

Final Report:
Technical Assistance for the
Idaho Pole Site
Bozeman, Montana
EPA Region 8



Solid Waste and
Emergency Response
(5203P)

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NOTICE

Work described herein was performed by GeoTrans, Inc. (GeoTrans) for the U.S. Environmental Protection Agency (EPA). Work conducted by GeoTrans, including preparation of this report, was performed under Work Assignment #58 of EPA contract EP-W-07-078 with Tetra Tech EM, Inc., Chicago, Illinois. Mention of trade names or commercial products does not constitute endorsement or recommendation for use.

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1.0 BACKGROUND

The site is a former wood treating facility. The facility began operation in 1945 using creosote as a preservative. Creosote was replaced with pentachlorophenol (PCP) in carrier oil in 1952. An oily discharge was noted by MDEQ in ditches near the site in 1978. The facility was closed in 1997. A Record of Decision was signed in 1992, and two Explanation of Significant Differences were prepared, one that was signed in 1996 and one that was signed in 1998.

Soil was excavated and treated, and the soil remedy is considered complete. The ground water remedy began operation in February 1997. It consists of two lines of extraction wells and two lines of injection wells, all located on the south side (i.e., the upgradient side) of I-90. Ground water treatment consists of bag filters followed by granular activated carbon (GAC). Nutrients are added to the treated water prior to reinjection into the aquifer to foster in-situ bioremediation. In addition, a product recovery interceptor trench is located on the north side (i.e., the down-gradient side) of I-90. Oily material collects in this trench on a daily to weekly basis, and is removed with absorbent pads that are disposed of in drums. This oily material likely represents source material not excavated during the soil remedy due to the presence of the interstate. It is possible that the reinjection of treated water upgradient of this trench augments the collection of the oily material within the trench. Pentachlorophenol (PCP) is the predominant contaminant of concern at the site and has the greatest horizontal and vertical extent at the site. One residential well located approximately 2,000 feet downgradient of the source area has been impacted by PCP. There are institutional controls in place to control ground water use within a specific area. The P&T system operation cost is on the order of \$150,000 to \$200,000 per year. Figures from the Five-Year Review are included in Attachment A to provide information regarding site layout, monitoring well locations, groundwater flow direction, contaminant extent before pumping, and contaminant extent from a recent sampling event.

Information was provided to GeoTrans on a conference call that took place on June 17, 2008 and at a site visit that occurred on July 15, 2008. During the site visit, EPA explained to GeoTrans that the ground water remedy has been planned in two phases. Phase I has served as an interim means of addressing ground water contamination, and Phase II would be a modified form of Phase I based on an evaluation of data collected during Phase I. EPA Region 8 and MDEQ subsequently requested that GeoTrans (“review team”), under contract to Tetra Tech, provide the following evaluations associated with progressing from Phase I to Phase II:

- Evaluate potential alternatives for collecting oil that is currently collected with adsorbent pads in the trench north of I-90
- Evaluate in-situ treatment options for the oily material beneath I-90, while also considering the limitations caused by the interstate highway
- Evaluate potential in-situ treatment options for ground water “hot-spots”
- Evaluate potential change from reinjection of treated water to discharge of treated water
- Suggest a potential framework for discontinuing P&T altogether, in conjunction with other actions related to hot-spot ground water treatment and addressing the oil under I-90, for subsequent discussion between site stakeholders

- Qualitatively review the ground water monitoring network to identify any deficiencies or redundancies in the spatial and temporal sampling
- Evaluate the existing data set to determine if adequate data exist to perform a capture zone analysis, and outline the steps involved in conducting the capture zone analysis
- Estimate the amount of water that might be produced from dewatering during installation of utilities along I-90

Each one of these items is discussed below in more detail.

2.0 POTENTIAL ALTERNATIVES FOR COLLECTING OIL IN THE INTERCEPTOR TRENCH

An interceptor trench is located on the downgradient (north) side of Interstate I-90 to collect product that reportedly migrates from under the higher highway. The trench is sufficiently deep that it intercepts the water table, allowing product globules to enter the trench and rise to the surface. The trench is open to the air, and product is collected by applying absorbent pads to the top of the water, allowing the pads to absorb the product, and then removing the pads for disposal when they are saturated. Absorbent pads are checked every other day. The number of absorbent pads replaced is contingent on the amount of product in the trench and varies by quarter. The pasture area north of I-90 where the trench is located is fenced to restrict public access. All aspects of the P&T system are on the opposite side of the highway from the trench, so no site-related infrastructure (piping, electricity, etc.) is available on the trench side of the highway.

To streamline the collection of product, the site team could consider another approach. Once the product rises to the water surface in the trench, it likely does not reenter the aquifer and move downgradient because of the lack of entry pressure to overcome the surface tension between the product and the wet soil pores of the trench. As a result, if product is allowed to accumulate for some period of time in the trench, product globules would eventually coalesce and form a more consistent layer. Once a layer is present, the product would be more apt to enter one or more passive skimmers with oleophilic filters. An example of such a passive skimmer is presented in Attachment B. Regardless of the approach used to collect product, and especially if the passive skimming option is used, the site team might consider placing a sturdy cover with a vent or a grate over the trench for visual and health and safety purposes. O&M would initially include two or three visits per week to check product quantity, to determine if globules are coalescing, and to determine if product is accumulating in the skimmers. Routine O&M would likely include weekly inspection of the trench and skimmers, plus collecting product from the skimmers for disposal.

Another potential approach to intercepting product downgradient of the highway is to install a permeable barrier wall constructed of organoclay in place of the current interceptor trench. Organoclay absorbs several pounds of product for each pound of organoclay. Theoretically, the organoclay would absorb oil but allow water to continue migrating downgradient. This approach would require periodic removal and reinstallation of the organoclay, and this periodic process could become fairly frequent if fouling occurs. Although the trench and the sorbent pads would no longer be needed, this approach could be more intrusive and expensive than the current or suggested approach if the organoclay requires frequent replacement.

The trench appears to be located side-gradient of the plume core. It may actually be located side-gradient, or this appearance may be an artifact of contouring the plume in the absence of recent sample results from former well 14-A. This raises a few questions:

1. Is the product observed in the trench contributing to dissolved-phased PCP contamination? If so, is it of sufficient quantity that source removal or plume capture is needed downgradient of the trench?
2. Are there other locations along the downgradient side of I-90 where there is product that is not being observed because a trench is not present in those locations? If so, are additional trenches merited?

A simple approach to addressing the first question is to collect a sample of the product and have it analyzed for its constituents. Addressing the second question would likely only be effectively answered by digging a test pit and monitoring for the presence of product. Decreasing PCP concentrations in wells downgradient of I-90 indicate that improvements are being made in downgradient water quality, that there may not be a continuing source of PCP beneath I-90 (or that in-situ bioremediation is helping to address this source), and that addressing these questions is not an immediate concern. However, these questions should likely be addressed before more aggressive source area remediation is considered in the process areas and before efforts are made to close the site.

3.0 IN-SITU ALTERNATIVES FOR ADDRESSING THE OIL BENEATH I-90

Addressing product in-situ beneath the interstate is challenging for several reasons.

- Characterization beneath the interstate is not complete, and the distribution and the amount of product beneath the interstate is unknown.
- Product appearing in the trench is present as globules rather than as continuous streams of product. This suggests that conventional recovery methods would be unsuccessful given that product recovery is generally most successful when product is continuous.
- Other removal methods, such as thermally enhanced recovery and in-situ chemical oxidation require effective characterization and relatively dense spacing of remedial points, which might be difficult with the interstate.
- Stabilization techniques used for polycyclic aromatic hydrocarbons (PAHs) such as catalyzed potassium permanganate is typically not effective for PCP.

For the above reasons, in-situ product removal or stabilization beneath I-90 beyond the current flushing efforts may not be appropriate, especially if product migration can be controlled with downgradient passive interceptor trenches and dissolved PCP concentrations in the downgradient portion of the plume continue to decrease with the current P&T system.

4.0 POTENTIAL ALTERNATIVES FOR ADDRESSING CONTAMINANT HOT SPOTS

Effectively addressing contaminant hot spots is highly dependent on effective source area characterization. Once characterization is complete, a clear objective is appropriate. Objectives could be one of the following (or perhaps another site-specific appropriate objective) listed from less aggressive to more aggressive:

- Eliminate free product (i.e., product that is capable of migrating)
- Remove all evidence of free or residual product (i.e., including product that is trapped between pore spaces but is not mobile)
- Remove free product and achieve soil and ground water concentrations that are pre-determined to allow for passive remediation to reach cleanup standards
- Remove free product and achieve soil and ground water cleanup standards

The objective is usually something similar to one of the last two objectives such that an active remedy, such as P&T, can be avoided or discontinued.

