Wisconsin
Department of Commerce

ENVIRONMENTAL & REGULATORY SERVICES DIVISION
P. O. Box 530
Park Falls, Wisconsin 54552

Tommy G. Thompson, Governor
William J. McCoshen, Secretary

February 25, 1998

Mr. Randy Anderson
Clark County Highway Department
801 Clay Street
Neillsville, WI 54456

FILE

Subject: **Close-out of Case #54446-9598-03 / BRRTS # 03-10-001478**
Clark County Highway Shop
Loyal,WI

Dear Mr. Anderson:

On February 23, 1998 the above site was reviewed for closure by the Site Review staff of the PECFA Bureau. Because the site involved only soil contamination, without a threat to groundwater, all issues relating to this site are administered by the staff within the Department of Commerce's PECFA Bureau. Using the standards established in NR 700, the Department has determined that this site has been remediated to a level protective of the environment and human health. The Department considers this site to meet environmental standards, and no further action is necessary.

This is based upon the information provided to us by your consultant and the modeling of the soil contamination they performed. If, in the future, site conditions indicate that any contamination that might remain poses a threat, the need for further remediation would be determined and required if necessary.

Thank you for your efforts in the protection of the environment. If you have any additional questions, please call me at 715-762-5557.

Sincerely,

Shanna L. Laube
Hydrogeologist
PECFA Program

cc:

1148 96 57

FILE COPY

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

WISCONSIN
DEPT. OF NATURAL RESOURCES

Tommy G. Thompson, Governor
George E. Meyer, Secretary
Donald R. Winter, District Director

Black River Falls Area Headquarters
910 Highway 54 East
Black River Falls, WI 54615
TELEPHONE 715-284-1400
FAX 715-284-1737

June 14, 1996

RECEIVED
JUN 18 1996
HZ DM PA FILE

File Ref: 03-10-001478

Clark County Highway Department
Attn: Mr. Randy Anderson
801 Clay Street
Neillsville, WI 54456

Subject: Site Investigation Report and Case Closure Request

Dear Mr. Anderson:

I have received and reviewed the above referenced report. The report states that remedial action is not necessary and closure of this site is requested. However, investigation results show levels of soil contamination well above the NR 720 residual contamination levels (RCLs). The site investigation report also indicates that a portion of these soils are accessible to excavation.

With these factors in mind, it would be doubtful that closure could be attained without additional information and clarification of the following items:

1. If soil that has contaminant levels above the NR 720 RCLs is to be left in place, an alternate contaminant level (ACL) should be developed. Please have your consultant review NR 720.19 for more information.

2. If contamination above the NR 720 RCLs remain on site, the use of a deed restriction or deed affidavit should be considered as an option at the time of closure.

3. Does the town of Loyal have future plans to install a municipal water well in the vicinity of this site?

Please have your consultant submit the information requested. At that time I will present this site to the Committee for closure consideration. If you have any questions about this letter, you may contact me at (715) 284-1418. Thank you for your cooperation.

Sincerely,

Patrick O. Glasspoole
Environmental Specialist

c: Peter Arntsen - CWE, 5707 Schofield Avenue, P.O. Box 107, Weston, WI 54476-0107
Bill Evans - WD

Central Wisconsin Engineers & Architects, Inc.

Engineers • Architects • Scientists • Surveyors

5707 SCHOFIELD AVENUE • PO BOX 107 • WESTON WI 54476-0107 • (715)359-9400 • FAX (715)355-4199
324 SOUTH MAIN STREET • VIROQUA WI 54665 • (608)637-2932 • FAX (608)637-3602

July 29, 1996

PECFA Bureau of Environmental and Regulatory Services Division
Department of Commerce
P.O. Box 7969
Madison, WI 53707-7969

RE: Clark County Highway Department Loyal LUST Site
WDNR #03-10-001478

Subject: Supplement to Case Closure Request

To Whom it May Concern:

In a letter written to Mr. Randy Anderson of the Clark County Highway Department on June 14, 1996 (a copy is enclosed), Mr. Patrick Glasspoole/WDNR - Black River Falls, responded to a request for case closure at the Highway Department's LUST site in Loyal. Specifically, he asked for additional information and/or clarification of three items before bringing the request to the Closure Committee. The purpose of this correspondence is to address those items.

