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DEVELOPMENT OF ARSENIC BACKGROUND IN MIDDLEPORT SOILS

**FMC CORPORATION
MIDDLEPORT, NEW YORK**

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MIDDLEPORT, NEW YORK**

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1.0 INTRODUCTION

1.1 GENERAL

FMC Corporation has completed implementation of the "Part A-Work Plan for Development of Arsenic Background in Middleport Soil" (Work Plan), dated September 2001 and revised by letter dated November 28, 2001. The Work Plan was prepared by and approved by the New York State Department of Environmental Conservation (NYSDEC), the New York State Department of Health (NYSDOH) and the United States Environmental Protection Agency (USEPA). For purposes of this report, NYSDEC, NYSDOH and USEPA are collectively referred to as "Agencies." The Work Plan was performed by FMC relative to and consistent with the provisions of an Administrative Order on Consent (AOC), Docket No. II-RCRA-90-3008(h)-0209, entered into by FMC, NYSDEC and USEPA and effective July 2, 1991.

The Work Plan provides for the collection of soil samples in Gasport, New York and analysis of these samples for arsenic. Data from the soil sampling are then to be used to calculate the typical or "background" soil arsenic levels in Eastern Niagara County, including the Middleport, New York area. The Gasport area was selected for collection of these samples based on similarity of soil characteristics and historic land use to Middleport, and the unlikelihood that due to distance and direction, past operations at the FMC Middleport plant would have affected soils in Gasport.

This report has been prepared pursuant to Section 5.6 of the approved Work Plan to summarize the information and data obtained during the study and present the associated statistical calculations specified in the Work Plan.

1.2 BACKGROUND

The following presents a chronology of pertinent events and activities performed during implementation of the Work Plan:

<i>Approximate Time</i>	<i>Event/Activity</i>
November 28, 2001	Agencies issue approved final Work Plan.
December 3, 2001	FMC advises Agencies of its intention to implement the Work Plan as requested by the Agencies and submits an implementation schedule.

<i>Approximate Time</i>	<i>Event/Activity</i>
December 17, 2001	Agencies approve the Work Plan and FMC's implementation schedule.
December 17, 2001	FMC begins Work Plan implementation.
December 2001 through February 2002	FMC performs desktop review to identify Gasport properties for site visits.
Late February 2002	FMC informs public of the Gasport soil sampling program.
Early March 2002	FMC notifies owners of Gasport properties selected for site visits of upcoming visits and issues an Information Sheet about the sampling program.
March 2002	Representatives of FMC, USEPA, NYSDEC and NYSDOH visit selected Gasport properties on March 19 and 20, 2002 to identify primary and alternate properties that will be sampled for arsenic levels in soils and to interview owners of the respective properties.
April 2002	FMC submits a report dated April 25, 2002 that summarizes the site visits and identifies specific primary and alternate properties selected for sample collection. FMC provides the Agencies with "Proposed Sample Locations on selected Properties Sketches."
May 2002	By letter dated May 9, 2002, the Agencies approve FMC's April 2002 Selection of Gasport Properties Report with modifications submitted by letter dated May 16, 2002. After receipt of approval, FMC obtains permission from property owners for the sampling activities.
May 20 - 24, 2002	150 soil samples are collected from the selected Gasport properties.
May - August 2002	Analysis of soil samples from 75 initial sample locations for total arsenic and data validation. The validated data for the initial 75 samples are sent to Agencies by letter dated June 28, 2002. The Agencies approve the data by letter dated August 13, 2002.

<i>Approximate Time</i>	<i>Event/Activity</i>
July – September 2002	Statistical evaluations specified in Section 4.0 of the Work Plan are performed on the data for the initial 75 samples and indicate additional data are required. FMC and the Agencies agree to analyze the additional 28 soil samples from the wooded-agricultural properties for arsenic in August 2002. The data are validated and submitted to the Agencies on September 13, 2002, along with the results of the statistical evaluation of the data for the initial 75 soil samples.
October 2002	By letters dated October 7, 2002, FMC provides the owners of sampled properties with the analytical results for soil samples collected from their properties
September – December 2002	Statistical analysis and calculations required in Section 4.0 of the Work Plan on the soil data for the initial 75 soil samples and the 28 additional soil samples are performed. A Preliminary Report on Data Evaluation and Statistical Analysis and the validated data from the additional 28 samples are submitted on October 31, 2002. The Agencies provide comments and approve the preliminary report by letter dated November 25, 2002.
December 2002 - present	Development of statistically derived comparison tools and criteria as required in Section 5.0 of the Work Plan, and preparation of a final report for the study.

2.0 SELECTION OF SAMPLE PROPERTIES

The Gasport area was determined to be similar to Middleport's character, history and usages (see Section 2.3 in the Work Plan). Furthermore, the Gasport area was determined to be sufficiently distant and in a direction from the FMC Facility in Middleport so as not to have been impacted by past operations, including air emissions, at the FMC Middleport facility. The following outlines the property type/usage groups and the number of properties to be sampled within each group:

<i>Major Property Type/ Usage</i>	<i>Number of Properties</i>
Orchard Land	3 Orchards
Wooded/Overgrown/ Agricultural Crop Field Land	2 Wooded Lands 5 Crop Fields
Commercial/Industrial Land	2 Business Properties 2 Industrial Properties
Residential/Public Land	7 Residential Properties 1 School Property

This section summarizes the activities performed to select the properties in Gasport that were sampled. These activities were performed pursuant to Section 2.6 of the Work Plan.

