SCREENING ECOLOGICAL RISK ASSESSMENT
CONSERVATION CHEMICAL CORPORATION
KANSAS CITY, MO

Prepared by U.S. Army Corps of Engineers
Kansas City District

For

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Region 7

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9.0

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1.0 INTRODUCTION

The US Army Corps of Engineers Kansas City District was tasked by the US Environmental Agency Region 7 to prepare a screening ecological risk assessment (SERA) at the Conservation Chemical Corporation (CCC) site to address the potential release of contaminants from groundwater outside the containment area into the nearby Missouri River. This task was undertaken to support USEPA Region 7 in their preparation of a Five-Year Review for the site. The SERA will be used to determine whether a more intensive investigation to determine impact on aquatic biota is warranted.

2.0 METHODS

2.1 Site Conceptual Model

The site conceptual model used for this assessment is relatively simple. Four groundwater sample points outside the containment area for the CCC site groundwater remedy and near the Missouri River, shown in Figure 1, showed apparently elevated concentrations of a number of contaminants. The most likely exposure route for these chemicals to impact the environment would be for the groundwater to discharge into the Missouri River. As the contaminants enter the surface water of the river, they could impact the aquatic biota in the immediate area of the discharge prior to being diluted by the flow of the river.

2.2 Modeling of Surface Water Concentrations

In assessing impact of contaminants on the aquatic biota, an important consideration is the degree of dilution associated with the discharge to surface water. Contaminants being released from an area of the sediment would be rapidly diluted in the river. The highest concentrations in the river water would thus occur in a layer above the sediment where the release is occurring. Plants, benthic macroinvertebrates, and bottom feeding fishes are likely to be present in this layer and would thus receive the highest exposures to the released contaminants. However, a documented model to estimate the concentrations on this basis was not identified.

A previous assessment of toxicological impact on aquatic biota at this site used an estimate that such water would be diluted 100 to 1,000-fold (GCA, 1985). In this SERA, the 100-fold dilution factor, which is at the more protective end of this range, is used for modeling contaminant concentrations in the river water from the groundwater results for

the sampling points nearer to the river - GP-4, GP-6, and MW-29C. The 1,000-fold dilution factor is used only for the results of MW-28C. This well is located substantially farther from the river shore than the other sample points and displays concentrations of a number of contaminants that are substantially higher than seen at the other sample points.

The equation used for modeling river water concentrations from groundwater results is:

$$RW = DF * GW$$

where RW = river water concentration in milligrams of contaminant per liter of water,
DF = dilution factor, 100 for GP-4, GP-6, MW-29C results, 1,000 for MW-28C,
GW = groundwater concentration in milligram per liter.

The data used in this screening risk assessment are the results of the 2006 annual groundwater monitoring (Burns & McDonnell, 2006). These data are presented in the form of a SADA file in Appendix A. SADA is the Spatial Analysis and Decision Assistance free software developed by the Institute for Environmental Modeling at the University of Tennessee. This software includes modules to facilitate visualization of data, statistical analysis, and human and ecological risk assessment.

As shown in Table 1, groundwater concentrations were selected from the data to model the river water concentrations. The maximum concentrations of each contaminant detected in the groundwater were generally used. However, in a few cases where the maximum detection occurred in monitoring well MW28-C, results from other samples points would result in a higher estimated river water concentration due to the difference in the dilution factor. In these cases, the lower groundwater concentrations from these other sample points were used instead of the MW-28C concentration.

2.3 Environmental Screening Levels

A number of ecological screening levels (ESLs) are available. These levels have been prepared by various governmental regulatory agencies and researchers. Some of these ESLs have been developed for general use while others address potential risks to receptors at specific trophic levels. Especially because of this last consideration, it seemed appropriate to screen the modeled river water concentrations versus a collection of these ESLs rather than attempting to select a single ESL to be protective of all receptors. The twelve ESLs selected are part of a set that are available for ecological screening through the SADA software. ESLs excluded from the SADA set are those which either have no values for the chemicals of potential concern (COPCs) or which are clearly not applicable to the current site (i.e., maritime ESLs). The ESLs used are summarized in Table 2.

The National Guidelines and Standards Office of the Environmental Quality Branch of Environment Canada provides nationally approved, science-based guidelines for water quality. The Canadian Water Quality Guidelines (Canadian WQG) are developed to

provide basic scientific information about water quality parameters and ecologically relevant toxicological threshold values for Canadian species to protect specific water uses. In deriving Canadian water quality guidelines for aquatic life, all components of the aquatic ecosystem (e.g., algae, macrophytes, invertebrates, fish) are considered if the data are available. The goal is to protect all life stages during an indefinite exposure to water. The guidelines provide a numeric value or narrative statement outlining the recommended guideline for over 100 substances, which, if exceeded, may impair the health of Canadian ecosystems and their beneficial uses.

The Canadian WQGs are derived from the available literature on the effects of the substance or physical property (e.g., temperature) on various species for the protection of the appropriate use (e.g., aquatic life). Guidelines should not be regarded as a blanket value for national water quality; guidelines may need to be modified on a site-specific basis to account for local conditions. For most water quality variables, a single maximum value, which is not to be exceeded, is recommended as a Canadian water quality guideline. This maximum value is based on a long-term no-effect concentration. Unless otherwise specified, a guideline value refers to the total concentration in an unfiltered sample. When available, the lowest observable effects level (LOEL) from a chronic exposure study on the most sensitive native Canadian species is multiplied by a safety factor of 0.1 to arrive at the final guideline concentration. Alternatively, the lowest LC50 or EC50 from an acute exposure study is multiplied by an acute/chronic ratio or the appropriate application factor (i.e., 0.05 for nonpersistent variables; 0.01 for persistent variables) to determine the final guideline concentration.

