Minnesota Pollution Control Agency

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

May 14, 1999

Mr. Douglas Hildre, P.E.
Environmental Control Manager
United Defense LP
Armament Systems Division
4800 East River Road
Minneapolis, Minnesota 55421-1498

RE: FMC Corporation Superfund Site

Dear Mr. Hildre:

Please find enclosed a Minnesota Pollution Control Agency memorandum regarding the proposed storm water retention basin on the FMC Corporation Superfund Site in Fridley.

If you have any questions regarding this memorandum, please contact me at (651) 296-7818.

Sincerely,

David N. Douglas
Project Manager
RCRA/Superfund
Site Response Section
Metro District

DND:csa

Enclosure

cc: Tom Bloom, U.S. Environmental Protection Agency
Joel Sanders, U.S. Navy

SF-00006-05 (4/86)

DEPARTMENT: POLLUTION CONTROL AGENCY

STATE OF MINNESOTA

Office Memorandum

DATE: May 12, 1999

TO: Steven Lee, Supervisor
Emergency Response
Site Remediation Section
Metro District

Through: Bruce Brott, Supervisor
RCRA/Superfund
Site Remediation Section
Metro District

FROM: David Douglas, Project Manager
RCRA/Superfund
Site Remediation Section
Metro District

PHONE: 296-7818

SUBJECT: Soil Sampling Protocol and Contingency Plan at Proposed BNSF Northtown Stormwater Retention Pond-Minnesota (1-3795-300), Dated April 22, 1999

Please find below the FMC Site Superfund staff response to the above-captioned document.

Field Screening and Sampling:

The staff requests that BNSF use U.S. Environmental Protection Agency Method 5035 and 8021 to analyze soil samples to determine the level of Contaminants of Concern (COCs) present in the excavated materials (see MPCA staff letter dated February 16, 1999). Also, since any COCs found are likely to be highly localized based on past removals, the MPCA staff requests that the above methods be used on any obviously visibly contaminated or smelly soil, especially contaminated soil that is found in conjunction with buried drums, drum carcasses, etc. Please note that the soils that remain on site may or may not meet future soil reference values for future site use scenarios. These soils may be re-evaluated in the future for compliance with the appropriate site use scenario.

If BNSF finds buried drums, drum carcasses, etc., at the planned limits of the excavation, the MPCA staff requests that BNSF and UDLP coordinate sampling and remediation of these areas including visibly contaminated soil associated with drums, drum carcasses, etc., consistent with project cleanup requirements identified by the MPCA staff for this project. For soil sampling, including excavations and stockpiles, the MPCA staff requests that BNSF follow the MPCA Risk Based Site Evaluation Manual guidance found in Section 5.6.1, Preliminary Investigations, Table 5E, page 2-26 and in Section 7.0, Sampling for Remediation Verification, Tables 7A, 7B and 7C, pages 2-29 through 2-31 (copies of these pages attached).

If, due to the construction of the storm water basin, FMC Site monitoring wells require modifications, the modifications shall be done according to Minnesota Department of Health Well Code. If the wells are modified (i.e., risers added) or surrounding ground elevations are changed due to construction activities, all points related to accurate measurement of water levels for each monitoring well shall be surveyed to establish accurate water level measurements.

As verified in a telephone conversation between David Douglas, of the MPCA staff,

and Douglas Hildre of United Defense LP (UDLP) on April 29, 1999, it is the MPCA staff understanding that UDLP has agreed to allow BNSF to stockpile soils to be taken off site and to land spread soils that are to remain on site, on the FMC Superfund Site pursuant to an access agreement between UDLP and BNSF.

Please let me know if you have any questions about this memorandum.

DND/csa

Attachment

Several different methods can be used to collect soil gas data, and the best method for a given site will depend upon the specific conditions at the site, the purpose of the sampling and the cost. Soil gas samples can be collected actively with the aid of direct-reading equipment (e.g., FIDs), or can be collected passively using carbon collectors . Table 5D lists some common methods for sampling soil gas.