1. Alternate Soil Contaminant Levels

Because several soil samples taken from the project site contained contaminant concentrations above the NR 720 recommended cleanup levels, alternate standards would be needed to allow case closure without remediating this soil. In addressing this issue, our approach is to demonstrate that existing contaminant concentrations will not cause NR 140 groundwater quality standards to be exceeded in the underlying sandstone aquifer, because that is the ultimate concern in leaving contaminated soils on site. In the following analysis, conservative (or "worst case") assumptions are made wherever there are unknown variables. Thus, we believe that our evaluation errs on the side of protecting groundwater.

a. Contaminant of Concern

This analysis focuses on benzene for two reasons: (1) benzene exceeds its NR 720 RCL more often and by a greater factor than does any other contaminant at this site and (2) benzene is commonly more persistent in groundwater than are any of the other BTEX compounds. Therefore, if it can be shown that NR 140 standards for benzene will not be exceeded in groundwater, then the other contaminants should also not violate NR 140 standards.

b. Extent of Contaminated Soil

Figure 1 shows the areal extent of soil containing at least one contaminant in a concentration that exceeds NR 720 RCL (see Appendix A for soil chemistry data). Note that the four borings left out of this contaminated area were found either to be entirely clean (i.e., GP-7 and GP-8) or contained only trace levels of diesel-range organics (i.e., GP-4 and GP-10). The resulting areal extent of soil contamination encompasses roughly 1500 ft^2.

c. Mean Benzene Concentration in Soil

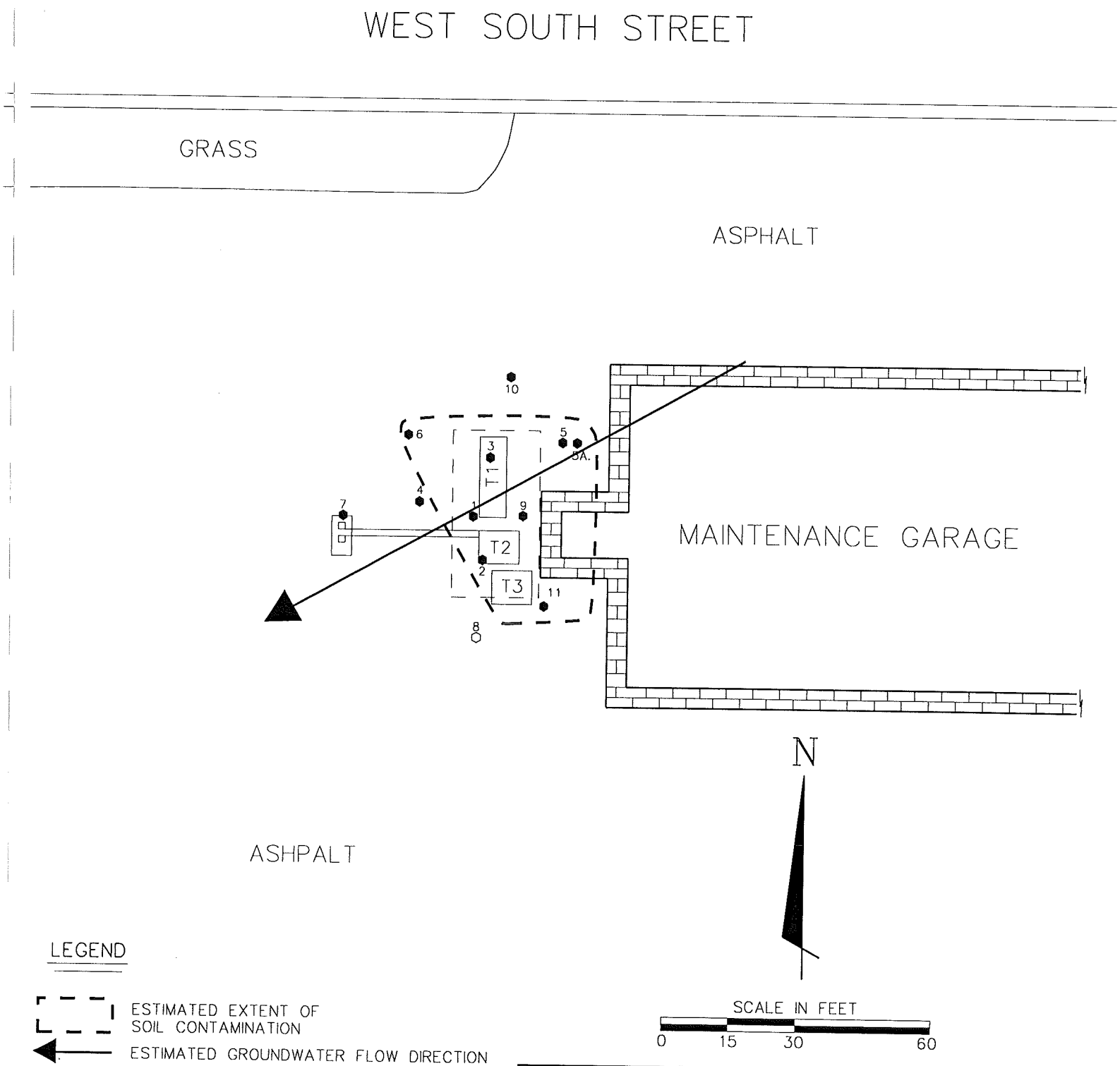
The mean benzene concentration for the contaminated soil was determined based on the 14 samples collected from within that soil volume (a copy of the soil chemistry data are included in Appendix A). Environmental chemistry data are often log-normally distributed, and the benzene concentrations from Appendix A follow that distribution (see Figure 2; note that non-detections of benzene in an otherwise contaminated sample were assigned concentrations of 0.013 μg/g, which is one-half of the detection limit). For this situation, the appropriate measure of mean concentration is the geometric mean (Swan and Sandilands, 1995). Thus, the mean benzene concentration within the contaminated soil is 0.20 μg/g (see Appendix B).

