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May 15, 2009

Via E-Mail and Overnight Mail

Mr. Matt Mortefolio, P.E.
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Bureau of Solid Waste & Corrective Action
Division of Solid and Hazardous Waste Materials
NEW YORK STATE DEPARTMENT OF
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Mr. Michael Infurna
USEPA Project Coordinator
Environmental Planning and Protection Division
UNITED STATES ENVIRONMENTAL
PROTECTION AGENCY, Region II
290 Broadway – 20th Floor
New York, NY 10007-1866

Re: RCRA Section 3008(h) Administrative Order on Consent (AOC)
Docket No. II-RCRA-90-3008(h)-0209
FMC Corporation, Middleport, NY Facility
EPA I.D. No. NYD002126845
Submittal of Corrective Measures Study Work Plan for Suspected Air Deposition Area and Culvert 105 Study Areas

Dear Messrs. Mortefolio and Infurna:

By letter dated April 16, 2009, the United States Environmental Protection Agency (USEPA) and the New York State Department of Environmental Conservation (NYSDEC), in consultation with the New York State Department of Health (NYSDOH), directed FMC Corporation (FMC) to submit a revised Corrective Study Measures (CMS) work plan for the Suspected Air Deposition Study Area South of Erie Canal and West of the County Line and for the Culvert 105 Study Area. In response to that directive, enclosed is the *Corrective Measures Study Work Plan for Suspected Air Deposition Area and Culvert 105 Study Areas*. The work plan was developed based on conceptual agreements reached during a March 4-5, 2009 meeting among representatives of FMC, USEPA, NYSDEC and NYSDOH, as documented in FMC's March 23, 2009 submittal, and with consideration of the Agencies' comments provided in the April 16, 2009 letter.

If there are any questions or if additional information is needed at this time, please contact me at (215) 299-6047 or at the above address.

Sincerely,

Brian M. McGinnis

Brian M. McGinnis
Remediation Project Manager
(215) 299-6047

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CORRECTIVE MEASURES STUDY WORK PLAN FOR SUSPECTED AIR DEPOSITION AND CULVERT 105 STUDY AREAS

FMC Corporation
Middleport, New York

Submitted to:
FMC Corporation, Middleport, NY

Submitted by:
AMEC Geomatrix, Inc., Amherst, NY

May 2009

Project 9936

AMEC Geomatrix

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CORRECTIVE MEASURES STUDY WORK PLAN FOR SUSPECTED AIR DEPOSITION AND CULVERT 105 STUDY AREAS

FMC Corporation
Middleport, New York

1.0 INTRODUCTION

FMC Corporation (FMC) is performing a Corrective Measures Study (CMS) for its Middleport, New York Facility (Facility or Site) under the terms and conditions of the Administrative Order on Consent (AOC), Docket No. II RCRA-90-3008(h)-0209, entered into by FMC, the New York State Department of Environmental Conservation (NYSDEC), and the United States Environmental Protection Agency (USEPA) (NYSDEC and USEPA are referred to herein as the "Agencies"). Pursuant to Section VI.3.d) of the AOC, the CMS for the Facility is being conducted using a phased approach for the study areas associated with the Facility's RCRA Facility Investigation (RFI).

The Agencies, in consultation with the New York State Department of Health (NYSDOH) stated in letter dated March 10, 2008, that "there is currently sufficient data in the above off-site areas [Culvert 105 & flood zone, the portion of Tributary One & flood zone south of Pearson Road, and the off-site portion of the suspected FMC arsenic air deposition area south of Barge Canal and west of the Niagara/Orleans County Line] to complete RFI characterization and delineation activities with respect to FMC-related soil contamination, and to support the subsequent development of a Corrective Measures Study (CMS) with respect to this soil contamination." The March 10, 2008 letter also specified that FMC would submit a draft CMS work plan for the suspected air deposition study area south of the Erie Barge Canal and west of the Niagara/Orleans County Line. FMC submitted a draft CMS work plan for this study area by cover letter dated April 30, 2008. The Agencies, in consultation with the NYSDOH, provided comments on the draft work plan by letter dated August 1, 2008. FMC requested a meeting and subsequently provided draft responses to the comments by letter dated September 10, 2008. FMC, the Agencies and NYSDOH met on March 4-5, 2009 to discuss the CMS work plan and reached general agreement on various CMS-related issues, as summarized in FMC's letter dated March 23, 2009 and Agencies' letter dated April 16, 2009. FMC, the Agencies and NYSDOH agreed to expand the scope of the CMS to include both the suspected air deposition study area south of the Erie Barge Canal and west of the Niagara/Orleans County Line and the entire Culvert 105 and Flood Zone study area. Figure 1 identifies the location of the air deposition and Culvert 105 study areas.

By cover letter dated May 6, 2009, FMC submitted revised final versions of the draft "RCRA Facility Investigation (RFI) Report Volume II – Suspected Air Deposition Study Area 1 (South of the Erie Canal and West of the Niagara/Orleans County Line) and Culvert 105 Study Area South of the Erie Canal" (RFI Volume II) (ARCADIS 2009b) and the draft "RCRA Facility Investigation (RFI) Report Volume IV – Culvert 105 and Flood Zone" (RFI Volume IV) (ARCADIS 2009c) for review and comment by the public. Draft RFI Volumes II and IV state that the nature and extent of potential historic releases of FMC-related constituents from the Facility in soil in suspected air deposition study area south of the Erie Barge Canal and west of the Niagara/Orleans County Line (for consistency of reference, and without intending to imply that there are or may be other "air deposition areas," this area is referenced herein as "Air Deposition Study Area 1") and the entire Culvert 105 and Flood Zone study area ("Culvert 105 Study Area") have been delineated and that there are sufficient data to perform the CMS for these areas. Draft RFI Volumes II and IV also propose specific areas of Air Deposition Study Area 1 and Culvert 105 Study Area (collectively referred to as "CMS Study Areas") for inclusion in the CMS.

This CMS Work Plan describes the CMS activities to address the presence of potentially FMC Facility-related constituents (predominantly arsenic) in soil and sediment (as described in the draft RFI Report Volumes II and IV, sediment is considered to be and is evaluated as soil) within the proposed CMS Study Areas. The CMS will develop and evaluate the corrective measure alternative (CMA) or alternatives (CMAs), including "no further action", and will recommend the corrective measure or measures to be taken with respect to properties in the CMS Study Areas.

1.1 CORRECTIVE ACTION OBJECTIVES

By letter dated March 26, 2009, the Agencies and the NYSDOH issued final Corrective Action Objectives (CAOs) applicable to off-Site (i.e., excluding the FMC Facility and FMC-owned North Railroad Property) study areas pertaining to soil and sediment. The letter, which describes the community input in the development of the CAOs, is included in Appendix A.

In the March 26, 2009 letter, the Agencies and NYSDOH specifically note the following:

> ". . . [T]he Agencies' CAOs are "goals" to be strived for during the CMS process, and should <u>not</u> be considered as rigid "pass/fail" criteria. Failure of a proposed CMA [corrective measures alternative] to completely satisfy all CAOs, may not necessarily disqualify it from selection as the final CMA, or one of the final CMAs. Such selection must be based on a number of factors which will be thoroughly evaluated during the CMS process." (Emphasis in original)

1.2 CMS CONSIDERATIONS

1.2.1 Community Considerations

The CMS Study Areas consist of approximately 230 off-Site properties that are not owned by FMC. Most of the properties are situated within the Village of Middleport and are occupied by single family homes. The average lot size of these single-family residential properties is on the order of 15,000 square feet. The neighborhoods generally have mature trees on most lots and/or along the street Right-of-Way (ROW).

Some of the properties within the CMS Study Areas consist of commercial properties, agricultural or undeveloped lands, Village of Middleport owned land (i.e., ROWs), and the Royalton-Hartland Central School District (Roy-Hart) property. The land uses within the CMS Study Areas (residential, school/public, commercial, industrial, and agricultural) will be considered in each facet of the CMS (including risk assessment, corrective measure alternative development, and evaluation of alternatives). In addition, the development and evaluation of corrective measure alternatives will consider the environmental setting within the neighborhoods including factors such as preservation of mature trees and maintenance of the neighborhood character to the extent practical.

Involvement of the community and affected property owners in the CMS process is considered critical to the successful implementation of any corrective measures to be implemented in the Study Areas. Community input will be sought at several stages during the CMS process as described in Section 3.0.