Specific source area characterization of remaining source areas and discussion of specific site objectives have not been discussed as part of this evaluation. Nevertheless, it is reasonable to conclude that thermally-enhanced recovery might be an appropriate remedial technology for remaining sources given the contaminant type and the limited size of any remaining sources. Remediation with this technology might be on the order of \$150 to \$200 per cubic yard. Therefore, a volume that is 200 feet wide by 100 feet long by 25 feet deep would likely cost on the order of \$2.8 million to \$3.7 million. Another potential alternative would be in-situ chemical oxidation with Fenton's reagent. The initial costs of this approach would likely be lower than that associated with thermally-enhanced recovery; however, multiple chemical oxidation events may be required, and the overall cost between the two approaches for a similar level of treatment may be similar. If the site team decides to consider source area remediation, the site team should revisit the areas requiring hot spot treatment. A review of existing characterization data and potentially additional characterization would be advised to limit the volume to be treated. The site team should also confirm that there is no source material under I-90 that is contributing to dissolved-phase impacts so that the investment in source area remediation has the potential achieve ROD cleanup standards and end long-term P&T operation. The costs of source area remediation could be compared to the estimated ongoing costs of operating the P&T remedy until it is appropriate to discontinue P&T. The analysis also should consider the potential for source area remediation to not reach its specified objectives, the potential benefits of potentially eliminating the need for long-term active remediation, and other potential benefits of reducing the magnitude or extent of the source areas.

5.0 POTENTIAL CHANGE FROM REINJECTION TO SURFACE WATER DISCHARGE OF TREATED WATER

By reinjecting treated water downgradient of the downgradient extraction system, the P&T remedy is generally preserving the natural hydraulic gradient, flushing the downgradient portion of the plume with clean water, and perhaps augmenting in-situ biodegradation. In the absence of reinjection, water would be removed from the system and the flow rate of clean water through the portion of the plume immediately downgradient of the extraction system would be lower. This slower flow rate and flatter hydraulic gradient may reduce the flushing of product from beneath the highway into the trench or it may have a negligible effect.

There have been significant decreases in downgradient PCP concentrations since the P&T system began operating. These decreases would likely have occurred over a longer period of time in the absence of reinjection. It is suspected that the same reinjection efforts will continue to yield decreasing concentrations downgradient of I-90.

The benefits of switching from reinjection to discharge to surface water are unclear. From a protectiveness perspective, the contamination present beneath the highway will be flushed downgradient under either scenario. The flushing has happened and would continue to happen faster with reinjection than it would with surface water discharge. In addition, the nutrient addition may be augmenting contaminant degradation. In either case (reinjection or surface water discharge), contamination downgradient of the injection system will not be captured or actively treated. From a cost perspective, upfront costs would be required for constructing the discharge line and obtaining a permit. Discharging the treated water to surface water instead of reinjecting it could reduce the extraction rate required for treatment. Insufficient information is available to the review team to determine the potential reduction and the associated cost savings; however, savings would likely be limited to less than \$10,000 per year due to a reduction in electricity and carbon usage. This savings, however, would likely be offset or completely eliminated due to an increase discharge monitoring required for surface water discharge. From a water conservation perspective, it is generally preferable to return water to an aquifer so that it remains in the watershed longer as a resource rather than discharging it to surface water where it will flow out of the watershed at surface water rates. From a carbon foot print perspective, the avoided electricity and carbon usage would help reduce the carbon foot print of the remedy.

6.0 POTENTIAL FRAMEWORK FOR DISCONTINUING P&T

Historical monitoring results suggest decreases in concentrations in the source area and downgradient of the source area. In addition, contaminant concentration decreases downgradient of I-90 appear to be ubiquitous among the monitored wells, suggesting that the ground water remedy as designed and currently operated (Phase I as described in the 1996 Explanation of Significant Differences) may be capable of achieving ROD goals for the aquifer downgradient of I-90. The concentration trends for several site monitoring wells are depicted in Figure 1. The decreases in downgradient wells have been significant, but it is not clear if concentrations will continue to decline to the PCP cleanup standard of 1 µg/L or asymptotically approach concentrations above this standard. Regardless, the decline is likely associated with source area control provided by the P&T system and perhaps the addition of nutrients to the reinjected water. The concentration decreases in the source area at well 5-A are likely partially due to previous source removal activities and to active pumping in the vicinity of 5-A. However, if these source area decreases are highly dependent on extracting water from the source area, pulling in cleaner

ground water from surrounding areas, and otherwise changing ground water flow patterns in the vicinity of the extraction wells, then concentrations will likely increase if pumping is discontinued.

Given the continuing decreasing PCP concentrations at the site, the review team would not suggest discontinuing P&T operation at this point unless another cost-effective plan for aggressive source removal would be implemented. Similarly, unless monitoring from additional locations (see next section) suggests concentrations in some downgradient wells are stable or increasing instead of decreasing, P&T operation likely does not need to be modified or reconfigured to eventually meet ROD goals on the downgradient side of I-90. That is, Phase II as described in the 1996 Explanation of Significant Differences could simply be a continuation of Phase I. Although the PCP concentrations at 5-A are now lower than the PCP concentrations were at wells GM-4 and 9-A at the time the ground water remedy was implemented, there are important differences between allowing the contamination at GM-4 and 9-A to continue migrating and discontinuing control of the contamination currently detected at 5-A:

- 5-A is in the source area where a continuing source of ground water contamination is likely present, whereas GM-4 and 9-A are downgradient of the source and will eventually cleanup if source control is provided (assuming a continuing source of PCP is not present beneath I-90)
- Concentrations at 5-A may be lower during pumping conditions than during non-pumping conditions
- Other portions of the source area may have higher PCP concentrations than those observed at 5-A

The path to permanently discontinuing P&T should likely be based on demonstrating that a continuing source is no longer present and that remaining concentrations in the former “source area” are sufficiently low to allow for natural degradation to occur before reaching receptors and where access to ground water can be restricted. The source area PCP concentration that allows for this condition could be estimated using transport modeling. Transport modeling with the Domenico equation as represented by the BIOSCREEN modeling package might be appropriate for this purpose. The absence of a continuing source of ground water contamination might be determined by additional source area sampling or by lack of rebound when pumping is discontinued temporarily for a shutdown rebound test.

A preliminary analysis using BIOSCREEN to determine an appropriate remaining concentration in the source area is conducted using the following two sets of parameters:

Parameter	Scenario #1	Scenario #2
Hydraulic conductivity	~ 100 feet per day	~ 80 feet per day
Hydraulic gradient	~ 0.01 feet per foot	~ 0.01 feet per foot
Longitudinal dispersivity	100 feet	100 feet
Transverse dispersivity	33 feet	33 feet
Vertical dispersivity	0 feet	0 feet
Retardation coefficient	4.9	16.5
Half-life due to decay	1 year	4 years

Both of these parameter sets are reasonable for the site but represent different magnitudes for sorption and decay since these parameters are not well understood for the site. These parameter

values were determined by generally fitting representative data from well GM-4, the 9-A/B/C cluster, the 25-A/B/C cluster, the 27-A/B cluster, and residential well RES-8 from 1990 to 1991 (before the P&T system began operation) and assuming the source began in 1955 (shortly after PCP was introduced to the site). The associated BIOSCREEN input and results screens are provided in Attachment C. The results from both scenarios suggest that for concentrations to decrease in the absence of pumping to 1 µg/L (the MCL for PCP) at well RES-8 (approximately 2,000 feet from the source area), that the source area concentration should be approximately 100 µg/L or lower.

Over the past four sampling events PCP concentrations at 5-A have ranged from 400 µg/L to 1,200 µg/L, which is higher than the 100 µg/L value suggested by the preliminary modeling described above. In the absence of more aggressive source removal, the review team would not suggest a temporary discontinuation of pumping for a shutdown test until the PCP concentrations at 5-A and other source area monitoring wells are below 50 µg/L for at least four consecutive sampling events. The concentration of 50 µg/L and the consecutive sampling events are chosen to account for the potential for rebound when pumping stops. If this condition is achieved and pumping is temporarily discontinued as part of a shutdown test, the review team would suggest that pumping would need to resume immediately if the concentration in 5-A or any other single source area monitoring well increases to 200 µg/L in a single event or increases to over 100 µg/L for two consecutive events. The review team believes that at least five source area monitoring wells should be included in the evaluation to discontinue or resume pumping.

A similar set of criteria could be used if the site team chooses to implement aggressive source remediation. That is, pumping or additional source area remediation should likely be implemented as long as the concentration in the source area monitoring wells exceeds 100 µg/L.

7.0 QUALITATIVE REVIEW OF THE GROUND WATER MONITORING NETWORK

The ground water monitoring network appears to provide reasonable information for evaluating remedy performance. However, there are a few locations that exhibited relatively high levels of contamination in the early 1990s but have not been sampled in many years. Many of these locations are the deeper wells at well clusters where shallow wells are sampled. The review team suggests adding the following monitoring wells to the existing monitoring program for the next two rounds of sampling and analyzing the samples for PCP:

- 3-A and 3-B
- 7-B
- 9-B and 9C
- 13-A
- 16-A and 16-B
- 22
- 23-B and 23-C
- 24-A2 and 24-B
- 26-B
- 29-D

The decision to continue sampling some or all of these suggested wells beyond the next two sampling events could be made based on the results.

Moving forward, it is suggested that contour maps illustrating PCP sampling results be generated independently for each of the depth intervals. Currently, only one map is prepared, and data from some wells are not included, and this complicates fate and transport analysis for each of the intervals.

