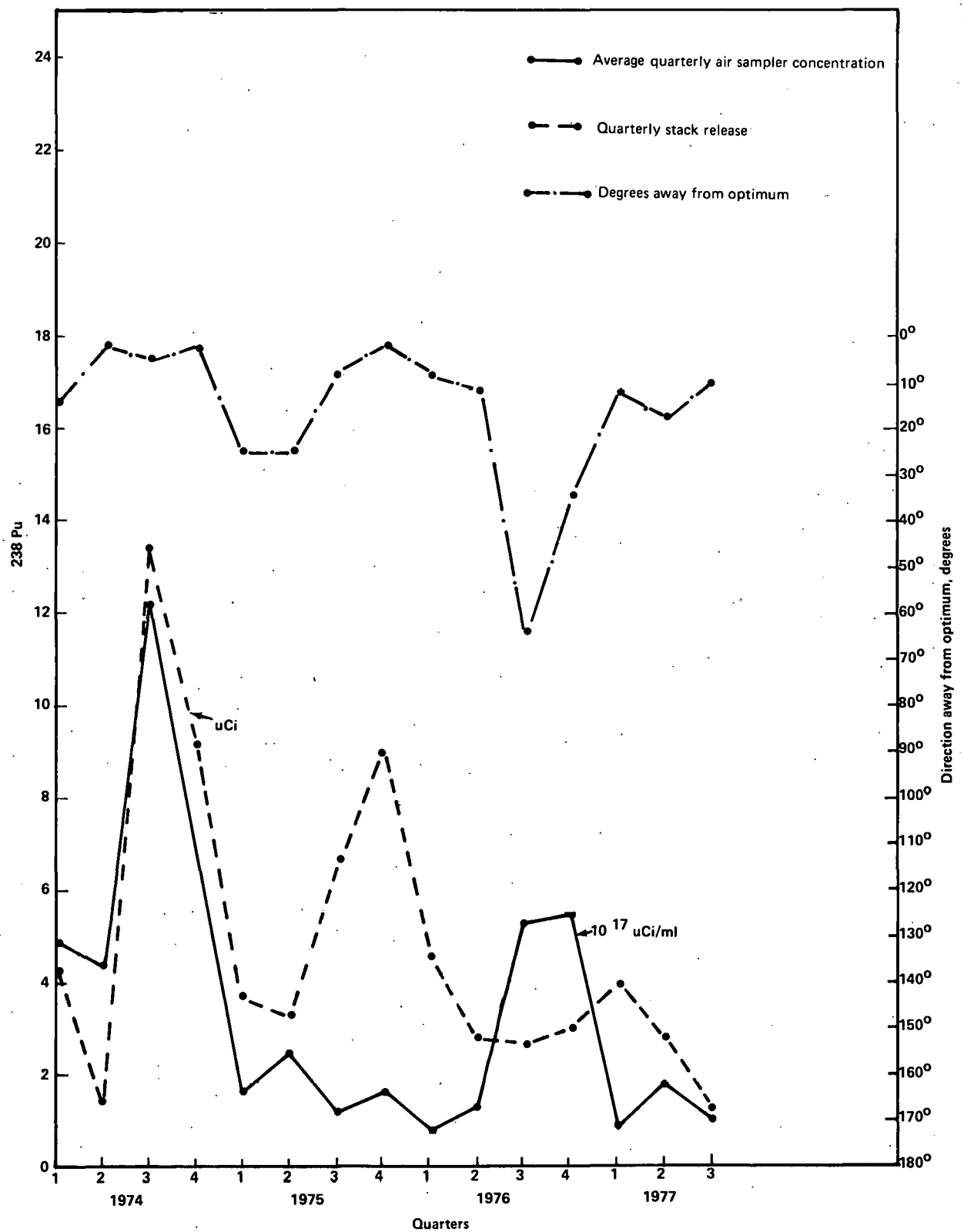

FIGURE 6 - Quarterly average concentration of ^{238}Pu in air at samplers 101, 102, 103 and 124 compared to stack emissions and direction away from optimum.

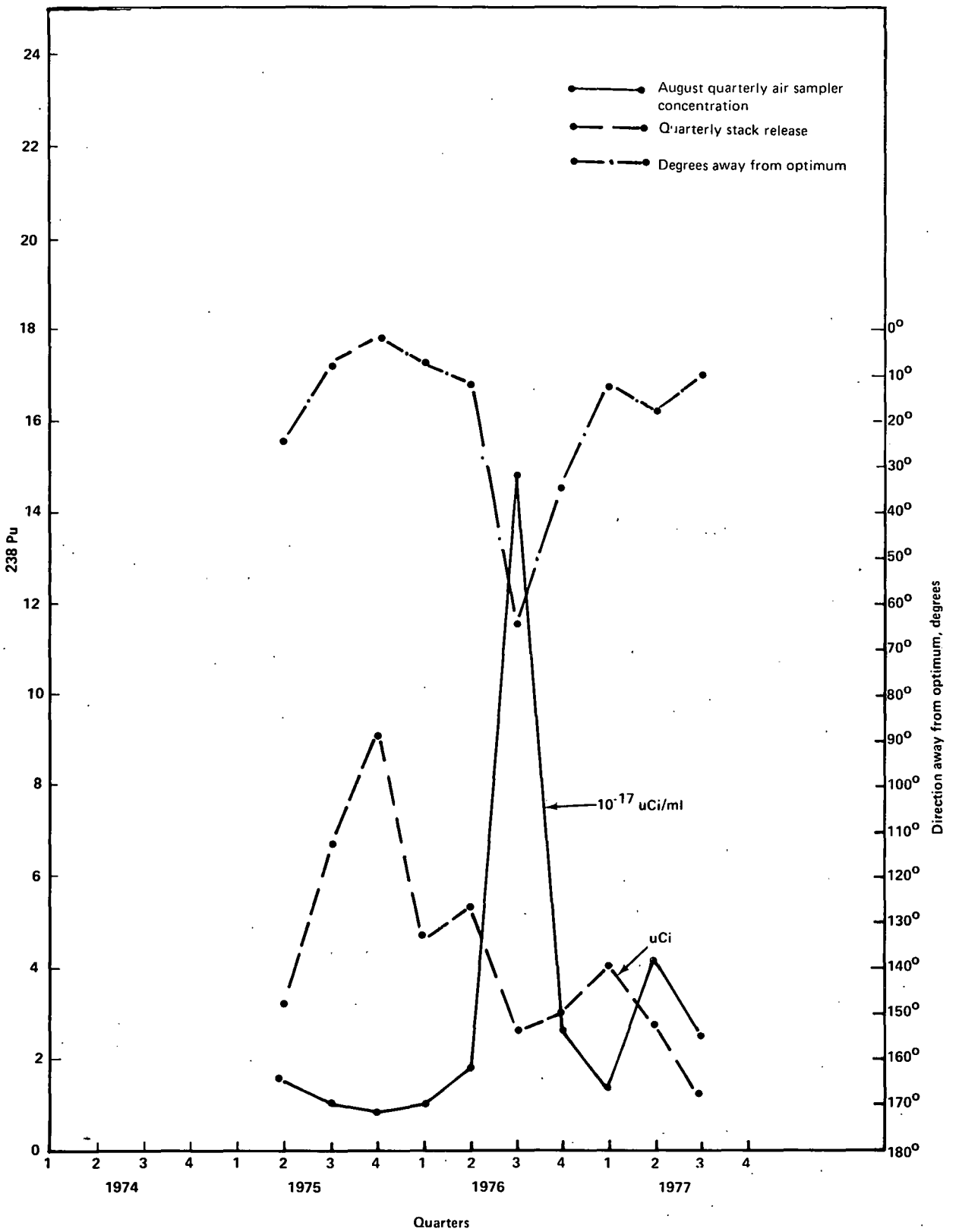

FIGURE 7 - Quarterly average concentration of ^{238}Pu in air at samplers 122 and 123 compared to stack emissions and direction away from optimum as a function of time.