2.1 DESKTOP REVIEW

The first step (Section 2.6B of the Work Plan) involved a desktop review of available current and historical documents for the Gasport area to identify potential areas that would be considered for sampling. The desktop review identified areas whose current property type/usage was consistent with the historic property type/usage. Any property whose historic type/usage is different for its current property type/usage was eliminated from consideration. The results of this desktop review were summarized in a "Summary Report-Selection of Gasport Areas for Site Visits" (Summary Report), submitted to the Agencies by cover letter dated January 31, 2002, along with a draft Site Visit Log. This Summary Report identified areas and properties in Gasport proposed for site visits.

By letter dated February 19, 2002, the Agencies provided comments on FMC's January 31, 2002 submittal and conditionally approved the Summary Report. FMC subsequently revised the Summary Report to address the Agencies' comments. The revisions to the Summary Report were submitted by letter dated March 4, 2002. This revised report was approved by the Agencies by letter dated May 9, 2002.

2.2 SITE VISITS

The Site Visit Task, as specified in Section 2.6C of the Work Plan, was performed in March and April 2002. At the end of February through early March 2002, FMC issued press releases detailing the Gasport soil sampling program to local and regional newspapers and radio stations. In addition, FMC issued an Information Sheet (dated Spring 2002) which described the background sampling program to local government officials, businesses and other people on FMC's mailing list. In early March 2002, owners of Gasport properties selected for site visits (as identified in FMC's Summary Report) were informed of the sampling program and the upcoming sites visit, and were provided with a copy of FMC's Information Sheet on the Gasport soil sampling program.

On March 19 and March 20, 2002, representatives of the NYSDEC, the NYSDOH, and FMC visited the Gasport properties/areas identified in the Summary Report. Owners of the properties were interviewed and the Site Visit Log was completed for each property visited. Using the information gathered during the site visits and the guidelines and principals specified in Section 2.6A of the Work Plan, primary and alternate properties were selected for the collection of background soil samples. A list of these properties and the information gathered during the site visits were summarized in a report entitled "Selection of Gasport Properties for the Collection of Background Samples, Volume 1-Text, Figures and Tables and Volume 2-Appendices", dated April 24, 2002. The April 2002 Volume 2 identifies the addresses and owners of the specific properties visited (Appendix A); completed Site Visit Logs (Appendix B) that contains information on the property history and characteristics (based on interviews of the property owners); and photographs of the properties visited taken by CRA (Appendix C) and by the NYSDEC (Appendix D). The April 2002 Volume 2, which contains all of the appendices to the report, was presented separately from Volume 1 and is considered confidential (not available for public review) so that the privacy of the property owners can be maintained.

The April 2002 report was submitted to the Agencies by cover letter dated April 24, 2002, along with "Proposed Sample Locations on Selected Properties Sketches". The

Agencies approved the April 2002 report with modifications specified in a letter dated May 9, 2002. FMC submitted revisions to the April 2002 report by letter dated May 16, 2002.

3.0 SAMPLE COLLECTION AND ANALYSES

3.1 ACCESS PERMISSION REQUESTS

After receipt of the Agencies' approval of the properties selected for sampling and the proposed preliminary sample locations, requests for permission to access properties for the collection of soil samples were made to the property owners (from May 6 though May 24, 2004). Proposed sampling properties were changed with approval of the Agencies when access permission was denied by the property owner.

3.2 SAMPLE LOCATIONS

Background soil sampling took place from May 20, 2002 to May 24, 2002. Soil samples were collected on 21 individual properties consisting of three orchards, two wooded areas, five agricultural fields, two business properties, two industrial properties, seven residential properties, and one school property. In accordance with the Work Plan, 150 soil samples (consisting of 75 initial samples and 75 additional sample) were collected. The sampled properties and the sample locations are identified as follows:

<i>Property Group</i>	<i>Property ID</i>	<i>Sample Location Names⁽¹⁾</i>
Orchard	Orchard-Oa	Oa-1A, Oa-2A, Oa-3A, Oa-4A Oa-1B, Oa-2B, Oa-3B, Oa-4B
	Orchard-Ob	Ob-1A, Ob-2A, Ob-3A, Ob-4A Ob-1B, Ob-2B, Ob-3B, Ob-4B
	Orchard-Od	Od-1A, Od-2A, Od-3A, Od-4A Od-1B, Od-2B, Od-3B, Od-4B
Wooded-Agricultural	Wooded-Wd	Wd-1A, Wd-2A, Wd-3A, Wd-4A Wd-1B, Wd-2B, Wd-3B, Wd-4B
	Wooded-We	We-1A, We-2A, We-3A, We-4A We-1B, We-2B, We-3B, We-4B
	Crop Field-Ca	Ca-1A, Ca-2A, Ca-3A, Ca-4A Ca-1B, Ca-2B, Ca-3B, Ca-4B
	Crop Field-Cc	Cc-1A, Cc-2A, Cc-3A, Cc-4A Cc-1B, Cc-2B, Cc-3B, Cc-4B