8.0 DETERMINE IF ADEQUATE DATA IS AVAILABLE TO CONDUCT A CAPTURE ZONE ANALYSIS

An appropriate capture zone analysis utilizes multiple lines of evidence to interpret actual capture. These lines of evidence for this site might include the following:

- A comparison of the amount of ground water flowing through the capture zone with the amount of water that is being extracted
- An interpreted capture zone from a potentiometric surface map
- Water levels from strategically placed well pairs for determining the direction of the hydraulic gradient at a particular location
- Numerical modeling that appropriately accounts for site-specific parameters
- Concentration trends at wells downgradient of the target capture zone

Each of these lines of evidence is discussed below.

The first above-mentioned line of evidence may be difficult to evaluate for this site because the injection wells are located relatively close to the extraction wells, and the reinjected water may influence the capture zone width estimated by this approach. It is noted, however, that a pumping configuration with reinjection occurring downgradient of extraction generally enhances capture.

The potentiometric surface maps generated from recent water level events shows the influence of pumping, but is not sufficiently detailed to provide a reliable interpretation of the capture zone. This is somewhat typical because water level measurements from many locations, often an impractical number of locations, are needed.

Interpreting capture using the direction of the hydraulic gradient based on strategically placed well pairs is not appropriate for all sites, but it does appear to be appropriate for this site. The most appropriate locations are likely at specified locations between the extraction wells and reinjection wells to demonstrate flow toward the extraction wells from the downgradient injection wells. These well pairs, however, are not present. Therefore, additional information is needed to consider this line of evidence.

Numerical modeling, or even analytical modeling, would likely be appropriate for this site, but the review team is not aware that such modeling has been performed for the site. A model with site-specific information would be useful because it could help account for influence on the capture zone from the reinjection of treated water near the extraction wells.

The decreasing PCP concentration trends at wells downgradient of I-90 is favorable evidence for evaluating capture; however, additional data are required to determine if capture is complete or adequate. For adequate capture, the concentration trends in the wells downgradient of I-90 would be expected to decrease over time to the cleanup standard of 1 µg/L or background

concentrations. Additional time is needed to see if concentrations will decrease this level or will asymptotically approach some concentration above 1 µg/L. An additional five years of sampling might be required to better evaluate capture with this line of evidence.

The review team suggests using an analytical model such as WhAEM or a simple numerical model such as MODFLOW in conjunction with MODPATH, using site-specific parameters, to determine if capture is likely provided by the existing system. The site-specific parameters should include the hydraulic gradient, saturated thickness of the contaminated formation, the hydraulic conductivity as determined by pump test results from the existing extraction wells, and the flow rates of each extraction and injection well. Particle tracking can be used with the modeling results to determine the capture zone. This effort should cost approximately \$7,500 if conducted by an experienced modeler that is familiar with the site. If the results are favorable for capture, then the site team could likely continue with the current system and evaluate PCP trends in downgradient wells. If the continued trends suggest adequate capture then there is an additional line of evidence. If the modeling suggests questionable or unfavorable results, the site team could consider placing four piezometer pairs between the row of extraction wells and the row of downgradient reinjection wells to determine if the gradient is consistently directed toward the extraction wells. This effort would likely cost on the order of \$30,000, including planning, piezometer installation, water level measurements, and analysis. If the gradient is directed toward the downgradient reinjection wells, then both the modeling and the piezometer pairs suggest capture is not provided. If the gradient is directed toward the extraction wells, then the site team could revisit the parameters used in the modeling or wait several years to more thoroughly evaluate the concentration trends in downgradient monitoring wells.

9.0 ESTIMATE OF WATER PRODUCED BY DEWATERING FOR UTILITY INSTALLATION

The installation of utilities would require trenching, and the relatively shallow water table (as shallow as 3 feet near portions of the site) would likely require dewatering during construction. Estimating the amount of water produced during dewatering depends on several site-specific factors, including depth of the water table, width and depth of the trench, and hydraulic conductivity of both the aquifer and the material surrounding the trench. Preliminary estimates using a simple numerical model (MODFLOW) suggest that the amount of produced water can vary substantially. The following table summarizes results using various input parameters.

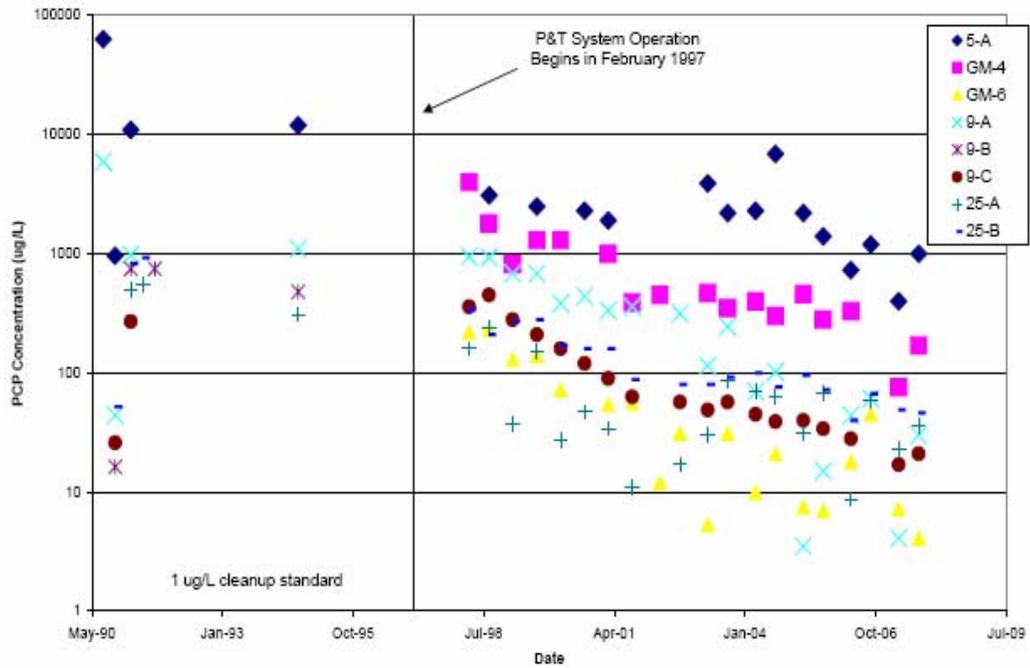
Parameter	Value	Result
Trench width	4 feet	
Depth to water	3 feet	
Trench depth	6 feet	
Trench length	100 feet	
Hydraulic conductivity*	25 feet per day	45 gpm
	50 feet per day	90 gpm
	100 feet per day	180 gpm

** The same hydraulic conductivity applies to the aquifer and to the area around the trench, which is used in calculating the trench conductance during modeling*

The above calculated yields are decreased by 33% if the saturated interval intercepted by the trench is decreased from 3 feet (i.e., 6 feet minus 3 feet) to 2 feet and are decreased by 66% if the saturated interval intercepted by the trench is decreased from 3 feet to 1 foot.

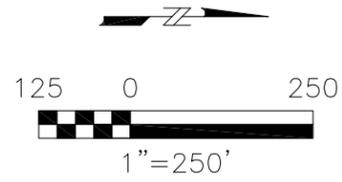
Because the water produced by the trench will likely be contaminated with PCP and perhaps other site-related contaminants, arrangements should likely be made to treat the produced water.

