PETROLEUM CONTAMINATED SITES GUIDANCE DOCUMENT FOR EMERGENCY RESPONSE ACTIONS

(March, 2005)

OHIO EPA
DIVISION OF EMERGENCY AND REMEDIAL RESPONSE
EMERGENCY RESPONSE AND SPECIAL INVESTIGATIONS SECTION
1800 WATERMARK DRIVE, COLUMBUS, OHIO 43215-1099

SECTION 1: INTRODUCTION

Releases of petroleum to the environment in Ohio are regulated by the Bureau of Underground Storage Tank Regulation (BUSTR), Division of State Fire Marshall, Ohio Department of Commerce, the Divisions of Wildlife and Oil and Gas, Ohio Department of Natural Resources (ODNR); the Public Utilities Commission of Ohio; the Ohio Environmental Agency (OEPA); the United States Coast Guard; the United States Environmental Protection Agency, (US EPA); and various local municipalities which have adopted pollution prohibition regulations and ordinances. This document has been adapted from the Bureau of Underground Storage Tank Regulations Corrective Actions Guidance Document, which in turn, evolved from a Petroleum Contaminated Soils Policy originally created by OEPA.

The purpose of this document is to offer guidance in situations where a release of petroleum has occurred from a non-BUSTR regulated source. This document has been developed specifically for emergency response actions and may not be appropriate for use at sites where a long term clean up is necessary, such as where there is extensive ground water contamination or more than just petroleum contamination. In these long term situations, the appropriate Ohio EPA District Office DERR Unit Supervisor should be contacted for guidance.

The following topics are outlined in this document: free product recovery recommendations, permit application responsibilities, petroleum action level calculations, and field sampling procedures. In no way does this document supersede any other applicable law, regulation, or cleanup criteria previously established by any government entity. OEPA reserves the right, pursuant to Chapters 3704, 3714, 3734, 3745, 3750, 6109, and 6111 of the Ohio Revised Code (ORC) and any other applicable state or federal laws or regulations to require further site investigation and abatement of release(s) of hazardous wastes, hazardous substances, industrial wastes or other wastes, pollutants or contaminants into the environment from any site and to seek civil penalties, reimbursement of oversight costs, response costs, and any other appropriate legal or equitable relief for any violation of law.

Another program has developed petroleum standards, which under certain circumstances are different from the BUSTR action levels applied in this document. OEPA's Voluntary Action Program (VAP) has developed cleanup standards based on land use and ground water use for various hazardous substances and petroleum under final rules adopted in December 1996. However, Paragraph (B)(1) of ∮3746.04 of the Ohio Revised Code (ORC) requires that the petroleum standards for *residential* and *commercial* properties be the standards adopted under Division (B) of ∮3737.882 of the ORC, the standards developed by BUSTR and described in Chapter 1301:7-9-13 of the Ohio Administrative Codes (OAC). The VAP developed direct contact soil standards for petroleum releases at *industrial* properties; these standards are described in Paragraph (B)(3)(a)(ii) of Rule 3745-300-08 of the OAC. These standards, like all VAP generic numerical standards, are applicable to a property undergoing a Voluntary Action under the supervision of a Certified Professional in accordance with all the requirements in ∮3745-300 of the OAC. Participating in the VAP and performing a cleanup in accordance with the VAP rules is an alternative to following this Petroleum Contaminated Sites Guidance Document for Emergency Response Actions.

Another Ohio EPA Guidance Document (DERR-00-DI-033, September 22, 2004) may be used to

address petroleum contaminated sites. Ohio EPA-DERR has developed a tiered approach to address petroleum contamination in soils. This approach includes the evaluation of indicator chemicals and residual petroleum constituents. Necessary inputs to calculate human health risk-based numerical standards, such as physicochemical and toxicity data, are documented. Analytical sampling requirements are provided for site assessment to ensure that sample results are compatible with the proposed risk assessment process. The petroleum-specific process to derive soil saturation limits is also provided.

SECTION II: IMMEDIATE RESPONSES TO RELEASES

FREE PRODUCT RECOVERY

During an emergency response, immediately begin recovery efforts. Absorbents, bailers, pumps, skimmers, vacuum trucks, and/or other techniques that facilitate free product recovery may be utilized. These efforts are to continue until a non-recoverable level is reached.

APPLICABLE OEPA PROGRAMS AND PERMITS

During emergency response activities, it may be necessary to install and/or utilize certain treatment technologies. The use of treatment technology may require the facility to obtain a permit. Please contact the appropriate district office for questions regarding the need for such permits (see Appendix C for the appropriate district office telephone number.)

SECTION III: PETROLEUM ACTION LEVELS

INTRODUCTION

The following "SITE FEATURE DEFINITIONS" and attached "SITE FEATURE WORK SHEET" (see Appendix A) can be used to determine petroleum cleanup standards at petroleum contaminated sites, **which are not regulated by BUSTR**. The definitions are for further clarification while using the work sheet. Once the points have been assigned and totaled, match the total score with the corresponding category in the "PETROLEUM ACTION LEVELS TABLE". The applicable category lists the cleanup standards that are to be used at the scored site.

In order to complete the site feature worksheet, it is necessary to gather site information. For those circumstances where site specific information has not been obtained, there are default 'unknown' values that may be used.

SITE FEATURE DEFINITIONS

Proximity to Water Supplies (Site Feature #1)

The proximity to a public or private water well or a water intake will be measured from the perimeter of the spill. The determination of sole source aquifer, sensitive area or well head protected area will be made based on whether or not the spill site is within one of the designated areas. For the purpose of this site feature, sensitive area will be interpreted as defined in BUSTR OAC 1301:7-9-09.

Depth to Ground Water (Site Feature #2)

Depth to ground water shall be measured in linear feet from the ground surface to the first zone of saturation that acts as a preferential pathway for migration. OAC 3745-27-01-B(49) defines zone of saturation as that part of the earth's curst, excluding the capillary zone, in which all voids are filled with water.

Site specific information should be used in the determination of the depth to ground water. However, if this is not feasible, then the information can be obtained through an evaluation of ODNR well logs. Another possible source are the county soil surveys published by the United States Department of Agriculture, Soil Conservation Service. These provide information on subsurface conditions to approximately six feet, including information on the depth to the water table and whether the water is perched. Additional information concerning the depth of the ground water may be obtained from ODNR Ground water Resource Maps and Pollution Potential Maps. Emphasis must be placed on the fact that these sources did not provide site-specific information. These may help provide a first-cut approximation and help identify areas that are vulnerable to contamination.

Predominant Type of Substratum (Site Feature #3)

A substratum type that best represents native soil and/or bedrock to the depth to ground water must be selected. If the boundary of a particular substratum type is unclear, the highest permeability soil or bedrock type most typical of the area should be chosen. Predominant type of substratum should be determined either by existing site or area substratum data, on-site borings and soil analysis, or consultation of the soil surveys published by the United States Department of Agriculture, Soil Conservation Service. (**Note:** If the predominant type of substratum is classified as fill material and the fill consists of a homogeneous mixture of clay-based soils, then the score for Column A may

be used. However, if the fill material consists of a heterogeneous mixture of cement, bricks, asphalt and/or similar unconsolidated material, then the score from Column C must be used.)