The EC20 Fish benchmark is the lowest test EC20 (20% effects concentration) values for fish. It represents the highest tested concentration not causing a reduction of as much as 20% in the reproductive output of female test organisms (Suter, 1996).

The EC25 Bass Population benchmark consists of estimates of the concentration causing a 25% reduction in the recruit abundance of a population of largemouth bass (Suter, 1996).

EPA Region 4 - Acute benchmarks are criteria or test endpoints divided by a factor of 10. The Region 4 surface water screening values were obtained from Water Quality Criteria documents and represent the chronic ambient water quality criteria values for the protection of aquatic life. They are intended to protect 95% of the species, 95% of the time. If there was insufficient information available to derive a criterion, the lowest reported effect level was used with the application of a safety factor of ten to protect for a more sensitive species. A safety factor of ten was also used to derive a chronic value if only acute information was available. Since these numbers are based on conservative endpoints and sensitive ecological effects data, they represent a preliminary screening of site contaminant levels to determine if there is a need to conduct further investigations at the site. See http://www.epa.gov/region04/waste/ots/ecolbul.htm#tbl1.

EPA Region 4 – Chronic benchmarks are criteria or test endpoints divided by a factor of 10. The Region IV surface water screening values were obtained from Water Quality

Criteria documents and represent the chronic ambient water quality criteria values for the protection of aquatic life. They are intended to protect 95% of the species, 95% of the time. If there was insufficient information available to derive a criterion, the lowest reported effect level was used with the application of a safety factor of ten to protect for a more sensitive species. A safety factor of ten was also used to derive a chronic value if only acute information was available. Since these numbers are based on conservative endpoints and sensitive ecological effects data, they represent a preliminary screening of site contaminant levels to determine if there is a need to conduct further investigations at the site.

The EPA R5 ESL benchmarks are Region 5 media-specific (soil, water, sediment, and air) Ecological Screening Levels (ESLs) for RCRA Appendix IX hazardous constituents. The ESLs are initial screening levels with which the site contaminant concentrations can be compared. The ESLs help to focus the investigation on those areas and chemicals that are most likely to pose an unacceptable risk to the environment. ESLs also impact the data requirements for the planning and implementation of field investigations. ESLs alone are not intended to serve as cleanup levels. See the August 2003 revision of the ESLs (formerly EDQLs) at http://www.epa.gov/reg5rcra/ca/ESL.pdf.

US EPA Region 6 recommends use of surface water benchmarks developed for the Texas Natural Resource Conservation Commission. These benchmarks are conservative screening level values intended to be protective of aquatic biota. Values were compiled from a prioritized list of published values. The primary benchmarks are chronic criteria obtained from Texas surface water quality standards or the most current federal National Ambient Water Quality Criteria. Additional benchmarks were derived using the LC50 approach. TNRCC Water Quality Division chronic values, ORNL secondary chronic values (Suter and Tsao 1996), or EPA Region 4 chronic screening values, in that order, were consulted to expand the number of chemicals with acceptable benchmarks.

The LCV Aquatic Plants benchmarks are the lowest acceptable chronic values for aquatic plants based on the geometric mean of the Lowest Observed Effect Concentration and the No Observed Effect Concentration. Chronic values are used to calculate the chronic NAWQC, but the lowest chronic value may be lower than the chronic NAWQC. Because of the short generation time of algae and the relative lack of standard chronic tests for aquatic plants, EPA guidelines are followed in using any algal test of at least 96-hour duration and any biologically meaningful response for the plant values.

The LCV Daphnids benchmark is the lowest acceptable chronic value for daphnids is based on either the geometric mean of the Lowest Observed Effect Concentration and the No Observed Effect Concentration or an extrapolation from 48-hour LC50s using equations from Suter et al (1987) and Suter (1993).

The equations for a daphnid CV for a non-metallic contaminant is:

Log CV = 1.11 log LC50 – 1.30 (PI = 1.35)

The LC50 is the lowest species mean 48-hour EC50 for Daphnids. The 95% prediction interval is log CV +- the PI value (95% prediction intervals contain 95% of observations).

The lowest acceptable chronic value for fish is based on either the geometric mean of the Lowest Observed Effect Concentration and the No Observed Effect Concentration or an extrapolation from 96-hour LC50s using equations from Suter et al (1987) and Suter (1993).
The equation for a fish CV for a non-metallic contaminant is:

Log CV = 1.07 log LC50 – 1.51 (PI = 1.5)

The LC50 is the lowest species mean 96-hour EC50 for fish. The 95% prediction interval is log CV +- the PI value (95% prediction intervals contain 95% of observations).

Tier II values were developed so that aquatic benchmarks could be established with fewer data than are required for National Ambient Water Quality Criteria. The Tier II Secondary Acute Value (SAV) is derived by taking the lowest genus mean acute value from data meeting specified criteria and dividing it by a Final Acute Value Factor whose value depends on the number of acute data requirements that are met. The Tier II Secondary Chronic Value (SCV) is derived by dividing the Secondary Acute Value (see above) by the Secondary Acute-Chronic Ratio. Values provided here are from Suter and Tsao (1996).