Figure 1: Decreasing Trends in PCP Concentrations at Site Monitoring Wells



ATTACHMENT A
FIGURES FROM THE FIVE-YEAR REVIEW

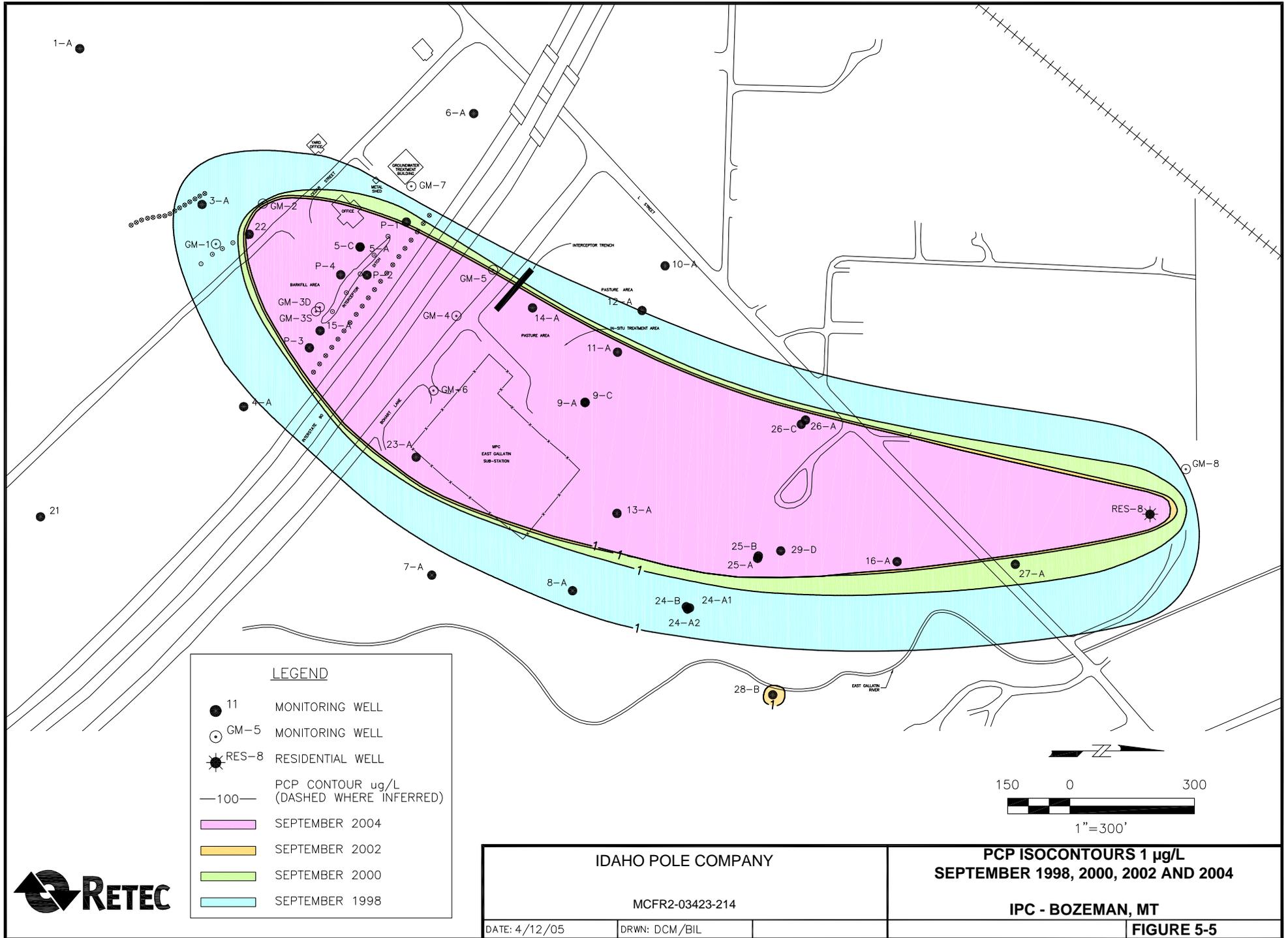
File: J:\3423\214\CUR_MONWELL_NET.dwg Layout: Layout1 User: milliamson Plotted: Apr 12, 2005 - 12:45pm Xref's:



LEGEND	
●	11 MONITORING WELL
⊙	GM-5 MONITORING WELL
☼	RES-8 RESIDENTIAL WELL
▲	SU-2 SUMP WELL
⊗	INJECTION WELL



IDAHO POLE COMPANY		MONITORING WELL NETWORK	
MCFR2-03423-214		IPC - BOZEMAN, MT	
DATE: 4/12/05	DRWN: MAW/BIL		FIGURE 2-1



LEGEND

- 11 MONITORING WELL
- ⊙ GM-5 MONITORING WELL
- ★ RES-8 RESIDENTIAL WELL
- 100- PCP CONTOUR $\mu\text{g/L}$
(DASHED WHERE INFERRED)
- SEPTEMBER 2004
- SEPTEMBER 2002
- SEPTEMBER 2000
- SEPTEMBER 1998



IDAHO POLE COMPANY		PCP ISOCONTOURS 1 $\mu\text{g/L}$ SEPTEMBER 1998, 2000, 2002 AND 2004	
MCFR2-03423-214		IPC - BOZEMAN, MT	
DATE: 4/12/05	DRWN: DCM/BIL	FIGURE 5-5	

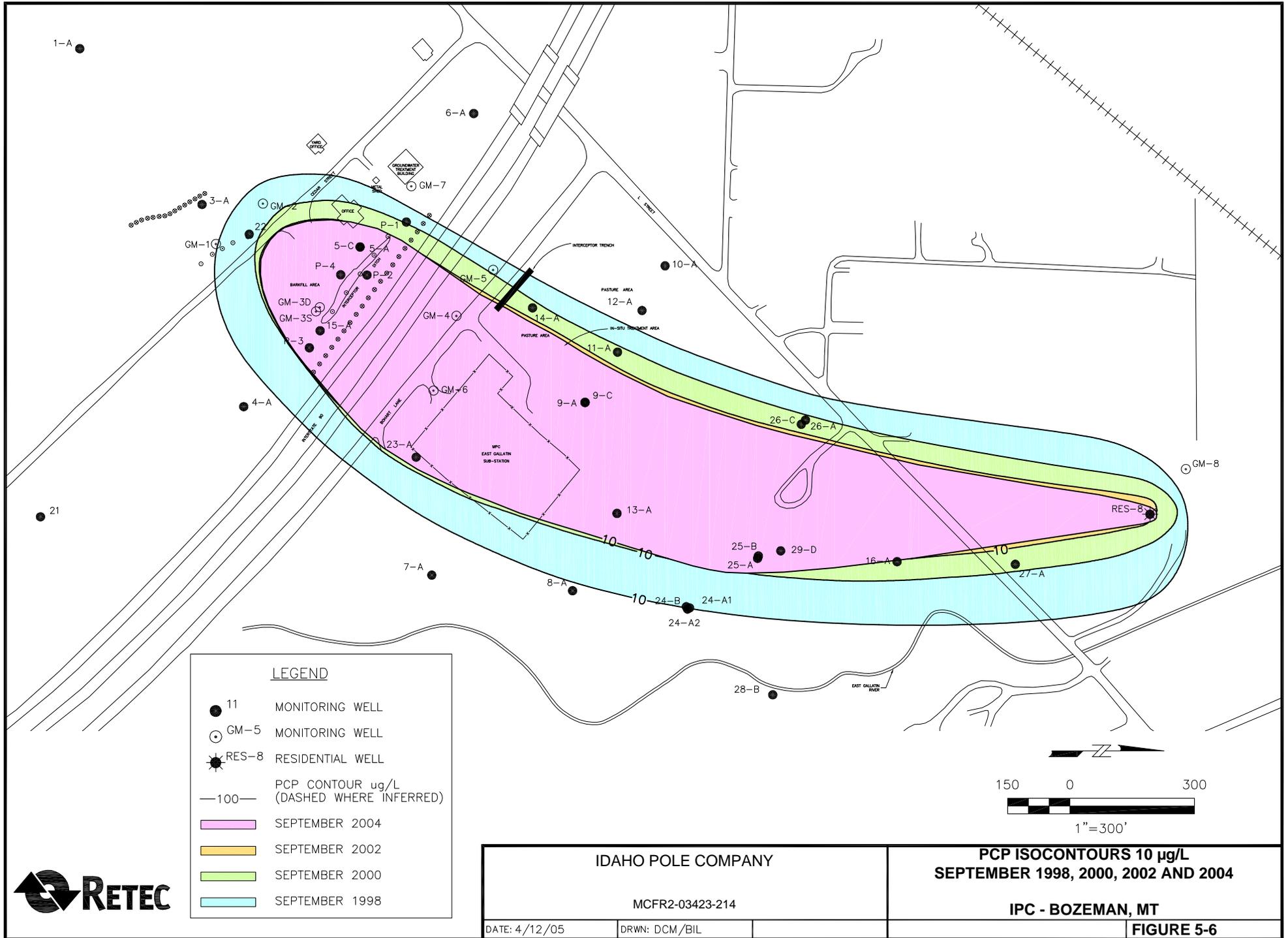
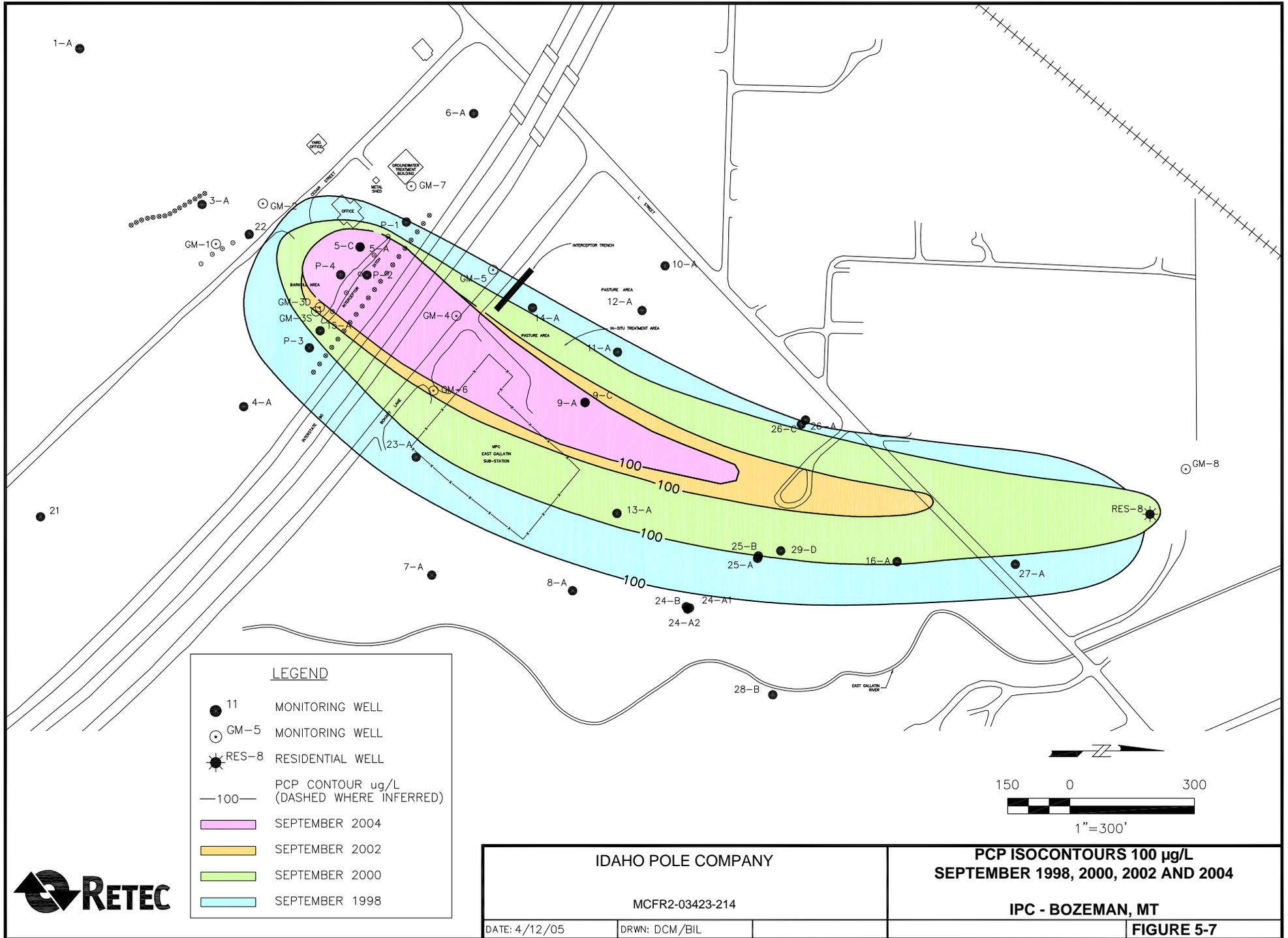
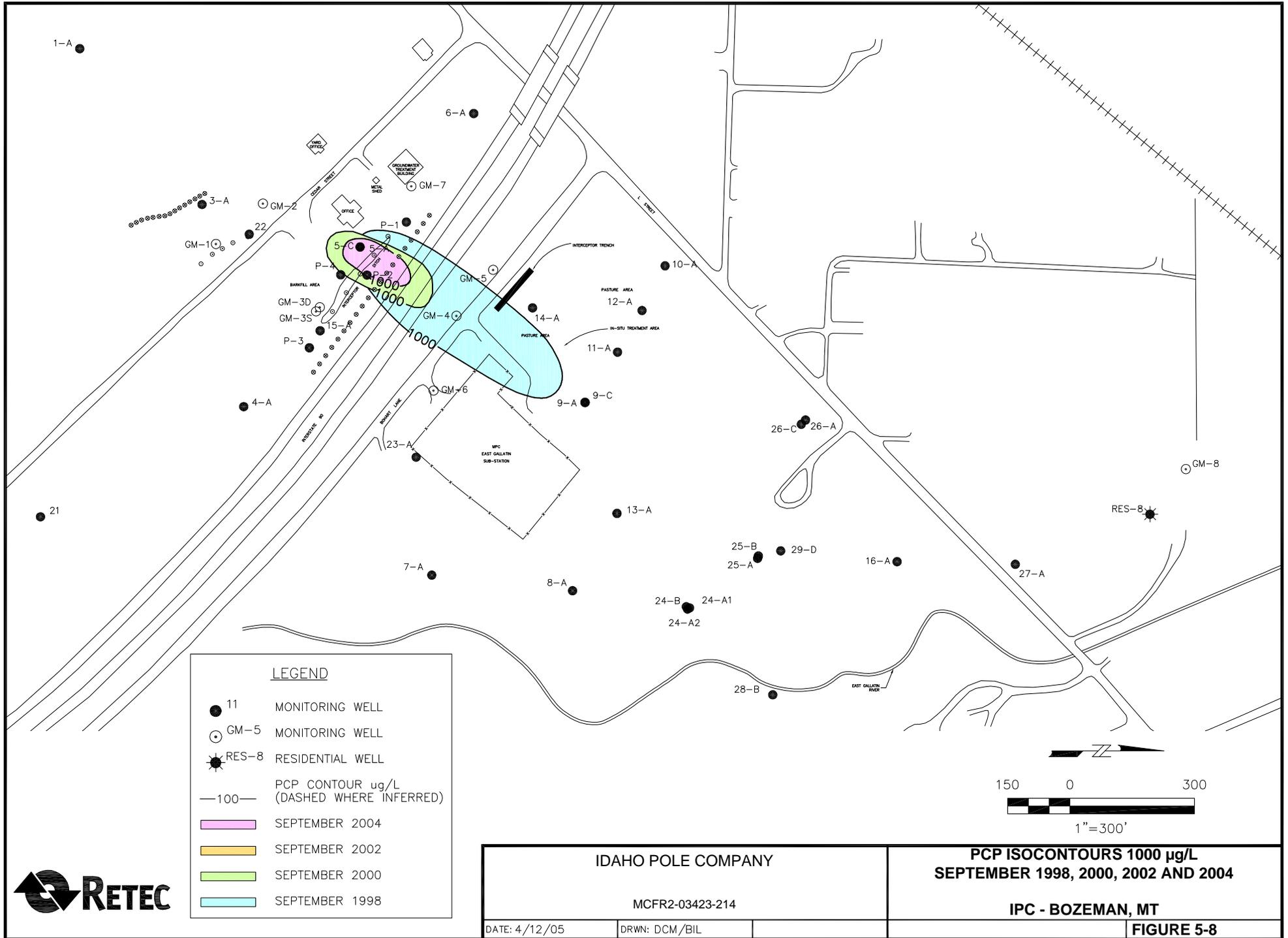


