Communicating Health Risks to the Community from a State-of-the Art Waste-to-Energy Resource Recovery Facility through Multimedia Environmental Monitoring Programs

Ramana K. Rao
Montgomery County Department of Public Works and Transportation
Division of Solid Waste Services, 101 Monroe Street
Rockville Maryland 20850

ABSTRACT

Since 1986, when Montgomery County, Maryland decided to construct a municipal solid waste Resource Recovery Facility (RRF), the County has been seeking citizen input through citizen advisory committee meetings. Due to public concern that organics, primarily dioxins, that are released from municipal waste combustion create the risk of potential health-effects including cancer, the County conducted a multiple pathway health-risk study in 1989. In this study, organics and trace metals that are known to be released from municipal waste combustors and are generally considered to be of importance from a public health perspective were addressed. The organics are: dioxins/furans, polycyclic-aromatic hydrocarbons (PAHs) and poly-chlorinated biphenyls (PCBs). The trace metals are: arsenic, beryllium, cadmium, chromium, nickel, lead, and mercury. This study concluded that the health-risks from the RRF are far below the levels that are considered acceptable by regulatory agencies.

In 1989, the Maryland Department of Natural Resources (DNR) independently conducted a health-risk study. In this study, DNR considered the same target chemicals as the 1989 WESTON study and addressed both the inhalation and food-chain pathways. The results from DNR's study for the RRF were similar to the Weston study.

The County conducted several citizen meetings for communicating the results of the health risk studies. In these meetings, some citizens living in the neighborhood of the facility still expressed concern, and asked the County to conduct an ambient monitoring program prior to and during the operation of the facility. The County agreed to conduct a multimedia environmental monitoring program. The County Council endorsed this program. The major objective of the program was to determine the existing background levels of toxics prior to the operation of the facility and incremental increases, if any, resulting from the operation of the facility. In this program, organics and trace metals discussed earlier, were periodically sampled. The media sampled were: air, soil, garden vegetables, surface water, fish and sediment from the farm ponds, dairy milk and hay. The pre-operational monitoring program in the air media commenced in February 1994 and concluded in January 1995. The pre-operational phase of the monitoring program in the non-air media commenced in April 1994 and concluded in April 1995. The facility commenced operations in May 1995. The operational phase of the monitoring program in the air media commenced in February 1996 and concluded in February 1997. The operational phase of the monitoring program in the non-air media commenced in April 1996 and is still ongoing. The results obtained todate in this monitoring program were presented to the citizens at several public briefings.

This paper discusses the original design of the program, citizen input to the design of the program, results of the program, and typical issues raised by the citizens in numerous public briefings conducted by the County, and the County's responses.

INTRODUCTION

In 1986, Montgomery County, Maryland decided to construct a solid waste Resource Recovery Facility (RRF) near Dickerson, Maryland, for the disposal of municipal waste generated within the County. Due to public concern that organics, primarily dioxins that are released from municipal waste combustion, create the risk of potential health-effects including cancer, the County, through its consultant Roy F. Weston, conducted a multiple pathway (air and nonair media) health-risk study in 1989. Because this facility was to be constructed within a mile of two fossil fuel fired electric power generating stations owned by the Potomac Electric Power Company (PEPCO), the Maryland Department of Natural Resources (DNR), Power Plant Siting Program, which is the technical arm of the State Permitting Agency also conducted a multiple pathway health-risk study. In both these studies, organics and trace metals that are known to be released from municipal waste combustors and are generally considered to be of importance from a public health perspective were considered. The organics are: dioxins and furans, polycyclic-aromatic hydrocarbons (PAHs), and poly-chlorinated biphenyls (PCBs). The trace metals are: arsenic, beryllium, cadmium, chromium, nickel, lead, and mercury. These studies concluded that the health-risks from the RRF are far below the levels that are considered acceptable by regulatory agencies.

In addition, the DNR study considered the health-risks from PEPCO facilities. The DNR study concluded that the health-risks from combined operation of the three facilities, are below levels that are considered acceptable by regulatory agencies. However, during discussions with citizens on the results obtained in the health-risk studies, concerned citizens asked the County to conduct an ambient monitoring program prior to and during the operation of the facility. In response to the citizen reqests, the County made commitments in the public hearings and adjudicatory hearings for the RRF to conduct a multimedia environmental sampling program. The major objective of this program was to monitor changes, if any, in environmental media, due to the operation of the facility. Typical citizen input into the health risk studies and the multimedia sampling program is summarized in Table 1.

As per this agreement, the County conducted a multimedia environmental monitoring program in two phases, a pre-operational phase and an operational phase. The duration of each phase was one year prior to and after commencement of full operation of the RRF. The pre-operational phase of the monitoring program was conducted from February 1994 to April 1995 while the construction of the 1,800 ton-per-day (TPD) RRF was progressing. The program provided baseline data for target chemicals in various environmental media including air, water, sediment, soil, earthworms, fish, garden vegetables, hay, and cow's milk [1].

The RRF started operations in May 1995. The facility consists of three units, each unit designed to combust 600 tons of solid waste per day and generate approximately 19 megawatts of electricity. Each unit has a separate flue and is equipped with the state-of-the art air pollution control (APC)equipment. The APC equipment consists of a dry scrubber and fabric filter baghouse for controlling acid gases, particulates and and organics, direct lime injection into the furnace for additional acid gas control, ammonia injection at the top of the furnace for nitrogen oxide control and activated carbon injection at the scrubber inlet for mercury control. In addition, the combustion residue is treated with dolomitic lime for minimizing leaching of metals from the residue.

The operational phase of the air monitoring program commenced in February 1996 and concluded in February 1997. The operational phase of the monitoring program in the non-air media commenced in April 1996 and is still ongoing. In March 1998, Weston submitted the final results from the air monitoring

program, and limited results from the non-air monitoring program[2]. The RRF is shown in Figure 1 and one of the primary multimedia sampling stations is shown in Figure 2.

SELECTION OF SAMPLING SITES

Air Media

Two primary sites were selected for air monitoring. The selection of primary sites was based on several factors. These are:

* Maximum impact locations obtained from EPA's dispersion/deposition modeling.
* EPA's siting criteria for ambient monitoring.
* Availability of property owned by government or quasi-government agencies.
* Access to electrical power and telephone service.
* Physical access to the site and security for the monitoring equipment.