2.4 Risk Characterization

Risks are evaluated for the site by calculating Environmental Quotients (EQs) based on the ratio of the modeled river water concentrations to the ESLs:

$$EQ = \frac{RW}{ESL}$$

where EQ = Environmental Quotient, a unitless value,
RW = modeled river water concentration in milligrams per liter,
ESL = Environmental Screening Level in milligrams per liter.

If an EQ is equal to or less than 1, ecological effects are not expected to occur. If the EQ is greater than 1, ecological effects are possible. For the SERA, it is assumed that the toxic effects of the COPCs may be considered additive. After the EQs for all of the COPCs are calculated using one set of ESLs, these are combined into a total EQ.

3.0 RESULTS

The EQs calculated for COPCs at the CCC site are summarized in Table 3. For the US EPA Region 4 – Chronic benchmarks, the total EQ is 2, based mostly on 2,4-dimethylphenol. For Canadian WQCs, the total EQ is 2 based on toluene. For other nine sets of ESLs considered, the total EQs are 1 or less, indicating that adverse ecological effects are unlikely.

The US EPA Region 4 – Chronic benchmarks give a total EQ of 2, with 2,4-dimethylphenol as the major chemical posing ecological risks. 2,4-Dimethylphenol was detected in all the samples taken at the CCC site at concentrations ranging from 11 to 12,000J µg/L. The value used to calculate the river water concentration for the 2,4-dimethylphenol EQ was 4,300 µg/L, taken from GP-6 at a depth of 75 ft below ground surface (bgs). However, 2,4-dimethylphenol was detected at a higher concentration of 12,000J µg/L in monitoring well MW-28C. As is also done with toluene, the lower value from GP-6 was used to model the river water concentration because the modeling factor of 100 for GP-6 generated a higher modeled river water concentration than modeling with the value detected in MW-28C and a modeling factor of 1,000.

It should also be noted that elevated 2,4-dimethylphenol concentrations do not all occur at depth, as is the case with toluene. At GP-4 at 20 ft bgs, 1,000 µg/L 2,4-dimethylphenol was detected. If this concentration had been modeled to the river, an EQ of 0.5 would have been calculated relative to the EPA Region 4 - Chronic benchmarks.

The Region 4 – Chronic benchmarks are based on conservative estimates to provide preliminary screening values to determine whether further evaluation is needed. These are not intended to be indicative of levels that definitely require cleanup.

The total EQ based on the Canadian Water Quality Criteria (WQC) is 2 with toluene being the chemical responsible for the exceedance. Toluene was detected in all, but one, of the samples ranging in concentration from 10 to 690 µg/L. The value used to calculate the river water concentration for the toluene EQ was 310 µg/L, taken from GP-6 at a depth of 75 ft below ground surface (bgs). However, toluene was detected at a higher concentration of 690J µg/L in monitoring well MW-28C. At GP-4 and GP-6, the concentration of toluene is maximal at the 75 ft depth and decreases significantly in the shallower samples.

It should be noted that the depth of the samples from which these EQs are estimated probably exceed the depth of the river near the shore. Thus, if further investigations were to be planned, sampling of the river near the shore might not give useful results. The contaminants, possibly being deeper than the riverbed near the shore, may not be discharged into the river near the shore, but may migrate to an impact zone farther out where the river is deeper. It would thus be important in planning any future investigation to determine the depth of the river near the shore to evaluate whether there is a potential for COPCs to be discharged there.

4.0 REFERENCES

Burns & McDonnell, 2006. "Front Street Remedial Action Corporation Conservation Chemical Company Site: Report of Annual Groundwater Monitoring, Survey No. 33."

GCA Corporation, 1985. "Assessment of the Toxicological Impact of Contaminants at the Conservation Chemical Corporation Site to Aquatic Biota: Summary Report", prepared for US Environmental Protection Agency, Office of Waste Programs Enforcement, Washington, DC.

Suter, G.W. II, A.E. Rosen, E. Linder, and D.F. Parkhurst 1987. End points for responses of fish to chronic toxic exposures. Environmental Toxicology and Chemistry 6:793-809.

Suter, G.W. II. 1993. Ecological Risk Assessment. Lewis Publishers, Chelsea, MI.

Suter, G.W. II. 1996. "Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Freshwater Biota." Environ. Toxic. Chem. 15:1232-1241.

Suter, G.W. II and C.L. Tsao 1996. Toxicological benchmarks for screening potential contaminants of concern for effects on aquatic biota: 1996 revision. ES/ER/TM-96/R2. Oak Ridge National Laboratory, Oak Ridge, TN. http://www.hsrd.ornl.gov/ecorisk/tm96r2.pdf.

Texas Natural Resource Conservation Commission. 2001. Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas. Toxicology and Risk Assessment Section, Texas Natural Resource Conservation Commission, Austin, TX. RG-263 (revised).