FIGURE 5-6





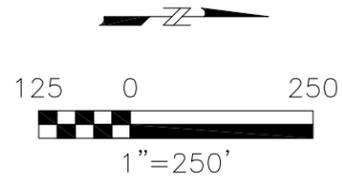
LEGEND

- 11 MONITORING WELL
- ⊙ GM-5 MONITORING WELL
- ★ RES-8 RESIDENTIAL WELL
- 100- PCP CONTOUR µg/L (DASHED WHERE INFERRED)
- SEPTEMBER 2004
- SEPTEMBER 2002
- SEPTEMBER 2000
- SEPTEMBER 1998

IDAHO POLE COMPANY		PCP ISOCONTOURS 1000 µg/L SEPTEMBER 1998, 2000, 2002 AND 2004	
MCFR2-03423-214		IPC - BOZEMAN, MT	
DATE: 4/12/05	DRWN: DCM/BIL		FIGURE 5-8



File: J:\3423\214\pc12-04.dwg Layout: Layout1 User: mwilliamson Plotted: Apr 12, 2005 - 12:49pm Xref's:



LEGEND	
● 11	MONITORING WELL
⊙ GM-5 4741.32	MONITORING WELL
-4736-	GROUNDWATER CONTOUR 1' INTERVAL (DASHED WHERE INFERRED)
NS	NOT SURVEYED
[4744.53]	NOT USED TO CONTOUR



IDAHO POLE COMPANY		POTENTIOMETRIC SURFACE MAP DECEMBER 2004	
MCFR2-03423-214		IPC - BOZEMAN, MT	
DATE: 4/12/05	DRWN: MAW/BIL		FIGURE 2-5

ATTACHMENT B
CUT SHEET FOR POTENTIAL PASSIVE OIL SKIMMER

Passive Hydrocarbon Skimmer

ORS Filter Bucket™

The ORS Filter Bucket™ is an independently floating passive hydrocarbon skimmer that is equipped with a visual alarm to indicate when the bucket is full. The heart of the system is a floating cartridge that recovers product for storage in an integral 2-liter reservoir. Actual separation of product from water is carried out by a mesh screen located in the cartridge. This screen is specially treated to pass oil and repel water.

OPERATION

As product passes through the cartridge, it passes into one of the two hoses and is gravity fed through the bucket wall and through a small check valve. When the cover of the bucket is removed, product can be seen flowing into the bucket. The rate of flow into the ORS Filter Bucket™ is dependent upon the viscosity of the product and the thickness of the slick. As product accumulates in the reservoir, the ORS Filter Bucket™ will ride lower in the water. At the same time, the product level indicator shaft will be extended through the lid of the bucket. The ORS Filter Bucket™ is designed so that the reservoir will cease taking on product just as the cartridge contacts the bucket handle.