One primary site, identified as the maximum impact site in this paper, was selected near the location of maximum annual ground level concentration (glc)/dry-deposition as predicted by EPA's dispersion/deposition models. The other primary site, identified as the "background site" was selected approximately 25 miles from the facility where the impact of the facility is insignificant as per the prediction of the dispersion models. At the two primary sites, organics, respirable particulates (PM-10), and metals were monitored. The organics are: dioxins and furans, PAHs, PCBs, and aldehydes as formaldehyde. The primary metals are: arsenic, beryllium, cadmium, chromium, nickel, lead, and mercury. Samples were collected at the two primary stations periodically and the sampling time was 24 hours.

In addition to the two primary sites, three secondary sites were selected as a result of citizen input based on concern about dioxins and furans in the ambient air. These stations were located in Lucketts, Virginia and Poolesville and Barnesville in Maryland. The Lucketts site was selected upwind of the facility based on the annual average predominant wind direction. At this site, a dioxin/furan monitoring station was installed on the roof of the Lucketts elementary school. Sampling was conducted at this site periodically and the sampling time was 24 hours. The other two secondary sites (Poolesville and Barnesville) were selected because they were population centers within five miles of the RRF. At the Poolesville site, a dioxin sampler was installed on the roof of the Poolesville High School. At the Barnesville site, a dioxin sampler was installed on the roof of the Monocacy Elementary School. At these two sites, samples were taken periodically and the sampling time was approximately 12 days. Sampling events for the pre-operational and operational phases are listed in Tables 2 and 3 respectively.

Non-Air Media

The non-air media sampling sites were selected for the following media: soil, earthworms, garden vegetables, fish, sediment and surface water from farm ponds, and hay and cow's milk from a dairy operation. These sites are shown in Figure 3.

Soil and Earthworm. Five sites were selected for soil and earthworm sampling. Of the five sites, two sites are located near the maximum wet deposition area, one site is located near the maximum dry deposition area, one site is located on the dairy farm about one mile from the maximum dry deposition area, and one site is located at the background air monitoring station. Earth-worms were sampled at all of these sites except the dairy farm.

Garden Vegetables. Three sites were selected for sampling garden vegetables. Of the three sites, one site is located near the maximum wet deposition area, one site is located near the maximum dry deposition area,

and the third site is located at the background air monitoring station. These sites correspond to soil sampling sites. At these sites, carrots, lettuce, and tomatoes were sampled.

Fish, Sediment and Water. Five farm ponds that are within four miles of the RRF site were selected for sampling fish, sediment, and surface water.

Hay and Cow's Milk. One farm closest to the maximum dry and wet deposition area, where dairy operations are taking place was selected for sampling soil, hay and cow's milk. This farm is located about one mile from the maximum dry deposition area.

Dry and wet deposition areas, air and nonair media sampling sites and the location of the RRF stack are shown in Figure 3.

SAMPLING AND ANALYTICAL METHODS

Air Media

Sampling and analytical methods, and the laboratories performing the analytical work, are listed in Table 4. As indicated in Table 4, methods developed by the U.S. EPA, wherever available, were adopted in this program. Where no EPA methods were available, or where those methods did not meet the sensitivity requirements of the program, alternative acceptable methods were identified. In many cases, the predicted maximum ground level concentrations (glcs) from the RRF are so low that they are below the detection limits of available sampling and analytical techniques. In such cases, Weston selected sampling and analytical methods that provide the lowest available detection limits.

Monitoring of all compounds at the two primary stations (Beallsville and Burtonsville) consisted of 24-hour time-integrated samples. At the three secondary sites (Lucketts, Poolesville and Barnesville), monitoring was limited to dioxins and furans. At the Lucketts site, 24-hour time-integrated samples were collected. At the remaining two secondary sites (Poolesville and Barnesville), the sampling period was extended to 12 days. This increase in the sampling period, and the proportional increase in the sample volume, was designed to enable the collection/detection of specific dioxin/furan isomers that are present at extremely low ambient levels. The detection of these specific low-level isomers and collection of the samples under a greater variety of wind directions would hopefully provide a more representative ambient dioxin/furan concentration over the long-term operation of the RRF.

Non-Air Media

Non-air media sampling events were conducted in summer and fall 1994 for the pre-operational phase and summer and fall of 1996 and spring 1997 for the operational phase. Field sample collections adhered to the work plan and to standard operating procedures (SOPs) developed for the monitoring program. All sampling equipment was properly decontaminated prior to sample collection. The samples were frozen on dry ice or in a refrigerator immediately after collection and shipped to the respective laboratories for analysis. Organics and metals sampled in each nonair media and the sampling and analytical methods are listed in Table 5.

DISCUSSION OF RESULTS

The results for selected compounds of interest that were collected in the pre-operational and operational phases are discussed in this section.

Air Media

Dioxins and Furans

24-Hour Samples. At the two primary stations and the Lucketts station where 24-hour events were conducted, a total of sixty two samples were collected in the pre-operational phase and 58 samples were collected in the operational phase. The minimum and maximum 2-3-7-8 TCDD toxic equivalent concentrations (TEQs) were 0.0147 picograms per cubic meter (pg/cu.m.) and 0.68 pg/cu.m. in the pre-operational phase and 0.014 pg/cu.m. and 0.107 pg/cu.m in the operational phase. A graphical summary of the 24-hour average 2,3,7,8-TCDD TEQs at the impact, background and Lucketts sites is presented in Figure 4. The data are presented as box-and-whisker plots and the vertical scale is logarithmic. The box is bounded by the 25th and 75th percentiles of the data set, and the line inside the box is the 50th percentile (median) of the data set. Half of the values in the data set fall within the range indicated by the box. The whiskers extend outward from the box to the maximum and minimum values. The median TEQ at the impact site (Beallsville) was 0.0598 pg/cu.m. during the pre-operational phase, and 0.047 pg/cu. m. during the operational phase.

The distributions shown in Figure 4 do not indicate significant differences in the TEQ data amongst sites during the pre-operational or operational phases. The overall range of median TEQs is small, between 0.04 and 0.06 pg/cu.m. Nondetected compounds were included in the TEQ as equal to half the analytical detection limit. Therefore, the TEQs presented in Figure 4 represent overestimates of the likely actual levels of dioxins and furans in the ambient air.

Long-duration Samples. At the two community sites (Poolesville High School and Monocacy Elementary School), long-duration dioxin/furan samples were collected over 12-day periods. A total of eleven samples were collected in the pre-operational phase and twenty one samples were collected in the operational phase. The minimum and maximum 2-3-7-8 TCDD toxic equivalent concentrations (TEQs) were 0.00738 pg/cu.m. and 0.04 pg/cu.m. in the pre-operational phase and 0.00646 pg/cu.m. and 0.227 pg/cu. m in the operational phase. A graphical summary of the 12-day average 2,3,7,8-TCDD TEQs at the two community sites is presented in Figure 5. The data are presented as box-and-whisker plots and the vertical scale is logarithmic. The box is bounded by the 25th and 75th percentiles of the data set, and the line inside the box is the 50th percentile (median) of the data set. Half of the values in the data set fall within the range indicated by the box. The whiskers extend outward from the box to the maximum and minimum values. The long-duration sample TEQs are similarly distributed as the 24-hour duration samples, between the two sites in both the pre-operational and operational phases.