1.2.2 Chemical(s) of Concern

Draft RFI Volumes II and IV state that the nature and extent of potential historic releases of FMC-related constituents from the Facility in soil in the CMS Study Areas have been delineated. Draft RFI Volumes II and IV conclude that arsenic data define the horizontal and vertical limits of potential Site-related impacts in soil in the CMS Study Areas. The extent of other potential FMC-related constituents at concentrations above soil screening levels (as described in Draft RFI Volumes II and IV) is within and less than the extent of the soil arsenic levels defined to background concentrations. Based on these findings, arsenic presence is expected to dictate the scope and extent of corrective action in the CMS Study Areas. Therefore, corrective action alternatives (CMAs) are developed to primarily address arsenic in soil to a specified concentration or concentration distribution.

Since lead and certain chlorinated pesticides (e.g., DDT, DDE and DDD) have been detected in some soil samples collected from the CMS Study Areas at low concentrations, the CMS will consider detections of "non-arsenic constituents" in the development and evaluation of corrective action alternatives. The concentrations of these non-arsenic constituents under current conditions will be compared to applicable regulatory criteria, risk-based screening levels and/or evaluated by site-specific risk assessment, as appropriate. In the comparative analysis of corrective measure alternatives, the concentrations of non-arsenic constituents estimated to remain in soils after remediation will be evaluated in like manner.

1.2.3 Soil Arsenic Background Considerations

Arsenic is a naturally occurring element present in soil as a result of both geologic background and widespread use of a variety of man-made products. In Western New York, arsenical pesticides were commonly used in fruit orchards and for other agricultural purposes. Therefore, the background level of arsenic in soil is a key consideration in delineation of arsenic concentrations which could potentially be attributable to migration from the FMC Facility.

As described in Draft RFI Report Volume I –Background and Related Information (RFI Volume I) (ARCADIS 2009a) and Draft RFI Volumes II and IV, FMC and the Agencies have estimated the background levels of arsenic (from natural and non-FMC related anthropogenic sources) in soil in the area on several occasions. The most recent soil arsenic background sampling and analysis program was performed in Gasport, New York and is referred to as the "2001-2003 Gasport Area Background Study".

The CMAs will be identified and evaluated to primarily address unacceptable human health risks associated with FMC-related constituents that may have been historically released from the FMC Facility to soil in the CMS Study Areas. Arsenic occurrence in the CMS Study Areas will be compared to local background levels of arsenic in soils. The 2001-2003 Gasport data and/or associated estimated Middleport Soil Arsenic Background Concentrations (as described in Draft RFI Volumes I, II and IV) will be used in the CMS. Comparisons to arsenic soil background concentration risk distribution(s) will be used as a tool to estimate the extent to which risks associated with current soil conditions in the CMS Study Areas are above background risks and for estimating the degree to which the CMAs would reduce risk to levels consistent with background conditions.

1.3 CMS TASKS

The CMS process will consist of the following major tasks:

- CMS Task 1: Community Participation
- CMS Task 2: Risk Assessments
- CMS Task 3: Identification and Development of the Corrective Measure Alternatives
- CMS Task 4: Evaluation of the Corrective Measures Alternatives
- CMS Task 5: Justification and Recommendation of the Corrective Measure or Measures
- CMS Task 6: Reports

2.0 CMS STUDY AREAS DESCRIPTION

2.1 CMS STUDY AREAS BOUNDARIES

Draft RFI Volumes II and IV identify the properties that are proposed to be included in the CMS Study Areas. The Draft RFI Volumes II and IV, as well as Draft RFI Volume I, are subject to public review and comment through July 2, 2009. Appendix B presents the Agencies' fact sheet that describes the draft RFI reports and includes figures that depict the proposed areas to be included in the CMS. After the public comment period, the Agencies will either approve or disapprove or require FMC to modify Draft RFI Volumes I, II and IV, including the proposed areas to be included in the CMS. The actual CMS Study Areas will be defined in Final RFI Volumes II and IV that will be approved by the Agencies.

Corrective measures technologies and alternatives will be identified to address the upper two feet of soil in Air Deposition Study Area 1. It is expected that subsurface soils at depths greater than two feet could not have been impacted by historic air depositions from past operations at the FMC Facility. Corrective measures technologies and alternatives for the Culvert 105 Study Area will be identified to address surface and subsurface soils.

The upper two feet of soil in the portion of the Culvert 105 Study Area south of the Erie Barge Canal is also contained in the Air Deposition Study Area 1. Where these two areas overlap, the upper two feet of soil will be addressed as part of the Air Deposition Study Area 1and subsurface soils will addressed as part of the Culvert 105 Study Area.

2.2 EXCLUDED AREAS AND PROPERTIES

Soil in Air Deposition Study Area 1 beneath public roads and existing permanent buildings was excluded from the RFI sampling and analysis activities since the underlying soil would not have been impacted by historic air depositions from past operations at the FMC Facility. The Village roads and many buildings within Air Deposition Study Area 1 existed prior to any operations involving chemicals of concern at the FMC Facility (constructed in the early 1920's). In addition, it is likely that surface soils were removed during construction of public roads and permanent buildings. Thus, the areas beneath public roads and existing buildings will be excluded from consideration in the CMS due to the unlikelihood that the underlying soil was impacted by historic air depositions from past operations at the FMC Facility.

Within Air Deposition Study Area 1, 46 residential properties received a letter from the Agencies in February 2007 that stated the following: 1) the sampling data were consistent with background arsenic soil levels found in residential properties in Gasport; 2) it was not necessary to restrict uses on the property; and 3) "no further sampling or other actions are

necessary at this time". Accordingly, these 46 No Further Action (NFA) properties are not included in the CMS.

2.3 UNSAMPLED PROPERTIES

There are approximately 17 properties in Air Deposition Study Area 1 where RFI sampling and analysis could not be performed prior to 2009. These 17 properties are proposed for inclusion in the CMS, as identified in Draft RFI Volume II, to the extent that the CMS will point out cases where unsampled properties are adjacent to properties included in the various corrective measure alternatives and will state that a determination of whether such unsampled properties should be included in any corrective measure will not be made unless and until property-specific sampling data are obtained. FMC will continue to offer soil sampling and analysis on the unsampled properties until the start of construction design activities associated with the selected corrective measures alternative.

3.0 TASK 1: COMMUNITY PARTICIPATION

3.1 GENERAL PRINCIPLES

FMC is committed to involving the Middleport community, affected property owners, local officials (including the Village of Middleport), and others potentially affected by the project. FMC has developed a project-specific public participation program in accordance with USEPA's 1996 RCRA Public Participation Manual. Goals of FMC's community participation program are as follows:

- **Provide Information** - Balanced and objective information will be provided to assist the community and stakeholders in understanding the project scope of work, the problems, the process for addressing the problems, the alternatives and the solutions to the problems. Information will be provided to the public and stakeholders by fact sheets, newsletters, web sites, open houses, availability sessions, and/or meetings.

- **Obtain Feedback -** Community and stakeholder feedback on the project scope of work, the problems, the process for addressing the problems, the alternatives and solutions to the problems will be obtained. Comments and feedback will be obtained by maintaining open communications; holding public comment periods, public information sessions, and/or public meetings; conducting surveys; community-wide mailings with return/reply comment cards and/or web-site discussion forums.

- **Provide Opportunities for Involvement –** Opportunities will be provided to the community and stakeholders for involvement during the implementation of the project and not just at the end of the project. Opportunities will be provided by holding meetings, workshops, information sessions and/or public meetings.

3.2 PROJECT SPECIFIC STAKEHOLDERS

Corrective measures activities would impact a number of project-specific stakeholders. The local project-specific stakeholders and their potential concerns (during the CMS and implementation of any corrective measures) recognized are as follows:

Local Project Specific Stakeholders	***Potential Major Concerns***
Village of Middleport	• Public safety and health of Village residents and Village workers • Impact to Village-owned property, roads and infrastructure • Quality of life (e.g., disruption of regular neighborhood activities, added noise, and traffic) • Preservation of the existing character of the Village (e.g., historic appearance, presence of mature trees, plantings) • Public image of the Village • Institutional controls which may be part of corrective measures • Impact to property values and economics of the Village • Schedule for a decision (e.g., the length of time until a final CMA decision is made concerning the affected properties) • Construction/Implementation Schedule for the selected corrective measure alternative
Owners of affected Properties within the CMS Study Areas	• Public safety and heath of residents of affected properties • Quality of life (e.g., disruption of regular neighborhood activities, added noise, and traffic) • Impact to property values • Preservation of trees and other plantings on affected properties • Determination by Agencies that no further action is required or that remedial actions have been completed on an affected property • Schedule for decision (e.g., the length of time until a final CMA decision is made concerning the affected properties) • Construction/Implementation Schedule for the selected corrective measure alternative
Royalton-Hartland Central School District (Roy-Hart)	• Public safety and health of students, teachers and district employees • Quality of life (e.g., disruption of regular activities, added noise, and traffic) • Determination by Agencies that no further action is required or that remedial actions have been completed on an affected property • Schedule for decision (e.g., the length of time until a final CMA decision is made concerning the affected properties) • Construction/Implementation Schedule for the selected corrective measure alternative

Local Project Specific Stakeholders	***Potential Major Concerns***
Middleport Community Input Group (MCIG)	• Same above concerns for the Village of Middleport and the CMS Study Areas property owners • Consideration of the USEPA's Green Remediation Program • Other issues and comments provided to FMC and the Agencies by emails sent on April 19, 2008 and subsequent dates
FMC	• Compliance with the terms and conditions of the AOC and applicable rules and regulations • Completion of the CMS process for the Study Areas • Potential project-related concerns of the Village and owners of affected properties • Constructability/Implementability and effectiveness of the selected corrective measure alternative • Cost effectiveness of performing the work • Impact to employees who live in and around Middleport

It should be noted that FMC is a member of the Middleport community, and as such, has similar concerns as the Village of Middleport and property owners.