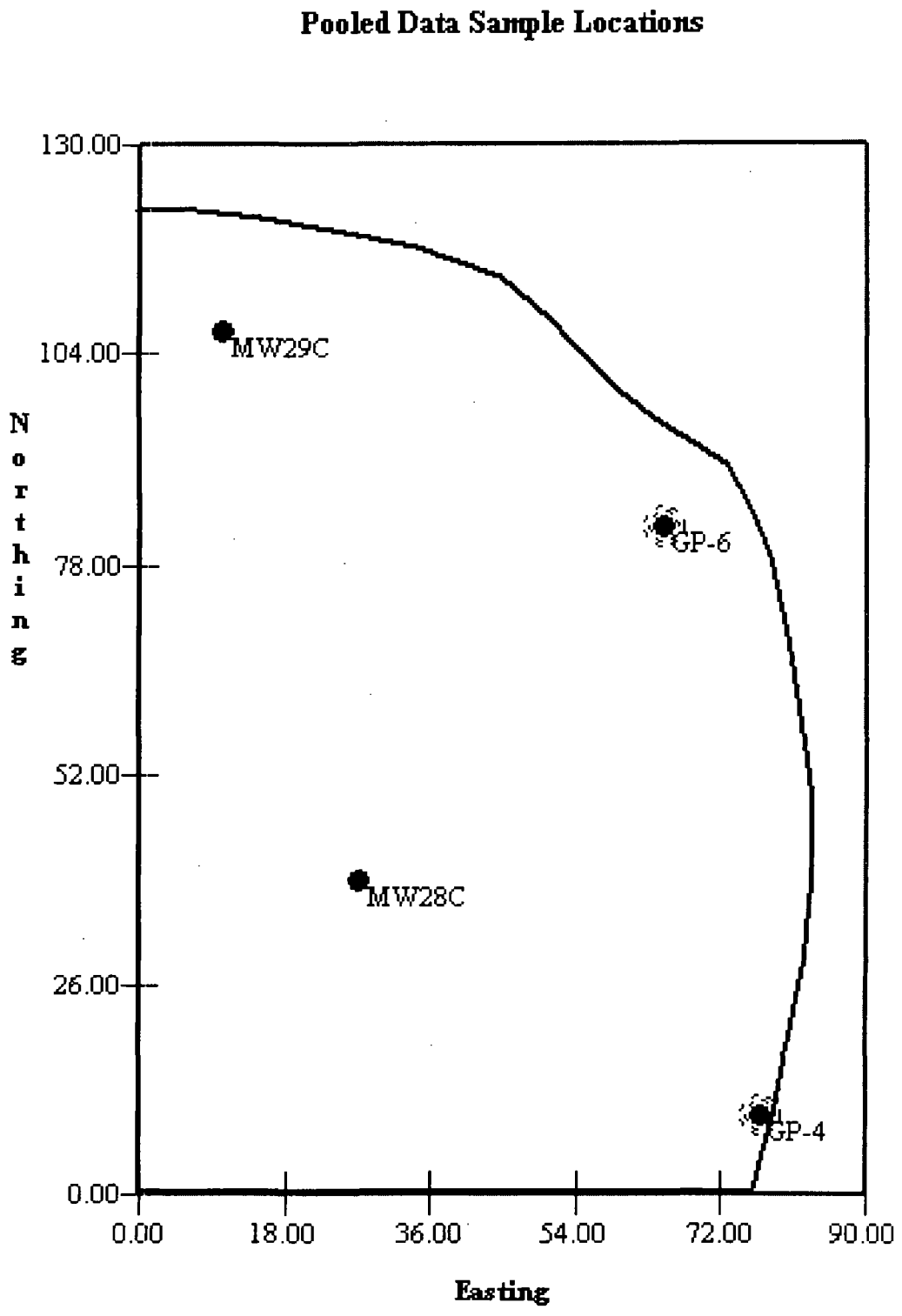

Figure 1 – Site Map of Area Considered

Table 1
Modeling of Surface Water Concentrations
Conservation Chemical Corporation Site, Kansas City, MO

Analyte	Groundwater Concentration	Units	Modeling Factor	Modeled Surface Water Concentration	Units	Sample Location	Depth
1,1-Dichloroethane	0.18	mg/L	100	0.0018	mg/L	GP-4	75
1,1-Dichloroethene	0.034	mg/L	1000	0.000034	mg/L	MW28C	87
cis-1,2-Dichloroethene	2.229	mg/L	100	0.02229	mg/L	GP-4[OS]	75
trans-1,2-Dichloroethene	0.0989	mg/L	100	0.000989	mg/L	GP-4[OS]	75
2,4,5-Trichlorophenol	0.064	mg/L	100	0.00064	mg/L	GP-6	75
2,4-Dichlorophenol	0.017	mg/L	100	0.00017	mg/L	GP-6	75
2,4-Dimethylphenol	4.3	mg/L	100	0.043	mg/L	GP-6	75
2-Butanone	3.1	mg/L	1000	0.0031	mg/L	MW28C	87
2-Methylphenol	5.4	mg/L	1000	0.0054	mg/L	MW28C	87
4-Methyl-2-pentanone	2	mg/L	1000	0.002	mg/L	MW28C	87
4-Methylphenol	1.6	mg/L	100	0.016	mg/L	GP-6	75
Acetone	19	mg/L	1000	0.019	mg/L	MW28C	87
Benzene	0.17	mg/L	100	0.0017	mg/L	GP-4	75
Ethylbenzene	0.016	mg/L	1000	0.00016	mg/L	GP-4	75
Methylene chloride	0.2	mg/L	1000	0.0002	mg/L	MW28C	87
Phenol	0.23	mg/L	100	0.0023	mg/L	GP-4	20
Toluene	0.31	mg/L	100	0.0031	mg/L	GP-6	75
Trichloroethylene (TCE)	0.141	mg/L	100	0.000753	mg/L	GP-4	75
Triethyl phosphorothioate [O,O,O-]	0.0017	mg/L	100	0.000017	mg/L	GP-4	75
Vinyl chloride	1.76	mg/L	100	0.0176	mg/L	GP-4	75
Xylene	0.06	mg/L	100	0.0006	mg/L	GP-4	75

[OS] On-site laboratory data from this sample used.