Trace Metals.

At the two primary sites, a total of 43 particulate (PM-10) samples were collected in the pre-operational phase and 46 PM-10 samples were collected in the operational phase for trace metal analysis. Of all the trace metals analyzed, chromium, nickel, lead and mercury were frequently detected. While chromium, lead and nickel were analyzed from the PM-10 samples, mercury was sampled by a different method as indicated in Table 4. The data for these four metals are presented as box-and-whisker plots in Figure 6. Non-detect values are included as one-half the detection limit. Again, the distributions shown in Figure 6 do not indicate significant differences in the data amongst sites during the pre-operational or operational phases.

Non-air Media

Trace Metals.

Of all the non-air media, fish tissue analysis for mercury in farm ponds and metals in cow's milk are of utmost interest to the citizens. Therefore, these results are discussed here.

Fish Tissue in Farm Ponds. Three types of fish were found in the farm ponds, blue gill, largemouth bass and green sunfish. Of the 12 blue gill samples collected in the five farm ponds, mercury was detected in six of the samples. In five of the samples mercury concentrations ranged from 0.039 to 0.13 ppm. Only one sample indicated the mercury concentration of 0.95 ppm. Of the 12 blue gill samples collected in the five farm ponds, mercury was detected in six of the samples. In five of the samples mercury concentrations ranged from 0.039 to 0.13 ppm. Only one sample indicated the mercury concentration of 0.95 ppm. Of the four green sunfish samples, mercury was detected in only one sample, and the concentration was 0.055 ppm. Of the nine samples of largemouth bass, mercury was detected in eight of the samples. The maximum concentration was 0.71 ppm. The Food and Drug Administration (FDA) limit for methyl mercury in fish is 1 ppm. The results are presented in Table 6.

Metals in Cow's Milk. The results presented in Table 7 indicate that none of the seven metals were detected in Cow's milk either in the pre-operational or the operational phases. There are no regulatory limits for metal concentrations in Cow's milk. Only data available from literature are presented in Table 7. A comparison of the detection limits of all seven metals with the literature values indicates that the metal concentrations in the milk samples collected at the Kingsbury Farm are extremely low.

CITIZEN ISSUES.

As stated earlier, results from this monitoring program were presented to the citizens in the neighboring community at several public briefings. It was emphasized that the minor differences in the ambient levels of dioxins and trace metals from the pre-operational phase to the operational phase represent natural variation of background levels of these pollutants, and the variation is dependent among other thing, on the meteorological situation during the sampling period. Typical questions raised by the citizens and the County's responses are summarized in Table 8.

CONCLUSIONS

The Resource Recovery Facility (RRF) is equipped with the state-of-the art Air Pollution Control Technology. From the ten quarterly stack tests conducted over the last two and half years of operation, the stack emissions have been extremely low. As of this writing, there has not been a single instance of permit exceedance for any of the stack emissions. Therefore, ground level concentrations (glcs) of any pollutant, including dioxins resulting from the RRF emissions, are not expected to be distinguished compared to the existing background levels.

ACKNOWLEDGEMENTS

The author wishes to acknowledge the assistance provided by Mike Merritt of Roy F. Weston and Carl Hildebrand and Richard Dimont of the County's solid waste services division in conducting the field work. The author also wishes to thank Peter Virag and Steve Mauch of Weston for providing the figures, and Melissa Nolan for her assistance in scanning the figures for this paper.

REFERENCES

1. Rao, Ramana; Virag, Peter; Haines, Andrew and R. Schlaak. "Baseline data for the assessment of air toxics impacts from a municipal waste resource recovery facility through multimedia environmental monitoring studies", presented at the 88th Annual Meeting of the Air and Waste Management Association, San Antonio, Texas, June 1995, paperNo. 95-TA30A.01

2. Draft Summary Report on the Ambient Air Toxics Monitoring for the Montgomery County Solid Waste Resource Recovery Facility near Dickerson, Maryland, prepared by Roy F. Weston, Inc., West Chester, Pennsylvania, prepared for Montgomery County, Department of Public Works and Transportation, Division of Solid Waste Services, march 1998.

Table 1. Public Participation in Health Risk Studies and Multimedia Sampling Program

Program	Citizen Advisory Committee /Public Input	Result
WESTON Health Risk Study 1988 - 1989	Cumulative health effects from PEPCO and County facility need to be studied	County cooperates with DNR in the conduct of the cumulative multiple pathway health risk study
DNR Cumulative Health Risk Study 1988 - 1989	Because of numerous assumptions and inadequacy of ambient data on noncriteria pollutants, conduct an ambient monitoring program	County agrees to conduct an environmental monitoring program prior to, and during the operation of the facility
Monitoring plan was presented to the Solid Waste Advisory Committee (SWAC), and the public in quarterly public briefings conducted in Sept.1993 and December 1993. The plan established 3 air sampling stations, 3 soil and garden vegetable stations, one dairy milk sampling station and two farm ponds for testing water and fish.	In the monitoring program, sample dioxins in the two communities north and south of the facility, sample more ponds and soil sites around the RRF.	County locates two additional dioxin monitoring stations in the two communities north and south of the facility for a total of five sites. County adds two additional soil sites for a total of five sites, and three additional ponds for a total of five ponds
Pre-operational ambient monitoring program commenced in Feb. 1994 and concluded in March 1995. Practical demonstrations of field monitoring protocols were held. Results were presented to the public at the quarterly briefings, and reports were distributed for citizen comments.	Conduct a cumulative health risk study that would take into account the operation of other sources in the area such as the Neutron Products. Monitor health statistics data on cancer in the County. .	After completing the operational phase of the monitoring program, the results will be submitted to an independent consultant for objective review and recommendations for future course of action.
	In the milk sampling program, there is no control herd. Dairy cows tested this year will be different from the dairy cows tested next year and the following year, as the farmer could have sold some cows each year and purchased some new cows.	Milk sampling is done from a milk tank. The herd consists of approximately 100 cows. In any dairy operation, either privately operated or County operated, the life span of a cow in the herd is generally 8 to 10 years. Typically 10 percent of the cows are sold annually. Therefore, the sampling source is 90 percent intact for the subsequent years.For this reason, the County does not intend to run a dairy operation.