The list of project-specific stakeholders and their potential concerns will be reviewed throughout the life of the project and will be revised as necessary and appropriate.

3.3 PROJECT-SPECIFIC DOCUMENT REPOSITORIES AND CONTACT LIST

Project-related documents will be/are available for review by the public in FMC's document repository located at the Middleport Free Library and at the NYSDEC's Region 9 office in Buffalo. Periodic updates on the progress of the project will also be available on the website at http://www.teapothollow.com. In addition, information on the projects and the MCIG's activities and electronic copies of major reports (e.g., Draft RFI Volumes I, II and IV, CMS Work Plan) are/will be available on the MCIG's website at http://www.middleport-future.com.

In addition, FMC's community relations representative(s) are located at 17 Vernon Street in Middleport. Representatives at the office are available to discuss the CMS activities and answer questions by appointment. Paper copies of major reports (e.g., Draft RFI Volumes I, II and IV, CMS Work Plan) are/will be available at this location for review by the community.

The following is a contact list for any project related questions.

Organization	*Contact*	*Phone Number*
FMC Corporation – Middleport Facility	Andy Twarowski – Plant Manager	716-735-3761, ext. 364
	Community Voice Message Box	716-735-3761, ext. 289 Please leave a message and an FMC Representative will return your call
	Robert Wojcik – Environmental Manager	716-735-3761, ext. 202
FMC Neighborhood House - (17 Vernon Street)	Debra Overkamp – FMC Community Liaison	716-735-7939
NYSDEC – Buffalo Office	Mike Hinton – Environmental Engineer	716-851-7220
NYSDEC – Albany Office	Matt Mortefolio– Environmental Engineer	518-402-8594
NYSDOH – Troy Office	Tamara S. Girard - Public Health Specialist	518-402-7860
USEPA Region II – New York City Office	Mike Infurna – Project Coordinator	212-637-4177

3.3 PROJECT-SPECIFIC PUBLIC PARTICIPATION ACTIVITIES

Communication with the stakeholders will include meetings, fact sheets, progress newsletters, public information sessions, open houses, establishment of a community information center and one-on-one conversations, as needed. Specific activities are summarized below:

Approximate Timing	*Proposed Activities*
A. Completion of the CMS Work Plan	A1. Notify local officials, FMC's Community Advisory Panel (CAP), MCIG and CMS Study Areas property owners after receipt of Agencies' approval of the CMS Work Plan
	A2. Place Work Plan in document repository
	A3. Meet with the MCIG to review the proposed CMS activities and/or hold information session(s)/workshop(s) on the work plan activities

Approximate Timing	***Proposed Activities***	
B. During CMS Implementation, after submittal of CMS technical memorandum and after issuance of a final Draft CMS Report, with recommendation of the corrective measure alternative(s), for public review and comments	B1.	Provide updates (i.e. newsletters, fact sheets, visits to property owners, revised schedules) to Project-Specific Stakeholders
	B2.	Place copies of technical memorandum and draft CMS Report in the document repositories and on the MCIG's website for public review
	B3.	Meet with the Project-Specific Stakeholders to review the CMS activities and/or solicit comments/input and/or otherwise provide opportunities (e.g., public meetings, information sessions) for the Project-Specific Stakeholders to discuss and comment on the technical memorandum and/or Draft CMS Report
	B4.	Document public and Project-Specific Stakeholders' comments and responses to comments

4.0 TASK 2: RISK ASSESSMENTS

4.1 PURPOSE

As described in subsequent sections of this Work Plan, one of the key criteria to be used in evaluation, justification and recommendation of a corrective measure or measures is the degree to which the corrective measure would mitigate unacceptable risks to human health which may be associated with FMC Facility-related constituents (predominantly arsenic) in soil in the CMS Study Areas. Given the difficulties of documenting the specific sources of arsenic on each property, comparison to local soil arsenic background conditions (based on the results of the 2001-2003 Gasport data and/or associated estimated Middleport Soil Arsenic Background Concentrations, as described in Draft RFI Volumes I, II and IV) will be used as a tool to estimate the extent to which risks associated with current soil conditions in the CMS Study Areas are above background risks and for estimating the degree to which the corrective measure alternatives would reduce risk to levels consistent with background conditions. The human health evaluation criterion as it pertains specifically to arsenic in soil will look at *the degree to which the corrective measure alternative would mitigate unacceptable risks to human health above the risks associated with local background soil conditions.*

Risk assessment will be utilized throughout the CMS process as follows:

1. To evaluate human health risks associated with exposure to arsenic in soils under background conditions for the Middleport area.

2. To evaluate human health risks associated with exposure to soils as they currently exist (i.e., the “no further action” alternative) in the CMS Study Areas.

3. To evaluate human health risks associated with each corrective measure alternative utilizing the post-remediation arsenic concentration distributions.

In the comparison of alternatives, the various corrective measures will be evaluated based on the extent each reduces human health risks.

Potential risk to human health is the primary criterion that will be used to evaluate corrective measure alternatives. Section 6.0 details the use of the other criteria including technical considerations, institutional considerations, and community acceptance.

4.2 RISK ASSESSMENT CHEMICALS OF CONCERN

As discussed in Section 1.2.2, arsenic presence in soil is expected to dictate the scope and extent of any corrective measures alternative that may be implemented in the CMS Study Areas. The risk assessments described in this Section therefore pertain primarily to arsenic.

The human health evaluation criteria for non-arsenic FMC-related constituents will be incorporated through comparison to applicable regulatory criteria and/or risk-based screening levels, and/or use of site-specific risk assessment, as appropriate. In the comparative analysis of corrective measures alternatives, the concentrations of non-arsenic constituents estimated to remain in soils after remediation will be evaluated in like manner.

4.3 HUMAN HEALTH RISK ASSESSMENT APPROACH

The primary focus of the health risk characterization will be to estimate the health risks potentially posed by the presence of arsenic in soil. This will include an exposure assessment (characterization of route of exposure and estimation of its magnitude) and a toxicity assessment (identification and evaluation of hazards posed by arsenic).

Risk assessment involves the use of a number of variables, assumptions or factors in the assessment of exposure. These factors and the resulting exposure estimates vary over time and across populations. The accuracy of the assumed values is also uncertain. For example, exposure factors such as the daily rate of soil ingestion are expected to vary from individual to individual. Measuring soil ingestion is technically challenging and poses the potential for measurement errors or uncertainties. For many exposure factors, there is no consensus in the professional community as to the range of values that best represents a given population.

In a deterministic risk assessment, exposure is expressed as one or two values (i.e., central tendency and reasonable maximum exposure) generally based on point estimates of various exposure parameters. The variability and uncertainty associated with exposure assumptions usually are not quantitatively considered in a deterministic risk assessment. This is a significant limitation in the ability of risk managers to understand and explain the likely range of risks to the affected community. On the other hand, probabilistic risk assessment considers ranges of values for exposure factors and weights possible values by the estimated probability of occurrence. “Monte Carlo” or similar computer simulations are used to select individual values from probability-weighted distribution of exposure factors to generate a range and frequency of potential exposures. The probabilistic risk assessment results are presented as probability distributions that enable a more transparent characterization of the range of community risks and uncertainties associated with the estimates.

According to USEPA (1997a, 2001), if a deterministic risk assessment, based on conservative exposure assumptions, leads to risk estimates that are below "levels of concern", then there is no need for a more complex probabilistic risk assessment. However, if a conservative deterministic assessment leads to estimates above levels of concern, a more sophisticated probabilistic risk assessment may be warranted. For exposure to arsenic in residential surface soil, the USEPA recommended toxicity values for arsenic are such that even background levels of arsenic would represent a "risk concern" using deterministic risk assessment methods. This supports the proposition that it would not be appropriate for the CMS to rely solely on the use of deterministic assessment to evaluate and compare alternatives.