Proximity to Structures or Preferential Migration Pathways (Site Feature #4)
The Site Feature 4 Worksheet must be completed and totaled in order to score this feature. The following are the structures and pathways considered:

1. Structures with basements or subsurface foundations refers to any structures, occupied or unoccupied, which have subsurface features such as crawl spaces, footer drains, or basements.
2. Water line includes water mains, laterals, tie-ins and any piping connected to a publicly or privately owned and/or operated drinking water distribution system.
3. Curtain drains, french drains or field tiles refers to manmade drainage systems used to conduct storm water away from a location, which may be affected by the release or can reasonably be assumed to be affected.
4. Shallow injection wells refers to injection of fluids into the subsurface. This could include storm water drainage, industrial/automotive waste and remediation wells.
5. Septic systems (tank & associated leaching systems) includes influent and effluent piping associated with the systems. However, this does not include piping to a system that enters a publicly or privately owned and/or operated sewage treatment works.
6. Structures without subsurface conditions refers to structures, occupied or unoccupied, that do not have subsurface features (i.e. structures built on slabs, or directly on the ground.)
7. Sanitary sewer lines includes sewer lines, tap-ins, laterals or any other conduit connected to a publicly or privately owned and/or operated sewage treatment works.
8. Natural gas lines
9. Pipelines or other conduits includes piping trenches, lined or unlined, concrete or otherwise.
10. Buried telephone/television cable lines includes the piping trenches, lined or unlined, concrete or otherwise.

Proximity to Surface Water and/or Sensitive Areas (Site Feature #5)
The proximity shall be measured from perimeter of spill to the surface water or sensitive area. Surface waters include all streams, lakes, reservoirs, ponds, marshes, wetlands, springs, irrigation systems, storm sewers, and other waterways and/or direct pathways to surface waters. Sensitive areas include any local, state or federal nature reserve, wildlife refuge, preserve, park or forest, or habitat of threatened an/or endangered species. **Note:** Consult ODNR Division of Natural Areas and Preserves for information regarding threatened and/or endangered species.

Land Use (Site Feature#6)
1. Commercial/Industrial
   Commercial land use refers to facilities that supply goods and/or services and are open to the public. Examples of such uses include, but are not limited to, warehouses, building supply facilities, retail gasoline stations, automobile service stations, automobile dealerships, retail warehouses, repair and service establishments for appliances and other goods, professional offices, banks, credit unions, office buildings, retail businesses selling food and or merchandise, hospitals, clinics, religious institutions, hotels, motels, personal service establishments and parking facilities. Industrial land use refers to property where the current or intended use is for manufacturing or assembling goods including parts, machines and chemicals, and transportation uses. Examples of such uses include, but are not limited to, lumber yards, power plants, metal-working and plating shops, blast furnaces,

coke plants, oil refineries, brick factories, chemical plants, plastic plants, assembly plants, non-public airport areas, limited access highways, railroad switching yards and marine port facilities.

2. Residential/Agricultural/Recreational
Residential land use refers to areas where the current or intended uses of the property would be for housing, education, and health care for adults, children, the elderly and the infirm. Examples of such uses included, but are not limited to, family residences; day care facilities with open-air playgrounds with exposed soils; schools, colleges and other educational institutions with open-air facilities; nursing homes, elder care and other long-term health care facilities where exposure routes to soil, sediment, ground water or surface water from the property could exist. Agricultural land use is included in this category because this land use generally includes the residence of the farm family and farming operations where food crops are grown and farm animals are raised. Recreational land use has been included in this category because of the wide range of potential exposure frequencies and durations and to ensure protection os sensitive sub-populations such as young children who could frequent these areas on a regular basis.

TEST METHODS

Soil and water samples collected at the site should be analyzed using the following applicable U.S. EPA test methods:

Contaminant	Analytical Method for Soil	Analytical Method for Water
Benzene	SW-846, Method 8260B or 8021B	US EPA Test Method 524.2**
Toluene	SW-846, Method 8260B or 8021B	US EPA Test Method 524.2**
Ethyl benzene	SW-846, Method 8260B or 8021B	US EPA Test Method 524.2**
Total Xylenes (o,m,p - xylenes)	SW-846, Method 8260B or 8021B	US EPA Test Method 524.2**
TPH for Gasoline Range	SW-846, Method 8015B	Not Applicable
TPH for Diesel Range	SW-846, Method 8015B	Not Applicable

** U.S. EPA Test Method 524.2 or 502.2 should be utilized in those situations where the Ohio Department of Health and/or a local health department, and/or the OEPA Division of Drinking and Ground Waters require that this analysis be used. Otherwise, a U.S. EPA SW-846 method may be utilized as long as the practical quantitation limit is lower than the action level stipulated by the Site Feature Work Sheet. **Source**: US EPA's Environmental Monitoring Systems Laboratory, "Methods for the Determination of Organic CPLs in Drinking Water", December 1988 (Revised July 1991).

APPENDIX A

SITE FEATURE WORK SHEET

SITE FEATURE WORK SHEET

SITE FEATURES	COLUMN A		COLUMN B		COLUMN C	
	Score 15 Points	Enter Score	Score 10 Points	Enter Score	Score 5 Points	Enter Score
1. Proximity of perimeter of spill to a public or private well or water intake	>1000 ft		300-1000 ft		<300 ft or inside of a designated sole source aquifer, sensitive area, well head protection area, or unknown	
2. Depth to ground water	>75 ft		25 -75 ft		<25 ft or unknown	
3. Predominant type of substratum	Unfractured clay, shale, claystone, mudstone, clay, silty clay, low permeable tills		Clayey silt, moderate permeable till, silty shale, unfractured siltstone-sandstone-limestone, sandy clay, clay loam. Silty clay loam, sandy silt, silty sand, clayey sand, coal, peat		Sand, gravel, loamy sand, sandy loam, poorly lithified sandstone, karst limestone, highly fractured rock, fill material, or unknown	
4. Proximity to structures or preferential migration pathways (see below)	<8 points		8-12 points		>12 points	
5. Proximity to surface water and/or proximity to sensitive areas	>120 ft		50-120 ft		<50 ft or unknown	
6. Land use	Commercial/ Industrial				Residential/Recreational/ Agricultural	
Add Subtotals	+		+		+	
					TOTAL SCORE	

SITE FEATURE 4 WORK SHEET

Structures with basements or subsurface foundations (i.e. crawl space, footer drains, basements) within 50 ft.	4 pts. _____
Water line within 50 ft.	4 pts. _____
Curtain drains, french drains or field tiles within 100 ft.	4 pts. _____
Shallow injection wells, if within 50 ft. score 3 pts.; if within 100 ft., score 1 pt.	3 pts. or 1 pt. _____
Septic Systems (tank & associated leachate systems) within 50 ft.	2 pts. _____
Building type structure without subsurface conditions tested above within 50 ft.	1 pt. _____
Sanitary sewer line within 50 ft.	1 pt. _____
Natural gas lines within 50 ft.	1 pt. _____
Pipelines or other conduits within 50 ft.	1 pt. _____
Buried telephone/television cable lines within 50 ft.	1 pt. _____
Buried electrical cable & lines within 50 ft.	1 pt. _____
	TOTAL POINTS _____

If Total Points from Site Feature 4 Work Sheet are:
<8, enter score of 15 in Column A for Site Feature 4 in the above chart
8-12, enter score of 10 in Column B for Site Feature 4 in the above chart
>12, enter score of 5 in Column C for Site Feature 4 in the above chart.