Table 2. Montgomery County Resource Recovery Facility ambient air sampling program - air quality monitoring events - Pre-operational Phase (1994 - 1995)

SITE TYPE	LOCATION	TYPE OF MONITORING	RELATION TO MCRRF STACK		DATE BEGUN (mm/dd/yr)	DATE ENDED (mm/dd/yr)	SAMPLING	
			DISTANCE (km)	DIRECTION			EVENT DURATION	FREQUENCY
Primary (Impact)	Beallsville Fire Station	PCB, PAH, PM, metals, aldehydes, dioxins/furans, meteorological data[1]	4.3	SE	2/19,25/94 3/3,9,21/94 4/2,14,26/94 5/8,14,20/94 6/1,13,25/94 7/1,7,19/94 8/6/94 11/28/94 12/22/94 1/4,15,27/95	1/27/95	24-hours	every 12 days*
Primary (Background)	Burtonsville Fire Station	PCB, PAH, PM, metals, aldehydes, dioxins/furans, meteorological data[1]	45.9	ESE	(See above)	(See above)	24-hours	every 12 days*
Secondary (Permanent)	Lucketts Elementary School	dioxins/furans	7.2	NW	2/13/94	1/15/95	24-hours	every 24 days*
Secondary (Mobile)	County Composting Facility (Dickerson)	dioxins/furans	0.5	SE	2/13/94	4/2/94	24-hours	every 12 days*
					4/13/94 5/9/94	5/9/94 5/19/94	~12 days	continuous
	Poolesville High School	dioxins/furans	6.8	SSE	5/20/94 6/1/94	5/31/94 6/14/94	~12 days	continuous
	Monocacy Elementary School	dioxins/furans	5.5	ENE	7/7/94 7/21/94 12/10/94 12/22/94	7/20/94 8/5/94 12/21/94 1/3/95	~12 days	continuous
	Poolesville High School	dioxins/furans	6.8	SSE	1/4/95 1/17/95 1/27/95	1/17/95 1/27/95 2/10/95	~12 days	continuous

* Sampled at 6-day intervals from 2/13/94 to 3/9/94, inclusive.

[1] Sampling for PCB's, PAH's and aldehydes was discontinued at the end of June 1994 meteorological monitoring was discontinued at Burtonsville in May 1994.

[2] Special sampling dates for the impact monitoring site only on 5/14/94 and 7/1/94.

Table 3. Montgomery County Resource Recovery Facility ambient air sampling program - air quality monitoring events - operational Phase (1996 - 1997)

SITE TYPE	LOCATION	TYPE OF MONITORING	RELATION TO MCRRF STACK		DATE BEGUN (mm/dd/yr)	DATE ENDED (mm/dd/yr)	SAMPLING	
			DISTANCE (km)	DIRECTION			EVENT DURATION	FREQUENCY
Primary (Impact)	Beallsville Fire Station	PCB, PAH, PM, metals, aldehydes, dioxins/furans, meteorological data[1]	4.3	SE	2/27/96 3/10,16,28/96 4/9,21/96 5/3,15,27/96 6/8,20/96 7/2,14/96 8/13/96 11/14,29/96 12/11,23/96 1/4,16,28/97 2/3,9/97 3/5/97	3/5/97	24-hours	every 12 days*
Primary (Background)	Burtonsville Fire Station	PCB, PAH, PM, metals, aldehydes, dioxins/furans,	45.9	ESE	(See above)	(See above)	24-hours	every 12 days*
Secondary (Permanent)	Lucketts Elementary School	dioxins/furans	7.2	NW	2/27/96	2/9/97	24-hours	every 24 days*
Secondary (Long-Term)	Poolesville High School	dioxins/furans	6.8	SSE	2/27/96 3/11/96 3/28/96 4/10/96 4/25/96 6/20/96 8/13/96 10/1/96 11/27/96 12/20/96 1/16/97	3/11/96 3/25/96 4/9/96 4/22/96 5/8/96 7/3/96 8/26/96 10/16/96 12/10/96 1/2/97 1/29/97	~12 days	continuous
	Monocacy Elementary School	dioxins/furans	5.5	ENE	(See above; not run on 12/20/96-1/2/97)	(See above; not run on 12/20/96-1/2/97)	~12 days	continuous

* Sampled at 6-day intervals from 2/13/94 to 3/9/94, inclusive.

[1] Sampling for PCB's, PAH's and aldehydes was discontinued at the end of June 1994 meteorological monitoring was discontinued at Burtonsville in May 1994.

[2] Special sampling dates for the impact monitoring site only on 5/14/94 and 7/1/94.

Table 4. Sampling and Analytical Methodology for Air Media Monitoring

Compound	Sampling Methodology		Analytical Laboratory	
	Sampling Media	Sampling and Analytical Methods	Pre-operational Phase	Operational Phase
Dioxins/Furans	PUF Sampler: General Metal Works Model GPS-1 which has a glass fiber filter and a polyurethane foam (PUF) sorbent trap	EPA Method TO-9/ HRGC/HRMS: High Resolution Gas Chromatography with Mass Spectroscopy	HuntingtonInc ; St. Paul, MN	Maxim Technology, Inc.
PAHs	PUF/XAD: Two PUF plugs, XAD-2 resin and a quartz glass fiber filter	EPA Method TO-13/ GC/MS-SIM:Gas Chromatography with Mass Spectroscopy and Selective Ion Monitor	PACE Inc; Camarillo, CA	Maxim Technology, Inc.
PCBs	Same as PAHs	EPA Method TO-4/ GC/MS	PACE Inc; Camarillo, CA	Maxim Technology, Inc.
Aldehydes	ADS/DNPH: Annular denuder tubes coated with 2,4-dinitrophenylhydrazine (DNPH) solution as an adsorbent	HPLC: High Purity Liquid Chromatography	Triangle Labs,. Columbus, OH	Data Analysis Technology, Inc.
PM-10/ Metals	PM-10 : Filter All Metals: Filter	PM-10: 40 CFR, Part 50, Appendix 5 Beryllium: ICP; Inductively Coupled Plasma All other metals: XRF: X-ray Fluorescence	Chester Labnet, Inc., Tigard, OR	Chester Labnet, Inc., Tigard, OR
Mercury	Mercury (Vapor+particle): Adsorbent	CVAF: Cold Vapor Atomic Fluorescence	Frontier Geoscience Seattle, Washington	Frontier Geoscience Seattle, Washington