<i>Property Group</i>	<i>Property ID</i>	<i>Sample Location Names⁽¹⁾</i>
Wooded-Agricultural (con't)	Crop Field-Cd	Cd-1A, Cd-2A, Cd-3A, Cd-4A Cd-1B, Cd-2B, Cd-3B, Cd-4B
	Crop Field-Ce	Ce-1A, Ce-2A, Ce-3A, Ce-4A Ce-1B, Ce-2B, Ce-3B, Ce-4B
	Crop Field-Ch	Ch-1A, Ch-2A, Ch-3A, Ch-4A Ch-1B, Ch-2B, Ch-3B, Ch-4B
Commercial-Industrial	Industrial-Ia	Ia-1A, Ia-2A, Ia-3A, Ia-1B, Ia-2B, Ia-3B
	Industrial-Ib	Ib-1A, Ib-2A, Ib-3A, Ib-1B, Ib-2B, Ib-3B
	Business-Bb	Bb-1A, Bb-2A, Bb-3A, Bb-1B, Bb-2B, Bb-3B
	Business-Bf	Bf-1A, Bf-2A, Bf-3A, Bf-1B, Bf-2B, Bf-3B
Residential-Public	Residential-Ra	Ra-1A, Ra-2A, Ra-3A, Ra-1B, Ra-2B, Ra-3B
	Residential-Rb	Rb-1A, Rb-2A, Rb-3A, Rb-1B, Rb-2B, Rb-3B
	Residential-Rc	Rc-1A, Rc-2A, Rc-3A, Rc-1B, Rc-2B, Rc-3B
	Residential-Re	Re-1A, Re-2A, Re-3A, Re-1B, Re-2B, Re-3B
	Residential-Rf	Rf-1A, Rf-2A, Rf-3A, Rf-1B, Rf-2B, Rf-3B
	Residential-Rg	Rg-1A, Rg-2A, Rg-3A, Rg-1B, Rg-2B, Rg-3B
	Residential-Rh	Rh-1A, Rh-2A, Rh-3A, Rh-1B, Rh-2B, Rh-3B
	School-Sa	Sa-1A, Sa-2A, Sa-1B, Sa-2B

Note:

- (1) Initial 75 sample locations are identified with an "A" at the end of the location name; the additional sample locations are identified with a "B" at the end of the location name.

Sketches and photographs identifying the sample locations are presented in Volume 2-Confidential Appendices to this report. Volume 2 contains specific information (i.e., property owners and addresses) about the properties sampled and is therefore considered confidential (not available for public review) so that the privacy of property owners can be maintained.

There were four initial and four additional sample locations on each of the three orchard properties. Orchard sample locations alternated between being collected between trees in a row and in the pathway between rows. Orchard Oa has a small stream and floodplain area located in the northwest corner. Orchard Ob has a drainage ditch along the roadway and Orchard Od has a surface water drainage ditch that runs parallel to a gravel access road that runs down the center of the property. Sample locations Oa-1A and Oa-1B were situated within the flood plain of the stream. Sample locations Od-3A and Od-3B were situated on the banks of the drainage swale, as directed by the Agencies' field representatives, and not from locations along the bottom of the drainage swale, as specified in Section 3.3 of the Work Plan.

There were four initial and four additional soil sample locations on each of the two wooded and five crop field properties. Portions of wooded property Wd and crop field Cd are situated within the floodplain of the East Branch of Eighteen-Mile Creek. The following sample locations are situated next to the creek: Wd-1A, Wd-1B, Wd-3A, Wd-4B, Wd-1A, Wd-1B, Cd-2A, Cd-2B, Cd-3A, and Cd-3B.

There were three initial and three additional soil sample locations on each of the commercial and industrial properties. The two commercial properties sampled are no longer used for commercial purposes but had historically been used for business purposes. Currently, the property Bb is unoccupied and Bf is partially used for residential purposes. None of the commercial or industrial properties contain surface water drainage ditches. Industrial property Ib is situated next to a railroad. Sample locations Ib-1A, Ib-1B, Ib-2A and Ib-1B were situated next to the railroad.

Three initial and three additional soil sample locations were sampled on each of the seven residential properties. Residential properties Ra and Rb are situated within the floodplain of the East Branch of Eighteen-Mile Creek. Sample locations Ra-1A, Ra-1B, Rb-3A and Rb-3B are situated within the floodplain of the East Branch of Eighteen-Mile Creek. Property Rg contains a surface water drainage ditch along its eastern property boundary and another ditch along the railroad that abuts the property to the south. Samples Rg-2A, Rg-2B, Rg-3A and Rg-3B were collected from the banks of the drainage ditches, as directed by the Agencies' field representatives, and not from the ditch invert.

Two initial and two additional soil samples were collected from the Gasport Elementary School property. Locations Sa-1A and Sa-1B are situated at the northeastern quadrant of the school property, and locations Sa-2A and Sa-2B are situated in an area near the gravel playground area.

3.3 SAMPLING PROCEDURES

CRA collected the soil samples in the presence of representatives of the Agencies. The split samples were provided to the Agencies at locations selected by the Agencies' field representatives.