PETROLEUM ACTION LEVELS (PPM)

CONSTITUENTS	CATEGORY 1	CATEGORY 2	CATEGORY 3	CATEGORY 4
Total Score	< 46 Points	46 - 60 Points	61 - 75 Points	> 75 Points
Soil BTEX	0.006 ppm Benzene 4 ppm Toluene 6 ppm Ethylbenzene 28 ppm Total Xylenes	0.17 ppm Benzene 7 ppm Toluene 10 ppm Ethylbenzene 47 ppm Total Xylenes	0.335 ppm Benzene 9 ppm Toluene 14 ppm Ethylbenzene 67 ppm Total Xylenes	0.5 ppm Benzene 12 ppm Toluene 18 ppm Ethylbenzene 85 ppm Total Xylenes
Ground Water BTEX	0.005 ppm Benzene 1 ppm Toluene 0.7 ppm Ethylbenzene 10 ppm Total Xylenes	0.005 ppm Benzene 1 ppm Toluene 0.7 ppm Ethylbenzene 10 ppm Total Xylenes	0.005 ppm Benzene 1 ppm Toluene 0.7 ppm Ethylbenzene 10 ppm Total Xylenes	0.005 ppm Benzene 1 ppm Toluene 0.7 ppm Ethylbenzene 10 ppm Total Xylenes
Soil TPH (Gasoline)	105 ppm TPH	300 ppm TPH	450 ppm TPH	600 ppm TPH
Soil TPH (Others)	380 ppm TPH	642 ppm TPH	904 ppm TPH	1156 ppm TPH

APPENDIX B

FIELD SAMPLING GUIDANCE

FOR PETROLEUM CONTAMINATE SITE CLEANUP

DURING EMERGENCY RESPONSE ACTIONS

FIELD SAMPLING GUIDANCE FOR PETROLEUM CONTAMINATED SITE CLEANUP DURING EMERGENCY RESPONSE ACTIONS

INTRODUCTION

Sampling is needed to determine if a petroleum contaminated site cleanup has achieved the specific concentrations presented in the Petroleum Action Levels Table in the Petroleum Contaminated Sites Guidance Document For Emergency Response Actions. Sampling will consist of collecting representative media from the area impacted by the petroleum release or discharge. For the purposes of this guidance document the following protocols recommended to be followed. This protocol has been established to address only sites that are involved in an emergency response action. The sampling protocol utilizes a biased sampling method that may not adequately characterize a site for other purposes such as risk evaluation and/or assessment. However, the sampling protocol will provide a framework for sampling scheme that can be modified to address the needs of the facility and/or vessel clean up process. The sampling protocol will assist in determining whether or not there are areas of contamination that may exceed the Petroleum Action Levels stipulated in the Petroleum Contaminated Site Guidance Document for Emergency Response Actions (April, 1997).

SAMPLING PROTOCOL FOR EMERGENCY RESPONSE ACTIONS

Soil Sampling
The first step to be undertaken is to determine the size of the area impacted by the release. This determination may be based on direct physical observation (such as oil stained vegetation, soils, etc.) and/or filed screening techniques (photoionization meter, flame ionization meter, immunoassay test kits, etc.) Once the affected area has been determined, it may be sampled prior to initiating cleanup or the affected area may be remediated and then sampled. (Note: It has been the experience of the Ohio EPA, Emergency Response Unit, On Scene Coordinators, that the sampling and subsequent analysis of grossly contaminated media will result in analytical concentrations that exceed the Petroleum Action Levels stipulated in the Petroleum Contaminated Sites Guidance Document. For the purposes of cost savings, the removal and proper disposal of grossly contaminated media may prove more cost effective.)

The size of the area impacted should be determined in approximate square feet. If the area impacted includes non-horizontal surfaces (such as the sidewalls of an excavation), these areas should also be included in the estimation. Upon arriving at a total square feet impacted by the spill, a determination of the number of samples to be collected can be made.

The area impacted will be divided in approximate 10' x 10' squares. These squares will be laid out so that they included as much of the impacted area as is possible although it is recognized that many spills can not be neatly broken into this shape. In each of these squares a grab sample will be collected from a point that would bias the sample towards the worst concentration (i.e. that point where it would be suspected that the contamination would be at its highest concentration). This bias may be based on physical observation (i.e. media that is discolored or has a detectable odor of petroleum), geologic factors (i.e. sample collected from the most permeable layer on the sidewall of an excavation, perhaps the root zone or a sand lens where petroleum is most likely to migrate), and/or other site specific features noted by the facility/vessel.

The grab sample will be collected utilizing recommended USEPA and OEPA guidance and will incorporate media from the impacted area. For each sample point two samples will be collected. One of these will be used for field screening with either a photoionization meter, flame ionization detector, or any other field screening method that will allow the facility to determine relative concentrations of petroleum in grab samples collected. The other will be retained for possible laboratory submittal.

The following table indicates the recommended number of grab samples that will be submitted for laboratory analysis. In the case where only one field screened samples is recommended to be submitted for laboratory analysis and more than one sample has been collected (i.e. area affected is > 100 square feet and < 500 square feet), the samples will

be rank ordered by the concentration of petroleum detected by the field screening method. The sample containing the highest concentration of petroleum will be submitted for analysis.

When more that one sample is to be submitted for laboratory analysis (i.e. area affected is greater than 500 square feet), the following procedure is recommended. The sample grid sections will be grouped in groups of five. The grouping will consist of sample grids that are adjacent to each other either horizontally or diagonally. If the number of grid sections is not a multiple of five then the grouping will consist of five adjacent grid sections and then the remainder would be grouped together. For each of these groupings, grab samples would be collected and field screened from each grid. A separate rank ordering of field screening results for each group would be collected and field screened from each grid. A separate rank ordering of field screening results for each group would then be done and the highest concentration sample from each grouping would be submitted for laboratory analysis.

SIZE OF AREA IMPACTED IN SQUARE FEET (S.F.)	**FIELD GRAB SAMPLES COLLECTED**	**FIELD SCREENED GRAB SAMPLES SUBMITTED FOR LABORATORY ANALYSIS**
0-100 S.F.	1	1
101-200 S.F.	2	1
201-300 S.F.	3	1
301-400 S.F.	4	1
401-500 S.F.	5	1
501-600 S.F.	6	2
601-700 S.F.	7	2
701-800 S.F.	8	2
801-900 S.F.	9	2
901-1000 S.F.	10	2
CONTINUE WITH THIS PATTERN	**ONE FOR EVERY 100 SQUARE FEET**	**ONE FOR EVERY 500 SQUARE FEET**

Water Sampling

For those sites where ground water and/or surface water may be or have been impacted by a spill or release, it it is recommended that a site specific sampling protocol be developed and utilized. Fore ground water this protocol could incorporate sampling existing wells if installed at appropriate depths, installing and sampling monitoring wells, or sampling any nearby surface discharge point. If monitoring wells are determined to be necessary, geoprobe samples may be useful in selecting appropriate locations for the wells. All water samples should be submitted for laboratory analysis.

INTERPRETATION OF ANALYTICAL RESULTS

Upon receiving the analytical results for a particular 10' x 10' grid section, a comparison should be made to the previously calculated Petroleum Action Level. If any of the concentrations of the applicable criteria exceed the Petroleum Action grid section, it is recommended that the facility take the following steps:

1) Perform additional remediation measures on the affected media in that grid section. Field screening results should be consulted to determine if other grid sections in the grouping should also be remediated prior to resampling. **EXAMPLE:** The field screening results for five grid sections were 700, 680, 10, 5, and 6 ppm. The 700 ppm sample was submitted for laboratory analysis and found to exceed the Petroleum Action Level calculated for the site. Therefore, the facility may assume that the 680 ppm field screened sample may also exceed the Petroleum Action Level. The facility would then remediate two grid sections prior to resampling.