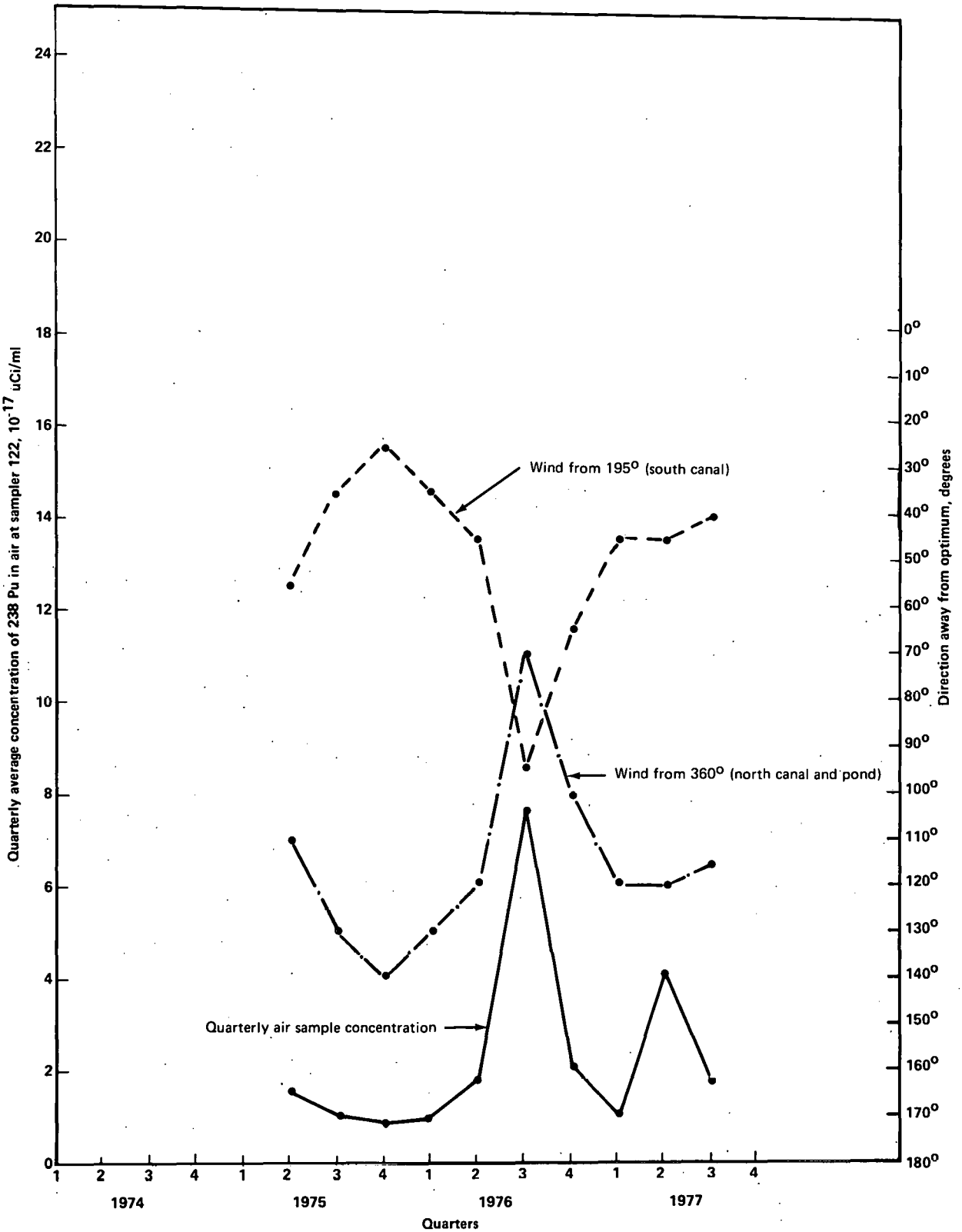

FIGURE 8 - Quarterly average concentration of ^{238}Pu in air compared to the direction of wind from across the south portion of the canal and the north portion of the canal and ponds as a function of time for sampler 122.

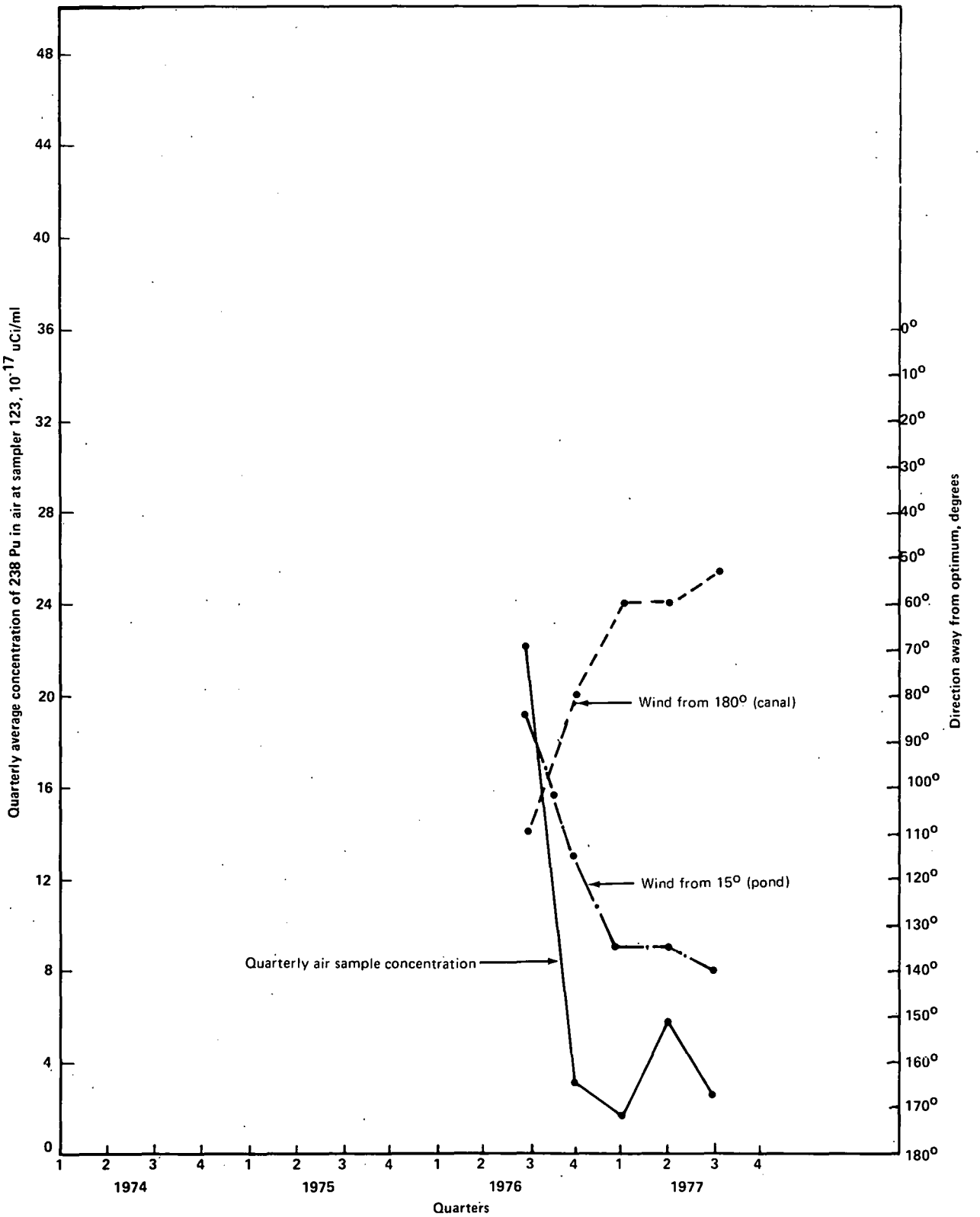

FIGURE 9 - Quarterly average concentration of ^{238}Pu in air compared to the direction of wind from across the south portion of the canal and the north portion of canal and ponds as a function of time for sampler 123.