Collection of samples followed the procedures set forth in the Sampling and Analysis Plan (SAP) which is presented in Appendix 3.A of the Work Plan. Some modifications to the procedures described in the SAP were required and were approved by the Agencies' field representatives. These modifications included:

- i) Laboratory validated pre-cleaned soil scoops (specified in Section 3 of the SAP) could not be obtained. Alternatively, a new, pre-cleaned, sterile soil scoop was used to collect the soil sample at each sample location.
- ii) Laboratory validated pre-cleaned soil bowls (specified in Section 3 of the SAP) could not be obtained. Alternatively, a new, pre-cleaned, sterile, 1-liter polyethylene wide mouth jar was used at each sample location for compositing/homogenizing the soil sample.
- iii) The SAP stated in Section 3.0 that new stainless steel trowels (one for each property to be sampled) were to be used to cut a one-foot square in the vegetative cover. Stainless steel trowels could not be obtained and would have been difficult and time consuming to use based upon past experience. As such, a carbon steel, straight edged shovel was used to cut a one-foot square through the sod. The sod was then peeled away with latex-gloved hands. The shovel was decontaminated between sample locations on a single property with deionized water. Between each sample property, the shovel was decontaminated by scrubbing in a bath of potable water and non-phosphate detergent, rinsing in a potable water rinse, rinsing with deionized water, rinsing with a 10 percent nitric acid solution, rinsing with deionized water and air drying. A rinse blank was collected for every 20 soil samples collected. The rinse blank was collected by pouring laboratory-supplied deionized water over the decontaminated shovel and collecting the rinse water in a laboratory supplied container for the analysis of total arsenic and lead.
- iv) The removed vegetative cover was shaken over the sample point to remove as much soil as possible from the root mat without causing significant root material to be dislodged. At several properties, primarily overgrown agricultural fields and orchards with thick grass, the root zone was deep (e.g., three to five inches

thick) and moist. In these situations, soil did not easily fall away from the root mat when shaken, and the soil was consequently scrapped off the bottom of the root mat with the dedicated soil scoop onto the center of the exposed soil square. Soil was scraped away, if possible, until the root mat was no thicker than two to three inches.

- v) Since 1-liter jars were used for soil compositing/homogenizing instead of bowls, at each location, soil was scooped into the one-liter polyethylene jar from a uniform hole, three inches in depth, situated in the center of the one-foot square. The soil was broken up inside the polyethylene jar with a dedicated scoop and the jar was then sealed and vigorously shaken. The jar was then reopened and the sample scooped out into 4-ounce amber glass laboratory jar(s).

Split soil samples were provided as requested by the Agencies' field representatives.

3.4 SAMPLE ANALYSIS

After the samples were placed in the 4-ounce soil jars, the jars were labeled. The labels were taped with clear tape and the jars were stored on ice. Sample labels included the sample identification (ID), the sample date and time, and the analysis to be performed. The sample ID indicated from which property and location the sample came and whether it was an initial or additional sample. All samples were stored and shipped with ice from the time of sampling until receipt at the laboratory. All 150 soil samples and associated quality assurance/quality control (QA/QC) samples were shipped to H2M Labs, Inc. (H2M) in Melville, New York.

Chain-of-Custody Forms were used to track all samples from the time of sampling to the time of arrival at the laboratory. Each shipping container sent to the laboratory contained a chain-of-custody. The chain-of-custody, in addition to listing the sample number and date and time of each sample collected and the analysis required, also indicated whether the laboratory was to analyze or hold any particular sample. Sample IDs and sample locations ending with an "A" were analyzed for total arsenic while those ending with a "B" were initially held by the laboratory.

H2M was instructed to analyze soil samples from the 75 initial sample locations (with names ending in an "A") for total arsenic, as listed below:

<i>Property Group</i>	<i>Property ID</i>	<i>Sample Locations</i>
Orchard (12 samples)	Orchard-Oa	Oa-1A, Oa-2A, Oa-3A, Oa-4A
	Orchard-Ob	Ob-1A, Ob-2A, Ob-3A, Ob-4A
	Orchard-Od	Od-1A, Od-2A, Od-3A, Od-4A
Wooded-Agricultural (28 samples)	Wooded-Wd	Wd-1A, Wd-2A, Wd-3A, Wd-4A
	Wooded-We	We-1A, We-2A, We-3A, We-4A
	Crop Field-Ca	Ca-1A, Ca-2A, Ca-3A, Ca-4A
	Crop Field-Cc	Cc-1A, Cc-2A, Cc-3A, Cc-4A
	Crop Field-Cd	Cd-1A, Cd-2A, Cd-3A, Cd-4A
	Crop Field-Ce	Ce-1A, Ce-2A, Ce-3A, Ce-4A
	Crop Field-Ch	Ch-1A, Ch-2A, Ch-3A, Ch-4A
Commercial-Industrial (12 samples)	Industrial-Ia	Ia-1A, Ia-2A, Ia-3A
	Industrial-Ib	Ib-1A, Ib-2A, Ib-3A
	Business-Bb	Bb-1A, Bb-2A, Bb-3A
	Business-Bf	Bf-1A, Bf-2A, Bf-3A
Residential-Public (23 samples)	Residential-Ra	Ra-1A, Ra-2A, Ra-3A
	Residential-Rb	Rb-1A, Rb-2A, Rb-3A
	Residential-Rc	Rc-1A, Rc-2A, Rc-3A
	Residential-Re	Re-1A, Re-2A, Re-3A
	Residential-Rf	Rf-1A, Rf-2A, Rf-3A
	Residential-Rg	Rg-1A, Rg-2A, Rg-3A
	Residential-Rh	Rh-1A, Rh-2A, Rh-3A
	School-Sa	Sa-1A, Sa-2A

After receipt of the final data for the 75 samples, the data was validated for QA/AC purposes by CRA. A data validation report and a copy of the laboratory data reports were submitted to the Agencies by cover letter dated June 28, 2002. The Agencies reviewed the reports and associated QA/QC documentation and determined that the arsenic data are "sufficiently precise and accurate to be used as presented, and that all analytical criteria for this determination have been met." The Agencies also provided the results for the split samples which were analyzed by Severn Trent Laboratories (STL) in Amherst, New York.