Therefore, for residential surface soil both deterministic and probabilistic risk assessment methodologies will be used in each of the three types of risk assessments identified above. Probabilistic risk assessment may not be applied to other exposure scenarios. The applicability of probabilistic assessment methods is constrained by the adequacy of the data set being analyzed. In particular, the sampling strategy and number of sample points must be sufficient to produce a meaningful representation of the distribution of the data points (in this case arsenic concentration in soil). Therefore, certain exposure scenarios may be limited to deterministic risk assessment methods simply because the scenario pertains to a limited number of sample data points. Examples where risk assessment may be limited to deterministic methods may include exposures to subsurface soils along Culvert 105 and exposures associated with certain non-residential properties.

4.4 SITE-SPECIFIC HUMAN HEALTH RISK ASSESSMENT METHODOLOGY

Human health risk assessments will be conducted for current conditions in the CMS Study Areas, for soil background conditions and for post-remediation conditions associated with the various corrective measures alternatives. The activities involved in the human health risk assessments are summarized in the subsections below.

The human health risk assessments will include the following elements:

1. Problem formulation

2. Exposure assessment, including the identification of exposure pathways and the calculation of exposure point concentrations,

3. Toxicity assessment,

4. Risk characterization, and

5. Description of uncertainties and limitations.

The human health risk assessment will be performed in accordance with relevant USEPA guidance, including but not necessarily limited to, the following documents (as appropriate):

- Risk Assessment Guidance for Superfund (RAGS): Human Health Evaluation Manual, Part A (USEPA, 1989);
- Risk Assessment Guidance for Superfund: Human Health Evaluation Manual, Part E – Dermal Risk Assessment (USEPA, 2002);
- Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual. Part F, Supplemental Guidance for Inhalation Risk Assessment. (USEPA, 2009)
- Risk Assessment Guidance for Superfund: Volume III – Part A, Process for Conducting Probabilistic Risk Assessment, OSWER 9285.7-45 (USEPA, 2001);
- Exposure Factors Handbook (USEPA, 1997);
- Guidance for Data Usability in Risk Assessment (USEPA, 1992a);
- USEPA Risk Characterization Program Memorandum (USEPA, 1995);
- Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (USEPA, December 2002. OSWER 9355.4-24); and
- Integrated Risk Information System (IRIS), which contains USEPA's on-line database of toxicity factors (http://www.epa.gov/ngispgm3/iris/index.html).

FMC sponsored a study to determine the oral bioavailability of arsenic in soil from Middleport (Roberts et al. 2007). This study will provide the basis for assessing the relative oral bioavailability of arsenic in soil. In addition, FMC sponsored a study to evaluate the dermal absorption of arsenic in soil from the Middleport area (Lowney et al. 2007). This study found that dermal absorption of arsenic from Middleport soil derived was negligible, so this exposure route will not be quantified in the risk assessment.

Whenever possible, the exposure assumptions used in the risk assessments will be site-specific. Deterministic analyses will include both average values that represent the central

tendency (CT) or average exposure and upper-bound values that may be used in estimating the reasonable maximum exposure (RME). The RME is the highest exposure that is reasonably expected to occur at a site, and is derived by using a combination of average and upper-bound values that yield an estimate approximating a 95th percentile exposure. For the probabilistic approach, distributions representing the expected range of values for each parameter will be combined to yield a probability distribution from which an upper-bound value representing an exposure at approximately the 95th percentile of the distribution will be selected to represent the RME.

4.5 HUMAN HEALTH RISK ASSESSMENT DELIVERABLE

The human health risk assessment methodology will be presented in detail in the following risk assessment memorandum:

- Technical Memorandum: FMC Middleport Risk Management Approach for the CMS - Suspected Air Deposition Area 1 and Culvert 105 Study Area

The purpose of this memorandum will be to describe the risk assessment methods and solicit input from the Agencies and community. The memorandum will include, but may not be limited to:

1. Evaluation of the adequacy of the arsenic soil data sets for supporting deterministic and probabilistic risk assessments for residential, industrial/commercial and other applicable exposures;

2. Description of the methodology or methodologies to be used to address non-arsenic constituents;

3. Description of the exposure pathways and the conceptual site model;

4. Description of the methodology or methodologies (e.g., deterministic and probabilistic) to be used in the risk assessments; and

5. Identification of the proposed exposure factor assumptions and description of the rationale for use of the proposed factors.

4.6 USE OF RISK ASSESSMENT FOR DEVELOPMENT AND COMPARISON OF ALTERNATIVES

Human health risks associated with arsenic in soil after the corrective measures have been implemented will be characterized for the corrective measures alternatives developed for detailed evaluation (see Section 5.0). The risk assessment for evaluation/comparison of

alternatives will be performed as described above using probabilistic and deterministic methodologies (see Section 4.3).

4.7 ECOLOGICAL RISK ASSESSMENT

The CMS will include a qualitative ecological risk assessment. Potential ecological impacts will be considered during corrective measure alternatives evaluation, including potential impacts to wildlife, habitat, mature trees and plantings in the CMS Study Areas.

5.0 TASK 3: IDENTIFICATION AND DEVELOPMENT OF THE CORRECTIVE MEASURE ALTERNATIVES

Task 3 includes identification of viable technologies appropriate to the CMS Study Areas land use types; screening of the technologies to identify a list of technologies for the development of corrective measure alternatives; identification and evaluation of various methods for removal of soil within the protected root zone of a mature tree; and performance of ongoing and proposed pilot studies to obtained additional data required to better assess and screen certain proposed technologies.

5.1 GENERAL CONSIDERATIONS

The following have been considered during identification and screening of technologies:

1. As required by the AOC, FMC performed a preliminary evaluation of corrective measures technologies and identified potentially applicable technologies in 1991, prior to starting the RFI. The results of that evaluation are presented in the report entitled "Pre-investigation Evaluation of Corrective Measures Technologies" (dated August 1991) (referred to as "1991 Technologies Evaluation Report").

2. Since arsenic in soils is expected to dictate the scope of remedial efforts in the CMS Study Areas, corrective measure technologies that can remove or isolate arsenic-containing soils or reduce the arsenic levels in the soil have been identified. Technologies which are clearly inappropriate for the relatively low arsenic levels and nature of arsenic in the soil (e.g., arsenic can not be destroyed) have not been considered. Potentially applicable technologies previously identified in the 1991 Technologies Evaluation Report that are considered inappropriate for the soils in the CMS Study Areas include soil washing, solidification/stabilization, vitrification, incineration, chemical extraction, chemical dechlorination, chemical reduction/oxidation, biological degradation, vapor extraction, and soil flushing.

3. The CMS Study Areas consist of properties within the community that are not owned by FMC. Potential disruption of the community was an important consideration in the selection of potentially feasible technologies.

4. The current land usages of these properties include residential, commercial/business, industrial, agricultural, public land and education (middle and high school). Technologies that are appropriate for the various land uses and physical characteristics of the CMS Study Areas, and the environmental settings within the CMS

Study Areas have been identified. FMC will solicit input from the community and local officials with respect to identification of future land uses, as appropriate.

5. Some technologies evaluated will be consistent with USEPA's "Green Remediation " strategies, including conservation and efficient use of natural resources and energy, reduction of negative impacts (e.g., generation of greenhouse gases) on the environment, minimization of pollution at its source, and reduction of waste to the extent practicable.

6. FMC has requested that a Corrective Action Management Unit (CAMU) be designated at eastern portion of the FMC Plant Facility for the permanent management of non-hazardous soils or materials generated in the course of remedial activities. For the purposes of this CMS, it is assumed that any excavated soil will be a non-hazardous waste. Soil disposal options/technologies will include the use of a CAMU at the FMC Facility as well as off-Site disposal or management options.