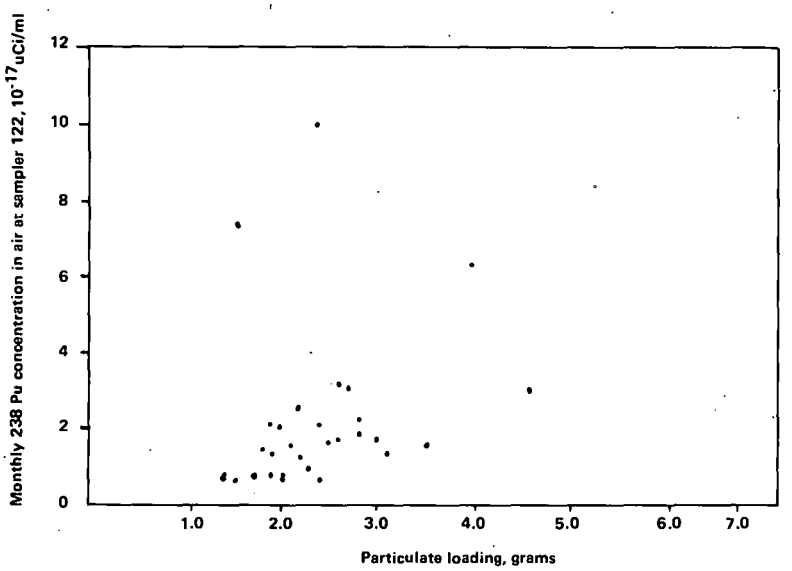

FIGURE 10 - ^{238}Pu concentration in air as a function of particulate loading at sampler 122.

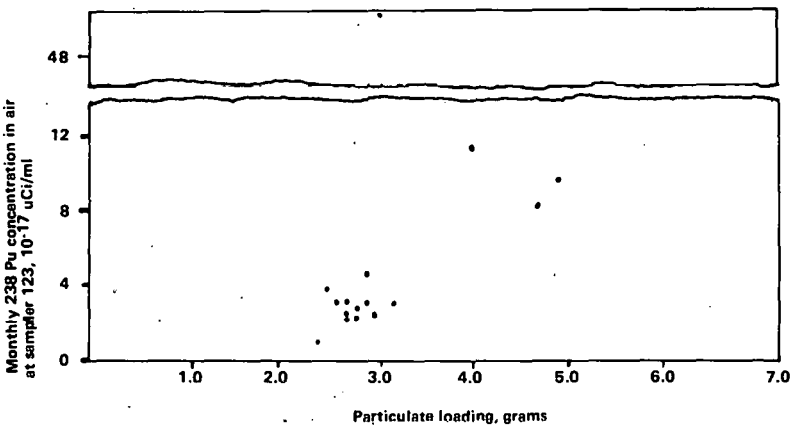

FIGURE 11 - ^{238}Pu concentrations in air as a function of particulate loading at sampler 123.

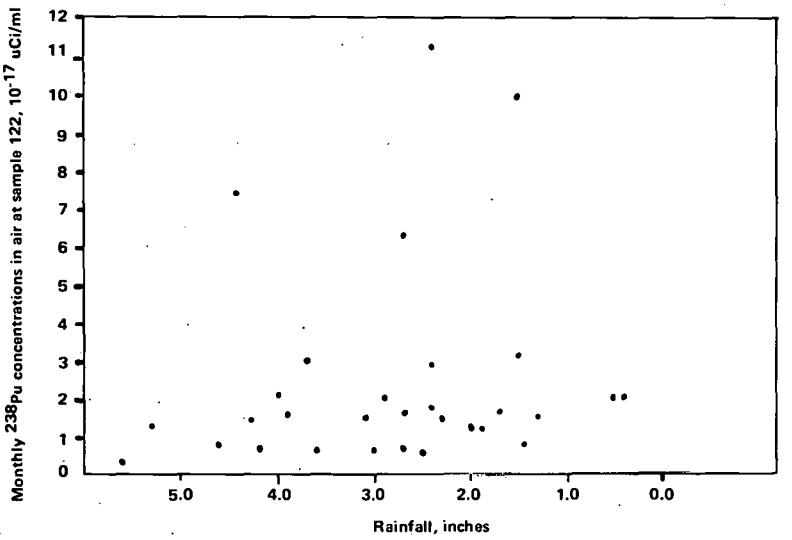

FIGURE 12 - ^{238}Pu concentration in air compared with rainfall at sampler 122.

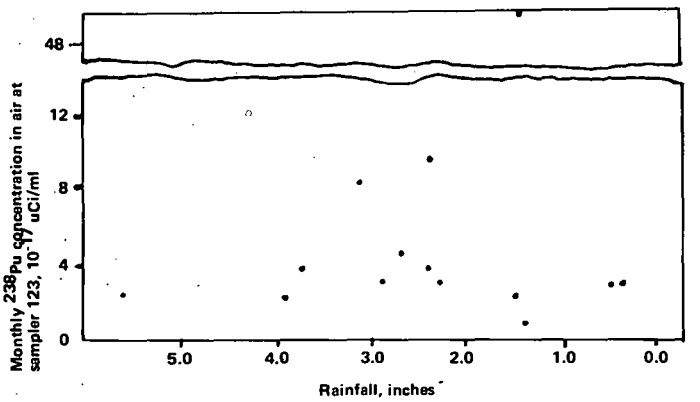

FIGURE 13 - ^{238}Pu concentration in air compared with rainfall at sampler 123.

Correlation of air sampler concentration and construction activities

There were several events which appear to have affected the concentration of plutonium-238 at air samplers 122 and 123 in 1976. On May 10, 1976, the water from Mound's drainage ditch going to the Miami-Erie Canal was diverted to the south. The only water in the north canal thereafter was that which was originally present or that produced from rain. On May 26, 1976, some excavation operations were conducted in the canal. During this time, sampler 123 was not operational; however, sampler 122 showed a slight increase in the plutonium-238 concentration. On June 28, 1976, the area around the canal was graded and seeded, and a straw cover was spread. There was, however, no increase in the plutonium-238 concentrations at sampler 122 during June.

During July, 1976, sampler 123 became operational. On July 15, 1976, a flapper valve was installed at the junction of the ditch and the canal to prevent water flow northward. Coincidentally, the plutonium-238 concentration in air at sampler 122 increased during July. This effect may be related to both the construction and the drying of the north portion of the canal. Again in September, an increase at both samplers 122 and 123 occurred. This increase may be related to the drying of the north canal since there was very little rainfall during September.

During 1977, construction activity was started in the pond area. Water was drained and excavation was performed on both ponds. Construction began on May 6, 1977, and continued on an intermittent basis through September 1977. There was an increase in plutonium-238 concentration at sampler 122, located very close to the construction area, during June of 1977 which may be related to construction activities and lack of rainfall. Opposed to this, sampler 123 plutonium-238 concentrations increased during May of 1977 and continued to decrease during the remainder of 1977. This may be related to meteorology since sampler 123 is some distance away from the construction area compared to sampler 122. Additionally, the air sampling data are reported on a monthly basis which may not show the effect of short-term and intermittent construction activities.

These correlations indicate that there is some impact on airborne concentrations of plutonium-238 at air sampling stations 122 and 123 from the contaminated sediment in the canal and ponds area.