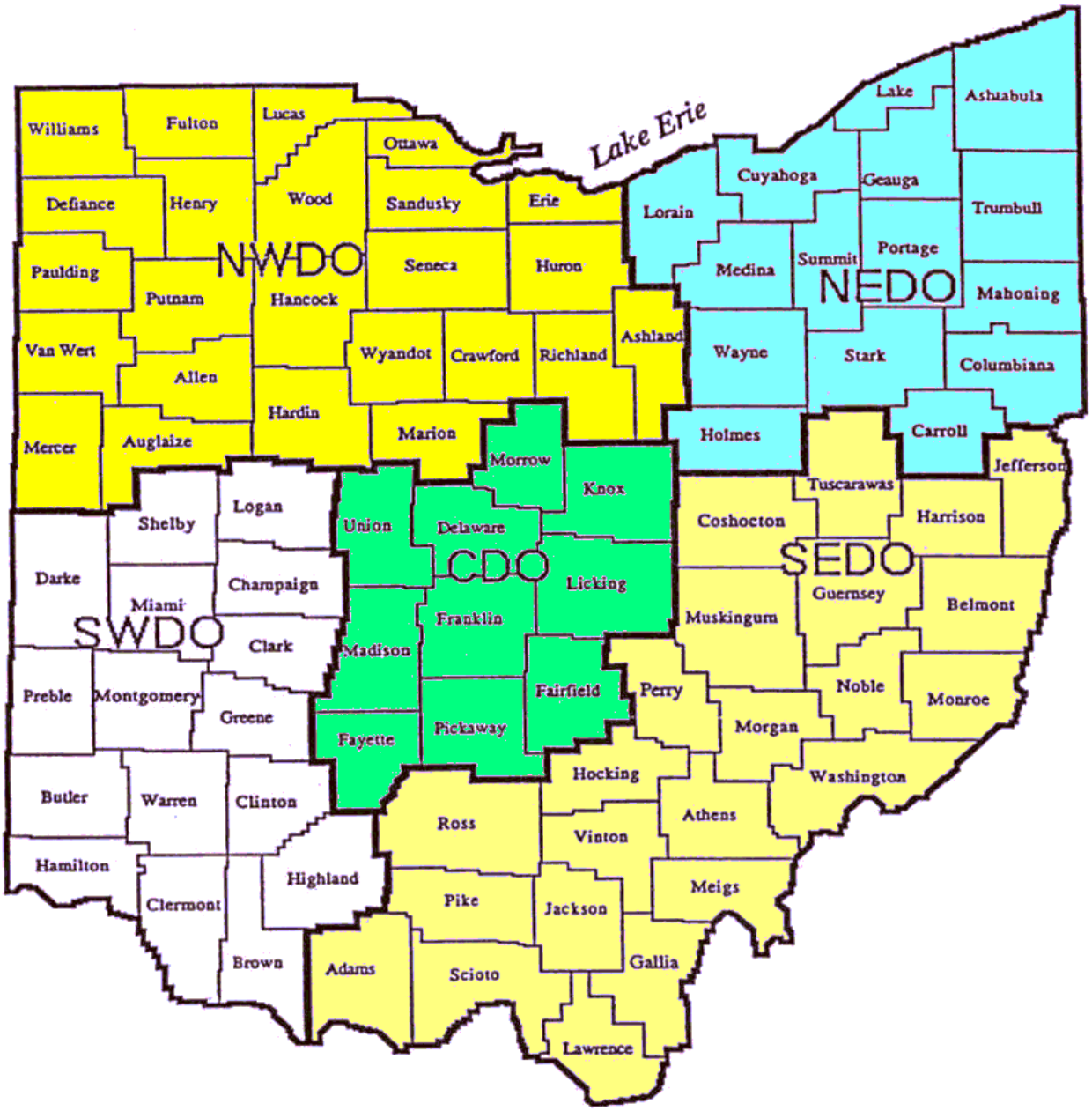
   Upon completion of remediation in that grid section (and/or other grid sections that field screened with a concentration similar to the highest concentration), samples would be collected again from all grid sections in that grouping, the samples would be field screened, and then ranked from highest to lowest concentration. The sample that contained the highest concentration based on field screening would then be submitted for laboratory analysis. This process would continue until analytical results are received that meet the calculated Petroleum Action Level for that site.

2) If either a ground water and/or surface water sample analysis indicates a concentration greater than the calculated Petroleum Action Level for the site, the facility/vessel will consult with the Ohio EPA On Scene Coordinator as to what actions well be taken.

APPENDIX C

OHIO EPA DISTRICT OFFICES

Ohio EPA
DISTRICT OFFICES



Central District Office
3232 Alum Creek Drive
Columbus, Ohio 43207-3461

Southeast District Office
2195 Front Street
Logan, Ohio 43138

Southwest District Office
401 East 5th Street
Dayton, Ohio 45402

Northeast District Office
2110 E. Aurora Road
Twinsburg, Ohio 44087

Northwest District Office
347 N. Dunbridge Road
Bowling Green, Ohio 43402

DISTRICT OFFICES:

CENTRAL DISTRICT OFFICE

3232 Alum Drive
Columbus, Ohio 43207

P.O. Box 1049
Columbus, Ohio 43216-1049

General Information	614-728-3778
Fax Number	614-728-3898
800 Number (Environmental Complaints Only)	1-800-728-3797
Acting Chief, Craig Butler	614-728-3778
District Administrator, Millicent Sims	614-728-3784
Air Pollution Control, Isaac Robinson	614-728-3802
Emergency & Remedial Response, Debbie Strayton	614-728-3819
Drinking & Ground Waters (Ground Water), Linnea Saukko	614-728-3860
Drinking & Ground Waters (Drinking Water),Scot Foltz	614-728-3860
Solid & Hazardous Waste Management, Steven Rath	614-728-3876
Surface Water (Water Pollution), William McCarthy	614-728-3837
Surface Water (Water Quality), Jeff Bohne	614-728-3837

NORTHEAST DISTRICT OFFICE

2110 East Aurora Road
Twinsburg, Ohio 44087

(calls placed to this district can be made on the Centrex system by dialing 7-3005 plus 1 then the last 3 digits of the telephone number only)

General Information	330-425-9171 or 330-963-1200
Fax Number	330-487-0769
800 Number (Environmental Complaints Only)	1-800-686-6330
Chief, William Skowronski	330-963-1130
Assistant Chief, Keith Riley	330-963-1111
District Administrator, Pat Billet	330-963-1262
Air Pollution Control, Dennis Bush	330-963-1233
Emergency & Remedial Response, Rod Beals	330-963-1218
Drinking & Ground Waters (Ground Water), Chris Khourey	330-963-1213
Drinking & Ground Waters (Drinking Water), Nancy Rice	330-963-1195
Solid & Hazardous Waste Management, Kurt Princic	330-963-1204
Surface Water (Water Pollution), John Januska	330-963-1100
Surface Water (Water Quality), Dave Stroud	330-963-1177

NORTHWEST DISTRICT OFFICE
347 North Dunbridge Road
Bowling Green, Ohio 43402

General Information	419-352-8461
Fax Number	419-352-8468
800 Number (Environmental Complaints Only)	1-800-686-6930
Chief, Edwin Hammett	419-373-3078
Assistant Chief, Jeff Steers	419-373-3079
District Administrator, Jim Ottarson	419-373-3077
Air Pollution Control, Gerald Rich	419-373-3124
Emergency & Remedial Response, Bruce Dunlavy	419-373-3036
Drinking & Ground Waters (Ground Water), Tim Fishbaugh	419-373-3094
Drinking & Ground Waters (Drinking Water), Douglas Scharp	419-373-3109
Solid & Hazardous Waste Management, Charles Hull	419-373-3076
Surface Water (Water Pollution), Allen Rupp	419-373-3000
Surface Water (Water Quality), Tom Balduf	419-373-3023

SOUTHEAST DISTRICT OFFICE
2195 Front Street
Logan, Ohio 43138

General Information	740-385-8501
Fax Number	740-385-6490
800 Number (Environmental Complaints Only)	1-800-686-7330
Chief, Steve Skinner	740-380-5295
Assistant Chief, Craig Butler	740-380-5202
District Administrator, Joe Anderson	740-380-5211
Air Pollution Control, Kay Gilmer	740-380-5257
Emergency & Remedial Response, Ken Dewey	740-380-5259
Drinking & Ground Waters (Ground Water), Mike Preston	740-380-5244
Drinking & Ground Waters (Drinking Water), Janet Barth	740-380-5250
Solid & Hazardous Waste Management, Dave Chenault	740-380-5292
Surface Water (Water Pollution), Dave Schuetz	740-380-5212
Surface Water (Water Quality), Joann Montgomery	740-380-5433