Table 5. Sampling and Analytical Methodology for Non-air Media Monitoring

Compound	Sampling Methodology	
	Sampling Media	Sampling and Analytical Methods
Dioxins/ Furans	Soil Earthworms Forage/Hay Cow's Milk Vegetable Crops Surface Water Sediment Fish	U.S. EPA Method 8290
PAHs	Soil Earthworms Forage Hay Cow's Milk Vegetable Crops Surface Water Sediment Fish	U.S. EPA Method 8270
PCBs	Soil Earthworms Forage Hay Cow's Milk Vegetable Crops Surface Water Sediment Fish	U.S. EPA Method 8080
Metals		
As, Be, Cd, Cr and Ni	Soil Earthworms Forage Hay Cow's Milk Vegetable Crops Surface Water Sediment Fish	U.S. EPA Method 6010
Pb	Soil Earthworms Forage Hay Cow's Milk Vegetable Crops Surface Water Sediment Fish	U.S. EPA Method 7421
Hg	Soil Earthworms Forage Hay Vegetable Crops Sediment Fish	U.S. EPA Method 7471
Hg	Cow,s Milk Surface Water	U.S. EPA Method 7470

Table 6. Mercury* Concentrations in Fish Tissue (ppm)

	Bluegill			
	Whole Body		Fillet	
Pond #	Pre-operational	Operational	Pre-operational	operational
1	0.039, 0.051	ND (0.05)	0.059	NA
2	ND (0.1)	ND (0.5)	ND (0.1), 0.13	0.06, 0.12
3	NA	NA	NA	NA
4	ND (0.1)	NA	NA	NA
5	ND (0.1)	0.95	NA	NA
	Green Sunfish			
	Whole Body		Fillet	
Pond #	Pre-operational	Oerational	Pre-operational	Operational
1	NA	NA	NA	NA
2	NA	NA	NA	NA
3	ND (0.1)	0.055	NA	NA
4	ND (0.1)	ND (0.05)	NA	NA
5	NA	NA	NA	NA
	Largemouth Bass			
	Whole Body		Fillet	
Pond #	Pre-operational	Operational	Pre-operational	Operational
1	NA	0.16	0.03	0.2
2	NA	NA	0.15	NA
3	NA	NA	NA	NA
4	NA	NA	NA	NA
5	ND (0.10), 0.71	0.352 -- 0.7	NA	0.294

* Inorganic Mercury
NA: Not Available
ND: Not Detected
Note: The Food and Drug Administration (FDA) limit for methyl mercury in fish is 1 ppm.

Table 7. Trace metal concentrations in cow's milk sampled at the Kingsbury Dairy Operations, parts per million (ppm)

Trace Metal	Milk Literature Levels	Pre-operational	Operational
Arsenic	140	ND (0.15 - 15)	ND (0.015 - 0.244)
Beryllium	NBV	ND (0.005 - 0.05)	ND (0.005 - 0.015)
Cadmium	20	ND (0.0015 - 1.5)	ND (0.010 - 0.015)
Chromium	NBV	ND (0.006 - 0.0074	ND (0.015 - 0.111)
Lead	50	ND (0.015 - 15)	ND (0.01 - 0.0231)
Mercury	50	ND (0.0002 - 0.2)	ND (0.0005 - 0.002)
Nickel	NBV	ND (0.006 - 10)	ND (0.025 - 0.06)

NBV: No background available
ND: Not detected, values in paranthesis are the sample quantitation limits
*: Gunderson, 1987

Table 8. Typical issues raised by the citizens and the county's responses.

1. Issue	We want our ponds tested every year and for all chemicals.
Response	Based on the data collected during the pre-operational and operational phases of the program, the County believes that sampling of ponds for water quality and fish tissue need not be performed every year; once in two or three years should be adequate. In any case, the results of this study will be submitted for an independent consultant for an objective review. This consultant will make recommendations to the County as to the future course of this program.
2. Issue	We would like to see existing environmental conditions and epidemiological information incorporated in to a health-risk study instead of only incremental health-risks from each facility, ie, we are interested in cumulative health risks.
Response	As stated earlier, the County has been conducting ambient monitoring program both in air and non-air media for toxic substances that are known to be released from combustion of municipal waste and are identified as of concern from a public health perspective. Baseline monitoring program was conducted from February 1994 to February 1995. RRF operational phase monitoring program was conducted from February 1996 to March 1997. An independent consultant who has expertise in health-risk assessments will review the data collected in this program. The consultant will also review the cumulative health-risk studies conducted by the County and the Maryland Department of Natural Resources (DNR), and make recommendations to the County with regard to addressing additional health issues. Interested citizens will have an opportunity to provide their input for conducting future studies.
3. Issue	How long the units run before the stack tests are conducted, and at what times?
Response	The units run for at least 24 hours before the stack tests are done. The tests are generally conducted during the daytime hours; sometimes, the testing is done during the night also.
4. Issue	Is ammonia released from the stack tested?
Response	Yes, ammonia is sampled during quarterly stack tests. The results show that the amount released at stack height is far below the OSHA safety levels at the ground level. Because of dispersion, the ammonia levels reaching the ground will be reduced further
5. Issue	Will there be any emissions testing or emissions reductions on Ozone alert (red flag) days?
Response	The Continuous Emissions Monitoring (CEM) Program operates 24 hours a day, 365 days per year except when maintenance is done on the equipment. NOx emissions are monitored by the CEM. The County has agreed to reduce RRF operations by 30% on red flag days so that NOx emissions are reduced.
6. Issue	What type of emergency management plans are in place in case of accidental release of toxic chemicals such as ammonia at the RRF?
Response	The County's Department of Fire and Rescue Services has emergency management plans in place for toxic substances release anywhere in the County. For the RRF in particular, Ogden has prepared and submitted to the County and the State an Operation and Maintenance Manual, which describes among other things, emergency management plans. At the next quarterly public briefing in June 96, personnel from the County's Fire and Rescue Services Department will discuss Montgomery County's Emergency Management Plans. The presentation will include the County's general emergency plans and examples of potential emergency occurrences at various facilities in the County including the RRF, and action plans at the RRF.