5.2 IDENTIFICATION & SCREENING OF TECHNOLOGIES

Based on the above considerations and review of the contaminated soil remedial technologies identified in 1991 Technologies Evaluation Report, the following response actions and/or technologies have been identified for further screening and/or evaluation:

1. No Action or No Further Action;

2. Institutional Controls (nonresidential properties only) to prevent or reduce potential for human exposure to contaminated soil. Institutional controls include use of deed restrictions (non-enforceable and requires property owner consent), private property agreements/easements (requires property owner consent and does not require intervention of government authority), and/or environmental easements (requires property owner consent and intervention of NYSDEC);

3. Access Restrictions (nonresidential properties only) consist of physical mechanisms that can restrict access and or maintain the integrity of another technology. Access restrictions include posting of signage and/or fencing;

4. Monitoring and Maintenance consists of activities required to verify and maintain the effectiveness of a remedial measure;

5. Engineered Cover (nonresidential properties only) involves the construction of an engineered cover to limit contact with contaminated soil;

6. Soil Excavation/CAMU involves the removal of contaminated soil and the disposal of the excavated soil in a CAMU at the FMC Facility;

7. Soil Excavation/Off-Site Disposal involves the removal of contaminated soil and the disposal of the excavated soil in a permitted commercial off-site disposal facility;

8. Soil Excavation/Off-Site Beneficial Reuse involves the removal of contaminated soil and off-site beneficial reuse, such as daily cover at a commercial landfill;

9. Phytoremediation involves the use of certain plants to reduce arsenic levels in soil. Plant materials accumulate arsenic and will require periodic harvesting/removal and off-site disposal. Phytoremediation is considered to be a "Green" technology;

10. Soil Tilling/Blending involves the tilling, mixing and blending of soil to reduce arsenic levels and to recycle land/soil. Soil Tilling/Blending is considered to be an in situ technology and a "Green" technology since it conserves a significant natural resource (soil).

11. Tree Preservation Measures involve special soil excavation methods or protocols that could potentially be attempted within the protected root zone of a tree to avoid destroying certain trees during soil excavation.

The above listed technologies will be used (as appropriate) in the development of CMAs. Additional information concerning the feasibility of phytoremediation and soil tilling/blending will be evaluated further as part of ongoing or proposed pilot studies, as discussed in Section 5.3.

Section 5.4 describes the identification of tree preservation methods that could be incorporated into corrective measures alternatives for further evaluation in the CMS.

5.3 PILOT STUDIES

The feasibility of phytoremediation and soil tilling/blending would need to be demonstrated under site conditions before these technologies could be incorporated into a recommended CMA.

Site-specific information concerning the effectiveness of the use of phytoremediation for reduction of soil arsenic level was obtained in an arsenic phytoremediation pilot study conducted in 2008. Additional information will be obtained in 2009 with the continuation of the pilot study through the 2009 growing season.

FMC may propose to conduct a soil tilling/blending pilot study to obtain site-specific information that can be used to evaluate the feasibility of this technology if the soil arsenic concentration data indicate the technology could be feasible and if an appropriate test site is available.

The results of the pilot study(ies) will be used in the CMS for the evaluation of CMAs involving phytoremediation and/or soil tilling/blending.

5.3.1 Arsenic Phytoremediation Pilot Study

The overall objective of the phytoremediation pilot study is to evaluate the effectiveness and feasibility of phytoremediation to reduce the arsenic levels in the soil in the test areas. In 2008 FMC implemented an approved Arsenic Phytoremediation Pilot Study Work Plan (Geomatrix Consultants, June 2008).

The results of the 2008 study were presented in the Arsenic Phytoremediation Pilot Study Report (AMEC Geomatrix, March 2009) ("March 2009 Report") submitted to the Agencies by letter dated March 13, 2009. By letter dated April 2, 2009, the Agencies, in consultation with the NYSDOH, provided comments on FMC's March 2009 Report, and communicated their determination that further study of the Brake Fern was warranted. FMC subsequently agreed to continue the pilot study through the 2009 growing season. Information obtained from the 2008 and 2009 pilot studies will be used to evaluate phytoremediation in the CMS.

5.3.2 Soil Tilling/ Blending Pilot Study (Optional)

Arsenic soil concentrations can vary significantly within the boundaries of each property. For properties with soils exhibiting generally low concentrations with less frequent instances of more elevated concentrations, or where most arsenic presence is limited the upper few inches of soil, tilling or blending of the soils may reduce elevated arsenic concentrations to acceptable levels and conserve soil.

FMC may propose to conduct a soil tilling/blending pilot study to obtain site-specific information that can be used to evaluate the feasibility of this technology in the CMS if the soil arsenic concentration data indicate the technology could be feasible and if an appropriate test site is available. Site-specific information and data (e.g., depth of mixing, level of effort required, maximum and average resulting arsenic concentrations, and associated costs) which would be obtained during any such pilot study would be incorporated into the CMS.

In order to evaluate the effectiveness and feasibility of soil tilling/blending, the pilot study would focus on the following study questions:

1. What pre-existing distributions and concentrations of arsenic in the soil are appropriate for use of tilling or blending?

2. What level of mechanical effort is required to effectively till or blend the soil?

3. What mechanical equipment is most suitable for tilling or blending the soil?

4. What depths can the mechanical equipment effectively till/blend soil?

5. What are the effects of tilling or blending on the distributions of arsenic in the soil in the test areas?

6. What conditions (e.g., land use, property configuration, soil type) are appropriate for use of tilling or blending?

7. What are the effects of tilling or blending on the physical characteristics of the soil in the test areas?

If a pilot study is determined to be appropriate, a Soil Tilling/Blending Pilot Study Work Plan would be submitted to the Agencies and community as an interim CMS deliverable (see Section 5.5).

If, based on review of the soil arsenic concentration data, soil tilling/blending is potentially feasible at a small number of properties, the technology can be evaluated in the CMS and could be a limited component of the recommended CMA without conducting a pilot study. However, pilot testing on the properties selected for soil tilling/bending would likely be performed as part of predesign investigations to demonstrate effectiveness prior to property wide application.

5.4 IDENTIFICATION AND EVALUATION OF TREE PRESERVATION MEASURES

Currently, FMC is not aware of any practical excavation methods which could remove soil from the root zone of a mature tree without substantial risk of tree death. Liabilities and common sense safety concerns will dictate that if the risk of tree death and uprooting is significant following excavation, the tree must be removed. A pilot study of soil removal methods within the protected root zones of trees is not practical in the timeframe of the CMS because for such a study to be valid it would have to monitor the condition of the trees long-term (i.e., over several years following excavation activities and exposure to the weather). Therefore, tree preservation measures will be identified and evaluated by researching the success of methods used on other similar projects and consultation with professional arborist(s).

Potential methods for removal of soil within the protected root zones of mature trees or other protocols will be identified and evaluated. The evaluation will include, but will not be limited to, the following considerations:

1. Ability to perform the work without causing permanent damage to the tree.

2. The level of effort and type of equipment required.

3. The safety of workers, residents and neighbors during implementation.

4. The potential for the tree to fall down or die during or after completion of the work.

5. The degree to which the soil removal and replacement can be accomplished.

6. The effectiveness of the method to reduce soil arsenic levels and/or human health risk levels associated with remaining soil arsenic concentrations.

7. Costs for performance of the work and potential future costs/liabilities.

Potential tree preservation methods to be considered include, but may not be limited to, hand excavation, limited mechanical surficial soil excavation, and/or partial multi-year excavation.

A memorandum will be prepared to present the results of this evaluation and will include description of the methods identified and likelihood of success. The results of the evaluation will be used in the CMS for the evaluation of CMAs involving tree preservation.

5.5 TASK 3 INTERIM DELIVERABLES

CMS Task 3 deliverables will be as follows:

1. Arsenic Phytoremediation Pilot Study Report – 2009 Growing Season, as specified in the approved Phytoremediation Pilot Study Work Plan;

2. Soil Tilling/Blending Pilot Study Work Plan (Optional);

3. Soil Tilling/Blending Pilot Study Report (Optional), as to be specified in the Soil Tilling/Blending Pilot Study Work Plan;

4. Technical Memorandum: Identification and Evaluation of Tree Preservation Measures

5.6 GENERAL CORRECTIVE MEASURES ALTERNATIVES (CMAS)

This subsection presents a preliminary identification of types of CMAs to be evaluated in the CMS. The CMAs are discussed in general terms below. The specifics of each

CMA (e.g., specific properties undergoing remediation and the precise technology mix) will be determined in the CMS in accordance with the AOC.

5.6.1 Suspected Air Deposition Study Area General CMAs

5.6.1.1 Residential Surface Soils

Surface soils are defined in this CMS as the upper two feet of soil. General CMAs to address residential surface soils in the Air Deposition Study Area 1 and Culvert 105 Study Area south of the Barge Canal include (see Figure 2):

- No further action. This alternative limits remedial action in the CMS Study Area to the ICMs and Early Actions already completed.

- Remediation to site-specific risk levels. These alternatives will entail cleanup of soils to achieve post-remediation site-specific human health risk levels (developed using probabilistic and/or deterministic human health risk assessment methods). These CMAs will be evaluated utilizing technology options as follows:

  - Excavation of all soils targeted for remediation, three disposal options will be evaluated (see Section 5.6.3).

  - Excavation (three disposal options) supplemented with phytoremediation, soil tilling/blending and/or appropriate tree preservation measures (if shown to be feasible). The degree to which the supplemental technologies are incorporated into this alternative will depend in part on the results of the pilot studies and evaluation of tree preservation measures (see Sections 5.3 and 5.4, respectively). If appropriate, more than one combination of supplemental technologies may be evaluated as separate CMA(s).