Dose equivalent estimates from inhalation

To complete the evaluation of the inhalation pathway, dose equivalent to man was calculated using air sampling data from air sampling stations 122 and 123. For purposes of this evaluation, the assumption was made that all the plutonium-238 found in the air samples is from the contaminated sediment in the canal/ponds area.

Dose equivalents to the lung and bone from inhalation of airborne plutonium-238 were calculated for 1 and 70 yr of exposure. The airborne concentration used for the 1-yr exposures was the highest monthly concentration measured in the canal and pond

area. This concentration, 54.4×10^{-17} μCi/ml, occurred during September, 1976, at sampling location 123. The highest average concentration for the first nine months of 1977 measured in the canal/pond area was used to calculate the 70-yr exposures. This concentration, 3.35×10^{-17} μCi/ml, was also measured at sampling location 123.

The dose equivalent estimates were based on additional assumptions. It was assumed that an individual would remain in the pond and canal area continuously for 1 yr and be subjected to the maximum concentrations found during one month at sampler 123. This individual would also be subjected continuously for 70 yr to the average concentration found at sampler 123 during the first nine months of CY-1977.

The following equations were used to determine the dose equivalent to the lung and to the bone of an individual over the two time periods.

DOSE EQUIVALENT TO LUNG FOR 1 AND 70 YEARS OF EXPOSURE

$$D(T) = \frac{51.1\ CIaTfafr\Sigma EF(RBE)n}{\lambda M}\left(1 - \frac{1-e^{-\lambda T}}{\lambda T}\right)$$

where D(T) = does equivalent delivered to the lung in 1 yr and 70 yr from continuous exposure to plutonium-238 in air - rem

C = average airborne concentration - μCi/ml

Ia = average air intake - 2×10^7 ml/day [5]

$T_{(1)}$ = time exposed - 365 days

$T_{(70)}$ = time exposed - 2.555×10^4 days

fa = fraction of inhaled material reaching organ of interest - 0.7 (max.) for pulmonary region [6]

fr = fraction of pulmonary deposition undergoing long-term retention - 0.6 for actinides (class y) [6]

$\Sigma EF(RBE)n$ = effective energy deposition per disintegration - 57 Mev [5]

λ = effective decay rate - 0.0014 day^{-1} for actinide (class y) from the pulmonary region [7]

M = lung mass - 1000 g

DOSE EQUIVALENT TO BONE FOR 1 AND 70 YEARS OF EXPOSURE

$$D(T) = \frac{51.1\ CIafa T\Sigma EF(RBE)n}{\lambda M}\left(1 - \frac{1-e^{-\lambda T}}{\lambda T}\right)$$

where D(T) = dose equivalent to bone resulting from continuous inhalation of airborne plutonium-238 for 1 yr and 70 yr - rem

C = average airborne concentration - μCi/ml

Ia = average air intake - 2×10^7 ml/day [5]

fa = fraction of inhaled material reaching organ of interest - 0.2 [5]

$T_{(1)}$ = time exposed - 365 days

$T_{(70)}$ = time exposed - 2.555×10^4 days

$\Sigma EF(RBE)n$ = effective energy deposition per disintegration = 284 Mev [5]

M = 7×10^3 g [5]

λ = effective decay rate - 3×10^{-5} day^{-1} [5]

The actual dose equivalents from these calculations are:

Dose equivalent during 1 yr to the lung
= 0.76 mrem/yr
Dose equivalent during 70 yr to the lung
= 14.6 mrem/70 yr
Dose equivalent during 1 yr to the bone
= 0.27 mrem/yr
Dose equivalent during 70 yr to the bone
= 71.5 mrem/70 yr

These values, when compared to ERDA/DoE guidelines of 1500 millirem/yr to the lung or bone of individuals in the population, are small. Additionally, these values are also less than those recommended by the USEPA of 1 millirad/yr to the pulmonary lung and 3 millirad/yr to the bone assuming a quality factor of 10 for alpha particles and a distribution factor of 5 to account for unequal distribution of plutonium in the bone. [8]

Dose equivalent estimates from ingestion of plants in the pond and canal area

Even though there is no evidence of other than negligible uptake of plutonium-238 by plants from soil or silt [9], the possibility of resuspension and deposition on the surface of plants may exist. Therefore, dose equivalents were calculated and are discussed below along with the assumptions and methodology used. Table 15 in the Appendix shows the maximum plutonium-238 concentrations found in various potential ingestion media during the plutonium study [1]. The concentration of concern here is the maximum found in vegetation, 3×10^{-3} nCi/g.

It is assumed that an individual will consume the vegetation present in the pond and canal area continuously for both 1 yr and 70 yr. This assumption is highly conservative since the vegetation of concern here is grass; however, for completeness it is considered. It is also assumed that the area has an average six-month growing season and vegetation will be available for only those six months. In order to incorporate this factor the dose assessment values were divided by two.

The equation used to determine the dose equivalent to the bone of an individual due to ingestion of vegetation is:

$$D(T) = \frac{51.1\ C i_w f_w T \Sigma EF(RBE)n}{\lambda M}\left(1 - \frac{1-e^{-\lambda T}}{\lambda T}\right)$$

where $D(T)$ = dose equivalent to the bone resulting from continuous ingestion of plutonium-238 in vegetation in 1 yr and 70 yr

C = average vegetation concentration μCi/g

I_w = average vegetation intake - 220 g/day (10% of total ingestion intake) [1,5]

f_w = fraction of ingested material reaching organ of interest - 2.4×10^{-5} [5]

$T_{(1)}$ = 365 days

$T_{(70)}$ = 2.555×10^4 days

$\Sigma EF(RBE)n$ = effective energy deposition per disintegration - 284 Mev [5]

λ = 3×10^{-5} day^{-1} [5]

M = 7×10^3 g [5]

The dose equivalent values calculated are:

Dose equivalent to the bone of an individual during 1 yr = 1.1 mrem/yr

Dose equivalent to the bone of an individual during 70 yr = 4.23 rem/70 yr

These values are also less than ERDA/DoE guidelines of 1500 millirem/yr to the bone of individuals in the population. Additionally, these values are less than the proposed USEPA guidance of 3 millirad/yr to the bone assuming a quality factor of 10 for alpha particles and a distribution factor of five to account for unequal distribution of plutonium in the bone. [8]

Conclusion

No statistically based conclusions could be drawn, although correlations were attempted. However, it appears from these correlations that trends do exist which indicate that air samplers 122 and 123 show some effects due to resuspension of sediment contaminated with plutonium-238.

The data also indicate that the effect on airborne plutonium-238 concentrations at samplers 122 and 123 is greatest when the wind is from the north. This suggests that the source for resuspension is the north portion of the canal.

There are also slightly increased airborne plutonium-238 concentrations at samplers 122 and 123 with increased particulate loading, decreasing rainfall, and increasing construction activity. These slight increases also support the supposition that samplers 122 and 123 receive some portion of plutonium-238 concentration from resuspension.

A dose equivalent estimate was calculated for 1 yr using the maximum monthly airborne concentration of plutonium-238 measured at air sampler 123. The maximum current average concentration for nine months of 1977 was used to determine the dose equivalent estimate for 70 yr. The calculated dose equivalent values were less than DoF/ERDA standards and less than proposed USEPA guidance.

A dose equivalent estimate was also calculated based on ingestion of vegetation for 1 yr and 70 yr even though this is extremely unlikely to occur. These values were also less than DoE/ERDA standards and proposed USEPA guidance.

This study indicates that, although the contaminated sediments in the canal and pond area appear to contribute to airborne plutonium-238, the observed maximum monthly concentration of plutonium-238 in air is a small fraction of the DoE/ERDA Radioactivity Concentration Guide (RCG) and the nine-month average concentration of plutonium-238 in air observed thus far during 1977 is less than 1% of the RCG. Dose equivalents, conservatively calculated from these data, are well within existing DoE/ERDA standards and proposed EPA guidance.