Figure 1. Montgomery County Waste-to-Energy Resource Recovery Facility (RRF)

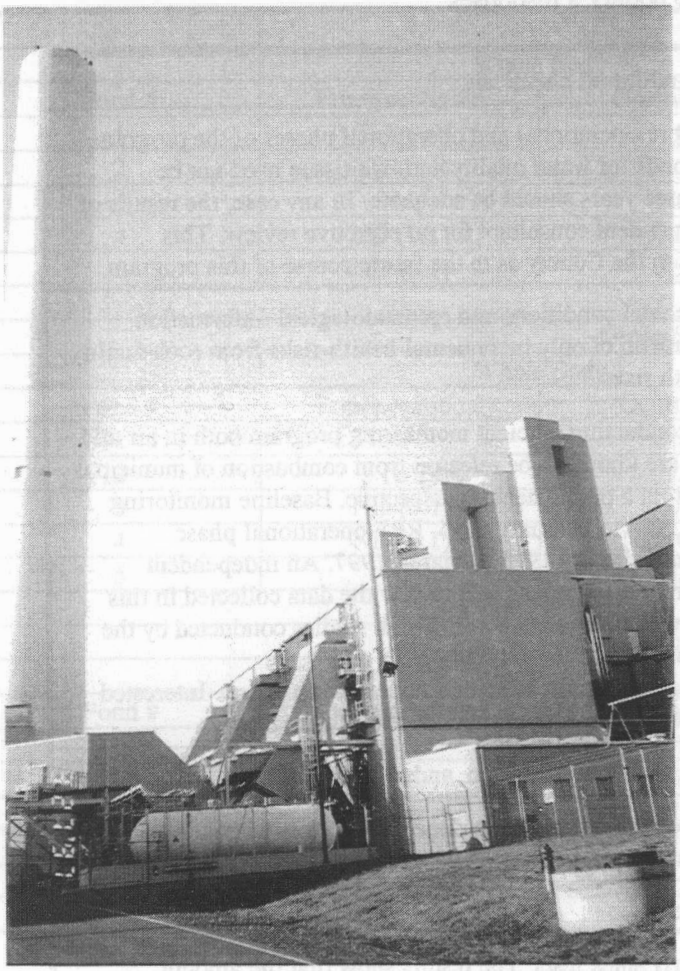


Figure 2. Multimedia Environmental Monitoring Station

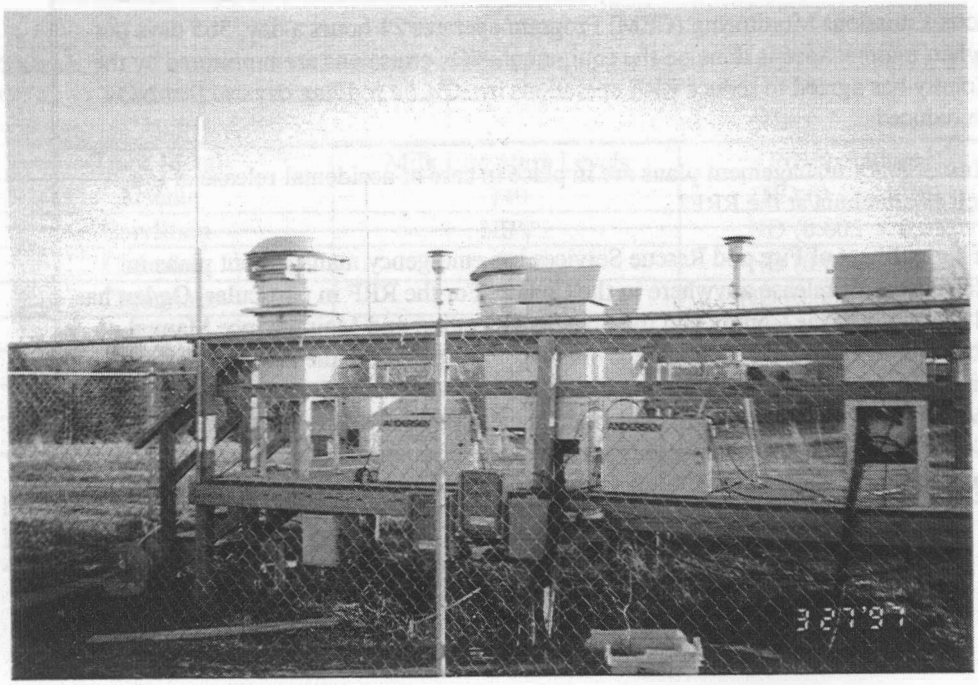
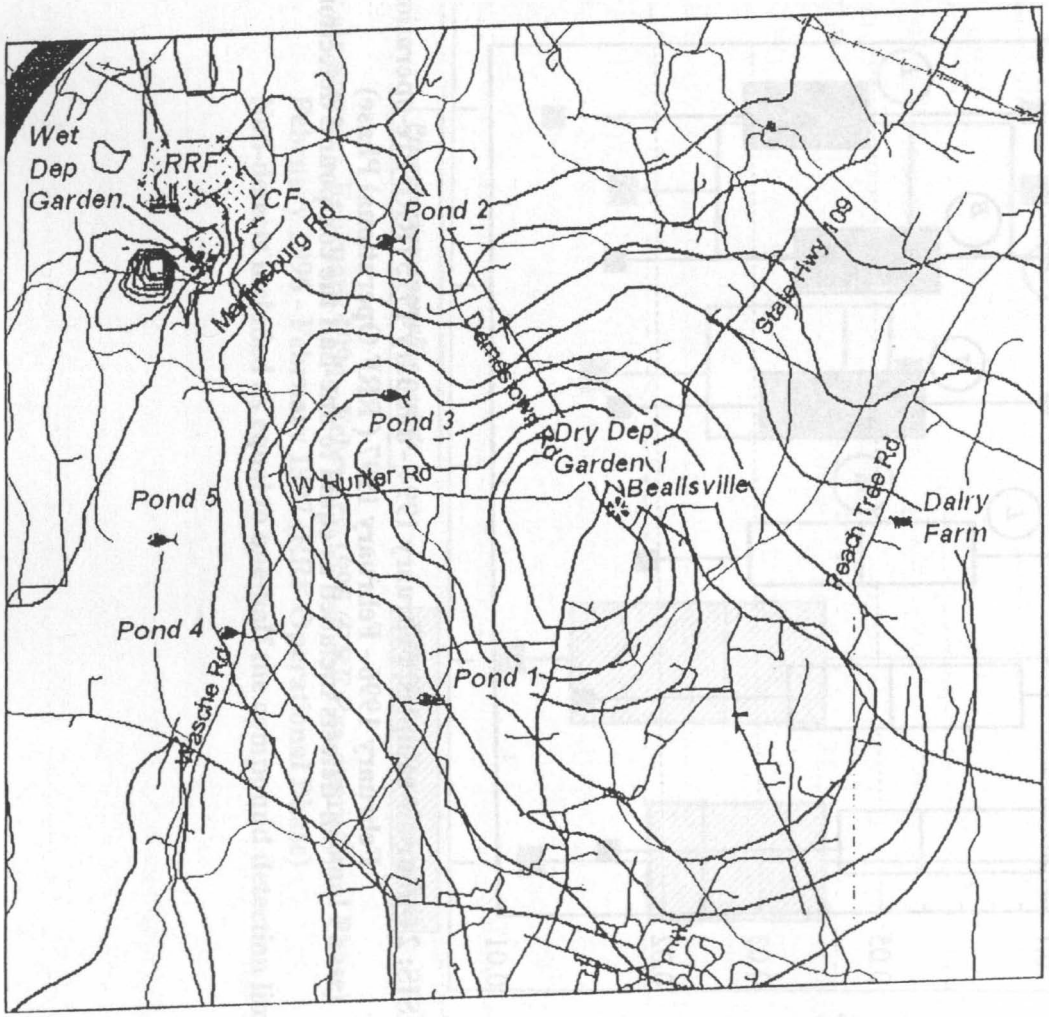