Table 2
Environmental Screening Levels
Conservation Chemical Corporation, Kansas City, MO

Analyte	Units	Canadian WQG	EC20 Fish	EC25 Bass Population	EPA R4- Acute	EPA R4- Chronic	EPA R5 ESL	EPA R6 FW	LCV Aquatic Plants	LCV Daphnids	LCV Fish	Tier II SAV	Tier II SCV
1,1-Dichloroethane	mg/L		8.22	1.59			0.047	5.13			14.7	0.83	0.047
1,1-Dichloroethene	mg/L			0.447	3.03	0.303	0.065	3	798	4.72	2.8	0.45	0.025
1,2-Dichloroethene	mg/L		5.72		13.5	1.35		14			9.54	1.1	0.59
2,4,5-Trichlorophenol	mg/L							*0.064*					
2,4-Dichlorophenol	mg/L				0.202	0.0365	0.011	0.085					
2,4-Dimethylphenol	mg/L				0.212	0.0212	0.1	0.21					
2-Butanone	mg/L		98.8	17.8			2.2	84.8		1390	282	240	14
2-Methylphenol	mg/L		*0.47*	*0.074*			0.067	1.12		1.32	0.489	0.23	0.013
4-Methyl-2-pentanone	mg/L			1.59			0.17	52.7			77.4	2.2	0.17
4-Methylphenol	mg/L						0.025	0.543					
Acetone	mg/L		162	23.7			1.7	202.4		1.56	508	28	1.5
Benzene	mg/L	0.37	0.021	0.229	0.53	0.053	0.114	0.13	525	98		2.3	0.13
Ethylbenzene	mg/L	0.09		0.398	4.53	0.453	*0.014*	2.18	438	12.9	0.44	0.13	0.0073
Methylene chloride	mg/L	0.0981	0.41	1.26	19.3	1.93	0.94	22		42.7	108	26	2.2
Phenol	mg/L		0.23	4.47	1.02	0.256	0.18	0.11	20	2.01	0.2		
Toluene	mg/L	0.002	0.026	0.2	1.75	0.175	0.253	2.9	245	25.2	1.27	0.12	0.0098
trans-1,2-Dichloroethene	mg/L						0.97	22					
Trichloroethylene (TCE)	mg/L	0.021	5.76	0.232			0.047	1.11		7.26	11.1	0.44	0.047
Triethyl phosphorothioate [O,O,O-]	mg/L						0.0582						
Vinyl chloride	mg/L						0.93	5.63					
Xylene	mg/L		2.68				0.027	1.34			62.3	0.23	0.013

Table 3
Environmental Quotients
Conservation Chemical Corporation, Kansas City, MO

			ENVIRONMENTAL QUOTIENTS BASED ON											
Analyte	Concentration	Units	Canadian WQG	EC20 Fish	EC25 Bass Population	EPA R4- Acute	EPA R4- Chronic	EPA R5 ESL	EPA R6 FW	LCV Aquatic Plants	LCV Daphnids	LCV Fish	Tier II SAV	Tier II SCV
1,1-Dichloroethane	0.0018	mg/L		0.0002	0.001			0.04	0 0004			0.0001	0 002	0.04
1,1-Dichloroethene	0.000034	mg/L			0.4	0 00001	0.0001	0.0005	0.00001	0.00000004	0.000007	0.00001	0.00008	0.001
cis-1,2-Dichloroethene	0.02229	mg/L		0.004		0.002	0.02		0.002			0.002	0.02	0.04
2,4,5-Trichlorophenol	0.00064	mg/L							0.01					
2,4-Dichlorophenol	0.00017	mg/L				0.0008	0.005	0.02	0.002					
2,4-Dimethylphenol	0.043	mg/L				0 2	2	0.4	0.2					
2-Butanone	0.0031	mg/L		0.00003	0.0002			0.001	0.00004		0.000002	0.00001	0.00001	0.0002
2-Methylphenol	0.0054	mg/L		0.01	0.07			0.08	0.005		0.004	0.01	0.02	0.4
4-Methyl-2-pentanone	0.002	mg/L			0.001			0 01	0.00004			0.00003	0 0009	0.01
4-Methylphenol	0.016	mg/L						0.6	0.03					
Acetone	0.019	mg/L		0.0001	0.0008			0.01	0.00009		0.01	0.00004	0.0007	0.01
Benzene	0.0017	mg/L	0.005	0.08	0.007	0.003	0.03	0.01	0.01	0.000003	0.00002		0 0007	0.01
Ethylbenzene	0.00016	mg/L	0.002		0.0004	0.00004	0.0004	0.01	0 00007	0.0000004	0.00001	0.000	0.001	0.02
Methylene chloride	0.0002	mg/L	0.002	0.0005	0.0002	0.00001	0.0001	0.0002	0.000009		0.000005	0.000002	0.000008	0.00009
Phenol	0.0023	mg/L		0.01	0.0005	0.002	0.009	0.01	0.02	0.0001	0.001	0.01		
Toluene	0.0031	mg/L	2	0.1	0.02	0.002	0.02	0.01	0.001	0.00001	0.0001	0.002	0.03	0.3
trans-1,2-Dichloroethene	0.000989	mg/L						0.001	0.00004					
Trichloroethylene (TCE)	0 000753	mg/L	0.04	0.0001	0.003			0.02	0.0007		0.0001	0.00007	0.002	0.02
Triethyl phosphorothioate [O,O,O-]	0.000017	mg/L						0.0003						
Vinyl chloride	0.0176	mg/L						0.02	0.0031					
Xylene	0.0006	mg/L		0 0002				0.02	0.0004			0.00001	0.003	0.05
TOTAL EQ			**2**	0.2	0.6	0.2	**2**	1	0.3	0.0001	0.02	0.03	0.1	0.9