Table 5D Soil Gas Sampling Methods

METHOD	EQUIPMENT	EXAMPLES	ADVANTAGES	DISADVANTAGES	COMMENTS
Active	PID, FID, Detector Tubes, Combustible Gas Indicators, etc.	OVM, OVA, Draeger, Gastech, etc.	Direct-reading equipment	PID not compound-specific. Detection limits for detector tubes may be too high.	Can be very effective if PID used in conjunction with detector tubes.
Passive	Activated Carbon Collectors	Petrex, EMFLUX, GORE-SORBER	Fairly simple installation. Collect compound-specific data	Interpretation of data may be difficult.	Useful for delineating limits of soil and/or ground water contamination.
Combination	Stainless Steel Canisters	Summa, Stabilizer	Portable system. Allows identification of contaminants	Does not provide actual concentration of contaminants in soil.	Good screening tool for determining contaminants of concern.

5.6 Soil Investigations

The general objectives of a soil investigation are to determine if a site poses a significant potential risk and whether or not a site requires further evaluation or remediation. Additional objectives are to minimize regulatory involvement and obtain quick regulatory closure. A preliminary soil evaluation should determine the concentrations of contaminants, the physical and chemical nature of the contaminants, the lateral and vertical distribution of contaminants, and the geologic conditions at the site. All soil exposure pathways (except food chain for human exposure and inhalation for ecological exposure) are assumed to exist. Site characterization of soil should incorporate three objectives: (1) the evaluation of human health and ecological exposure scenarios, (2) the evaluation of soil leaching potential, and (3) the estimation of contaminant volume needing remediation.

Prior to conducting a soil investigation, the following data should, if possible, be compiled:

- **Identification of COPCs** (see Section 2.0). These will be based on historic land use and site activities. Samples should be collected from areas of visibly contaminated soil, soil near sumps, pits, drains, sewer pipes, process areas, and any other suspect areas identified in the site use evaluation.
- **Quantification of COPCs.** Select appropriate MDH, EPA, or other lab methods which will quantify COPCs and meet DQOs.
- Identify suspect areas of concern based on site history, site inspection, and/or limited analytical data.

5.6.1 Preliminary Investigations

5.6.1.1 Evaluation of Human and Ecological Exposure to Soil

For preliminary soil investigations, it is assumed that all common human and ecological soil exposure pathways exist. These pathways include inhalation (for humans only), dermal contact and ingestion, but do not include indirect exposure via the foodchain (for humans). A residential property use scenario is assumed. A preliminary sampling plan must conservatively assess human and ecological exposure risk relative to the appropriate standards or criteria. To adequately assess human and ecological exposure risk, soil sampling needs to address both the lateral and vertical distribution of contaminants.

For a preliminary evaluation of soils, adequate lateral spatial coverage is required. As long as desired DQOs are met, it is recommended that field screening or field analytical methods be used (XRF, immunoassay, mobile lab). In conjunction with lab samples, these field methods can provide better spatial coverage of a site at a lower cost. The number of lateral soil sampling locations will be determined by the surface area of a site and the presence of discrete areas of contamination (i.e., source areas). Guidelines for determining the number of sampling locations for sites *with no apparent discrete areas of soil contamination* are listed in Table 5E. Additional information on exposure areas and concentrations can be found in the MPCA *Risk-Based Evaluation for Soil - Human Health Pathway Guidance*.

Table 5E Recommended Minimum Preliminary Soil Sampling Density

Surface Area of Site	Number of Lateral Sample Locations
less than 2 acres	6 sample locations per 0.5 acre (12/acre)
2-5 acres	sample locations placed on 75' centers (~ 8 /acre)
5-40 acres	sample locations placed on 100' centers (~ 4 /acre)
40+ acres	sample locations placed on 130' centers (~ 3 /acre)

The sample locations can be determined using a grid or can be randomly spaced to cover the suspected contaminated area. More samples, in addition to the numbers listed above, may be required due to site-specific contamination or geologic conditions.

The suspected contaminated area is often an exposure area which is defined as the location of potential contact between a human or environmental receptor and a release of contaminants. Hot spots should be identified using field screening, visual, olfactory, and past and present property use data to target areas where releases are likely to have occurred. If discrete source areas (hot spots) are known or suspected, samples shall be collected and analyzed from three separate lateral locations within each hot spot. Sample locations are sited to attempt to quantify the maximum contaminant concentrations and provide adequate definition of the extent of contamination. These sample locations should be biased towards visual, olfactory, and screening observations as well as suspect areas based on past and present land use. Compositing of lateral soil samples and averaging of lateral soil sample analytical results are *not acceptable* in preliminary investigations.

Direct exposure also needs to be assessed in the vertical direction. Generally, when assessing the direct exposure pathway, averaging vertical contaminant concentrations is not allowed, unless analytical data show that contaminant concentrations are fairly homogeneous. The most relevant

interval for the direct exposure pathway is the top two to six inches of soil. However, deeper soils must also be evaluated because they may become exposed at a later date. The key is to evaluate each horizon or layer of contaminated soil.