d. Mean Benzene Concentration in Soil Water

Feenstra, et al. (1991) present a method for estimating the concentration of an organic contaminant in soil water given its total concentration measured in a soil sample. This method accounts for the fact that the total contaminant mass can be distributed in three phases: dissolved in soil water, volatilized into soil air and sorbed to the soil solids. Nonaqueous (or "free") liquid phase is also possible, and the presence of that phase is inferred if the computed dissolved concentration is greater than the compound's effective solubility.

To estimate "worst-case" conditions for the project site, the total contaminant mass will be partitioned only between the dissolved and sorbed state, and contaminant loss through volatilization shall be ignored. This assumption reduces the pertinent equation to:

$$C_w = \frac{(C_t)(P_b)}{[(K_d)(P_b) + (\eta_w)]}$$

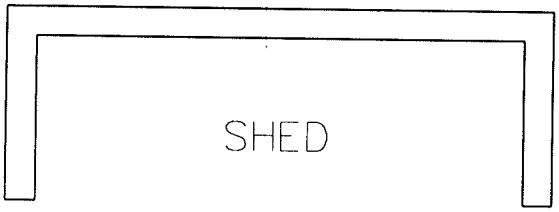


LEGEND

ESTIMATED EXTENT OF SOIL CONTAMINATION

ESTIMATED GROUNDWATER FLOW DIRECTION

T1: 1,000 GALLON DIESEL FUEL
T2: 500 GALLON UNLEADED GASOLINE
T3: 500 GALLON FUEL OIL



CAD FILE: clarkloy.S70		LEVELS: 3/5-8/11/12
SHEET TITLE: ESTIMATED EXTENT OF SOIL CONTAMINATION		
PROJECT: CLARK COUNTY HIGHWAY DEPARTMENT LOYAL, WISCONSIN		
CENTRAL WISCONSIN ENGINEERS & ARCHITECTS, INC.	DRAWN BY: WRN	FIGURE 1
	CHECKED BY: Pete	
	APPROVED BY:	PROJ. NO. 17489550
	DATE: 7/96	DNR NO. NCD/UID 1478

where C_w is the soil water concentration (in mg/L)
C_t is the measured soil concentration (in μg/g)
P_b is the soil bulk density (in g/cm^3)
K_d is the distribution coefficient (in cm^3/g)
η_w is the water-filled porosity (no units)

In this case, the mean soil concentration is known (0.20 μg/g), but the other variables must be estimated. Reasonable values of bulk density and porosity for a glacial till are 2.0 g/cm^3 and 0.25, respectively (Peck et al., 1974); and it will be assumed that the pore spaces become 100 percent saturated when recharge infiltrates through the soil (therefore N_w equals 0.25). The distribution coefficient is a function of the contaminant in question, the fraction of organic carbon present in the soil, and the soil's clay content (Lyman et al., 1992). Using conservative values for the benzene soil-water partition coefficients and the percentages of organic carbon and clay expected in the till yields a distribution coefficient of 0.0176 cm^3/g (see Appendix B).

Therefore, the mean benzene concentration in soil water that comes in contact with contaminated soil is:

$$C_w = \frac{(0.20\ \mu g/g)(2.00\ g/cm^3)}{[(0.0176\ cm^3/g)(2.00\ g/cm^3) + (0.25)]} = 1.40\ mg/L$$

e. Groundwater Recharge Rates

Site-specific recharge rates are not available, but Batten (1989) has reported a range of 0.9 to 4.2 inches/year for groundwater recharge through similar types of geologic material in neighboring Wood County. To maximize the potential effects of soil contamination on groundwater, a rate of 4.2 inches/year (or 0.001 ft/day) will be assumed for the project site.

f. Benzene Concentrations in Groundwater

To simulate "worst-case" conditions, the 0.001 ft/day of recharge entering the sandstone aquifer from beneath the contaminated soil zone is assumed to contain benzene in a concentration of 1.40 mg/L for an indefinite period of time. In reality, recharging benzene concentrations would be less than what was calculated in 1.e. due to contaminant mass losses in the 20 foot zone of uncontaminated till that exists between the bedrock aquifer and the overlying soil contamination. Also, the source loading rate would drop over time as contaminants were flushed out of the soil.