Based on the preliminary data adequacy statistical analysis on the arsenic data for the initial 75 samples (as described in Section 4.0 of this report), it was agreed that 22 additional samples were required for the Wooded-Agricultural group. The Agencies and FMC subsequently agreed to analyze all of the soil samples collected from the following 28 additional sample locations for total arsenic:

<i>Property Group</i>	<i>Property ID</i>	<i>Sample Locations</i>
Wooded-Agricultural (28 Additional Samples)	Wooded-Wd	Wd-1B, Wd-2B, Wd-3B, Wd-4B
	Wooded-We	We-1B, We-2B, We-3B, We-4B
	Crop Field-Ca	Ca-1B, Ca-2B, Ca-3B, Ca-4B
	Crop Field-Cc	Cc-1B, Cc-2B, Cc-3B, Cc-4B
	Crop Field-Cd	Cd-1B, Cd-2B, Cd-3B, Cd-4B
	Crop Field-Ce	Ce-1B, Ce-2B, Ce-3B, Ce-4B
	Crop Field-Ch	Ch-1B, Ch-2B, Ch-3B, Ch-4B

The samples were analyzed by H2M in August 2002. The arsenic data for these 28 additional soil samples were reviewed and validated by CRA. The data validation report, the laboratory reports and the validated data were submitted to the Agencies under cover letter dated September 13, 2002. In addition, the data adequacy statistical analysis on the arsenic data for the initial 75 samples (as described in Section 4.0 of this report) was also submitted to the Agencies. By letter dated October 15, 2002, the Agencies determined that the data associated with the 28 additional samples were acceptable for use.

Appendix A presents the final data validation reports, validated data, and the associated correspondences.

4.0 DATA ADEQUACY STATISTICAL ANALYSIS

Table 1 summarizes the validated arsenic data and the Agencies' split sample results for all 103 background soil samples analyzed. A single arsenic concentration per sample location was calculated by taking the arithmetic average of the results for all duplicate and split samples collected from a single location. The background arsenic data are summarized as follows:

<i>Major Property Type/ Usage</i>	<i>Number of Sample Locations</i>	<i>Range of Arsenic Concentrations (mg/kg)</i>
Orchard Land (3 Orchards)	12	3.1 – 121.3
Wooded/Overgrown/Agricultural Crop Field Land (2 Wooded Lands, 5 Crop Fields)	56	3.1 – 56.7
Commercial/Industrial Land (2 Business and 2 Industrial Properties)	12	2.2 – 32.8
Residential/Public Land (7 Residential Properties, 1 School)	23	3.3 – 21.1

Appendix B presents the data adequacy statistical analysis and calculations as required under Section 4.0 of the Work Plan. The statistical analysis was performed by Gradient Corporation.

In accordance with the Work Plan, the arsenic data for the initial 75 soil samples were evaluated to determine the adequacy of the data and to determine if additional data was needed. Based on the statistical analysis, the Agencies and FMC agreed that 22 additional samples were required for the Wooded-Agricultural group. Accordingly, all soil samples collected from the 28 additional sample locations in the Wooded-Agricultural group were analyzed for total arsenic. The results of this statistical analysis were presented in Gradient's memorandum dated September 13, 2002 and submitted to the Agencies under cover letter dated September 13, 2002 (see Appendix B).

After receipt of the data for the 28 additional soil samples, the arsenic data for all 56 Wooded-Agricultural sample locations were again statistically evaluated for data adequacy. This evaluation determined that there were sufficient data to represent the Wooded-Agricultural land group and that the overall arsenic data set (for 103 sample

locations) was adequate. Therefore, no additional data were necessary. The results of this statistical analysis were presented in Gradient's memorandum dated October 30, 2002 and submitted to the Agencies under cover letter dated October 31, 2002 (see Appendix B).

The statistical analysis required in Section 4.0 of the Work Plan also identified four potential outliers within the Wooded-Agricultural land group. No outliers were identified in the other three property groups. The four potential outliers are as follows:

<i>Major Property Type/ Usage</i>	<i>Sample Location</i>	<i>Arsenic Concentrations (mg/kg)</i>
Wooded/Overgrown/ Agricultural Crop Field Land	Ca-1A	56.7
	Ch-3A	53.5
	Ch-2B	36.9
	Ca-4A	32.3

Subsequent statistical calculations used to develop comparison tools and criteria (as required in Section 5.0 of the Work Plan) were performed using data sets with and without the potential outliers.