SOUTHWEST DISTRICT OFFICE
401 East Fifth Street
Dayton, Ohio 45402-2911

General Information	937-285-6357
Fax Number	937-285-6249
Fax Number	937-285-6404
800 Number (Environmental Complaints Only)	1-800-686-8930
Chief, Tom Winston	937-285-6016
Assistant Chief, Jeff Hines	937-285-6020
District Administrator, Joyce Hanauer	937-285-6026
Air Pollution Control, Jeff Hines	937-285-6020
Emergency & Remedial Response, Mike Starkey	937-285-6439
Drinking & Ground Waters (Ground Water), Rich Bendula	937-285-6452
Drinking & Ground Waters (Drinking Water), Jeff Davidson	937-285-6111
Solid & Hazardous Waste Management, Don Marshall	937-285-6076
Surface Water (Water Pollution), Jim Simpson	937-285-6033
Surface Water (Water Quality), Diana Zimmerman	937-285-6440

APPENDIX D

PETROLEUM ACTION LEVEL RISK CALCULATIONS

SFM/BUSTR
SOIL BTEX ACTION LEVEL JUSTIFICATION

Action levels for benzene, toluene, ethylbenzene, and xylene (BTEX) were derived through risk and soil-water partitioning calculations. Several assumptions were made based on professional judgment and experience. Often, conservative values and assumptions were selected to add factors of safety to the calculated end value. The documents used to calculate these action levels are listed here under references.

All toluene, ethylbenzene, and xylene (TEX) action levels are calculated on the assumption that groundwater ingestion by a child is the primary route of exposure. Action levels for soils were back calculated from documented toxicities, documented ground water consumption rates, and partitioning coefficients for groundwater to soil. BTEX action levels in category 1 match those values calculated by the RCRA technical section of the Ohio Environmental Protection Agency (OEPA) for petroleum contaminated soils (PCS) interim final policy. These PCS values in category 1 were derived assuming a hazard quotient of .33 or one/third. The hazard quotient (HQ) is the ration of a single substance exposure level over a specified time period to reference dose for that substance derived from a similar exposure period. When we assume higher values of the HQ, up to 1, we increase our intake of a particular compound and approach a known adverse health effect. The value of HQ was changed to 1 for TEX calculations in category 4. After this calculation was completed, the remaining categories were averaged in, down to the PCS values in category 1. TEX values vary from higher values on the left of the chart to lower values on the right. This reflects the decreased risk of exposure in areas which score higher, or to the left side of the chart. Being that the primary exposure pathway is assumed to be ingestion of groundwater, very large factors of safety exist for areas which are not truly sensitive (i.e. areas without direct groundwater pathway). Thus, the TEX action levels are highly conservative category 4.

One of the underlying assumptions in the Site Feature Scoring System is that the primary route of exposure to contaminants from a petroleum underground storage tank (UST) release would vary according to the site's location and proximity to sensitive areas; or areas where water is obtained from a local source (i.e. groundwater or surface water body). If a site is located away from areas that would be considered sensitive, where the permeability of the substratum is low, where the water table is low and where few man made or natural pathways of contaminant migration exist, the primary route of exposure would most likely be ingestion of soils. This assumes that an individual would excavate to the contamination and be in contact with it for some length of time. Other routes of exposure in this scenario that should be taken into account are dermal contact and inhalation of the contaminants. By removing the groundwater pathway, we can calculate a reasonable action level for benzene. This action level will in no way have the same factors of safety built in as do the TEX action levels in category 4, yet we can still take a conservative approach to the assumptions. For instance, we will assume that soil ingestion is the primary route of exposure to a child 365 days a year, for five years, who ingests soils from the contaminated site alone during those five years. In an industrialized or commercial area, the exposed population would take a more opposite profile. The action calculated value for an action level for benzene is .793 mg/kg or ppm. To be conservative, this value was rounded down to .600 mg/kg or ppm and entered into category 4. Thus, the benzene values range from .600 ppm on the left in category 4 to .006 ppm in category 1, where ingestion of groundwater was assumed to be the primary route. The benzene action levels between categories 1 and 4 were simply interpolated.

TPH SOIL AND GROUNDWATER ACTION LEVEL JUSTIFICATION

Total petroleum hydrocarbons (TPH) are a varied mixture of many compounds. To assess the toxicity of a particular petroleum product alone would be nearly impossible. If we can identify the most toxic components of a particular product, we can produce some conservative values or action levels. The amount of BTEX in a given petroleum product is of concern due to the toxicity associated with it. The amount of BTEX in a gasoline or diesel can significantly vary. At most, gasoline can be referenced to contain 36% BTEX. Diesel contains only a small portion of BTEX, only 2 % at most. The average BTEX component of gasoline of all the references listed below is 20.26%. Using the percentage of BTEX in gasoline and diesel and assuming that the product in question consists solely of petroleum hydrocarbon, a conservative action level for TPH may be back calculated using the following equation:

$$\% \text{ BTEX in product} = \frac{\text{BTEX in the soil (ppm)}}{\text{TPH in the soil (ppm)}}$$

Since we are attempting to create an action level that applies for gasoline, diesel, and other similar petroleum products in a non-sensitive area, we can average the highest concentration of these two products together and derive a value for the % of BTEX in product. This average value would allow more reasonable end action levels for our non-sensitive area. The highest value of each product is selected to add factors of safety to our calculated number.

2% ÷ 36% / 2 = 19%
diesel ÷ gasoline / 2 = average

Note that this value of 19% is only 1% less than the average BTEX component in gasoline noted to be 20.26% above. Thus, at sites which are diesel specific, the action level would still be very conservative. This assumes that, in general, the toxicity of hydrocarbons decrease as the molecules become non-aromatic and more straight-chained. Even when considering the presence of polynuclear aromatic hydrocarbons (PAH), the end action level should be conservatively based on the known toxicity of BTEX. This is due primarily to the assumption that the TPH portion of the contaminated soil is as toxic as the BTEX portion. Another factor entering the calculations which make the end action level conservative is the fact that the % BTEX in the soil has already been calculated on a conservative basis.

The soil TPH action level for category 1 assumes a total BTEX in product of 36% in order to add very high factors of safety. TPH in category 4, being considered non-sensitive, was calculated using a total BTEX in product of 19%. The calculated value for TPH in category 4 is 607 mg/kg or ppm. This value was rounded down to 600 ppm to add even more factors of safety. The same calculation method used for category 4 was used for categories 2 and 3. Ground water values for TPH were calculated using a total BTEX in the product of 36%, thus being highly conservative.