To determine the benzene concentrations in groundwater, the recharging concentration must be mixed (diluted) with a specified volume of groundwater. The standard practice according to NR 720.09 is to assume that recharge mixes with the groundwater flowing in the upper 5 feet of aquifer thickness. Because groundwater flows generally to the west-southwest beneath this site (see Lippelt, 1990) the width of aquifer exposed to contaminated recharge is about 60 feet (see Figure 1). This translates to a cross-sectional area of 300 ft^2 (60 feet of width times 5 feet of depth). The volume of groundwater flowing through that cross-sectional area is an estimated 37.8 ft^3/day (see Appendix B). Therefore, the mixing of groundwater with contaminated recharge dilutes the contaminant concentrations by a factor of 26 (see Appendix B); and the 1.40 mg/L of benzene estimated to be in the recharge would produce a concentration of 0.054 mg/L benzene in the groundwater directly beneath contaminated soils.

g. Benzene Concentrations at Site Boundary

The estimated benzene concentration in groundwater beneath the contaminated soil area (54 μg/L assuming a 5-foot mixing zone in the aquifer) is ten times the NR 140 ES for this contaminant. However, as groundwater transports the benzene downgradient, concentrations will be reduced through dispersion. To simulate that effect and estimate benzene concentrations at the site's downgradient boundary (roughly 250 feet to the west-southwest), the model known as SOLUTE (Beljin, 1991) was utilized. Using the site hydrogeologic data and the benzene loading rate from part d. (above) yields a concentration of 4 μg/L at the property's downgradient boundary under "worst-case" conditions (see Appendix D for assumptions and model output). Note that this model does not account for the diluting effect of recharge that occurs between the source area and site boundary.

h. Summary and Conclusion

Using a series of "worst-case" assumptions, it has been shown that the contaminant of greatest concern (benzene) would not exceed NR 140 enforcement standards in groundwater flowing beneath the site's downgradient boundary. In reality, benzene concentrations would likely be less than the predicted 4 μg/L for five reasons: (1) all assumptions were made to favor a "worst-case" outcome; (2) the source strength was not diminished over time as would actually occur; (3) the buffer zone of uncontaminated soil that overlies the aquifer was ignored; (4) the diluting effect of recharge was ignored; and (5) no biodegradation was allowed to occur. Therefore, it is not unrealistic to argue that benzene concentrations would not even exceed the NR 140 preventive action limit in groundwater leaving the site (for example, the

SOLUTE output in Appendix E shows that this is achievable simply by allowing benzene to biodegrade with a conservatively low half-life of 75 days).

2. Use of a Deed Restriction

The analysis conducted to address Item 1 (above) demonstrates that exceedances of NR 140 enforcement standards in the groundwater downgradient of this site are unlikely even if no soil remediation is undertaken. In addition, there are no private or public water-supply wells located downgradient of the contamination (note that well constructor's reports in Appendix C show the city municipal wells to occur in Sections 10 or 15, which is east to northeast of the site). Nonetheless, it would be prudent and acceptable to the Highway Department for the closure of this site to be contingent upon the writing of a suitable deed restriction.

3. Future Plans for Municipal Wells

The City of Loyal is planning to replace one of its existing wells in the near future. City officials have indicated that any new wells will be installed in the same general areas as the existing wells (i.e., on the east side of Loyal, upgradient from the Highway Department's property).

REFERENCES

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Young, H.L., Mandle, R.J., Kontis, A.L., and Siegel, D.I., 1988, The Cambrian-Ordovician Regional Aquifer System in the Northern Midwest; in: Swain, L.A., and Johnson, A.I., eds., Aquifers of the Midwestern Area; Am. Water Res. Assoc., Monograph Series No. 13, p. 5-38.

I trust that this letter has addressed the concerns expressed by Mr. Glasspoole relative to the Clark County Highway Department LUST site in Loyal and that this case can now be presented to the Closure Committee for consideration. If there are any questions, please contact me or Peter Arntsen at 715-359-9400.

Sincerely,

CENTRAL WISCONSIN ENGINEERS & ARCHITECTS, INC.

David L. Ozsvath

David L. Ozsvath, Ph.D., P.G.
Senior Hydrogeologist

Enclosures: Letter from WDNR to Clark County Highway Department
Appendix A: Soil Chemistry Data
Appendix B: Supporting Calculation
Appendix C: Hydraulic Conductivity Estimates
Appendix D: Solute Model Assumptions and Output
Appendix E: Solute Output for Conditions Allowing Biodegradation

cc: Mr. Randy Anderson, Clark County Highway Department (w/o enclosures)
PECFA/Wisconsin Department of Commerce (hold for PECFA application)

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