- Remediation to achieve post remediation average arsenic concentrations on each property below a specified average arsenic soil cleanup number with a maximum single point soil arsenic concentration. The average and maximum soil arsenic cleanup numbers will be developed based on risk assessment (probabilistic and/or deterministic methods) or comparison to the local background data. As requested by the Agencies, FMC intends to evaluate an average soil arsenic cleanup number of 20 ppm with a maximum single point concentration (e.g., 40 ppm) in the CMS. Other average and maximum cleanup numbers may be evaluated in additional CMAs as appropriate. These CMAs will be evaluated utilizing technology options as follows:

- Excavation of all soils targeted for remediation, three disposal options will be evaluated (see Section 5.6.3).

- Excavation (three disposal options) supplemented with phytoremediation, soil tilling/blending and/or appropriate tree preservation measures (if shown to be feasible). The degree to which the supplemental technologies are incorporated into this alternative will depend in part on the results of the pilot studies and evaluation of tree preservation measures (see Sections 5.3 and 5.4, respectively). If appropriate, more than one combination of supplemental technologies may be evaluated as separate CMA(s).

- Remediation to specified arsenic cleanup numbers on a point by point basis. These CMAs will entail cleanup of all residential soils containing arsenic at concentrations above a specified cleanup number. As requested by the Agencies, FMC intends to evaluate a point by point cleanup number of 20 ppm in the CMS. Other cleanup numbers may be evaluated in additional CMAs as appropriate. These CMAs will be evaluated utilizing technology options as follows:

  - Excavation of all soils targeted for remediation, three disposal options will be evaluated (see Section 5.6.3).

  - Excavation (three disposal options) supplemented with phytoremediation, soil tilling/blending and/or tree preservation techniques (if shown to be feasible). The degree to which the supplemental technologies are incorporated into this alternative will depend in part on the results of the pilot studies and evaluation of tree preservation methods (see Sections 5.3 and 5.4, above). If appropriate, more than one combination of supplemental technologies may be evaluated as separate CMA(s).

5.6.1.2 Nonresidential Soils

Consistent with the Agencies' final CAOs, with agreement by the property owner, and based on current and reasonably anticipated future non-residential use of a property, a combination of institutional and/or engineering control methods may be acceptable as corrective measures as long as they are determined to render adequate, long-term protection of human health and the environment. For properties which are deemed appropriate for nonresidential designation, the following CMAs will be evaluated:

- No further action. This alternative limits remedial action in the CMS Study Area to the ICMs and Early Actions already completed.

- Institutional controls (including Institutional controls and/or access restrictions, as described in Section 5.2) to prevent future residential development without additional investigation and/or remedial action, reduce or prevent potential human exposure to contaminated soil, and/or to restrict access or maintain the integrity of another technology.

- Engineering controls (e.g., engineered cover) to prevent potential human exposure to soil with unacceptable human health risk levels based on appropriate site-specific nonresidential exposure scenario(s).

- Soil tilling/blending (for surficial soils only) and/or excavation on properties with arsenic concentrations associated with unacceptable risk levels using the appropriate site-specific nonresidential exposure scenario(s).

5.6.2 Culvert 105 Study Area General CMAs

5.6.2.1 Residential Surface Soils North of the Barge Canal

As with the suspected air deposition area general CMAs, surface soils are defined in this CMS as the upper two feet of soil. Surface soils in the portion of the Culvert 105 Study Area south of the Barge Canal are addressed as part of the Air Deposition Study Area 1 (see Section 5.6.1.1). General CMAs to address residential surface soils in the Culvert 105 Study Area north of the Barge Canal (see Figure 3) include the CMAs identified in Section 5.6.1.1 for residential surface soils in the Air Deposition Study Area 1.

5.6.2.2 Culvert 105 Subsurface Soils General CMAs

Subsurface soils in the Culvert 105 Study Area are defined as soils greater than two feet below ground surface which have been potentially impacted by buried pipe sections of Culvert 105 north and south of the Erie Canal. General CMAs to address subsurface Culvert 105 soils include (see Figure 4):

- No action.

- Sewer cleaning and slip lining (if required). This CMA entails removal of accumulated sediment within piped sections of Culvert 105 which could represent a source of potential arsenic migration to surrounding soils or downstream surface water. In areas where the pipe is determined to be sufficiently damaged or deteriorated such that

collapse of soil into the pipe is a risk during or after cleaning, slip lining of these sections may be performed in addition to or in lieu of cleaning.

- Excavation to achieve site-specific risk levels. This CMA would include excavation of subsurface soils with arsenic concentrations which pose an unacceptable human health risk levels using the appropriate site-specific subsurface soil exposure scenario(s). Three disposal options will be evaluated (see Section 5.6.3).

- Remediation to achieve post remediation average arsenic concentrations below a specified cleanup number with a maximum single point soil arsenic concentration. These alternatives will entail cleanup of soils to achieve the targeted post-remediation average concentrations of arsenic on each remediated property based on the existing data and backfill concentrations for excavated soils. The average and maximum soil arsenic cleanup numbers will be developed based on risk assessment (probabilistic and/or deterministic methods) or comparison to the local background data. Three disposal options will be evaluated (see Section 5.6.3).

5.6.2.3 Nonresidential Soils

Consistent with the Agencies' final CAOs, with agreement by the property owner, and based on current and reasonably anticipated future non-residential use of a property, a combination of institutional and/or engineering control methods may be acceptable as corrective measures as long as they are determined to render adequate, long-term protection of human health and the environment. For properties which are deemed appropriate for nonresidential designation, the CMAs that will be evaluated are described in Section 5.6.1.2.

5.6.3 CMA Disposal Options

For each CMA involving excavation of soil, three disposal options will be considered and evaluated:

1. Off-site disposal as solid waste at a permitted disposal facility.

2. Off-site beneficial reuse (i.e., disposal as daily cover at a commercial facility or other beneficial reuse, if any).

3. Permanent management at a Corrective Action Management Unit (CAMU) which, if approved, would be constructed at the eastern portion of the Facility.

6.0 TASK 4: EVALUATION OF CORRECTIVE MEASURES ALTERNATIVES

Once the list of corrective measures alternatives has been developed, the detailed evaluation will follow the process specified in the AOC, except that community acceptance and "green remediation practices" have been added as evaluation criteria.

6.1 EVALUATION CRITERIA

The evaluation criteria to be used to evaluate each CMA and recommend the most appropriate alternative are described below:

Community/Property Owner Acceptance

This criterion evaluates remedies based on the degree to which they are acceptable to the community and property owner and incorporates community concerns into the evaluation of the remedial alternatives.

Based on surrounding land use and the community, it is anticipated that the focus of community concerns will be on possible short-term and long-term impacts during remediation, overall effectiveness of the remedy, socioeconomic concerns such as the environmental setting and character of the Study Area neighborhoods, and potential for development or beneficial reuse of the property and/or adjacent land. Tree destruction is a key socioeconomic impact which will be considered.

Community acceptance will be evaluated throughout the CMS process and community concerns will be considered during the process. Section 3.0 describes the community participation process.

Technical

The technical criterion involves evaluation of each CMA based on performance, reliability, implementability and safety.

The performance of the CMA is a function of its effectiveness and its useful life. Effectiveness is the ability of the CMA to reduce unacceptable human health risk levels (based on site-specific risk assessment). The useful life is the length of time over which the effectiveness can be maintained.

Reliability is assessed based on the degree to which the technologies employed in the CMA have been demonstrated to be effective under site conditions and uncontrollable changes over

time. Reliability also considers the frequency and complexity of any operation and maintenance which may be required to maintain effectiveness of the CMA.

Implementability includes the relative ease of installation or construction (constructability) and the time required to achieve a given level of response (including the time required for implementation and the time it takes to actually obtain beneficial results). It also considers external factors which may affect implementation including the need for special permits and agreements, equipment and disposal availability.

The safety evaluation includes threats to the safety of workers and community members during and after implementation of the CMA.

Environmental

The environmental criterion requires assessment of the short and long term beneficial and adverse impacts of the CMA on the environment and, in particular any adverse effects on environmentally sensitive areas.

Human Health

The human health criterion requires assessment of each CMA in terms of the extent to which it mitigates short and long term potential exposure and protects human health (i.e., reduction of human health risk levels to those risks associated the background conditions) both during and after implementation. Protection of human health during implementation will consider public and worker safety issues and short term environmental concerns such as erosion, dust generation, and community disruption. For the human health concerns after implementation, site-specific risk assessments will be conducted for all CMAs as described in Section 4.0.