Figure 3. Locations of the RRF and Multimedia Sampling Stations



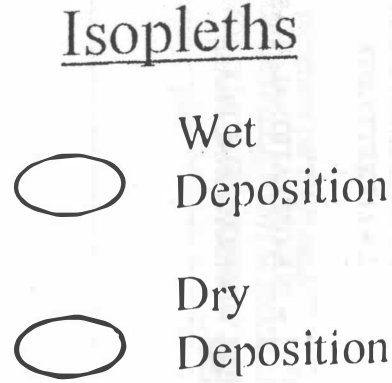
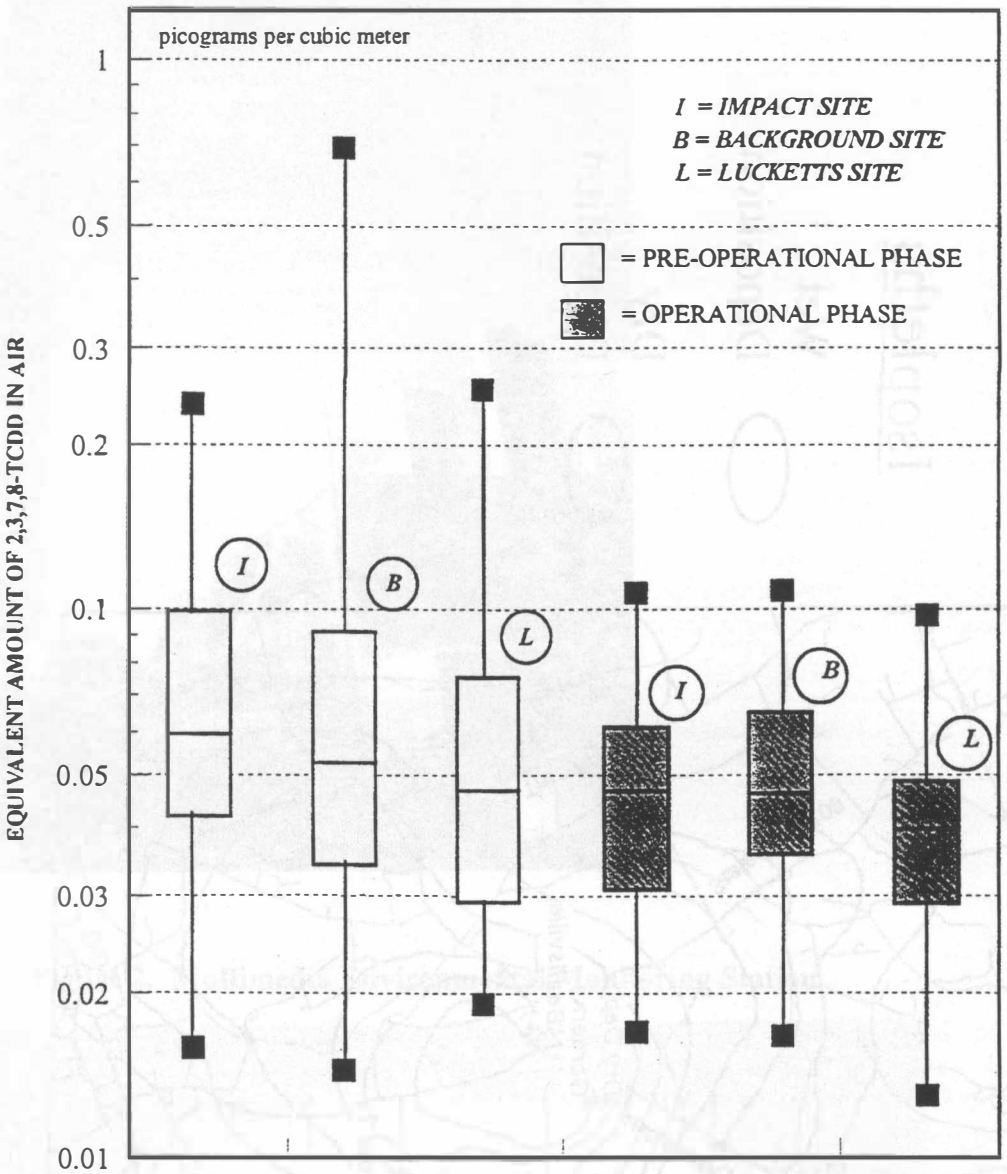
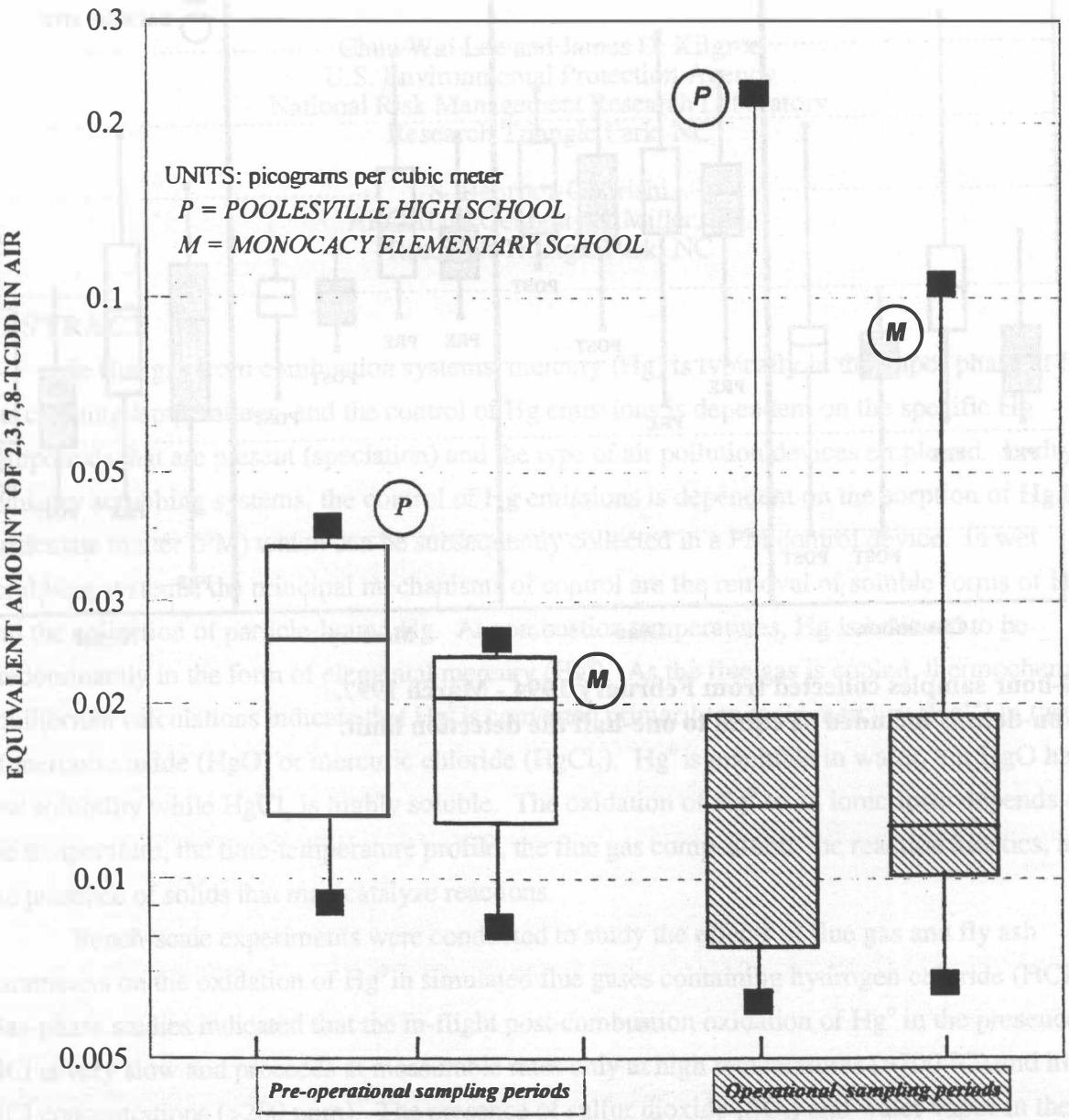