BUSTR
Petroleum Underground Storage Tank Site Feature Scoring System

SITE FEATURES	COLUMN A		COLUMN B		COLUMN C		COLUMN D	
	SCORE 20 IF TRUE	SCORE	SCORE 15 IF TRUE	SCORE	SCORE 10 IF TRUE	SCORE	SCORE 5 IF TRUE	SCORE
1.Distance of UST System from closest drinking water supply well or intake currently in use.	> 1000 ft. away		301-1000 ft. away		< 301 ft. away		Inside of designated sensitive area	
2. Average depth to ground water.	> 50 ft.		31-50 ft.		15-30 ft. or unknown		< 15 ft.	
3. Predominant soil type of substratum	Clay or shale		Silt or clayey sands or fine sandstone					
4. Natural and/or manmade conduits or receptors	< 8		8-10		11-13		> 13	
SUBTOTAL:								

TOTAL SCORE _____

SFSS Action Levels (ppm)

	CATEGORY 1	CATEGORY 2	CATEGORY 3	CATEGORY 4
TOTAL SCORE	<31	31-50	51-70	>71
Soil BTEX	.005/4/6/28	.170/7/10/47	.335/9/14/67	.005/12/18/85
Ground water BTEX	.005/1/.700/10	.005/1/.700/10	.005/1/.700/10	.005/1/.700/10
Soil TPH (gasoline)	105	300	450	600
Soil TPH (others)	380	642	904	1156

TOTAL PETROLEUM HYDROCARBON (SOIL)

Category 1:

.36 = 38.006 ppm BTEX / TPH IN SOIL (PPM)
105.57 ppm = TPH IN SOIL

Category 2:

.19 = 64.2 ppm BTEX / TPH IN SOIL (PPM)
337.8 ppm = TPH IN SOIL

Category 3:

.19 = 90.4 ppm BTEX / TPH IN SOIL (PPM)
475.8 ppm = TPH IN SOIL

Category 4:

.19 = 115.6 ppm BTEX / TPH IN SOIL (PPM)
608.4 ppm = TPH IN SOIL

TOTAL PETROLEUM HYDROCARBONS (SOIL)

ANALYTICAL GROUP 1

Category 1:

.36 = 38.006 ppm BTEX / TPH IN SOIL (PPM)
105.57 ppm = TPH IN SOIL

Category 2:

.19 = 64.2 ppm BTEX / TPH IN SOIL (PPM)
337.8 ppm = TPH IN SOIL

Category 3:

.19 = 90.4 ppm BTEX / TPH IN SOIL (PPM)
475.8 ppm = TPH IN SOIL

Category 4:

.19 = 115.6 ppm BTEX / TPH IN SOIL (PPM)
608.4 ppm = TPH IN SOIL

ANALYTICAL GROUPS 2, 3, &4

Based on an average BTEX component in Analytical groups 2, 3, & 4 of 2 to 3% plus taking into account poly nuclear aromatic component of 6%.

Category 1:

.10 = 38.006 ppm BTEX / TPH IN SOIL (PPM)
380.0 ppm = TPH IN SOIL

Category 2:

.10 = 64.2 ppm BTEX / TPH IN SOIL (PPM)
642.0 ppm = TPH IN SOIL

Category 3:

.10 = 90.4 ppm BTEX / TPH IN SOIL (PPM)
904.0 = TPH IN SOIL

Category 4:

.10 = 115.6 ppm BTEX / TPH IN SOIL (PPM)
1156.0 ppm = TPH IN SOIL

SFM/BUSTR Calculation for Soil Action Levels

I	=	Intake			
AT	=	Average Time	CF	=	Conversion Factor
BW	=	Body Weight	FX	=	Fraction Ingested from Contaminated Source
ED	=	Exposure Duration			
EF	=	Exposure Frequency	SA	=	Skin Surface Area Available for Contact
IR	=	Intake/Contract Rate			
SFo	=	Slope Factor	AF	=	Soil to Skin Adherence Factor
CS	=	Concentration in the soil			
CW	=	Concentration in the water	ABS	=	Absorption Factor
HQ	=	Hazard Quotient			
RFDo	=	Referenced Oral Dose			
Kd	=	Partitioning Coefficient (soil to groundwater)			
K(oc)	=	organic carbon Partitioning Coefficient			
(oc)	=	organic carbon (assume .01, Ohio farm soils range from 1-4%)			

Developed for Category 4 (right side of table)

BENZENE

Supporting Risk Calculation for Carcinogenic Effects (Cancer-Benzene 6 ppm Child)

1. INGESTION OF SOIL:

$$\text{Intake (mg/kg-d)} = \frac{CS \times IR \times CF \times FX \times EF \times ED}{BW \times AT}$$

$$I = CS \times 8.9E\text{-}7$$

$$\text{Benzene} = .006 \times 8.9E\text{-}7 = 5.3E\text{-}9$$

$$\text{Risk} = 5.3E\text{-}9 \times 2.9E\text{-}2 = 2E\text{-}10$$

2. DERMAL CONTACT WITH SOIL

$$\text{Absorbed dose (mg/kg-d)} = \frac{CS \times CF \times SA \times AF \times ABS \times EF \times ED}{BW \times AT}$$

$$\text{Absorbed dose} - \frac{CS \times IE\text{-}6 \times 3160 \times 2.11 \times 25 \times 365\ d/yr \times 5yr}{16 \times 25550}$$

$$\text{Benzene} = .006 \times 7.44E\text{-}6 = 4.46E\text{-}8$$

$$\text{Risk} = 4.46E\text{-}8 \times 3.2E\text{-}2 = 1.42E\text{-}9$$

Adjustment of an administered dose (e.g. intake) to an absorbed dose:

SFd = 2.9E-2/.9 = 3.2E-2

3. INHALATION OF AIRBORNE CHEMICALS:

$$\text{Intake (mg/kg-d)} = \frac{CA \times IR \times ET \times EF \times ED}{BW \times AT}$$

$$= \frac{CA \times .83 \times 24 \times 365\ d/yr \times 5 \times yr}{16 \times 25550}$$

Benzene = CA x 8.9E-2
= 7.23E-6 x 8.9E-2 = 6.4E-7
Risk = 6.4E-7 x 2.9E-2 = 1.9E-8

TOTAL RISK = 2.06E-8

Carcinogen (child)

Back-calculate for health based action level for soil ingestion (no pathway in groundwater)

Intake = CS x 8.9E-7

Risk = Intake x SFo
where, HQ or Risk = 2.062E-8 and SFo = 2.9E-2
Intake = 2.062E-8 / 2.9E-2 = 7.1103E-7

So, CS = 7.1103E-7 / 8.97E-7 = 7.92E-1 mg/l
CS = .793 ppm

TOLUENE, ETHYLBENZENE, XYLENE

Non-carcinogen (child)

Back-calculate for health based action level for ingestion of groundwater as primary pathway. Assume a hazard quotient, HQ, of one.

TOLUENE
Exposure = CW x .0625
HQ = Exposure / RFDo
where HQ = 1 and RFDo = 3E-1 or .3
so, Exposure = 1 x.3 = .3
so, CW = .3 / .0625 = 4.8 mg/l
CS = CW x KD, where KD = K(oc) x (oc)
so, CS = CW x (K(oc) x (oc))
CS = (4.8) x (250 x .01) = 12 ppm

REFERENCES

"California Leaking Underground Fuel Tank (LUFT) Manual" State of California Leaking Underground Fuel Tank Task Force, May, 1988

"Determining Soil Response Action Levels Based on Potential Contaminant Migration to Groundwater: A compendium of examples" (EPA/540/2-89/057)

"Development of Standard, Pure-Compound Base Gasoline Mixture for use as a Reference in Field and Laboratory Experiments" by David K. Kreamer and Klaus J. Stetenbach GWMR, 1990

"Risk Assessment Guidance for Superfund" (EPA/540/1-89/002)

"Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual, Supplemental Guidance, Standard Default Exposure Factors", Interim Final, 3-25-91, OSWER: 9285.6-03

Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual, Part B, Development of Risk-based Preliminary Remediation Goals", Interim, 9-91, OSWER: 9285.7-01B

"The Ohio Environmental Protection Agency Petroleum Contaminated Soil (PCS) Policy", pp. 01-03-2000, Interim Final, issued 3-25-91

APPENDIX E

FIELD SAMPLING GUIDANCE FOR PETROLEUM CONTAMINATED SITE CLEANUP DURING EMERGENCY RESPONSE OPERATIONS

A QUICK OVERVIEW

INTRODUCTION

1.) The Field Sampling Guidance is to be used in conjunction with the **Petroleum Contaminated Sites Guidance Document for Emergency Response Actions**.