For human exposure, it is assumed that the top four feet of soil is accessible, and four to twelve feet below grade is potentially accessible. Refer to the MPCA Guidance on Incorporation of Planned Property Use Into Site Decisions. Ecological exposure is assumed to be limited to the uppermost four feet of soil. These assumptions may need to be adjusted on a site-specific basis. Compositing of vertical soil samples *is not acceptable except under site specific circumstances that have been reviewed and approved by MPCA staff.* Averaging of vertical soil sample analytical results is also *not acceptable* in preliminary investigations. The following soil sampling guidelines are suggested:

- Collect surface (upper two- to six inches) samples.
- Collect a separate sample for each distinct soil horizon.
- For the vertical profile for human exposure, two separate intervals will be considered: 0-4 feet, and 4-12 feet. These intervals correspond to accessible and potentially accessible soils, respectively. A *worst case* sample shall be collected from both the accessible and potentially accessible depth intervals and submitted for laboratory analysis. Selection of samples may be based on the following:

  1. If a field screening or field analytical instrument is used (See Table 5A) field results may be good overall indicators as to whether or not worst-case contamination has been encountered.
  2. Visual and olfactory observations as well as past and present site use may provide good indications as to where to collect worst case samples.
  3. Geologic observations can also direct worst case sampling under some circumstances. If VOCs are the target compounds and field screening does not yield any indications of contamination, collecting a soil sample at the upper surface of low permeability units such as clay or silt may be acceptable. However, keep in mind that certain contaminants saturate low porosity zones before being deflected around them and often highest concentrations, although potentially trapped, are found here.

- For the vertical profile for ecological exposure, the soil screening values apply only to the top four feet. Selection of samples should be based on the same three criteria listed above for human exposure.

5.6.1.2 The Evaluation of Soil Leaching Potential

In a preliminary investigation , levels of soil contaminants are compared with the Soil Leaching Values (SLVs) as an estimate of the likelihood for leaching potential. SLVs can be found in the MPCA Risk Based Guidance for the Soil Leaching Pathway Users Guide. Evaluation of each specific hot spot must be conducted using samples meeting the following sampling guidelines:

- Worst case samples shall be collected as discussed in Section 5.6.1.
- Samples shall include those collected above the capillary fringe.
- Log soil borings to establish geologic conditions at the site. Continuous sampling of soil borings is generally recommended.

5.6.2 Extensive Investigations

If contaminant levels exceed the appropriate standards or criteria and a cleanup is not conducted, a more extensive investigation is necessary. In extensive investigations, site specific inputs are used rather than generic defaults.

Extensive investigations require detailed characterization of surface and subsurface soil horizons, contaminant chemistry, and actual and potential receptors *sufficient for a site specific risk assessment.* In addition, site specific inputs are used to calculate site specific (Tier 2) SLVs to estimate of the likelihood for leaching potential. Information regarding the calculation of Tier 2 SLVs can be found in the MPCA *Risk-Based Guidance for the Soil Leaching Pathway User's Guide* (May 1998).

More flexibility with respect to remediation goals may be available if it can be demonstrated that the default standards and criteria cannot be met, and that no receptors will be adversely impacted by utilizing alternate compliance points, remediation time, or remediation strategy. In this case, site specific standards and criteria are generated using site specific data.

Extensive investigations may be conducted when:

- remediation of the site based on preliminary investigation results is not practicably feasible, or cost-effective; or
- default parameters do not adequately represent geologic conditions or exposure pathways at the site, for example, if complexities at the site involve heterogeneous, discontinuous soils, multiple source areas or contaminant streams, or unusual terrain (e.g., shallow buried bedrock valleys); or
- contaminants without specific standards or criteria are present; or
- a regulated party (RP or VP) believes site-specific data will ultimately result in a more protective or cost-effective investigation or remedy.

Extensive investigations may require:

- actual sampling of biota to determine if bioaccumulation or direct effects are occurring. This situation requires evaluation and approval by the MPCA staff and the Risk Assessors. Refer to the Risk-Based Evaluation for Soil - Human Health Pathway Guidance and the Risk-Based Evaluation for Ecological Receptors - Soil Pathway Guidance for additional guidance. The document entitled "EPA Ecological Risk Assessment Guidance for Superfund - Appendix B" (EPA 540-R-97-006) is one source for information on biota sampling; and
- use of bioassays, determination of site-specific bioavailability, population and community analyses.