Surveillance of the area, i.e., continued air sampling, will be maintained to assure that radiation exposure of the public will remain well within existing and proposed guidance.

In conclusion, the contaminated sediment present in the abandoned Miami-Erie Canal is quite stable even though not covered with water and disturbed by construction activities and further action such as removal or covering up is apparently not warranted.

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Appendix

Data presentation

The data from which the conclusions of this study were based are presented in this appendix.

AIR SAMPLING DATA

Offsite plutonium-238 air sampling data from January 1974 through September 1977 were compiled. Some air sample data were monthly and some quarterly; however, in order to compare the data, the values are reported as monthly. Tables 1 through 4 show plutonium-238 air sample concentrations from 1974 through September 1977. In each table the average value of plutonium at each air sampler and the estimate of the standard deviation at the 68% confidence level are given. In addition, the average value of plutonium-238 at the air sampler for each month and the estimate of the standard deviation at the 68% confidence level are given. Table 5 is a summary of the data from 4 yr with the mean and standard deviation at the 95% confidence level.

PARTICULATE LOADING DATA

Particulate loading data from January, 1975, through September 1, 1977, from offsite air samples were compiled. These values were measured weekly; however, to compare to monthly and quarterly plutonium air sampler values, they were composited accordingly. Tables 6 through 8 show particulate loading values from 1975 through September, 1977. In each table the monthly value, the average for each sampler, and the estimate of standard deviation at the 68% confidence level are given. In addition, the average particulate loading value for each month and the estimate of the standard deviation at the 68% confidence level are given. Table 9 shows a summary of the particulate loading data in which the mean annual particulate loading is given for each sampler and the standard deviation at the 95% confidence level. Also in Table 9, the means of 1975, 1976, and 1977 are given along with the standard deviation at the 95% confidence level.

SEDIMENT DATA

Data for plutonium-238 in the waterways near Mound Facility were taken from the Mound Laboratory Plutonium Environmental Plutonium Study, 1974 [1]. These values represent "very surface" maximum plutonium-238 concentrations which may involve soil which could be resuspended. Table 10 shows the maximum concentration of each sediment location.

RAINFALL DATA

Rainfall data from January 1974 through September 1977 were compiled from onsite rain collection devices. Table 11 shows the rainfall data by month, the average and estimated standard deviation.

STACK EMISSIONS

The monthly stack emissions of plutonium-238 were compiled for the years 1974 through September 1977. Table 12 shows these values and the average and estimated standard deviation at the 95% confidence level.

METEOROLOGICAL DATA

Table 13 shows the monthly resultant wind direction and annual resultant wind direction for the years 1974 through August 1977 [2].

AIR SAMPLER DIRECTION AND DISTANCE

Fifteen offsite plutonium-238 air sampling locations were involved in this study. Table 14 shows the direction and distance from Mound of each sampler.

References

1. D. R. Rogers, Mound Laboratory Environmental Plutonium Study - 1974, MLM-2249 (September 1975), 142 pp.

2. "Local Climatological Data," U. S. Department of Commerce, National Oceanic and Atmospheric Administration, Environmental Data Service.

List of tables

Table 1 - 1974 PLUTONIUM-238 AIR SAMPLE CONCENTRATIONS [a]

Date	Sampling Stations 101	102	103	104	105	108	110	111	112	115	118	119	$\bar{X}$	S
1/74	2.0	1.3	3.0	0.9	3.6	2.0	[b]	0.09	2.0	0.08	3.0	0.1	1.6	1.3
2/74	10.0	11.0	3.0	1.4	0.5	1.0	[b]	0.2	0.3	0.4	0.9	0.3	2.6	4.0
3/74	9.0	2.0	1.8	0.8	0.7	3.0	[b]	0.3	0.3	0.2	1.0	0.1	1.7	2.6
4/74	9.0	2.0	3.0	0.7	1.0	6.0	[b]	0.3	1.0	0.2	3.0	0.1	2.4	2.8
5/74	4.0	0.9	3.0	3.0	1.0	2.0	[b]	0.5	0.4	0.07	0.4	0.1	1.4	1.4
6/74	3.0	6.0	8.0	1.0	0.5	0.9	[b]	0.9	1.0	0.03	0.4	0.2	2.0	2.6
7/74	3.0	10.0	6.0	2.0	1.5	7.0	[b]	3.2	1.0	8.0	3.0	[b]	4.5	3.1
8/74	32.0	3.0	2.0	1.0	0.3	8.0	[b]	1.2	5.0	0.5	2.0	0.3	5.0	9.2
9/74	15.0	6.0	33.0	2.0	2.0	3.0	4.0	1.8	8.0	0.8	2.0	0.3	6.5	9.3
10/74	3.0	3.0	5.0	1.0	[b]	2.0	0.6	0.5	4.0	0.2	0.9	0.2	1.6	1.7
11/74	6.0	5.0	6.0	0.4	[b]	2.0	0.2	0.4	0.7	2.0	2.0	0.5	2.3	2.3
12/74	25.0	4.0	2.0	0.5	[b]	0.6	0.5	0.7	0.8	1.0	0.6	0.4	3.3	7.3
$\bar{X}$	10.1	4.5	6.3	1.2	1.2	3.1	1.3	0.8	2.0	1.1	1.6	0.2		
S	9.5	3.3	8.6	0.8	1.0	2.5	1.8	0.9	2.4	2.2	1.0	0.1		

[a] in 10^{-17} µCi/ml

[b] No data

Table 2 - 1975 PLUTONIUM-238 AIR SAMPLE CONCENTRATIONS[a]

Date	Sampling Station 101	102	103	104	105	108	110	111	112	115	118	119	122	$\bar{X}$	S
1/75	3.36	1.90	3.13	0.28	[b]	1.59	0.19	0.29	0.49	0.13	0.40	0.20	[b]	1.09	1.22
2/75	1.64	1.28	0.86	0.56	[b]	1.21	0.27	0.29	0.49	0.13	0.40	0.20	[b]	0.67	0.51
3/75	0.37	0.58	1.41	0.73	0.85	0.39	0.28	0.29	0.49	0.13	0.40	0.20	7.38	1.04	1.94
4/75	4.44	1.64	0.93	0.68	1.28	0.73	0.26	0.43	0.45	0.21	0.46	0.16	1.41	1.01	1.14
5/75	2.24	1.42	0.96	9.38	0.48	0.72	0.42	0.43	0.45	0.21	0.46	0.16	2.06	1.41	2.48
6/75	5.57	3.02	2.05	0.53	5.40	1.06	0.47	0.43	0.45	0.21	0.46	0.16	1.17	1.61	1.90
7/75	1.67	1.20	1.61	1.46	0.41	0.74	0.17	0.50	0.34	0.23	[b]	0.07	1.60	0.83	0.63
8/75	1.67	1.32	0.98	0.63	0.63	0.86	0.11	0.33	0.32	0.38	0.17	0.07	0.80	0.64	0.48
9/75	1.14	0.68	0.45	0.40	0.26	0.57	0.14	0.27	0.23	0.06	0.77	0.07	0.68	0.44	0.32
10/75	3.06	2.84	1.73	0.23	0.12	0.71	0.24	0.03	0.31	0.02	0.28	0.14	0.64	0.80	1.06
11/75	1.81	1.22	1.27	0.47	0.08	0.58	0.05	0.53	0.12	0.02	0.14	0.14	1.30	0.59	0.60
12/75	1.20	0.65	0.80	2.06	0.26	0.11	0.23	0.15	0.14	0.26	0.70	0.14	0.64	0.56	0.56
$\bar{X}$	2.35	1.48	1.35	1.45	0.98	0.77	0.24	0.33	0.36	0.17	0.42	0.14	1.77		
S	1.50	0.78	0.72	2.55	1.60	.38	0.12	0.14	0.14	0.11	0.19	0.05	2.03		