2.) The Field Sampling Guidance was developed for use in emergency response actions. The majority of these actions historically have involved releases of petroleum from vehicular accidents and/or home heating oil tanks not regulated by BUSTR and have been limited in volume to less than 300 gallons.

3.) The sampling protocol utilizes a biased sampling method derived from practical field experience. The sampling protocol is not derived from a statistically valid sampling scheme and it may not adequately characterize a site for a detailed risk evaluation and/or assessment. However, if properly applied, the sampling protocol should insure that the majority of site soils contain concentrations of petroleum less than or equal to the recommended cleanup goals of the petroleum contaminated sites guidance document for emergency response operations.

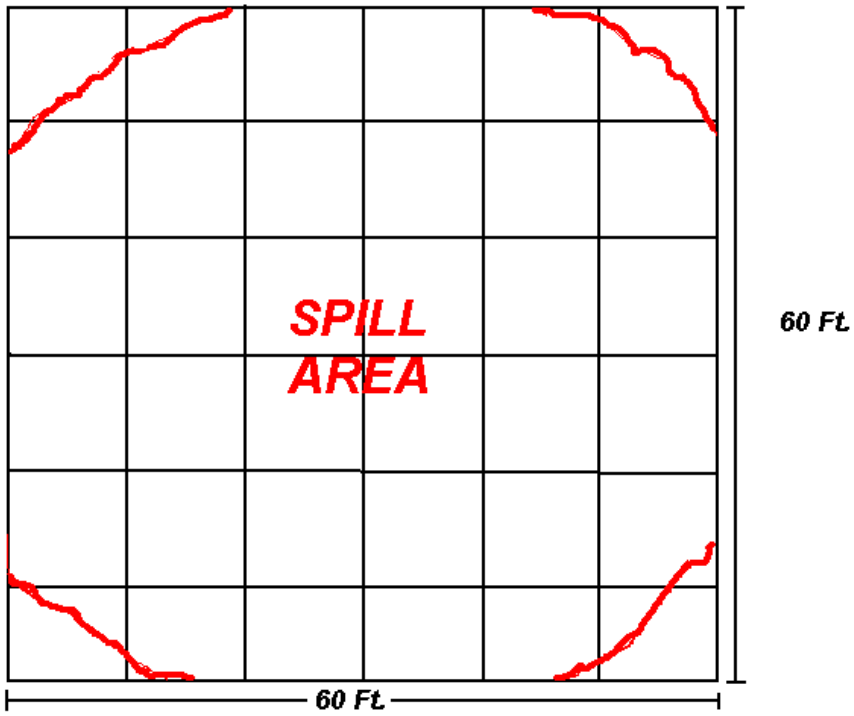
4.) The field sampling guidance does not include guidance on the sampling of groundwaters or surface waters. In cases where these media are impacted a site specific sampling plan is needed.

SAMPLING PROTOCOL

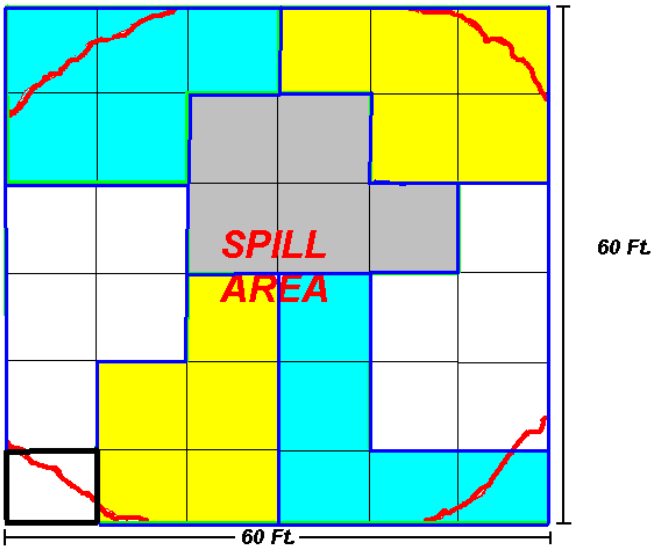
1.) Determine the size of the area impacted by the release. This determination may be based on direct physical observation and/or field screening.

2.) Measure and divide the area so that the entire area is overlain by grid sections which are ten foot by ten foot square.

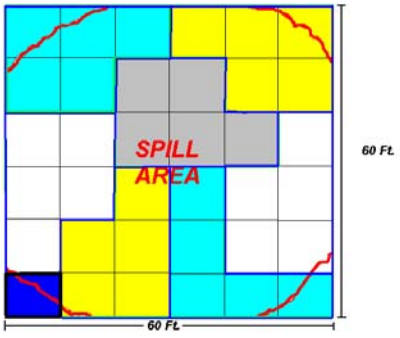
For example this spill area has been overlain by 36 ten foot by ten foot grids. The total surface area impacted by the spill would be estimated at 3600 feet.



3.) Group adjacent grid sections into groupings of five. Only grid sections which are adjacent either horizontally or diagonally may be grouped together.



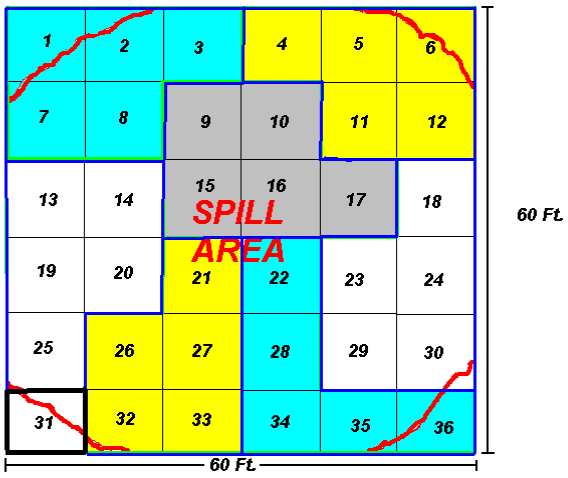
4.) If the total number of grid sections is not a multiple of five then there will be grid sections left over after the initial grouping. This/these remaining grid section or sections would then be grouped together and considered a sample grouping. If the total number of grid sections is less than five (spill area is less than 500 square feet) then these sections would be grouped together and considered a sample group.



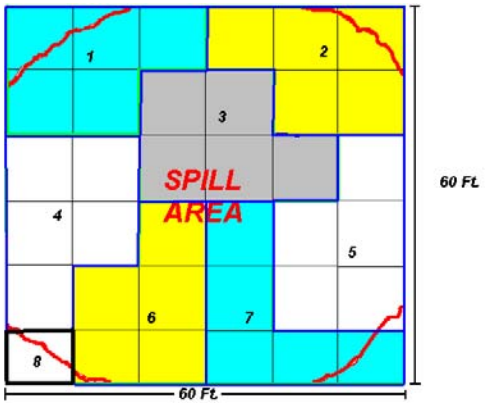
5.) Within each grid section (the ten foot by ten foot area) of a sample grouping (five grid sections grouped together), a sample biased towards the highest potential petroleum concentration present would be collected. These samples would be field screened and then rank ordered from highest to lowest concentration.

FOR EXAMPLE, THE FOLLOWING FIELD SCREENING CONCENTRATIONS WERE OBTAINED FOR GRID SECTIONS 1,2,3,7, AND 8.

