UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5

DATE: October 18, 2001

SUBJECT: Chemical Recovery Systems, Elyria, Ohio, Preliminary Ecological Risk Assessment

FROM: David Brauner, Ecologist DMB

TO: Gwen Massenburg

I have performed a Screening Level (preliminary) Ecological Risk Assessment (SLERA) for the above mentioned site, including some basic food-chain exposure modeling and sediment screening. The SLERA is based on information from a Site Team Evaluation Prioritization (STEP) Report (for Chemical Recovery Systems, Sept. 29, 1997) and fish tissue data from 1982 and 1992. I have confined my investigation to fish, surface water, and sediments collected from the East Branch of the Black River. The focus of this SLERA is on potentially contaminated fish and those ecological receptors exposed to potentially contaminated sediments and surface waters.

I compared the maximum concentrations in the fish tissue (each species was analyzed separately), as well as the maximum concentrations in the sediment and surface water samples, to established benchmarks. The ratio of the maximum concentration to the screening value is known as the Hazard Quotient (HQ). If the HQ for a particular Contaminant of Potential Ecological Concern (COPEC) is greater than one, there is the potential for ecological risk.

It does not appear that Polychlorinated Biphenyls or pesticides pose any significant ecological threat to the fish in the East Branch of the Black River. With the exception of PCB Aroclor-1248 in the common carp, no HQ exceeded one in any of the fish tissue data for which there were benchmarks available. Even in that one case, the HQ was only 1.01 (and the benchmark was for PCBs in general), which suggests that there may not be ecological risk due to that chemical or that the risk may be negligible. No pesticide had a HQ greater than one. There is some uncertainty associated with this analysis as many chemicals did not have benchmarks; and in most cases, screening numbers for a surrogate species (generally either Brook Trout or Rainbow Trout) were used for the risk calculations. Evidently, no metal analysis was done on fish caught in the East Branch of the Black River, as no data were available for that branch of the river.

A basic food-chain model was also done to examine potential risk to piscivorus birds (Great Blue Heron) and mammals (mink). This model may or may not be appropriate due to the apparently highly developed areas in proximity to the Black River. In any case, there was no indication of risk to piscivores from exposure through the food chain. Exposure was estimated using the following equation: $(C \times I)/bw = ED$, where:

C = concentration in prey, I = food intake rate, bw = body weight of predator, ED = estimated daily dose. The ED was compared to established screening numbers from the Wildlife Exposure Handbook (EPA 600/R-93/187) to calculate HQs. No HQs exceeded one.

There is, however, some indication of potential ecological risk from the sediments. Table 1 indicates which COPECs potentially pose ecological risk at the site as suggested by HQs larger than one. There were no screening numbers for the following chemicals: 4-chlorophenyl phenyl ether, carbazole, endrin ketone, beryllium, calcium, magnesium, potassium,

sodium, and thallium. The lack of screening numbers represents a source of uncertainty. Calcium, magnesium, potassium, and sodium can be considered "essential nutrients" and hence may not pose an ecological risk.

Table 1. COPECs in sediment samples

Chemical Contaminant	Maximum Concentration (ug/kg)	No. of Detections	Max. conc. estimated? (J)	Screening value (ug/kg)**	Hazard Quotient
phenanthrene	1900J (1600)*	8/8	Y	0.4	4750J (4000)
b-BHC	6.3	1/8	N	5	1.26
aldrin	5.2	8/16	N	2	2.6
endosulfan II	2.3J	1/4	Y	0.1	23.0
acenaphthene	140J	3/4	Y	17	8.235
fluoranthene	2900	8/8	N	39.8	72.864
a-chlordane	2.4J	3/4	Y	1.7	1.412
	(mg/kg)			(mg/kg)	
copper	99.5	4/4	N	54.8	1.816
iron	24200	4/4	N	20000	1.21
mercury	0.43	1/4	N	0.13	3.308
nickel	51.4	4/4	N	37.9	1.356

* For phenanthrene, the values in parentheses refer to the maximum NON-estimated values (1600 ug/kg) as opposed to the maximum estimated concentration (1900 ug/kg).

** Ref: aldrin, b-BHC: Ontario; endosulfan II: USEPA R5 ESL; fluoranthene, copper, nickel: ARCS NEC; iron: USEPA R6; a-chlordane, acenaphthene, phenanthrene, mercury: USEPA R4

There is also the possibility of ecological risk from chemical contaminants in the surface water. Potential risk is primarily from inorganics, but two organic COPECs may also pose risk. Table 2 summarizes the COPECs that were detected and exceeded screening values. Again, calcium can be considered to be an "essential nutrient" and thus may not pose ecological risk.

Table 2. COPECs in surface water samples

Chemical Contaminant	Maximum Concentration (ug/l)	No. of Detections	Max. conc. estimated? (J)	Screening value (ug/l)*	Hazard Quotient
1,1-dichloroethane	110	1/5	N	47	2.34
Vinyl chloride	65	1/5	N	9.2	7.065
Aluminum	492	5/5	N	87	5.655
Cadmium	26.2	1/5	N	1.1	23.818
Calcium	176000	5/5	N	116000	1.517
Cobalt	9	1/5	N	5	1.8
Copper	709	5/5	N	11.8	60.085
Iron	2490	5/5	N	1000	2.490
Lead	10.4	3/5	N	3.2	3.25
Selenium	15.8	1/5	N	5	3.16
Zinc	121	5/5	N	106	1.142

* Ref: Vinyl chloride, cobalt: Region 5 ESLs; Calcium: LCV Daphnids; all others: Region 4 - Chronic

Conclusions and Recommendations:

According to results of fish tissue analyses, it appears that ecological risk to piscivores from organic compounds is negligible or absent. However, testing for inorganic contamination in fish tissue was not done for fish collected from the East Branch of the Black River. Therefore, additional fish collection with tissue analysis should be done to test for inorganic contamination.

On the other hand, analyses of surface water and sediment samples suggest the potential for ecological risk in both of those media. The most recent sediment and surface water sampling results were reported in the 1997 STEP report. There was potentially significant risk from some organic compounds in sediments, but risk from organic COPECs in surface water may be negligible. There is also potential ecological risk from inorganic COPECs in both sediments and surface water. For surface waters, the highest concentrations of, and in some cases the only detection of, many COPECs were in the same sample location. This suggests the possibility of a localized "hot-spot", but inorganic contamination was found in most or all samples. Pesticides, other organics (such as PAHs), and inorganics can be highly toxic to aquatic organisms, including fish.

As a result, it would be informative to do follow-up sampling of both sediments and surface waters to determine if the concentrations of the COPECs that were detected in the 1997 study are still persisting, their concentrations have changed, or if there are new COPECs. These results will be will be useful in characterizing current potential ecological risk and determining if that risk has changed since 1997.

I may be contacted at 6-1526 if you have questions or comments.

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References:

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USEPA Region 6 - Freshwater : ***no reference available***

cc: Larry Schmitt, Section Chief, RRS #1