ORS Filter Bucket™

SPECIFICATIONS

Dimensions

Height	16"
Diameter	10"
Weight	7lbs
Capacity	2 liters

Materials

Body	polyethylene
Hoses	polyethylene
Check valves	nylon
Cartridge	100 Mesh Oleophilic/hydrophobic (blue) 60 Mesh Oleophilic/hydrophobic (green)

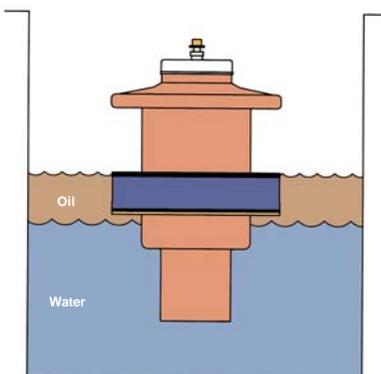
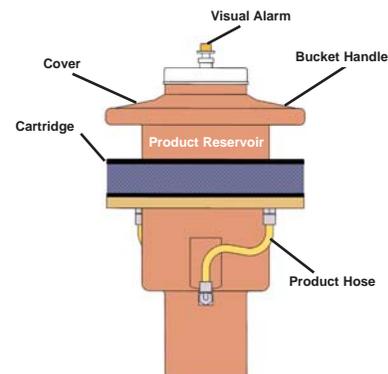


Figure 1 - Installation

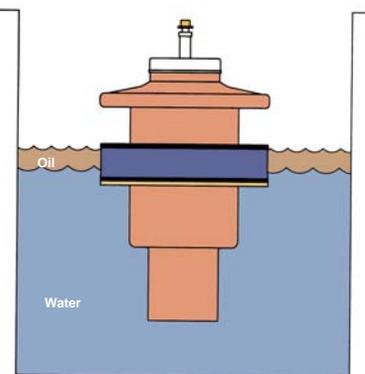


Figure 2 - Capturing Process

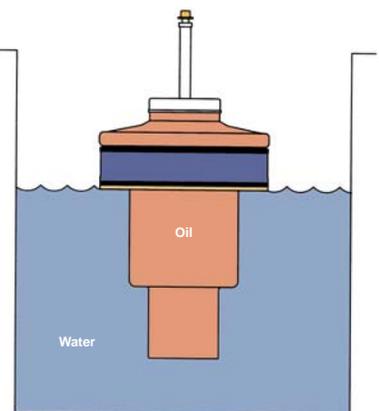


Figure 3 - Full

CALL GEOTECH TODAY (800) 833-7958

Geotech Environmental Equipment, Inc.
 2650 East 40th Avenue • Denver, Colorado 80205
 (303) 320-4764 • **(800) 833-7958** • FAX (303) 322-7242
 email: sales@geotechenv.com website: www.geotechenv.com

ATTACHMENT C
BIOSCREEN MODELING INPUT/OUTPUT

BIOSCREEN Natural Attenuation Decision Support System

Air Force Center for Environmental Excellence

Version 1.4

Idaho Pole
High Decay Scenario
Run Name

Data Input Instructions:

115
↑ or
0.02

1. Enter value directly...or
2. Calculate by filling in grey
(To restore cells below.)

Variable*
20

formulas, hit button below).
Data used directly in model.
Value calculated by model.

1. HYDROGEOLOGY

Seepage Velocity* Vs 1810.6 (ft/yr)
or
Hydraulic Conductivity K 3.5E-02 (cm/sec)
Hydraulic Gradient i 0.01 (ft/ft)
Porosity n 0.2 (-)

2. DISPERSION

Longitudinal Dispersivity alpha x 100.0 (ft)
Transverse Dispersivity* alpha y 33.0 (ft)
Vertical Dispersivity* alpha z 0.0 (ft)
or
Estimated Plume Length Lp 2500 (ft)

3. ADSORPTION

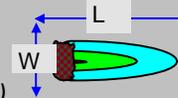
Retardation Factor* R 4.9 (-)
or
Soil Bulk Density rho 1.7 (kg/l)
Partition Coefficient Koc 228 (L/kg)
Fraction Organic Carbon foc 2.0E-3 (-)

4. BIODEGRADATION

1st Order Decay Coeff* lambda 6.9E-1 (per yr)
or
Solute Half-Life t-half 1.00 (year)
or Instantaneous Reaction Mode.
Delta Oxygen* DO (mg/L)
Delta Nitrate* NO3 (mg/L)
Observed Ferrous Iron* Fe2+ (mg/L)
Delta Sulfate* SO4 (mg/L)
Observed Methane* CH4 (mg/L)

5. GENERAL

Modeled Area Length* 2500 (ft)
Modeled Area Width* 500 (ft)
Simulation Time* 35 (yr)



6. SOURCE DATA

Source Thickness in Sat.Zone* 50 (ft)

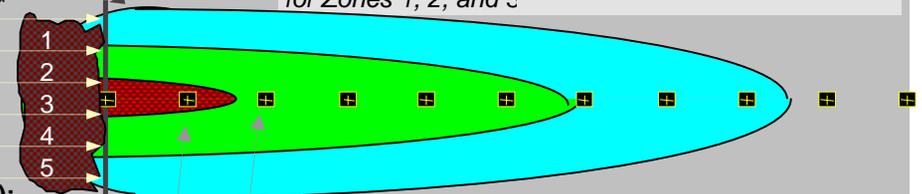
Source Zones:

Width* (ft)	Conc. (mg/L)*
0	0
0	0
250	11
0	0
0	0

Source Halflife (see Help):

Infinite Infinite (yr)
Inst. React. ↑ 1st Order
Soluble Mass infinite (Kg)
In Source NAPL, Soil

Vertical Plane Source: Look at Plume Cross-Section and Input Concentrations & Widths for Zones 1, 2, and 3



View of Plume Looking Down

Observed Centerline Concentrations at Monitoring Wells
If No Data Leave Blank or Enter "0"

7. FIELD DATA FOR COMPARISON

Concentration (mg/L)	5.0	.98	.83	.6	.1						
Dist. from Source (ft)	0	250	500	750	1000	1250	1500	1750	2000	2250	2500

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE
View Output

RUN ARRAY
View Output

Help

Recalculate This Sheet

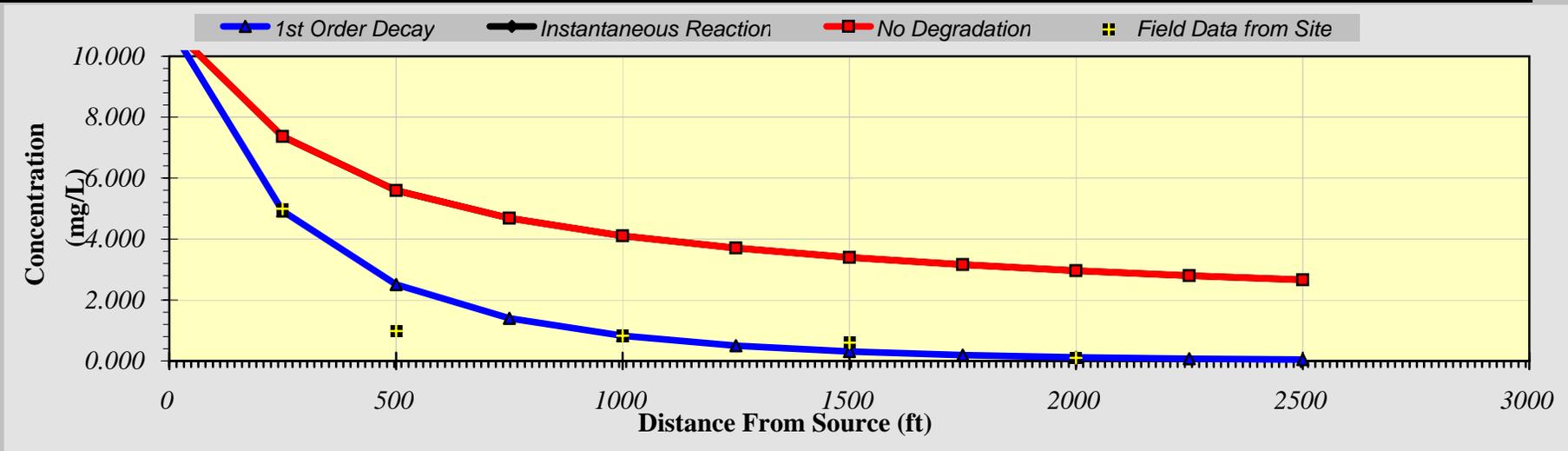
Paste Example Dataset

Restore Formulas for Vs, Dispersivities, R, lambda, other

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0) High Decay Scenario

Distance from Source (ft)

TYPE OF MODEL	0	250	500	750	1000	1250	1500	1750	2000	2250	2500
No Degradation	11.000	7.365	5.595	4.683	4.108	3.702	3.397	3.157	2.961	2.798	2.659
1st Order Decay	11.000	4.927	2.504	1.402	0.823	0.496	0.305	0.189	0.119	0.075	0.048
Inst. Reaction	11.000	7.365	5.595	4.683	4.108	3.702	3.397	3.157	2.961	2.798	2.659
<i>Field Data from Site</i>		5.000	0.980		0.830		0.600		0.100		



Calculate Animation

Time:
35 Years

Return to Input

Recalculate This Sheet

BIOSCREEN Natural Attenuation Decision Support System

Air Force Center for Environmental Excellence

Version 1.4

Idaho Pole
Low Decay Scenario
Run Name

Data Input Instructions:

115
↑ or
0.02

1. Enter value directly...or
2. Calculate by filling in grey
(To restore
cells below.

Variable*
20

formulas, hit button below).
Data used directly in model.
Value calculated by model.