The Agencies reviewed both the September 13, 2002 and the October 31, 2002 submittals and provided comments on the submittals by letter dated November 25, 2002. A copy of the Agencies' November 2002 letter and FMC's responses to the Agencies' comments are presented in Appendix C. After determining that FMC's responses are acceptable, the results and calculations will be revised based on FMC's responses to the Agencies' November 2002 comments. Appendix D presents the revised results and calculations for the data adequacy statistical analysis.

5.0 DEVELOPMENT OF STATISTICAL COMPARISON TOOLS AND CRITERIA

As required in Section 5.0 of the Work Plan, the background data set was used to develop a number of statistically derived values that could be used to compare investigative data obtained in the Middleport study area to background. The statistical calculations were performed by Gradient and are presented in Appendix E.

In summary, the following data and statistically derived values can be used to represent the background data set when comparing "background" to FMC's investigative data for the Middleport study areas:

<i>Comparison Tool</i>	<i>Arsenic Concentration (mg/kg)</i>	
	<i>Range</i>	<i>Mean</i>
1. Background Data (including potential outliers)		
Orchard Land	3.1 - 121.3 mg/kg	33.3
Wooded-Agricultural Land	3.1 - 56.7 mg/kg	7.9
Commercial/Industrial Land	2.2 - 32.8 mg/kg	11.7
Residential/Public Land	3.3 - 21.1 mg/kg	10.1
2. Background Data (excluding potential outliers)		
Orchard Land	3.1 - 121.3 mg/kg	33.3
Wooded-Agricultural Land	3.1 - 11.9 mg/kg	5.0
Commercial/Industrial Land	2.2 - 32.8 mg/kg	11.7
Residential/Public Land	3.3 - 21.1 mg/kg	10.1
3. Weighted Mean		
(including potential outliers)		9.7
(excluding potential outliers)		8.1
4. 95 th Percentile		
(including potential outliers)		21.5
(excluding potential outliers)		19.2
5. 95% Upper Confidence Limit (UCL) on Weighted Mean		
(including potential outliers)		11.6
(excluding potential outliers)		8.7

<i>Comparison Tool</i>	<i>Arsenic Concentration (mg/kg)</i>	
	<i>Range</i>	<i>Mean</i>
6. 95% UCL on the 95 th Percentile (Upper Tolerance Limit (UTL))		
(including potential outliers)		30.3
(excluding potential outliers)		28.2
7. 99 th Percentile		
(including potential outliers)		40.7
(excluding potential outliers)		38.8
8. 95% UCL on the 99 th Percentile		
(including potential outliers)		86.8
(excluding potential outliers)		85.7

The definitions for the statistical tools (as related to the background arsenic data set) are as follows:

1. Weighted Mean – This value is intended to provide a mean of the background data set which is not biased by the number of sample points in each property group and reflects the historic land use in the Middleport area. The weighted mean is calculated using the mean of the arsenic data of each individual property usage group and the following percentages or weighting factors of each property group (see Section 1.0 of the Work Plan);

<i>Property Group</i>	<i>Weighting Factor</i>
Orchard Land	3%
Wooded-Agricultural Land	55%
Commercial/Industrial Land	9%
Residential/Public Land	33%

The formulas used to calculate the weighted mean are presented in Section 5.3 of the Work Plan

2. 95th Percentile – This is a calculated value below which fall 95 percent of the background data set, weighted by land use. Five percent of the aggregated background data set lies above the 95th Percentile. Section 5.4 of the Work Plan describes the methods used to calculate the 95th Percentile

3. 95% Upper Confidence Limit (UCL) on the Weighted Mean - The 95% UCL is a value such that there is confidence that the true weighted background arsenic average will fall below it 95 percent of the time. If an infinite number of background sample data were available, the 95% UCL would equal the weighted mean of the infinite data set.
4. Upper Tolerance Limit (UTL) - The UTL is the 95% UCL on the 95th Percentile and is a value such that there is confidence that the true 95th Percentile will fall below it 95 percent of the time. If an infinite number of background sample data were available, the UTL would equal the 95th Percentile of the infinite data set.
5. 99th Percentile - This is a calculated value below which fall 99 percent of the background data set, weighted by land use. One percent of the aggregated background data set lie above the 99th Percentile.
6. 95% UCL on the 99th Percentile - The 95% UCL on the 99th Percentile is a value such that there is confidence that the true 99th Percentile will fall below it 95 percent of the time. If an infinite number of background sample data were available, the UTL would equal the 99th Percentile of the infinite data set.