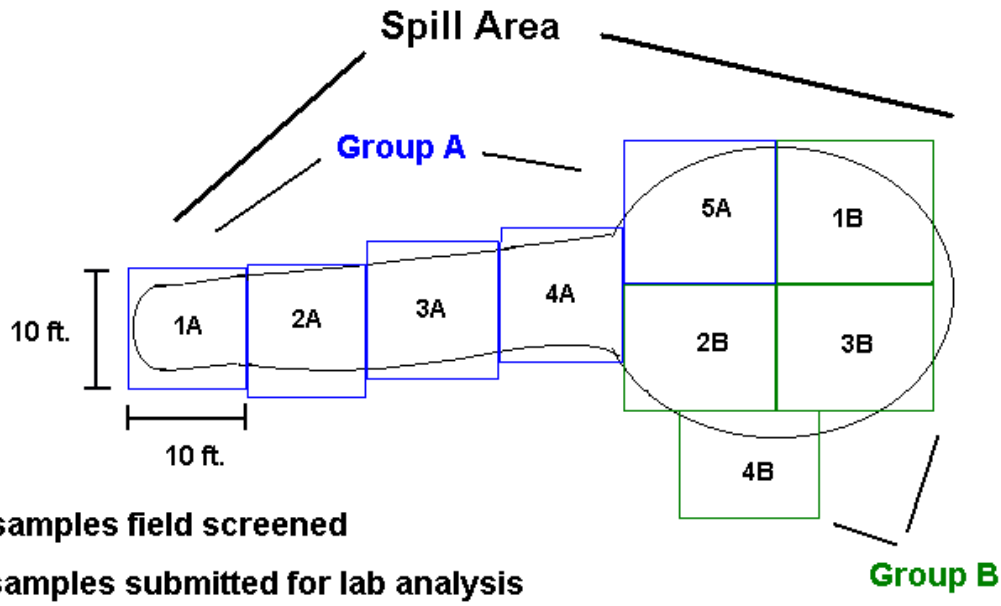
GRID SECTION	CONCENTRATION
1	10 PPM
2	12 PPM
3	9 PPM
7	14 PPM
8	200 PPM



6.) The sample that contained the highest concentrations based on the field screening for each sample grouping would be submitted for laboratory analysis. In the example above the grid sample collected in grid #8 would be submitted for laboratory analysis for sample grouping #1. For the entire spill area there would be 36 field samples screened and there would be eight samples submitted to the laboratory.

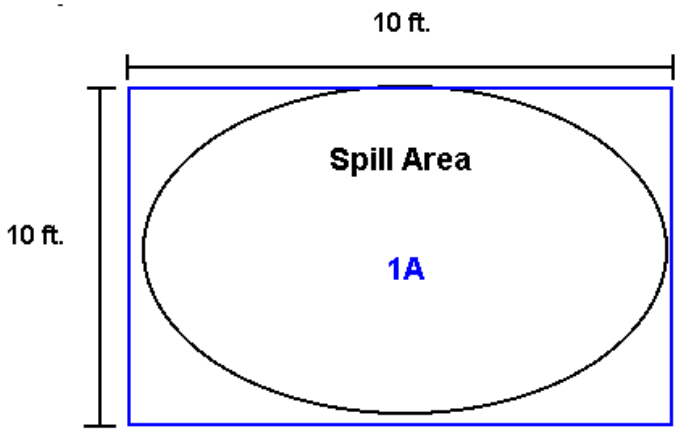


EXAMPLES OF VARIOUS SHAPED SPILL AREAS AND GRIDDING TECHNIQUE



** 9 samples field screened

** 2 samples submitted for lab analysis

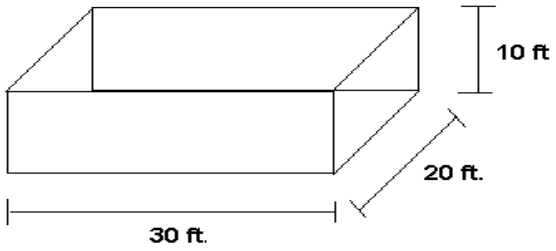


** 1 sample field screened

** 1 sample submitted for lab analysis

EXAMPLES OF VARIOUS SHAPED SPILL AREAS AND GRIDDING TECHNIQUE

Underground Storage Tank Excavation

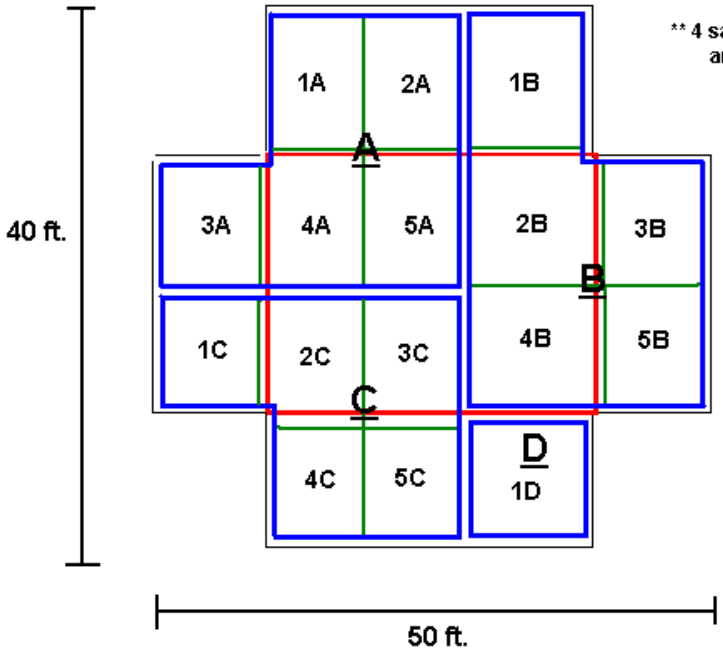


-Tank Excavation

- Grid Section Groups

** 16 samples field screened

** 4 samples submitted for lab analysis



INTERPRETATION OF ANALYTICAL RESULTS

Upon receiving the analytical results for a particular 10' x 10' grid section a comparison should be made to the previously calculated petroleum action level. If any of the concentrations of the applicable criteria exceed the petroleum action level for that grid section it is recommended that the facility take the following steps:

1.) Perform additional remediation measures on the affected media in that grid section. Field screening results should be consulted to determine if other grid sections in the sample grouping should also be remediated prior to sampling.

Example: the field screening results for five grid sections were 700, 680, 10, 5, and 6 ppm. The 700 ppm sample was submitted for laboratory analysis and found to exceed the petroleum action level calculated for the site. Therefore, the facility may assume that the 680 ppm field screened sample may also exceed the petroleum action level. The facility would then remediate two grid sections prior to resampling.

Upon completion of remediation in that grid section (and/or other grid sections which field screened with a concentration similar to the highest concentration grid), samples would be collected again from all grid sections in that sample grouping, the samples would be field screened and ranked again. The highest concentration sample would be submitted for laboratory analysis. This process would continue until analytical results are received which meet the petroleum action level for the site.

2.) If either a ground water and/or surface water sample analysis indicates a concentration greater than the calculated petroleum action level for the site, the facility/vessel shall consult with the appropriate Ohio EPA On Scene Coordinator as to what actions shall be taken.

TEST METHODS

Soil and water samples collected at the site should be analyzed using the following applicable U.S. EPA test methods:

Contaminant	Analytical Method for Soil	Analytical Method for Water
Benzene	SW-846, Method 8260B or 8021B	US EPA Test Method 524.2**
Toluene	SW-846, Method 8260B or 8021B	US EPA Test Method 524.2**
Ethyl benzene	SW-846, Method 8260B or 8021B	US EPA Test Method 524.2**
Total Xylenes	SW-846, Method 8260B or 8021B	US EPA Test Method 524.2**
TPH for Gasoline Range	SW-846, Method 8015B	Not applicable
TPH for Diesel Range	SW-846, Method 8015B	Not applicable

** U.S. EPA Test Method 524.2 or 502.2 should be utilized in those situations where the Ohio