1. HYDROGEOLOGY

Seepage Velocity* Vs 1500.2 (ft/yr)
↑ or
Hydraulic Conductivity K 2.9E-02 (cm/sec)
Hydraulic Gradient i 0.01 (ft/ft)
Porosity n 0.2 (-)

2. DISPERSION

Longitudinal Dispersivity alpha x 100.0 (ft)
Transverse Dispersivity* alpha y 33.0 (ft)
Vertical Dispersivity* alpha z 0.0 (ft)
↑ or
Estimated Plume Length Lp 2500 (ft)

3. ADSORPTION

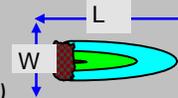
Retardation Factor* R 16.5 (-)
↑ or
Soil Bulk Density rho 1.7 (kg/l)
Partition Coefficient Koc 912 (L/kg)
Fraction Organic Carbon foc 2.0E-3 (-)

4. BIODEGRADATION

1st Order Decay Coeff* lambda 1.7E-1 (per yr)
↑ or
Solute Half-Life t-half 4.00 (year)
or Instantaneous Reaction Mode.
Delta Oxygen* DO (mg/L)
Delta Nitrate* NO3 (mg/L)
Observed Ferrous Iron* Fe2+ (mg/L)
Delta Sulfate* SO4 (mg/L)
Observed Methane* CH4 (mg/L)

5. GENERAL

Modeled Area Length* 2500 (ft)
Modeled Area Width* 500 (ft)
Simulation Time* 35 (yr)



6. SOURCE DATA

Source Thickness in Sat.Zone* 50 (ft)

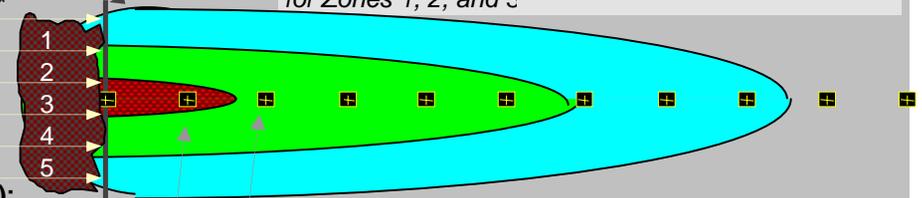
Source Zones:

Width* (ft)	Conc. (mg/L)*
0	0
0	0
250	11
0	0
0	0

Source Halflife (see Help):

Infinite Infinite (yr)
Inst. React. ↑ 1st Order
Soluble Mass infinite (Kg)
In Source NAPL, Soil

Vertical Plane Source: Look at Plume Cross-Section and Input Concentrations & Widths for Zones 1, 2, and 3



View of Plume Looking Down

Observed Centerline Concentrations at Monitoring Wells
If No Data Leave Blank or Enter "0"

7. FIELD DATA FOR COMPARISON

Concentration (mg/L)	5.0	.98	.83	.6	.1						
Dist. from Source (ft)	0	250	500	750	1000	1250	1500	1750	2000	2250	2500

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE **RUN ARRAY** **Help** Recalculate This Sheet

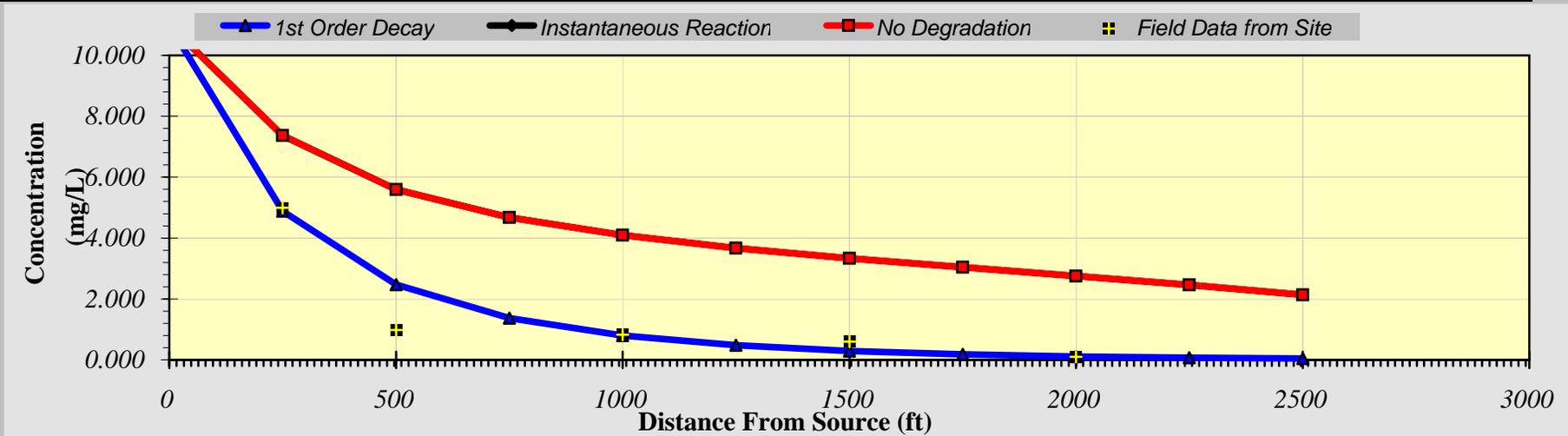
View Output **View Output** Paste Example Dataset

Restore Formulas for Vs, Dispersivities, R, lambda, other

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

Distance from Source (ft)

TYPE OF MODEL	0	250	500	750	1000	1250	1500	1750	2000	2250	2500
No Degradation	11.000	7.364	5.593	4.678	4.095	3.674	3.338	3.042	2.756	2.458	2.137
1st Order Decay	11.000	4.890	2.467	1.371	0.799	0.478	0.291	0.180	0.112	0.070	0.044
Inst. Reaction	11.000	7.364	5.593	4.678	4.095	3.674	3.338	3.042	2.756	2.458	2.137
Field Data from Site		5.000	0.980		0.830		0.600		0.100		



Calculate Animation

Time:

35 Years

Return to Input

Recalculate This Sheet

BIOSCREEN Natural Attenuation Decision Support System

Air Force Center for Environmental Excellence

Version 1.4

Idaho Pole
High Decay Predict.
Run Name

Data Input Instructions:

115
↑ or
0.02

1. Enter value directly...or
2. Calculate by filling in grey
(To restore
cells below.

Variable*
20

formulas, hit button below).
Data used directly in model.
Value calculated by model.

1. HYDROGEOLOGY

Seepage Velocity* Vs 1810.6 (ft/yr)
↑ or
Hydraulic Conductivity K 3.5E-02 (cm/sec)
Hydraulic Gradient i 0.01 (ft/ft)
Porosity n 0.2 (-)

2. DISPERSION

Longitudinal Dispersivity alpha x 100.0 (ft)
Transverse Dispersivity* alpha y 33.0 (ft)
Vertical Dispersivity* alpha z 0.0 (ft)
↑ or
Estimated Plume Length Lp 2500 (ft)

3. ADSORPTION

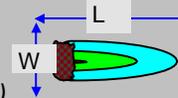
Retardation Factor* R 16.5 (-)
↑ or
Soil Bulk Density rho 1.7 (kg/l)
Partition Coefficient Koc 912 (L/kg)
Fraction Organic Carbon foc 2.0E-3 (-)

4. BIODEGRADATION

1st Order Decay Coeff* lambda 1.7E-1 (per yr)
↑ or
Solute Half-Life t-half 4.00 (year)
or Instantaneous Reaction Mode.
Delta Oxygen* DO (mg/L)
Delta Nitrate* NO3 (mg/L)
Observed Ferrous Iron* Fe2+ (mg/L)
Delta Sulfate* SO4 (mg/L)
Observed Methane* CH4 (mg/L)

5. GENERAL

Modeled Area Length* 2500 (ft)
Modeled Area Width* 500 (ft)
Simulation Time* 100 (yr)



6. SOURCE DATA

Source Thickness in Sat.Zone* 50 (ft)

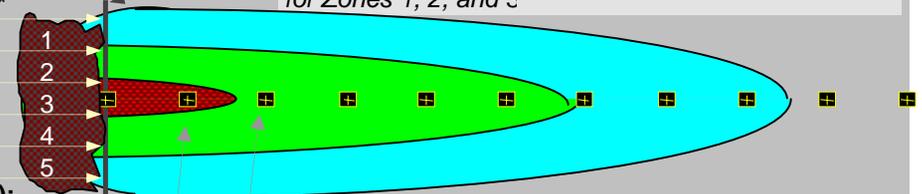
Source Zones:

Width* (ft)	Conc. (mg/L)*
0	0
0	0
250	0.075
0	0
0	0

Source Halflife (see Help):

Infinite Infinite (yr)
Inst. React. ↑ 1st Order
Soluble Mass infinite (Kg)
In Source NAPL, Soil

Vertical Plane Source: Look at Plume Cross-Section and Input Concentrations & Widths for Zones 1, 2, and 3



View of Plume Looking Down

Observed Centerline Concentrations at Monitoring Wells
If No Data Leave Blank or Enter "0"

7. FIELD DATA FOR COMPARISON

Concentration (mg/L)											
Dist. from Source (ft)	0	250	500	750	1000	1250	1500	1750	2000	2250	2500