APPENDIX A

SADA FILE OF DATA EVALUATED

SADA File of Data Evaluated

Easting	Northing	Media	Contamina	Sample	Result	Detect	Depth	Date
77	10	SW	1,1-Dichlor	GP-4	0	0	20	8/30/2004
77	10	SW	1,1-Dichlor	GP-4	0.00012	1	45	8/30/2004
77	10	SW	1,1-Dichlor	GP-4	0.0018	1	75	8/30/2004
77	10	SW	1,1-Dichlor	GP-4	0	0	20	8/30/2004
77	10	SW	1,1-Dichlor	GP-4	0	0	45	8/30/2004
77	10	SW	1,1-Dichlor	GP-4	0	0	75	8/30/2004
77	10	SW	2,4,5-Trich	GP-4	0	0	20	8/30/2004
77	10	SW	2,4,5-Trich	GP-4	0.00001	1	45	8/30/2004
77	10	SW	2,4,5-Trich	GP-4	0.00004	1	75	8/30/2004
77	10	SW	2,4-Dichlor	GP-4	0	0	20	8/30/2004
77	10	SW	2,4-Dichlor	GP-4	0	0	45	8/30/2004
77	10	SW	2,4-Dichlor	GP-4	0	0	75	8/30/2004
77	10	SW	2,4-Dimeth	GP-4	0.01	1	20	8/30/2004
77	10	SW	2,4-Dimeth	GP-4	0.0029	1	45	8/30/2004
77	10	SW	2,4-Dimeth	GP-4	0.0048	1	75	8/30/2004
77	10	SW	2-Butanone	GP-4	0	0	75	8/30/2004
77	10	SW	2-Butanone	GP-4	0.00081	1	20	8/30/2004
77	10	SW	2-Butanone	GP-4	0.00058	1	45	8/30/2004
77	10	SW	2-Methylph	GP-4	0.0046	1	20	8/30/2004
77	10	SW	2-Methylph	GP-4	0.0012	1	45	8/30/2004
77	10	SW	2-Methylph	GP-4	0.0013	1	75	8/30/2004
77	10	SW	4-methyl-2-	GP-4	0	0	20	8/30/2004
77	10	SW	4-methyl-2-	GP-4	0	0	45	8/30/2004
77	10	SW	4-methyl-2-	GP-4	0.00023	1	75	8/30/2004
77	10	SW	4-Methylph	GP-4	0.0051	1	20	8/30/2004
77	10	SW	4-Methylph	GP-4	0.0013	1	45	8/30/2004
77	10	SW	4-Methylph	GP-4	0.0012	1	75	8/30/2004
77	10	SW	Acetone	GP-4	0.0084	1	20	8/30/2004
77	10	SW	Acetone	GP-4	0.0074	1	45	8/30/2004
77	10	SW	Acetone	GP-4	0.0036	1	75	8/30/2004
77	10	SW	Benzene	GP-4	0	0	20	8/30/2004
77	10	SW	Benzene	GP-4	0	0	45	8/30/2004
77	10	SW	Benzene	GP-4	0.0017	1	75	8/30/2004
77	10	SW	cis-1,2-Dicl	GP-4	0.0017	1	20	8/30/2004
77	10	SW	cis-1,2-Dicl	GP-4	0.001	1	45	8/30/2004
77	10	SW	cis-1,2-Dicl	GP-4	0.0021	1	75	8/30/2004
77	10	SW	Ethylbenze	GP-4	0	0	20	8/30/2004
77	10	SW	Ethylbenze	GP-4	0	0	45	8/30/2004
77	10	SW	Ethylbenze	GP-4	0.00016	1	75	8/30/2004
77	10	SW	Methylene	GP-4	0	0	20	8/30/2004
77	10	SW	Methylene	GP-4	0	0	45	8/30/2004
77	10	SW	Methylene	GP-4	0	0	75	8/30/2004
77	10	SW	O,O,O-Trie	GP-4	0	0	20	8/30/2004
77	10	SW	O,O,O-Trie	GP-4	0	0	45	8/30/2004
77	10	SW	O,O,O-Trie	GP-4	0.000017	1	75	8/30/2004
77	10	SW	Phenol	GP-4	0.0023	1	20	8/30/2004
77	10	SW	Phenol	GP-4	0.00056	1	45	8/30/2004
77	10	SW	Phenol	GP-4	0.00048	1	75	8/30/2004