Figure 4. Distribution of Toxic Equivalents for 24-hour Dioxin/furan Samples



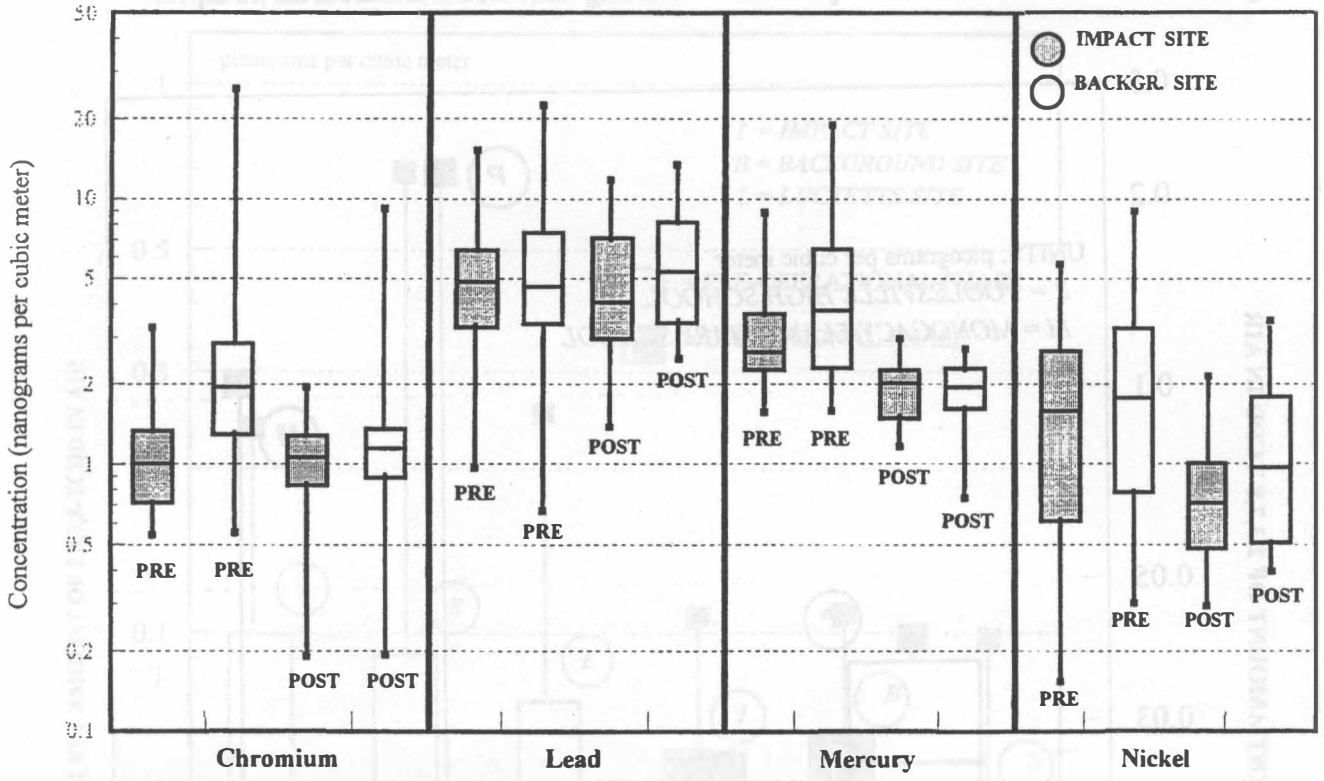
BASIS: 24-hour air samples, February 1994 - January 1995 (RRF Pre-operational Phase)
February 1996 - February 1997 (RRF Operational Phase)
Non-detects included as equal to one-half the compound detection limit

Figure 5. Distribution of Toxic Equivalents for Long-duration Dioxin/furan Samples



BASIS: 12-day air samples, February 1994 - February 1995 (RRF Pre-operational Phase)
February 1996 - February 1997 (RRF Operational Phase)
Non-detects included as equal to one-half the compound detection limit

Figure 6. Trace Metals Concentrations in the Air Media



Basis: 24-hour samples collected from February 1994 - March 1997.
Non-detects included as equal to one-half the detection limit.