In addition, the human health evaluation will present a comparison of estimated post-remediation concentrations of non-arsenic constituents to applicable regulatory criteria (e.g., NYSDEC Soil Cleanup Objectives identified in 6 NYCRR Subpart 375-6.8(b), as utilized in Draft RFI Report Volumes II and IV) and/or current risk-based screening levels (e.g., USEPA Soil Screening Levels), and/or use of site-specific risk assessment.

Institutional

The Institutional criterion considers the effects of Federal, State, and local environmental and public health standards, regulations, guidance, advisories, ordinances, or community relations on the design, operation, and timing of each alternative.

Cost

This criterion addresses the capital costs, annual operation and maintenance costs (if any), and present worth analysis (if any). A cost estimate will be prepared for implementation of each CMA.

Capital costs consist of direct (construction) and indirect (non-construction and overhead) costs. Direct costs include expenditures for the equipment, labor and material necessary to perform remedial actions. Indirect costs include expenditures for engineering, financial and other services that are not part of actual construction activities but are required to implement the corrective measure.

Green Remediation Practices

The CMAs will be evaluated for consistency with USEPA's Green Remediation concepts and strategies (refer to USEPA website location http://www.clu-in.org/greenremediation/) at the request of the MCIG and consistent with the final CAOs. USEPA is encouraging "green remediation" practices that consider all of the environmental effects of remedial actions, including energy requirements, air emissions, effects to land and ecosystems, material consumption and waste generation, and impacts on long-term environmental stewardship. The CMAs will be evaluated to determine which alternatives offer the maximum net environmental benefit.

6.2 DECISION FRAMEWORK

Figures 2 through 4 illustrate how the various residential CMAs (non-residential CMAs have been excluded from these figures) are structured and how they will be evaluated.

7.0 TASK 5: JUSTIFICATION AND RECOMMENDATION OF THE CORRECTIVE MEASURE OR MEASURES

In accordance with the AOC, the results of the evaluation of alternatives described in Section 6.0 will be used to justify and recommend the corrective measure alternative or alternatives most appropriate for remediation of soils in the Air Deposition Area 1 and Culvert 105 Study Area. This will include preparation of summary tables which compare the CMAs based on the evaluation of each CMA to the seven criteria discussed in Section 6.0. Any tradeoffs among community acceptance, health risks, environmental effects, and other pertinent factors will be highlighted. The degree to which each CMA meets the CAOs (see Section 1.2) will also be discussed.

As indicated in Section 2.0, community input will be sought and encouraged by FMC throughout the CMS process. Community input will help determine how to qualitatively weight certain attributes of the comparative evaluation (for example, maintaining the current character of the neighborhoods versus meeting a specific concentration at every location). The relative influence given to each evaluation criteria will be discussed and justified in the CMS.

The Agencies will select the final corrective measure alternative or alternatives based on the results of the CMS tasks 4 and 5.

8.0 REPORTS AND OTHER DELIVERABLES

As described in the prior sections, the following deliverables will be prepared for review by the Agencies, NYSDOH and other project-specific stakeholders:

1. Technical Memorandum: FMC Middleport Risk Management Approach for the CMS-Suspected Air Deposition Area 1 and Culvert 105 Study Area (see Section 4.5).

2. The following documents will be prepared as part of CMS Task 3 (see Section 5.5):

    - Arsenic Phytoremediation Pilot Study Report – 2009 Growing Season.
    - Soil Tilling/Blending Pilot Study Work Plan (Optional)
    - Soil Tilling/Blending Pilot Study Report (Optional)
    - Technical Memorandum: Identification and Evaluation of Tree Preservation Measures

3. Draft CMS Report presenting the results of all CMS Tasks, including the recommended corrective measures alternative or alternatives. The Draft CMS Report will be subject to formal public comment review prior finalization.

4. Final CMS Report.

The Agencies will select the final corrective measure alternative or alternatives based on the results of the CMS tasks 4 and 5 as documented in the Final CMS Report.

9.0 PROJECT SCHEDULE

The preliminary project schedule for performance of the CMS is as follows:

Item	Target Completion Date
CMS Work Plan Submittal	May 15, 2009
Agencies' Approval of CMS Work Plan	July 31, 2009
(If determined appropriate) Soil Tilling/Blending Pilot Study Work Plan submittal/Agencies' final Approval	July 15, 2009 / September 2, 2009
Technical Memorandum: FMC Middleport Risk Management Approach for the CMS-Suspected Air Deposition Area 1 and Culvert 105 Study Area	September 16, 2009 *
Technical Memorandum: Identification and Evaluation of Tree Preservation Measures	October 28, 2009 *
Soil Tilling/Blending Pilot Study Report	December 16, 2009
Arsenic Phytoremediation Pilot Study Report – 2009 Growing Season	February 2009
Draft CMS Report	March 3, 2010 *
Formal Public Comment Period	March - April 2010 *
Final CMS Report and Agencies' selection of the final corrective measure alternative or alternatives	April -June 2010 *

Note:

* Target completion date which is based on receipt of Agencies' approval of the CMS Work Plan by July 31, 2009.

The project schedule will be revised during the implementation of the project as appropriate.

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FIGURES

CITY:SYRACISE, NY GROUP: ENVCAD DB: P. LISTER LD: P. LISTER PM: D. WRIGHT LYR: ON=*;OFF=REF, (FRZ)
G:\ENVCAD\SYRACUSE\ACT\B0037735\0000\00001\DWG\VOLUME-IV\37735B04.DWG LAYOUT: 1 SAVED: 5/14/2009 12:03 PM ACADVER: 17.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 5/14/2009 12:03 PM BY: LISTER, PAUL
XREFS: IMAGES: CATALOG: B0037665\0000\XREF
37665X01

CULVERT 105 STUDY AREA (PINK)

LEGEND:

- RFI AIR DEPOSITION STUDY AREA 1 (GREEN)
- RFI CULVERT 105 STUDY AREA (PINK)
- FMC FACILITY
- CULVERT 105 BURIED PIPE
- CULVERT 105 FORMER BURIED PIPE
- CULVERT 105 OPEN DITCH SECTION
- EDGE OF WATER

0 300' 600'
GRAPHIC SCALE

FMC FACILITY

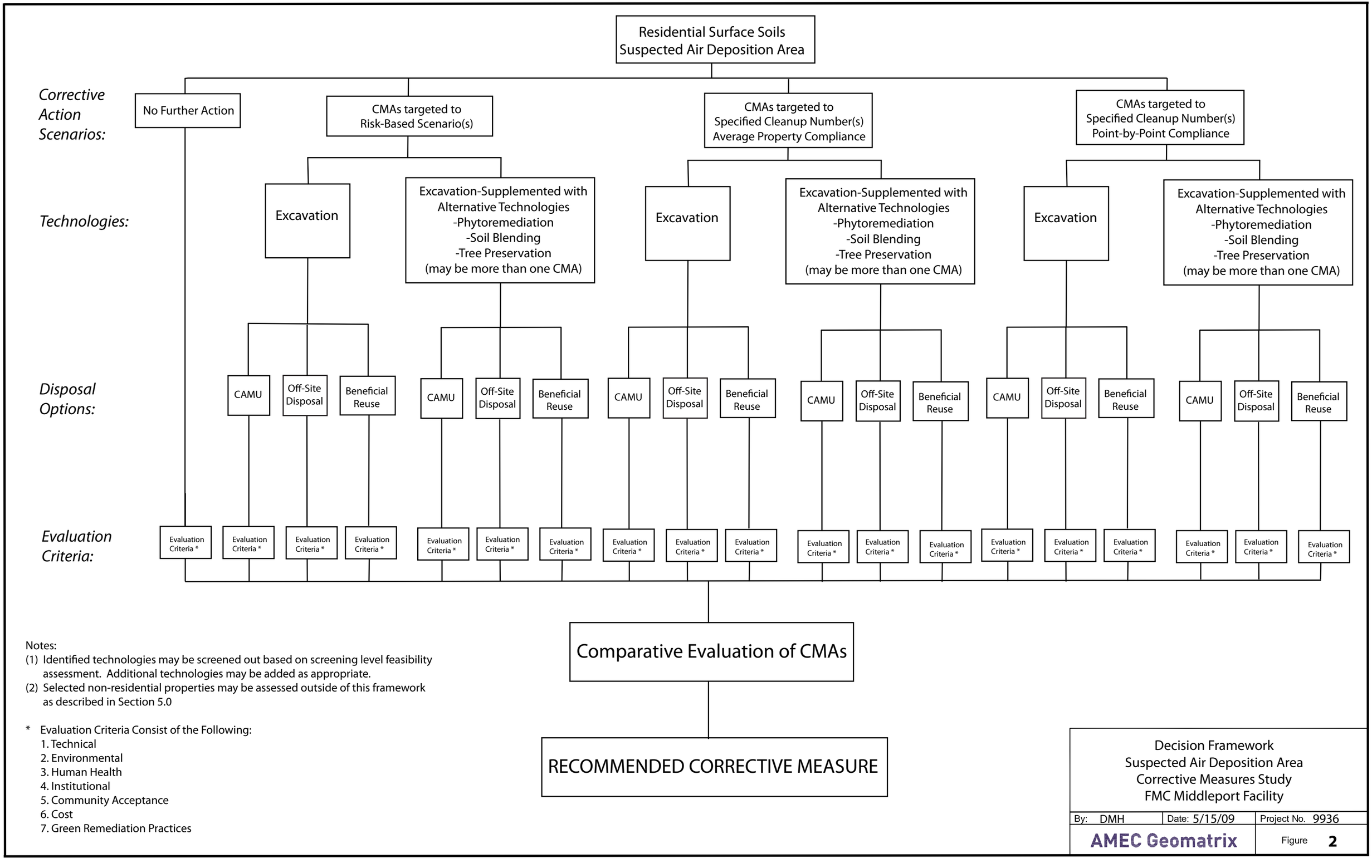
AIR DEPOSITION STUDY AREA 1 (GREEN OUTLINE)