77	10	SW	Toluene	GP-4	0.0001	1	20	8/30/2004
77	10	SW	Toluene	GP-4	0.00012	1	45	8/30/2004
77	10	SW	Toluene	GP-4	0.0015	1	75	8/30/2004
77	10	SW	Total Xyle	GP-4	0	0	20	8/30/2004
77	10	SW	Total Xyle	GP-4	0	0	45	8/30/2004
77	10	SW	Total Xyle	GP-4	0.0006	1	75	8/30/2004
77	10	SW	trans-1,2-D	GP-4	0	0	20	8/30/2004
77	10	SW	trans-1,2-D	GP-4	0	0	45	8/30/2004
77	10	SW	trans-1,2-D	GP-4	0.00014	1	75	8/30/2004
77	10	SW	Trichloroetl	GP-4	0	0	20	8/30/2004
77	10	SW	Trichloroetl	GP-4	0	0	45	8/30/2004
77	10	SW	Trichloroetl	GP-4	0	0	75	8/30/2004
77	10	SW	Vinyl Chlor	GP-4	0.00057	1	20	8/30/2004
77	10	SW	Vinyl Chlor	GP-4	0.00066	1	45	8/30/2004
77	10	SW	Vinyl Chlor	GP-4	0.011	1	75	8/30/2004
65	83	SW	1,1-Dichlor	GP-6	0	0	20	8/30/2004
65	83	SW	1,1-Dichlor	GP-6	0	0	45	8/30/2004
65	83	SW	1,1-Dichlor	GP-6	0.0015	1	75	8/30/2004
65	83	SW	1,1-Dichlor	GP-6	0	0	20	8/30/2004
65	83	SW	1,1-Dichlor	GP-6	0	0	45	8/30/2004
65	83	SW	1,1-Dichlor	GP-6	0	0	75	8/30/2004
65	83	SW	2,4,5-Trich	GP-6	0	0	20	8/30/2004
65	83	SW	2,4,5-Trich	GP-6	0	0	45	8/30/2004
65	83	SW	2,4,5-Trich	GP-6	0.00064	1	75	8/30/2004
65	83	SW	2,4-Dichlor	GP-6	0	0	20	8/30/2004
65	83	SW	2,4-Dichlor	GP-6	0	0	45	8/30/2004
65	83	SW	2,4-Dichlor	GP-6	0.00017	1	75	8/30/2004
65	83	SW	2,4-Dimeth	GP-6	0.00011	1	20	8/30/2004
65	83	SW	2,4-Dimeth	GP-6	0.0029	1	45	8/30/2004
65	83	SW	2,4-Dimeth	GP-6	0.043	1	75	8/30/2004
65	83	SW	2-Butanon	GP-6	0	0	20	8/30/2004
65	83	SW	2-Butanon	GP-6	0	0	45	8/30/2004
65	83	SW	2-Butanon	GP-6	0	0	75	8/30/2004
65	83	SW	2-Methylph	GP-6	0	0	20	8/30/2004
65	83	SW	2-Methylph	GP-6	0.00059	1	45	8/30/2004
65	83	SW	2-Methylph	GP-6	0.0039	1	75	8/30/2004
65	83	SW	4-Methylph	GP-6	0	0	20	8/30/2004
65	83	SW	4-Methylph	GP-6	0	0	45	8/30/2004
65	83	SW	4-Methylph	GP-6	0.016	1	75	8/30/2004
65	83	SW	Acetone	GP-6	0	0	20	8/30/2004
65	83	SW	Acetone	GP-6	0.00029	1	45	8/30/2004
65	83	SW	Acetone	GP-6	0.0046	1	75	8/30/2004
65	83	SW	Benzene	GP-6	0	0	20	8/30/2004
65	83	SW	Benzene	GP-6	0	0	45	8/30/2004
65	83	SW	Benzene	GP-6	0.0011	1	75	8/30/2004
65	83	SW	cis-1,2-Dicl	GP-6	0	0	20	8/30/2004
65	83	SW	cis-1,2-Dicl	GP-6	0.00062	1	45	8/30/2004
65	83	SW	cis-1,2-Dicl	GP-6	0.016	1	75	8/30/2004
65	83	SW	Ethylbenze	GP-6	0	0	20	8/30/2004
65	83	SW	Ethylbenze	GP-6	0	0	45	8/30/2004
65	83	SW	Ethylbenze	GP-6	0	0	75	8/30/2004
65	83	SW	Methylene	GP-6	0	0	20	8/30/2004