[a] in 10^{-17} µCi/ml

[b] No data

Table 3 - 1976 PLUTONIUM-238 AIR SAMPLE CONCENTRATIONS[a]

Date	Sampling Station 101	102	103	104	105	108	110	111	112	115	118	119	122	123	$\bar{X}$	S
1/76	0.658	1.21	0.586	0.215	0.077	0.288	0.117	1.00	0.122	0.077	0.361	0.04	0.651	[b]	0.416	0.379
2/76	0.683	1.04	1.17	0.224	0.164	0.215	0.106	0.161	0.267	0.145	0.346	0.04	0.551	[b]	0.393	0.363
3/76	0.344	0.890	0.588	0.149	0.140	0.344	0.077	0.346	0.191	1.45	0.401	0.04	1.79	[b]	0.519	0.543
4/76	0.260	0.762	5.37	0.987	0.286	0.188	[b]	0.20	0.124	0.058	1.71	0.056	1.74	[b]	0.978	1.511
5/76	0.643	0.762	0.981	0.077	0.077	0.216	0.077	0.218	0.429	0.052	9.500	0.056	2.49	[b]	1.20	2.58
6/76	0.852	1.05	1.27	0.449	0.469	0.082	0.086	0.236	0.432	0.094	0.843	0.056	1.25	[b]	0.551	0.452
7/76	0.637	7.45	7.48	1.92	0.218	0.389	0.101	0.2	0.263	0.04	0.551	0.063	11.30	3.81	2.46	3.66
8/76	0.637	7.45	7.48	1.92	0.218	0.389	0.101	0.2	0.263	0.04	0.551	0.063	1.48	8.23	2.07	3.11
9/76	0.637	7.45	7.48	1.92	0.218	0.389	0.101	0.2	0.263	0.04	0.551	0.063	9.97	54.4	5.98	14.34
10/76	14.36	1.0	1.01	0.517	0.212	0.706	0.420	0.729	0.247	0.138	0.356	0.027	2.06	3.13	1.78	3.72
11/76	14.36	1.0	1.01	0.517	0.212	0.706	0.420	0.729	0.247	0.138	0.356	0.027	2.06	3.13	1.78	3.72
12/76	14.36	1.0	1.01	0.517	0.212	0.706	0.420	0.729	0.247	0.138	0.356	0.027	2.06	3.13	1.78	3.72
$\bar{X}$	4.04	2.59	2.95	0.784	0.209	0.384	0.184	0.412	0.258	0.201	1.32	0.047	3.12	12.64		
S	6.23	2.93	3.01	0.725	0.102	0.214	0.152	0.296	0.096	0.396	2.60	0.015	3.57	20.56		

[a] in 10^{-17} µCi/ml

[b] No data

Table 4 - 1977 PLUTONIUM-238 AIR SAMPLE CONCENTRATIONS[a]

Date	Sampling Station 101	102	103	104	105	108	110	111	112	115	118	119	122	123	124	$\bar{X}$	S
1/77	0.147	1.296	0.416	0.295	0.142	0.032	0.064	0.028	0.026	0.072	0.248	0.039	0.717	2.157	1.979	0.511	0.719
2/77	0.147	1.296	0.416	0.295	0.147	0.032	0.064	0.028	0.026	0.072	0.248	0.039	0.748	0.961	1.208	0.382	0.448
3/77	0.147	1.296	0.416	0.295	0.147	0.032	0.064	0.028	0.026	0.072	0.248	0.039	1.572	2.219	0.614	0.481	0.674
4/77	3.181	0.681	0.880	0.469	0.036	0.027	0.077	0.211	0.176	0.114	1.229	0.113	2.973	2.794	0.797	0.917	1.129
5/77	3.181	0.681	0.880	0.469	0.036	0.027	0.077	0.211	0.176	0.114	1.229	0.113	2.934	9.604	2.482	1.481	2.497
6/77	3.181	0.681	0.880	0.469	0.036	0.027	0.077	0.211	0.176	0.114	1.229	0.113	6.293	4.726	4.201	1.494	2.058
7/77	0.440	0.761	0.516	0.499	0.227	0.285	0.149	0.317	0.196	0.213	1.122	0.112	1.502	3.041	3.168	0.837	0.998
8/77	0.440	0.761	0.516	0.499	0.227	0.285	0.149	0.317	0.196	0.213	1.122	0.112	0.613	2.374	1.509	0.622	0.620
9/77	0.440	0.761	0.516	0.499	0.227	0.285	0.149	0.317	0.196	0.213	1.122	0.112	3.126	2.282	2.903	0.877	1.028
$\bar{X}$	1.26	0.913	0.604	0.421	0.136	0.115	0.097	0.185	0.133	0.133	0.866	0.088	2.28	3.35	2.10		
S	1.45	0.290	0.211	0.095	0.083	0.128	0.040	0.127	0.080	0.063	0.466	0.037	1.82	2.55	1.19		

[a] in 10^{-17} μCi/ml

Table 5 - SUMMARY OF PLUTONIUM-238 AIR SAMPLE CONCENTRATIONS[a]

Sample	1974	1975	1976	1977	$\mu \pm 2\sigma$
101	10.1 ±19	2.35 ± 3.0	4.04 ± 12.46	1.26 ± 2.90	4.44 ± 5.78
102	4.5 ± 6.6	1.48 ± 1.56	2.59 ± 5.86	0.913 ± 0.580	2.37 ± 2.25
103	6.3 ±17.2	1.35 ± 1.44	2.95 ± 6.02	0.604 ± 0.422	2.80 ± 4.57
104	1.2 ± 1.6	1.45 ± 5.10	0.784 ± 1.45	0.421 ± 0.19	0.964 ± 1.39
105	1.2 ± 2.0	0.98 ± 3.20	0.209 ± 0.204	0.136 ± 0.166	0.631 ± 0.946
108	3.1 ± 5.0	0.77 ± 0.76	0.384 ± 0.428	0.115 ± 0.256	1.09 ± 1.27
110	1.3 ± 3.6	0.24 ± 0.24	0.184 ± 0.304	0.097 ± 0.080	0.455 ± 0.905
111	0.8 ± 1.8	0.33 ± 0.28	0.412 ± 0.592	0.185 ± 0.254	0.432 ± 0.483
112	2.0 ± 4.8	0.36 ± 0.28	0.258 ± 0.192	0.133 ± 0.160	0.688 ± 1.20
115	1.1 ± 4.4	0.17 ± 0.22	0.201 ± 0.792	0.133 ± 0.126	0.401 ± 1.12
118	1.6 ± 2.0	0.42 ± 0.38	1.32 ± 5.20	0.866 ± 0.932	1.05 ± 1.42
119	0.2 ± 0.2	0.14 ± 0.10	0.047 ± 0.030	0.088 ± 0.074	0.119 ± 0.06
122	[b]	1.77 ± 4.06	3.12 ± 7.14	2.28 ± 3.64	2.39 ± 2.99
123	[b]	[b]	12.64 ±41.12	3.35 ± 5.10	8.00 ±20.72
124	[b]	[b]	[b]	2.10 ± 2.38	2.10 ± 2.38
$\mu \pm 2\sigma$	2.78± 2.35	0.91 ± 0.63	2.08 ± 3.19	0.845 ± 0.494	

[a] in 10^{-17} µCi/ml

[b] No data

Table 6 - 1975 PARTICULATE LOADING DATA[a]