In some site specific situations, averaging and compositing of samples may be acceptable. It is important to note that averaging is not acceptable for acutely toxic contaminants (see the MPCA *Risk-Based Evaluation for Soil - Human Health Pathway Guidance*). For certain pathways, specifically for human soil exposure and ecological soil food chain exposure, the 95% upper confidence limit (UCL) of the arithmetic mean should be calculated for the data set. This is to ensure that the average concentration used in risk calculations does not underestimate the exposure potential. The 95% UCL of the mean requires a minimum of 10 data points. The appropriate standards and criteria are generally applied to these averaged soil concentrations

If compositing of samples is conducted and grid sampling is used, each grid square should be divided into four sub-areas for composite sampling. The composite concentration can then be applied to the grid square. If composite sampling is conducted without a grid, assign the composite concentration to the centroid of the polygon formed by the individual sample locations (no more than four). Averaging of composite sample data is not acceptable, since the composite samples are already representative of a physical average of the sub-samples. For more information on this topic, please refer to Section 5 (Data Collection and Evaluation) of the MPCA *Risk-Based Evaluation for Soil - Human Health Pathway Guidance*.

Certain site-specific soil data are required for the assessment of human health risks. Parameters such as soil moisture and total organic carbon should be analyzed. See the MPCA *Risk-Based Evaluation for Soil - Human Health Pathway Guidance* for additional information. All laboratory method detection limits should be low enough so data can be used for risk evaluation purposes. In order to be used to evaluate risk, the data should also be representative of potential exposure scenarios.

6.0 SURFACE WATER SAMPLING

(To be added at a later date)

7.0 SAMPLING FOR REMEDIATION VERIFICATION

7.1 Introduction

Information presented in this section is intended to guide the environmental professional in the recommended methods for verifying that soil contamination has been adequately remediated. Primarily, the minimum number and the location of required samples are addressed.

Verification sampling strategies for soil remediation depend on the type of remediation -- excavation or in-situ treatment. The minimum number of samples and sampling locations are different for each remediation type. While the minimum number of samples required is easily determined for both situations, determining the sampling locations is more complex and requires some professional judgment. The sampling strategies are outlined below.

Ex-situ remedies may be amenable to statistical sampling strategies or batch sampling. Any proposed sampling for ex-situ remedies should be developed on a site by site basis with the oversight of the MPCA project staff.

7.2 Excavations

Verifying that contaminated soil has been remediated by means of excavation requires samples from the excavation floors and sidewalls. The tables below provide the minimum number of samples necessary to verify cleanup for various sizes of excavations. Remediation verification is demonstrated by comparing the analytical results from each sampling point with the cleanup goals. If the cleanup goals are exceeded at any point, this verification methodology may require additional excavation at that point until the goals are met. Specifically, if less than ten samples are collected from either excavation floors or sidewalls, the calculated average concentrations will have very little meaning from a risk standpoint. In these situations, the appropriate risk/cleanup standards should be considered as numbers that are not to be exceeded in any sample.

A sampling strategy that uses bias to choose sample locations is recommended. This guidance document cannot dictate the exact locations for sample collection using this strategy. The location of the sample collection points relies on site specific information from the remedial investigation, analysis of the release or contaminant distribution and the soil types encountered in the excavation. Sampling and analyzing the soil samples from the locations most likely to have contaminants can minimize the number of samples needed to verify that remediation is complete. Since professional judgment and site specific knowledge are required for selecting sampling locations, the rationale used to select these locations must be well documented in the implementation report.

Analysis of data generated by prior investigations at the site should yield information for the verification analysis. The field personnel present during the remediation should be sufficiently familiar with the conditions on site to implement an appropriate verification sampling plan. Soil verification sampling should incorporate all pertinent biases of a site which may include, but are not limited to, the following:

- preferential pathways of contaminant migration
- source areas, stained soils, other site specific "clues" (e.g., fractures in clays)
- changes in soil characteristics (e.g., sand/clay interfaces)
- soil types and characteristics.

Compositing soil samples for verifying soil remediation may be acceptable for non-volatile parameters. Generally, when sampling for non-volatile parameters, each composite sample to be analyzed may be comprised of a maximum of four subsamples. However, please be aware that if contamination is indicated in a composited sample at levels above the cleanup goal, the entire area of the excavation comprising the composite sample may require additional excavation until the cleanup goals are met. Suspected contaminated areas discovered during verification sampling should not be sampled as part of a composite but should be sampled discretely.