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE
View Output

RUN ARRAY
View Output

Help

Recalculate This Sheet

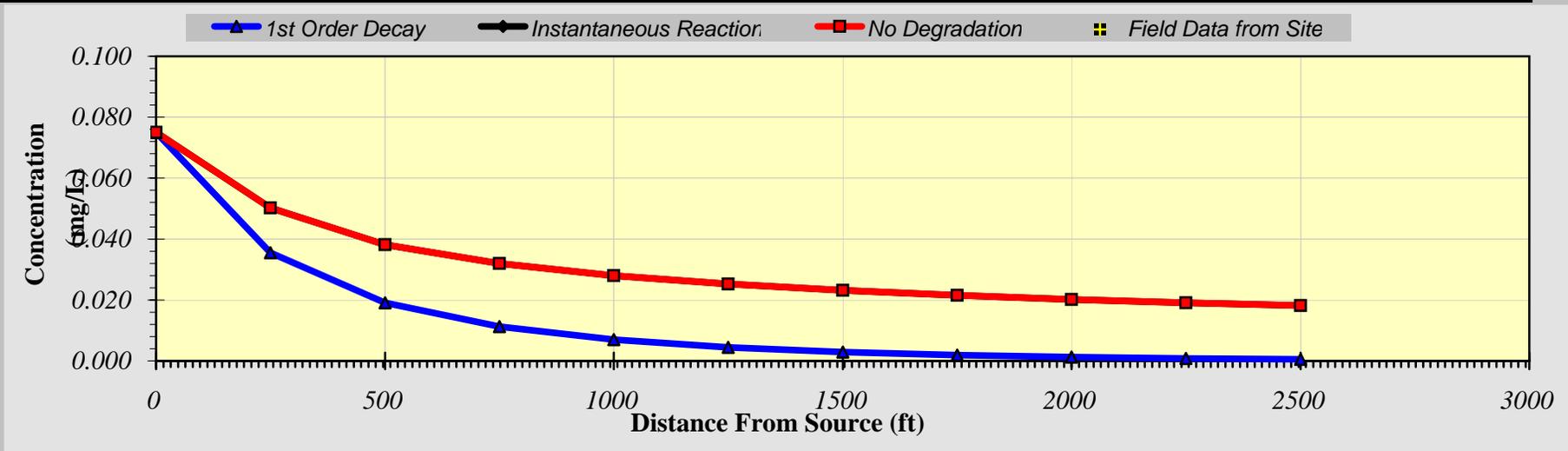
Paste Example Dataset

Restore Formulas for Vs, Dispersivities, R, lambda, other

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

Distance from Source (ft)

TYPE OF MODEL	0	250	500	750	1000	1250	1500	1750	2000	2250	2500
No Degradation	0.075	0.050	0.038	0.032	0.028	0.025	0.023	0.022	0.020	0.019	0.018
1st Order Decay	0.075	0.036	0.019	0.011	0.007	0.004	0.003	0.002	0.001	0.001	0.001
Inst. Reaction	0.075	0.050	0.038	0.032	0.028	0.025	0.023	0.022	0.020	0.019	0.018
Field Data from Site											



Calculate Animation

Time:

Return to Input

Recalculate This Sheet

BIOSCREEN Natural Attenuation Decision Support System

Air Force Center for Environmental Excellence

Version 1.4

Idaho Pole
 Low Decay Predict.
 Run Name

Data Input Instructions:

115
 ↑ or
 0.02

1. Enter value directly...or
 2. Calculate by filling in grey
 (To restore cells below.)

Variable*
 20

formulas, hit button below).
 Data used directly in model.
 Value calculated by model.

1. HYDROGEOLOGY

Seepage Velocity* Vs 1500.2 (ft/yr)
 or
 Hydraulic Conductivity K 2.9E-02 (cm/sec)
 Hydraulic Gradient i 0.01 (ft/ft)
 Porosity n 0.2 (-)

2. DISPERSION

Longitudinal Dispersivity alpha x 100.0 (ft)
 Transverse Dispersivity* alpha y 33.0 (ft)
 Vertical Dispersivity* alpha z 0.0 (ft)
 or
 Estimated Plume Length Lp 2500 (ft)

3. ADSORPTION

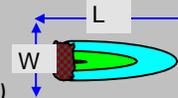
Retardation Factor* R 16.5 (-)
 or
 Soil Bulk Density rho 1.7 (kg/l)
 Partition Coefficient Koc 912 (L/kg)
 Fraction Organic Carbon foc 2.0E-3 (-)

4. BIODEGRADATION

1st Order Decay Coeff* lambda 1.7E-1 (per yr)
 or
 Solute Half-Life t-half 4.00 (year)
or Instantaneous Reaction Mode.
 Delta Oxygen* DO (mg/L)
 Delta Nitrate* NO3 (mg/L)
 Observed Ferrous Iron* Fe2+ (mg/L)
 Delta Sulfate* SO4 (mg/L)
 Observed Methane* CH4 (mg/L)

5. GENERAL

Modeled Area Length* 2500 (ft)
 Modeled Area Width* 500 (ft)
 Simulation Time* 100 (yr)



6. SOURCE DATA

Source Thickness in Sat.Zone* 50 (ft)

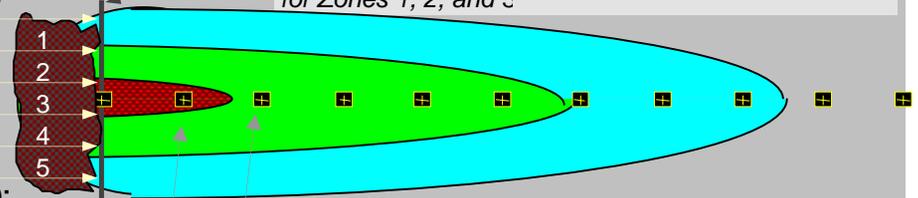
Source Zones:

Width* (ft)	Conc. (mg/L)*
0	0
0	0
250	0.1
0	0
0	0

Source Halflife (see Help):

Infinite Infinite (yr)
 Inst. React. ↑ 1st Order
 Soluble Mass infinite (Kg)
 In Source NAPL, Soil

Vertical Plane Source: Look at Plume Cross-Section and Input Concentrations & Widths for Zones 1, 2, and 3



View of Plume Looking Down

Observed Centerline Concentrations at Monitoring Wells
 If No Data Leave Blank or Enter "0"

7. FIELD DATA FOR COMPARISON

Concentration (mg/L)											
Dist. from Source (ft)	0	250	500	750	1000	1250	1500	1750	2000	2250	2500

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE
 View Output

RUN ARRAY
 View Output

Help

Recalculate This Sheet

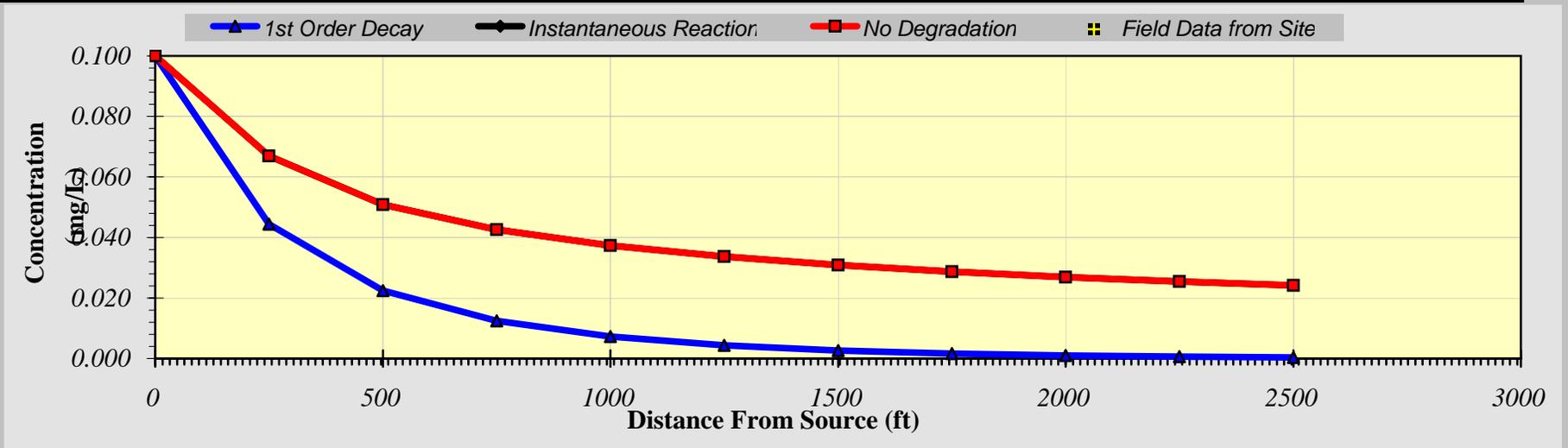
Paste Example Dataset

Restore Formulas for Vs, Dispersivities, R, lambda, other

DISSOLVED HYDROCARBON CONCENTRATION ALONG PLUME CENTERLINE (mg/L at Z=0)

Distance from Source (ft)

TYPE OF MODEL	0	250	500	750	1000	1250	1500	1750	2000	2250	2500
No Degradation	0.100	0.067	0.051	0.043	0.037	0.034	0.031	0.029	0.027	0.025	0.024
1st Order Decay	0.100	0.044	0.022	0.012	0.007	0.004	0.003	0.002	0.001	0.001	0.000
Inst. Reaction	0.100	0.067	0.051	0.043	0.037	0.034	0.031	0.029	0.027	0.025	0.024
Field Data from Site											



Calculate Animation

Time:

Return to Input

Recalculate This Sheet