Date	Sampling Station 101	102	103	104	105	108	110	111	112	115	118	119	122	$\bar{X}$	S
1/75	1.2567	1.4431	1.1674	1.6860	[b]	3.4780	0.8037	1.3770	1.2671	1.4125	0.9848	0.8476	[b]	1.4295	0.7293
2/75	1.8783	1.8783	0.9299	1.6418	[b]	2.5551	1.7208	1.4027	1.5867	1.5769	1.8263	0.9589	[b]	1.6323	0.4498
3/75	3.2838	1.7944	1.3378	2.1161	[b]	2.9979	1.3408	2.1192	1.4098	1.3068	1.3224	2.2267	1.5813	1.9473	0.6490
4/75	5.9248	1.8779	1.6785	2.6505	2.1436	2.8557	1.8941	2.2969	1.9871	1.9905	1.4583	1.7495	1.8323	2.338	1.1450
5/75	9.0526	3.8302	2.7383	4.2094	2.6568	3.8353	2.5072	4.1908	3.2276	3.8786	2.9425	3.0375	2.7710	3.7598	1.7006
6/75	5.6461	2.9551	2.3423	3.2093	2.5185	3.4428	1.9227	3.4848	2.1294	2.83683	2.1271	1.8655	2.1826	2.8228	1.0165
7/75	6.9330	3.8998	3.2513	3.9681	3.5766	4.6081	2.5871	3.8174	3.0201	4.5122	2.9654	[b]	2.9833	3.8435	1.1594
8/75	3.4675	2.9063	2.5619	3.0473	3.6365	3.6454	1.9688	3.4543	2.5057	3.0291	2.4450	2.1029	2.3462	2.8551	0.5792
9/75	3.7585	3.1916	2.3356	2.9788	2.7476	3.8466	2.1052	2.9185	2.6811	2.9185	[b]	2.1451	1.9988	2.8022	0.6040
10/75	3.4909	2.7001	2.3906	2.7786	2.3006	3.8481	2.0441	2.7615	2.2347	2.2089	2.1137	[b]	1.9745	2.5705	0.5851
11/75	3.4683	2.5934	2.2604	2.7206	2.1966	3.8969	1.9293	2.7706	2.4393	2.3309	2.1107	1.6855	1.9229	2.4866	0.6241
12/75	2.6294	2.0550	1.3989	2.6068	1.9258	3.0359	1.1996	2.0685	2.5998	2.1351	1.4410	0.8294	1.4305	1.9504	0.6586
$\bar{X}$	4.2327	2.5938	2.0327	2.8036	2.6336	3.5038	1.8353	2.7218	2.2574	2.5549	1.9761	1.7449	2.1023		
S	2.2402	0.8039	0.7139	0.7797	0.6088	0.5672	0.5132	0.9065	0.6145	0.9302	0.6465	0.7048	0.4881		

[a] in grams

[b] No data

Table 7 - 1975 PARTICULATE LOADING DATA[a]

Date	101	102	103	104	105	108	110	111	112	115	118	119	122	123	$\bar{X}$	S
1/76	1.8316	1.5775	0.8672	1.6775	1.2306	2.6301	0.8399	1.6601	1.6606	1.6304	1.0243	1.1612	1.3894	[b]	1.4754	0.4785
2/76	2.5800	1.7202	1.4992	2.3063	1.4210	3.2623	[b]	1.9419	1.5800	2.0445	1.4650	1.2354	1.5025	[b]	1.8799	0.5889
3/76	4.4657	2.2474	1.9618	2.9882	2.7161	3.9487	1.9286	3.0444	1.5314	2.9116	2.3503	1.9406	2.8408	[b]	2.6827	0.8341
4/76	4.6447	2.8955	2.4068	3.4833	2.6215	3.5382	2.0953	2.9213	2.5225	2.8022	2.6234	2.1274	2.5525	[b]	2.8642	0.6886
5/76	4.4825	2.7692	2.1361	2.9975	2.3850	3.3299	2.0352	2.7790	1.6117	2.7969	2.9244	1.9931	2.2262	[b]	2.6513	0.7343
6/76	6.5721	3.8945	3.3991	3.7864	3.5240	4.8397	3.2206	4.2084	3.5412	4.3286	3.6114	2.2412	3.0611	[b]	3.8637	1.0336
7/76	3.7972	2.8462	2.4260	3.4197	2.5452	3.4658	2.1584	3.2828	2.3984	3.7811	2.8994	1.9271	[b]	2.5483	2.8812	0.6151
8/76	6.0084	3.6026	3.0249	4.2915	3.2593	[b]	2.7875	3.7564	3.1936	3.8370	3.4310	2.6061	3.4805	4.6871	3.6897	0.9009
9/76	4.5093	4.0966	2.3337	3.0716	2.3921	3.1365	2.0604	2.8226	2.6284	2.4926	2.7781	2.0299	2.4207	3.0102	2.8416	0.7127
10/76	5.3150	3.6523	2.5832	3.1051	2.6036	[b]	2.2875	2.9448	[b]	2.5736	[b]	2.6016	2.4259	2.9106	3.0003	0.8553
11/76	3.6283	2.7859	2.4082	2.3919	2.3788	[b]	1.5988	2.2651	[b]	2.4079	2.4930	2.2342	1.9061	2.7245	2.4352	0.4944
12/76	2.9236	2.2125	2.0831	2.7093	1.8898	2.0564	2.1440	2.2914	2.3945	2.1361	2.1184	1.8555	2.0123	2.5525	2.2414	0.3074
$\bar{X}$	4.2303	2.6917	2.2608	3.0191	2.4139	3.3564	2.1051	2.8265	2.3062	2.8119	2.5162	1.9961	2.3471	3.0722		
S	1.3794	1.1137	0.6549	0.7001	0.6604	0.7303	0.6036	0.7261	0.7076	0.8014	0.7693	0.4449	0.6359	0.8128		

[a] in grams

[b] No data

Table 8 - 1977 PARTICULATE LOADING DATA[a]

Date	101	102	103	104	105	108	110	111	112	115	118	119	122	123	124	$\bar{X}$	S
1/77	2.3609	2.2961	2.0268	2.7996	2.0201	2.9723	1.7278	2.5448	2.4077	2.4000	1.8445	1.6007	1.7225	2.7768	1.7764	2.2185	0.4391
2/77	2.1697	1.9070	1.7516	2.0003	2.3516	2.1880	1.6401	2.3804	1.7120	1.7924	1.5715	1.1913	1.8748	2.3952	1.7668	1.9128	0.3389
3/77	4.6245	2.7484	2.2880	2.6834	2.6130	4.5042	2.2246	2.9636	2.8275	2.7321	2.4376	1.4095	2.5041	2.7432	2.3138	2.7745	0.8147
4/77	4.9835	3.1393	2.3690	3.2787	2.6696	2.5480	2.3338	3.2014	2.4864	2.6296	2.4528	1.3622	2.7180	2.7723	2.4739	2.7612	0.7636
5/77	9.7624	5.3489	4.2686	5.2703	4.3700	6.1153	3.8359	5.4754	3.8912	4.5625	4.7033	3.8414	4.5670	4.9458	4.2935	5.0168	1.4680
6/77	4.6090	2.9623	2.4706	3.5622	2.7495	3.6340	2.5739	3.7343	2.4820	3.3512	3.0243	2.1760	3.9849	2.9125	2.7615	3.1325	0.6662
7/77	6.3698	3.2972	2.7572	4.0239	2.8654	3.7431	2.7906	4.3051	2.8846	4.2498	3.0746	2.1497	2.1221	3.2457	2.8528	3.3821	1.0635
8/77	4.1725	3.6563	2.7714	3.6165	2.9106	3.8846	2.6800	4.6405	3.5705	3.0874	2.7288	1.9894	2.4021	3.0534	2.6977	3.1908	0.7149
9/77	3.4782	3.3420	[b]	3.0057	2.4866	[b]	[b]	3.3760	[b]	2.9514	[b]	1.7720	2.6135	2.6671	2.3942	2.8087	0.5294
$\bar{X}$	4.7256	3.1886	2.5879	3.3601	2.7818	3.6987	2.4758	3.6246	2.7827	3.0840	2.7297	1.9436	2.7232	3.0569	2.5923		
S	2.2954	0.9752	0.7609	0.9320	0.6558	1.2342	0.6900	1.0201	0.6894	0.8732	0.9553	0.7934	0.9511	0.7477	0.7483		