TABLE 1
2002 ARSENIC BACKGROUND DATA
GASPORT SAMPLING PROGRAM
FMC MIDDLEPORT PLANT SITE

				Arsenic Concentration (mg/kg)				
Property Group	Land UseType	Property ID	Sample Location	Initial Sample Data	NYSDEC			Final Dataset
					Field Duplicate Data	Split Sample Data	Additional Sample Data	
Wooded-Ag	Crop Field	Crop Field - Ca	Ca-1A	56.7				56.7
Wooded-Ag	Crop Field	Crop Field - Ca	Ca-2A	5.2				5.2
Wooded-Ag	Crop Field	Crop Field - Ca	Ca-3A	5.0	4.6			4.8
Wooded-Ag	Crop Field	Crop Field - Ca	Ca-4A	33.5		31.1		32.3
Wooded-Ag	Crop Field	Crop Field - Cc	Cc-1A	3.2				3.2
Wooded-Ag	Crop Field	Crop Field - Cc	Cc-2A	3.3		3.1		3.2
Wooded-Ag	Crop Field	Crop Field - Cc	Cc-3A	3.2				3.2
Wooded-Ag	Crop Field	Crop Field - Cc	Cc-4A	3.2				3.2
Wooded-Ag	Crop Field	Crop Field - Cd	Cd-1A	4.1		3.5		3.8
Wooded-Ag	Crop Field	Crop Field - Cd	Cd-2A	9.8				9.8
Wooded-Ag	Crop Field	Crop Field - Cd	Cd-3A	3.7				3.7
Wooded-Ag	Crop Field	Crop Field - Cd	Cd-4A	9.4				9.4
Wooded-Ag	Crop Field	Crop Field - Ce	Ce-1A	3.4				3.4
Wooded-Ag	Crop Field	Crop Field - Ce	Ce-2A	4.6				4.6
Wooded-Ag	Crop Field	Crop Field - Ce	Ce-3A	4.2				4.2
Wooded-Ag	Crop Field	Crop Field - Ce	Ce-4A	3.7		2.8		3.3
Wooded-Ag	Crop Field	Crop Field - Ch	Ch-1A	3.3				3.3
Wooded-Ag	Crop Field	Crop Field - Ch	Ch-2A	5.5				5.5
Wooded-Ag	Crop Field	Crop Field - Ch	Ch-3A	54.4		52.6		53.5
Wooded-Ag	Crop Field	Crop Field - Ch	Ch-4A	7.7				7.7
Wooded-Ag	Crop Field	Crop Field - Ca	Ca-1B				4.9	4.9
Wooded-Ag	Crop Field	Crop Field - Ca	Ca-2B				4.1	4.1
Wooded-Ag	Crop Field	Crop Field - Ca	Ca-3B				3.5	3.5
Wooded-Ag	Crop Field	Crop Field - Ca	Ca-4B				7.1	7.1
Wooded-Ag	Crop Field	Crop Field - Cc	Cc-1B				3.0 J	3.0
Wooded-Ag	Crop Field	Crop Field - Cc	Cc-2B				2.9 J	2.9
Wooded-Ag	Crop Field	Crop Field - Cc	Cc-3B				2.3 J	2.3
Wooded-Ag	Crop Field	Crop Field - Cc	Cc-4B				4.4 J	4.4
Wooded-Ag	Crop Field	Crop Field - Cd	Cd-1B				5.1 J	5.1
Wooded-Ag	Crop Field	Crop Field - Cd	Cd-2B				11.9 J	11.9
Wooded-Ag	Crop Field	Crop Field - Cd	Cd-3B				4.4 J	4.4
Wooded-Ag	Crop Field	Crop Field - Cd	Cd-4B				8.4 J	8.4
Wooded-Ag	Crop Field	Crop Field - Ce	Ce-1B				4.7 J	4.7
Wooded-Ag	Crop Field	Crop Field - Ce	Ce-2B				3.4 J	3.4
Wooded-Ag	Crop Field	Crop Field - Ce	Ce-3B				4.1 J	4.1
Wooded-Ag	Crop Field	Crop Field - Ce	Ce-4B				4.0 J	4.0
Wooded-Ag	Crop Field	Crop Field - Ch	Ch-1B				5.3 J	5.3
Wooded-Ag	Crop Field	Crop Field - Ch	Ch-2B				36.9 J	36.9
Wooded-Ag	Crop Field	Crop Field - Ch	Ch-3B				5.3 J	5.3