65	83	SW	Methylene	GP-6	0	0	45	8/30/2004
65	83	SW	Methylene	GP-6	0.0001	1	75	8/30/2004
65	83	SW	4-methyl-2	GP-6	0	0	20	8/30/2004
65	83	SW	4-methyl-2	GP-6	0	0	45	8/30/2004
65	83	SW	4-methyl-2	GP-6	0.00014	1	75	8/30/2004
65	83	SW	Phenol	GP-6	0	0	20	8/30/2004
65	83	SW	Phenol	GP-6	0	0	45	8/30/2004
65	83	SW	Phenol	GP-6	0	0	75	8/30/2004
65	83	SW	Toluene	GP-6	0	0	20	8/30/2004
65	83	SW	Toluene	GP-6	0.00023	1	45	8/30/2004
65	83	SW	Toluene	GP-6	0.0031	1	75	8/30/2004
65	83	SW	Total Xyle	GP-6	0	0	20	8/30/2004
65	83	SW	Total Xyle	GP-6	0	0	45	8/30/2004
65	83	SW	Total Xyle	GP-6	0.00025	1	75	8/30/2004
65	83	SW	trans-1,2-D	GP-6	0	0	20	8/30/2004
65	83	SW	trans-1,2-D	GP-6	0	0	45	8/30/2004
65	83	SW	trans-1,2-D	GP-6	0.00018	1	75	8/30/2004
65	83	SW	Trichloroeth	GP-6	0	0	20	8/30/2004
65	83	SW	Trichloroeth	GP-6	0	0	45	8/30/2004
65	83	SW	Trichloroeth	GP-6	0.0002	1	75	8/30/2004
65	83	SW	Vinyl Chlor	GP-6	0	0	20	8/30/2004
65	83	SW	Vinyl Chlor	GP-6	0.0003	1	45	8/30/2004
65	83	SW	Vinyl Chlor	GP-6	0.012	1	75	8/30/2004
27	39	SW	1,1-Dichlor	MW28C	0.00018	1	87	8/30/2004
27	39	SW	1,1-Dichlor	MW28C	0.000034	1	87	8/30/2004
27	39	SW	2,4,5-Trich	MW28C	0	0	87	8/30/2004
27	39	SW	2,4-Dichlor	MW28C	0	0	87	8/30/2004
27	39	SW	2,4-Dimeth	MW28C	0	1	87	8/30/2004
27	39	SW	2-Butanone	MW28C	0.0031	1	87	8/30/2004
27	39	SW	2-Methylph	MW28C	0.0054	1	87	8/30/2004
27	39	SW	4-Methylph	MW28C	0.0046	1	87	8/30/2004
27	39	SW	Acetone	MW28C	0.019	1	87	8/30/2004
27	39	SW	Benzene	MW28C	0.00014	1	87	8/30/2004
27	39	SW	cis-1,2-Dicl	MW28C	0.0068	1	87	8/30/2004
27	39	SW	Ethylbenze	MW28C	0.000017	1	87	8/30/2004
27	39	SW	Methylene	MW28C	0.0002	1	87	8/30/2004
27	39	SW	4-methyl-2	MW28C	0.002	1	87	8/30/2004
27	39	SW	Phenol	MW28C	0.001	1	87	8/30/2004
27	39	SW	Toluene	MW28C	0.00069	1	87	8/30/2004
27	39	SW	Total Xyle	MW28C	0.000071	1	87	8/30/2004
27	39	SW	trans-1,2-D	MW28C	0.000019	1	87	8/30/2004
27	39	SW	Trichloroeth	MW28C	0.00026	1	87	8/30/2004
27	39	SW	Vinyl Chlor	MW28C	0.0024	1	87	8/30/2004
10	107	SW	1,1-Dichlor	MW29C	0.00026	1	89	8/30/2004
10	107	SW	1,1-Dichlor	MW29C	0	0	89	8/30/2004
10	107	SW	2,4,5-Trich	MW29C	0	0	89	8/30/2004
10	107	SW	2,4-Dichlor	MW29C	0	0	89	8/30/2004
10	107	SW	2,4-Dimeth	MW29C	0.0054	1	89	8/30/2004
10	107	SW	2-Butanone	MW29C	0	0	89	8/30/2004
10	107	SW	2-Methylph	MW29C	0.00043	1	89	8/30/2004
10	107	SW	4-Methylph	MW29C	0	0	89	8/30/2004
10	107	SW	Acetone	MW29C	0	0	89	8/30/2004

10	107	SW	Benzene	MW29C	0.00044	1	89	8/30/2004
10	107	SW	cis-1,2-Dicl	MW29C	0.0012	1	89	8/30/2004
10	107	SW	Ethylbenze	MW29C	0	0	89	8/30/2004
10	107	SW	Methylene	MW29C	0	0	89	8/30/2004
10	107	SW	Phenol	MW29C	0	0	89	8/30/2004
10	107	SW	Toluene	MW29C	0.00046	1	89	8/30/2004
10	107	SW	Total Xylei	MW29C	0.00017	1	89	8/30/2004
10	107	SW	trans-1,2-D	MW29C	0	0	89	8/30/2004
10	107	SW	Trichloroetl	MW29C	0	0	89	8/30/2004
10	107	SW	Vinyl Chlor	MW29C	0.0023	1	89	8/30/2004
77	10	SW	cis-1,2-Dicl	GP-4o	0.00228	1	20	8/30/2004
77	10	SW	cis-1,2-Dicl	GP-4o	0.00373	1	45	8/30/2004
77	10	SW	cis-1,2-Dicl	GP-4o	0.02229	1	75	8/30/2004
65	83	SW	cis-1,2-Dicl	GP-6o	0	1	20	8/30/2004
65	83	SW	cis-1,2-Dicl	GP-6o	0.000648	1	45	8/30/2004
65	83	SW	cis-1,2-Dicl	GP-6o	0.01616	1	75	8/30/2004
77	10	SW	trans-1,2-D	GP-4o	0	1	20	8/30/2004
77	10	SW	trans-1,2-D	GP-4o	0	0	45	8/30/2004
77	10	SW	trans-1,2-D	GP-4o	0.000989	1	75	8/30/2004
65	83	SW	trans-1,2-D	GP-6o	0	0	20	8/30/2004
65	83	SW	trans-1,2-D	GP-6o	0	0	45	8/30/2004
65	83	SW	trans-1,2-D	GP-6o	0.000655	1	75	8/30/2004
77	10	SW	Trichloroetl	GP-4o	0	1	20	8/30/2004
77	10	SW	Trichloroetl	GP-4o	0	0	45	8/30/2004
77	10	SW	Trichloroetl	GP-4o	0	1	75	8/30/2004
65	83	SW	Trichloroetl	GP-6o	0	0	20	8/30/2004
65	83	SW	Trichloroetl	GP-6o	0	0	45	8/30/2004
65	83	SW	Trichloroetl	GP-6o	0.000753	1	75	8/30/2004
77	10	SW	Vinyl Chlor	GP-4o	0.00101	1	20	8/30/2004
77	10	SW	Vinyl Chlor	GP-4o	0.00152	1	45	8/30/2004
77	10	SW	Vinyl Chlor	GP-4o	0.0176	1	75	8/30/2004
65	83	SW	Vinyl Chlor	GP-6o	0	0	20	8/30/2004
65	83	SW	Vinyl Chlor	GP-6o	0.000466	1	45	8/30/2004
65	83	SW	Vinyl Chlor	GP-6o	0.00672	1	75	8/30/2004