[a] in grams

[b] No data

Table 9 - SUMMARY OF PARTICULATE LOADING IN AIR SAMPLES[a]

Sampler	1975	1976	1977	$\mu \pm 2\sigma$
101	4.2327 ± 4.4804	4.2303 ± 2.7588	4.7256 ± 4.5908	4.3962 ± 2.3277
102	2.5938 ± 1.6078	2.6917 ± 2.2274	3.1886 ± 1.9504	2.8247 ± 1.1230
103	2.0327 ± 1.4278	2.2608 ± 1.3098	2.5879 ± 1.5218	2.2938 ± 0.8213
104	2.8036 ± 1.5594	3.0191 ± 1.4002	3.3601 ± 1.8640	3.0609 ± 0.9349
105	2.6336 ± 1.2176	2.4139 ± 1.3208	2.7818 ± 1.3116	2.6098 ± 0.7610
108	3.5038 ± 1.1344	3.3564 ± 1.5606	3.6987 ± 2.4684	3.5196 ± 1.0549
110	1.8353 ± 1.0264	2.1051 ± 1.2072	2.4758 ± 1.3800	2.1387 ± 0.7004
111	2.7218 ± 1.8130	2.8265 ± 1.4522	3.6246 ± 2.0402	3.0576 ± 1.0306
112	2.2574 ± 1.2290	2.3062 ± 1.4152	2.7827 ± 1.3788	2.4488 ± 0.7757
115	2.5549 ± 1.8604	2.8119 ± 1.6028	3.0840 ± 1.7464	2.8169 ± 1.0045
118	1.9761 ± 1.2930	2.5162 ± 1.5386	2.7297 ± 1.9106	2.4073 ± 0.9244
119	1.7449 ± 1.4096	1.9961 ± 0.8898	1.9436 ± 1.5868	1.8949 ± 0.7672
122	2.1023 ± 0.9762	2.3471 ± 1.2718	2.7232 ± 1.9022	2.3909 ± 0.8293
123	[b]	3.0722 ± 1.6256	3.0569 ± 1.4954	3.0646 ± 1.1046
124	[b]	[b]	2.5923 ± 1.4966	2.5923 ± 1.4966
$\mu \pm 2\sigma$	2.5379 ± 0.5108	2.7110 ± 0.4285	3.0237 ± 0.5332	

[a] in grams

[b] No data

Table 10 - MAXIMUM "VERY SURFACE" PLUTONIUM-238 CONCENTRATION OF SEDIMENT IN WATERWAYS NEAR MOUND FACILITY

Waterway	Maximum "Very Surface" Concentration (nCi/g ± 2σ)
Runoff Hollow	0.0286 ± 0.0061
North Pond	0.0223 ± 0.0051
South Pond	
North Basin	0.0653 ± 0.0114
South Basin	0.208 ± 0.028
North Canal	0.267 ± 0.033
Drainage Ditch	0.450 ± 0.050
South Canal	0.395 ± 0.045
Overflow Creek	0.270 ± 0.034

Table 11 - MONTHLY RAINFALL QUANTITIES[a]

Month	1974	1975	1976	1977	$\bar{X} \pm 2S$
January	2.71	2.94	3.04	[b]	2.90 ± 0.34
February	[b]	4.55	2.47	1.36	2.79 ± 3.24
March	1.83	4.42	2.43	3.89	3.14 ± 2.43
April	6.15	4.24	1.67	3.65	3.93 ± 3.69
May	4.88	4.05	1.30	2.38	3.15 ± 3.23
June	9.24	1.85	5.25	2.71	4.76 ± 6.63
July	0.90	2.69	2.40	2.34	2.08 ± 1.61
August	9.40	4.57	3.10	5.55	5.66 ± 5.38
September	5.85	2.65	1.48	1.49	2.87 ± 4.13
October	1.30	4.21	2.86		2.79 ± 1.46
November	3.69	1.96	0.50		2.05 ± 3.19
December	1.85	3.55	0.41		1.95 ± 3.14
$\bar{X} \pm 2S$	4.35±6.07	3.47±2.02	2.24±1.32	2.92±2.78	

[a] in inches
[b] No data

Table 12 - PLUTONIUM-238 STACK EMISSIONS[a]

Month	1974	1975	1976	1977	$\bar{X} \pm 2S$
January	0.3931	1.5040	1.2743	1.9561	1.2819 ± 1.3135
February	3.0414	1.3038	1.8263	0.9702	1.7854 ± 1.8168
March	0.8578	0.8414	1.4920	1.0816	1.0682 ± 0.6061
April	0.4197	1.5363	1.6025	0.4524	1.0027 ± 1.3101
May	0.3766	0.6084	2.3899	0.8875	1.0656 ± 1.8145
June	0.5981	1.0441	1.2792	1.4880	1.1024 ± 0.7639
July	1.7356	1.1923	0.4265	0.3823	0.9342 ± 1.3019
August	9.2344	2.0212	1.0779	0.5094	3.2107 ± 8.1278
September	2.4060	3.4124	1.1463	0.4096	1.8436 ± 2.6633
October	2.3631	3.9174	1.2844		2.5216 ± 2.6473
November	1.4619	3.2343	0.9743		1.8902 ± 2.3786
December	5.2884	1.8962	0.7195		2.6347 ± 4.7446
$\bar{X} \pm 2S$	2.3480 ± 5.2022	1.8760 ± 2.1585	1.2911 ± 1.0221	0.9041 ± 1.0864	
Total ±2S	28.1761 ±18.02	22.5118 ± 7.48	15.4931 ± 3.54	8.137 ± 3.26	

[a] in μCi

Table 13 - METEOROLOGICAL DATA MONTHLY RESULTANT WIND DIRECTION

Month	1974	1975	1976	1977	Average
January	220°	230°	240°	250°	235°
February	250°	250°	230°	240°	242.5°
March	240°	w70°	270°	220°	240°
April	230°	310°	250°	230°	255°
May	230°	230	230°	240°	235°
June	220°	210°	220°	260°	227.5°
July	230°	220°	260°	250°	240°
August	200°	220°	360°	220°	250°
September	230°	260°	250°		246.7°
October	230°	200°	270°		233.3°
November	230°	220°	260°		236.7°
December	220°	250°	250°		240°
Annual Resultant	230°	230°	250°	240°	

Table 14 - AIR SAMPLER DIRECTION AND DISTANCE

Air Sampler	Direction from Mound (°)	Distance from Mound (mi)
101	15	1.52
102	50	0.618
103	75	0.570
104	195	0.950
105	255	0.713
108	35	9.98
110	95	6.56
111	195	5.51
112	315	1.19
115	270	4.47
118	110	1.09
119	300	28.0
122	325	0.285
123	235	0.333
124	80	0.380

Table 15 - MAXIMUM PLUTONIUM-238 VALUES FOUND IN VEGETATION AND FISH IN THE MAIMI ERIE CANAL AND POND AREA

Material Analyzed	^{238}Pu Concentration (nCi/g)
Vegetation (grass)	3×10^{-3}
Vegetation (algae)	1×10^{-1}
Fish (edible portion)	5×10^{-6}

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