TABLE 1
2002 ARSENIC BACKGROUND DATA
GASPORT SAMPLING PROGRAM
FMC MIDDLEPORT PLANT SITE

<i>Property Group</i>	<i>Land UseType</i>	<i>Property ID</i>	<i>Sample Location</i>	<i>Arsenic Concentration (mg/kg)</i>				
				<i>Initial Sample Data</i>	<i>Field Duplicate Data</i>	<i>NYSDEC Split Sample Data</i>	<i>Additional Sample Data</i>	<i>Final Dataset</i>
Wooded-Ag	Crop Field	Crop Field - Ch	Ch-4B				3.3 J	3.3
Wooded-Ag	Wooded	Wooded - Wd	Wd-1A	6.9	6.9			6.9
Wooded-Ag	Wooded	Wooded - Wd	Wd-2A	7.9		7.3		7.6
Wooded-Ag	Wooded	Wooded - Wd	Wd-3A	8.8				8.8
Wooded-Ag	Wooded	Wooded - Wd	Wd-4A	5.1				5.1
Wooded-Ag	Wooded	Wooded - We	We-1A	4.2				4.2
Wooded-Ag	Wooded	Wooded - We	We-2A	5.2				5.2
Wooded-Ag	Wooded	Wooded - We	We3A	4.7		3.8		4.3
Wooded-Ag	Wooded	Wooded - We	We-4A	3.7				3.7
Wooded-Ag	Wooded	Wooded - Wd	Wd-1B				3.3 J	3.3
Wooded-Ag	Wooded	Wooded - Wd	Wd-2B				6.7 J	6.7
Wooded-Ag	Wooded	Wooded - Wd	Wd-3B				8.1 J	8.1
Wooded-Ag	Wooded	Wooded - Wd	Wd-4B				7.2 J	7.2
Wooded-Ag	Wooded	Wooded - We	We-1B				4.7	4.7
Wooded-Ag	Wooded	Wooded - We	We-2B				3.2	3.2
Wooded-Ag	Wooded	Wooded - We	We-3B				4.0	4.0
Wooded-Ag	Wooded	Wooded - We	We-4B				3.4	3.4
Com-Ind	Industrial	Industrial - Ia	Ia-1A	33.5	32.1			32.8
Com-Ind	Industrial	Industrial - Ia	Ia-2A	26.1				26.1
Com-Ind	Industrial	Industrial - Ia	Ia-3A	3.5		3.1		3.3
Com-Ind	Industrial	Industrial - Ib	Ib-1A	12.5				12.5
Com-Ind	Industrial	Industrial - Ib	Ib-2A	20.4		20.8		20.6
Com-Ind	Industrial	Industrial - Ib	Ib-3A	4.9				4.9
Com-Ind	Commercial	Commercial - Bb	Bb-1A	2.4 J	6.1 J	2.2 2.3		3.3
Com-Ind	Commercial	Commercial - Bb	Bb-2A	4.6				4.6
Com-Ind	Commercial	Commercial - Bb	Bb-3A	5.2				5.2
Com-Ind	Commercial	Commercial - Bf	Bf-1A	7.5				7.5
Com-Ind	Commercial	Commercial - Bf	Bf-2A	9.9		2.9		6.4
Com-Ind	Commercial	Commercial - Bf	Bf-3A	13.2				13.2
Orchard	Orchard	Orchard - Oa	Oa-1A	14.7				14.7
Orchard	Orchard	Orchard - Oa	Oa-2A	8.8		8		8.4
Orchard	Orchard	Orchard - Oa	Oa-3A	27.8				27.8
Orchard	Orchard	Orchard - Oa	Oa-4A	10.4				10.4
Orchard	Orchard	Orchard - Ob	Ob-1A	3.7	3.8			3.8
Orchard	Orchard	Orchard - Ob	Ob-2A	40.4		45.9		43.2
Orchard	Orchard	Orchard - Ob	Ob-3A	4.6				4.6
Orchard	Orchard	Orchard - Ob	Ob-4A	3.1				3.1
Orchard	Orchard	Orchard - Od	Od-1A	130	129	105		121.3
Orchard	Orchard	Orchard - Od	Od-2A	81.9				81.9

TABLE 1
2002 ARSENIC BACKGROUND DATA
GASPORT SAMPLING PROGRAM
FMC MIDDLEPORT PLANT SITE

<i>Property Group</i>	<i>Land UseType</i>	<i>Property ID</i>	<i>Sample Location</i>	<i>Arsenic Concentration (mg/kg)</i>					<i>Final Dataset</i>
				<i>Initial Sample Data</i>	<i>Field Duplicate Data</i>	<i>NYSDEC Split Sample Data</i>		<i>Additional Sample Data</i>	
Orchard	Orchard	Orchard - Od	Od-3A	24.5					24.5
Orchard	Orchard	Orchard - Od	Od-4A	56.3					56.3
Res-Pub	Residential	Residential - Ra	Ra-1A	6.3					6.3
Res-Pub	Residential	Residential - Ra	Ra-2A	17.4			12.5		15.0
Res-Pub	Residential	Residential - Ra	Ra-3A	4.5					4.5
Res-Pub	Residential	Residential - Rb	Rb-1A	16.7			3.5		10.1
Res-Pub	Residential	Residential - Rb	Rb-2A	11.6					11.6
Res-Pub	Residential	Residential - Rb	Rb-3A	12.8					12.8
Res-Pub	Residential	Residential - Rc	Rc-1A	8.7			7.2		8.0
Res-Pub	Residential	Residential - Rc	Rc-2A	9.5					9.5
Res-Pub	Residential	Residential - Rc	Rc-3A	9.9					9.9
Res-Pub	Residential	Residential - Re	Re-1A	5.7					5.7
Res-Pub	Residential	Residential - Re	Re-2A	7.7					7.7
Res-Pub	Residential	Residential - Re	Re-3A	18.6			20.3		19.5
Res-Pub	Residential	Residential - Rf	Rf-1A	14.7			14.3		14.5
Res-Pub	Residential	Residential - Rf	Rf-2A	21.1					21.1
Res-Pub	Residential	Residential - Rf	Rf-3A	14.5					14.5
Res-Pub	Residential	Residential - Rg	Rg-1A	7.3					7.3
Res-Pub	Residential	Residential - Rg	Rg-2A	5.6					5.6
Res-Pub	Residential	Residential - Rg	Rg-3A	8.0			7.3		7.7
Res-Pub	Residential	Residential - Rh	Rh-1A	4.6	3.9		4.2		4.2
Res-Pub	Residential	Residential - Rh	Rh-2A	20.3 J					20.3
Res-Pub	Residential	Residential - Rh	Rh-3A	9.1					9.1
Res-Pub	School	School - Sa	Sa-1A	4.2	4.3	3.3	3.5		3.8
Res-Pub	School	School - Sa	Sa-2A	3.3					3.3
Total Number of Samples:				75		22		28	103

Note:

J Associated value is estimated.