FMC CORPORATION - MIDDLEPORT, NEW YORK
CORRECTIVE MEASURES STUDY WORK PLAN

SITE LOCATION

ARCADIS

FIGURE
1



Notes:
(1) Identified technologies may be screened out based on screening level feasibility assessment. Additional technologies may be added as appropriate.
(2) Selected non-residential properties may be assessed outside of this framework as described in Section 5.0

* Evaluation Criteria Consist of the Following:
1. Technical
2. Environmental
3. Human Health
4. Institutional
5. Community Acceptance
6. Cost
7. Green Remediation Practices

Decision Framework
Suspected Air Deposition Area
Corrective Measures Study
FMC Middleport Facility

By: DMH	Date: 5/15/09	Project No. 9936
AMEC Geomatrix		Figure 2

Residential Surface Soils
Culvert 105

Suspected Air Deposition Area CMS (See Figure 2)

South Of Canal

North Of Canal

Corrective Action Scenarios:

No Further Action

CMAs targeted to Risk-Based Scenario(s)

CMAs targeted to Specified Cleanup Number(s) Average Property Compliance

CMAs targeted to Specified Cleanup Number(s) Point-by-Point Compliance

Technologies:

Excavation

Excavation-Supplemented with Alternative Technologies
-Phytoremediation
-Soil Blending
-Tree Preservation
(may be more than one CMA)

Excavation

Excavation-Supplemented with Alternative Technologies
-Phytoremediation
-Soil Blending
-Tree Preservation
(may be more than one CMA)

Excavation

Excavation-Supplemented with Alternative Technologies
-Phytoremediation
-Soil Blending
-Tree Preservation
(may be more than one CMA)

Disposal Options:

CAMU | Off-Site Disposal | Beneficial Reuse

Evaluation Criteria:

Evaluation Criteria *

Comparative Evaluation of CMAs

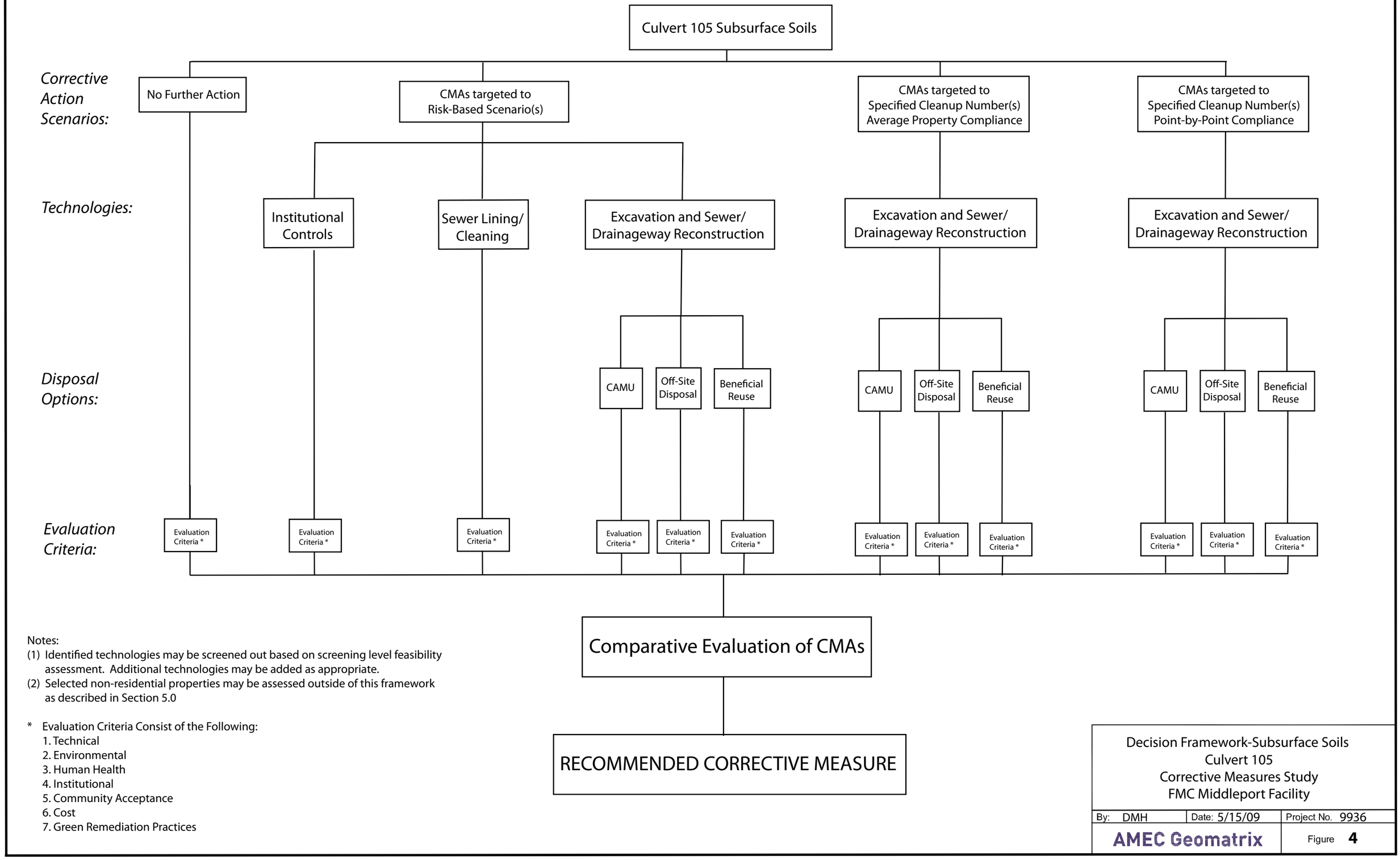
RECOMMENDED CORRECTIVE MEASURE

Notes:
(1) Identified technologies may be screened out based on screening level feasibility assessment. Additional technologies may be added as appropriate.
(2) Selected non-residential properties may be assessed outside of this framework as described in Section 5.0

* Evaluation Criteria Consist of the Following:
1. Technical
2. Environmental
3. Human Health
4. Institutional
5. Community Acceptance
6. Cost
7. Green Remediation Practices

Decision Framework- Surface Soils
Culvert 105
Corrective Measures Study
FMC Middleport Facility

By: DMH	Date: 5/15/09	Project No. 9936
AMEC Geomatrix		Figure 3



Notes:
(1) Identified technologies may be screened out based on screening level feasibility assessment. Additional technologies may be added as appropriate.
(2) Selected non-residential properties may be assessed outside of this framework as described in Section 5.0

* Evaluation Criteria Consist of the Following:
1. Technical
2. Environmental
3. Human Health
4. Institutional
5. Community Acceptance
6. Cost
7. Green Remediation Practices

Decision Framework-Subsurface Soils
Culvert 105
Corrective Measures Study
FMC Middleport Facility

By: DMH	Date: 5/15/09	Project No. 9936
AMEC Geomatrix		Figure 4

APPENDIX A

Agencies' Corrective Action Objectives for Off-Site Soils and Sediments

TO BE PROVIDED IN HARD COPY

APPENDIX B

Agencies' May 2009 Fact Sheet for FMC Middleport, NY Facility Environmental Investigation Reports for Air Deposition Area #1 and Culvert 105 Soil and Sediment

TO BE PROVIDED IN HARD COPY