The minimum required number of verification samples is determined by the subsequent tables. Confirmation sampling should generally be conducted on a grid.

7.2.1 Excavation Floor

The minimum acceptable number of floor samples to be analyzed is based on the area of the excavation floor as designated in Table 7A shown below.

Table 7A Excavation Floor Samples

Area of Floor (sq ft)	Number of Samples
<500	2
500-<1,000	3
1,000-<1,500	4
1,500-<2,500	5
2,500-<4,000	6
4,000-<6,000	7
6,000-<8,500	8
8,500-<10,890 (0.25 acres)	9
>10,890	Use Guidance Below

The following guidance is to be used when excavation floor areas exceed 10,890 square feet:

Floor Acreage	Square Feet	Grid Interval
0.25 - 3.0	10,890-130,680	15 - 30 Feet
3.0 and over	130,680 +	30 Feet plus

7.2.2 Excavation Sidewalls

Sidewall samples are required to verify that the horizontal extent of the soil contamination has been remediated. The number of sidewall samples shall be determined by Table 7B shown below. In no case is less than one sample on each sidewall acceptable. Known hot spots should be sampled separately. Once again, when sampling for non-volatile parameters, each sample to be analyzed may be comprised of four subsamples.

Table 7B Excavation Sidewall Samples

Area of Sidewall (sq ft)	Number of Samples
<500	4
500-1,000	5
1,000-1,500	6
1,500-2,000	7
2,000-3,000	8
3,000-4,000	9
>4,000	1 sample per 45 lineal feet of sidewall

When sampling the sidewalls of excavations that exceed five feet in depth, the sidewall sampling locations must be staggered in the vertical plane. This will ensure that lateral remediation has been adequate at all depths within the excavation.

7.3 Soil Stockpiles

Often times an excavation results in a contaminated soil stockpile that then needs to be treated (on- or off-site) or sent off-site for appropriate disposal. Sampling of the stockpile is necessary in order to characterize the contaminated or treated soil and to determine the appropriate final disposition. Landfills and the various types of treatment facilities (such as thermal treatment facilities or land farm sites) have permitted limits on the levels of contaminants they can accept. Sampling is necessary to ensure receiving facilities are operating within their permit limits. Additional samples beyond what is recommended here may be necessary based on each facility's specific permit requirements. TCLP and/or total analyses should be conducted for each type of contaminant suspected to be present. The detection limits for the total analyses should be determined based on the requirements of the receiving facilities permit, or on the cleanup level established for the site. The following table shall be used to determine the appropriate number of stockpile samples to be collected for analyses.

Table 7C Stockpile Samples

Cubic Yards of Soil in Pile	Number of Samples
0-500	1 per 100 cubic yards
501- 1000	1 per 250 cubic yards
1001 or more	1 per 500 cubic yards

If less than ten samples are collected from a stockpile, a calculated average concentration will have very little meaning from a risk standpoint. Therefore, in this type of situation, the appropriate risk/cleanup standards should be considered as numbers that are not to be exceeded in any sample. Compositing of stockpile samples is acceptable for the non-volatile parameters. Each sample may be comprised of four subsamples collected randomly from within the stockpile.

7.4 In-Situ Soil Remediation

When in-situ remedies are used, the effectiveness of the remedy must be verified by soil sampling. In these cases, three-dimensional sampling must be undertaken to verify that the soils have been adequately treated.

In instances of in-situ stabilization, the sampling should be conducted using a grid pattern with a vertical component added at each node. The number of samples collected for analyses should be determined using Tables 7A and 7B. The vertical extent of the remedy should be determined by compositing samples within each grid over 10 foot depth intervals extending to the bottom of the stabilization zone.

For in-situ treatment such as soil vapor extraction (SVE), the number of samples collected for analyses should be determined using Tables 7A and 7B, but should be biased toward the sampling points located remote from the SVE points. The vertical component must also be addressed and, therefore, the soil borings should be screened continuously using a PID, and any soils showing elevated organic vapors should be sampled. If no elevated PID readings are detected, discrete samples should be collected at 5 foot intervals over the depth of the treatment zone.

Compositing of remediation verification samples is acceptable for in-situ remediations for the non-volatile parameters. Each sample may be comprised of no more than 4 subsamples.