



DEPARTMENT OF THE AIR FORCE
AIR FORCE INSTITUTE FOR ENVIRONMENT, SAFETY AND
OCCUPATIONAL HEALTH RISK ANALYSIS (AFMC)
BROOKS AIR FORCE BASE TEXAS

13 Oct 00

MEMORANDUM FOR 314 AW/JA
ATTENTION: LT COL ROGERS

FROM: AFIERA/RSRE
2513 Kennedy Circle
Brooks AFB TX 78235-5123

SUBJECT: Consultative Letter, IERA-RS-BR-CL-2000-0088, Status Update of the Ecological Impact/Transport and Transformation Subcommittee, Interagency Perchlorate Steering Committee (IPSC)

1. AFIERA/RSRE, as co-chair of the Ecological Impact/Transport and Transformation Subcommittee (Eco Subcommittee) of the IPSC, is pleased to provide you an update on the activities of the subcommittee. This includes activities since the subcommittee's submission of a document on ecological effects of perchlorate to USEPA NCEA in November 1998.
2. Originally, the Eco Subcommittee had planned to submit their additional data and field study results to the IPSC by October 2000. However, analytical method development have caused the project timelines to slip, resulting in a projected delivery date of mid-February 2001 for the Perchlorate Biotransport Study Report. Of course, we will send interim analytical results as soon the data has been validated. In this update, we have presented the results of additional toxicity assays, described analytical challenges and proposed a timeline for completion of these tasks.
3. Final hardcopy reports of the Perchlorate Biotransport Study workplan were mailed on 13 Oct 00. Final bioassay reports will be forwarded electronically as they are received. If you have any questions, please call me at DSN 240-6121 or Dr Ron Porter at 240-6127.

A handwritten signature in black ink that reads "G. Cornell Long".

G. CORNELL LONG, GS-13
Environmental Scientist

Attachments:
Ecological Impact/Transport And Transformation Subcommittee, Status Update--11 October 2000

cc: Annie Jarabek, USEPA NCEA
Mark Sprenger, USEPA OERR-ERTC

Clarence Callahan, USEPA Region IX Superfund Office
Randy Bruins, USEPA NCEA

ECOLOGICAL IMPACT/TRANSPORT AND TRANSFORMATION SUBCOMMITTEE

Status Update--11 October 2000

Introduction

This document will provide an update on the activities of the Ecological Impact/Transport and Transformation Subcommittee of the Interagency Perchlorate Steering Committee. This update will include activities since the Subcommittee's submission of a document on ecological effects of perchlorate to USEPA NCEA in November 1998. These activities include a meeting in Little Rock, AR, performance of toxicity assays and a biotransport study. It will also highlight challenges associated with the analysis of perchlorate in complex biological matrices. Finally, a schedule is presented with expected milestones from Oct 00 to Jan 01.

Meeting at Little Rock AFB, AR ("Eco Summit")

In April 1999, following the first external peer review on perchlorate, Lt Col Dan Rogers, USAF, hosted a meeting of invited experts and stakeholders to review recommendations on data gaps regarding ecological impact/transport and transformation of perchlorate. These recommendations were made by the IPSC Eco Subcommittee, USEPA NCEA and the external peer review panel. Identified data gaps were prioritized for funding purposes. Attendees represented USEPA, Texas Tech University, USAF, Quechan Indian Tribe, National Park Service and the Perchlorate Study Group. Beginning with the literature search on perchlorate toxicity conducted in early 1998, the group stepped through the sequence of events that led to the writing of the Subcommittee report, the recommendations in the USEPA draft characterization report (December 1998) and the report of the external peer review (February 1999).

Following a discussion of all recommendations, the group prioritized them based on whether they directly supported the risk characterization document, were funded, and would meet a Fall 1999 deadline (the initial projection of the next external peer review). Based on these criteria, the group prioritized the list of data gaps as shown below:

1. Farm gate analysis
2. Field studies (occurrence data)
3. Bioaccumulation analysis
4. Fish accumulation analysis
5. Translocation from irrigation water to irrigated crops
6. Seed accumulation
7. Maternal transfer of perchlorate to eggs (avian)
8. *Eisenia* full life cycle assay
9. Neurological effects in *Xenopus*
10. Toxicity mechanism in birds

Lt Col Rogers agreed to seek funding for the top three priorities and Dr Ron Porter (AFIERA/RSRE) offered that the AF would fund three chronic bioassays (*Selenastrum*, *Pimephales* and *Hyallolella*).

Funding Issues and Farmgate (Market Basket) Analysis

Lt Col Rogers was able to obtain a commitment from the Army to partially fund some of the identified data gaps and in November 1999 AFIERA/RSRE received \$650K from the Army Environmental Center. While RSRE pursued a contract that would address the site-specific studies and funded a follow-on effort with USEPA NERL/ERD, they also engaged in dialogue with USDA regarding the farmgate analysis, which subsequently became known as the market basket analysis. USDA offered a vehicle, called the Pesticide Data Program or PDP, which would allow easy sample collection of agricultural commodities. The PDP would facilitate collection of 100 samples of eight different commodities over a three month period. RSRE would secure the laboratory for the analysis. However, it became apparent that the sample collection, which is contracted to the states, would be far more costly than anticipated (~\$215K for 800 samples). When USDA was approached about becoming a funding partner to help offset the cost of the sample collection, they appeared reluctant to such a commitment and the project was postponed indefinitely.

Ecological Effects

A number of comments were made relative to the selection of "Tier 1" toxicity assays completed in Nov 98. The AF used internal funds to complete additional assays to fill data gaps identified in the peer review process. Internal EPA peer review recommended an algal assay (Nabholz). A non-daphnid sediment invertebrate assay was recommended by internal EPA peer review (Bruins and Suter). The external peer review (Cardwell) rated this need as a low priority. A chronic, life cycle assay for fish was recommended by both the internal and external peer reviews.

The completed bioassays include a 96-hour chronic toxicity assay using *Selenastrum capricornutum*, a 28-day chronic assay using *Hyallolella azteca* that measured survival, growth, and fecundity, and a 35-day early life stage definitive toxicity test using *Pimephales promelas* that measured growth, larval hatch, and larval survival. Results are shown in Table 1 along with results of previous assays funded by RSRE.

Table 1—Summary of Test Results

Test Species	Completion Date	Test Type	Endpoints (as mg/L ClO ₄)				
			LC ₅₀	NOEC	LOEC	ChV	IC25
<i>Daphnia magna</i>	Nov 98	Acute definitive	490				
<i>Pimephales promelas</i>	Nov 98	Acute definitive	1655				
<i>Eisenia foetida</i>	Nov 98	Acute definitive	4450/4450 ¹				
<i>Ceriodaphnia dubia</i>	Nov 98	Chronic definitive	66	10	33	18.2	17
<i>Pimephales promelas</i>	Nov 98	Chronic definitive	614	155	280	208	212
<i>Lactuca sativa</i>	Nov 98	Chronic definitive (soil)		<80	80	<80	78
<i>Lactuca sativa</i>	Nov 98	Chronic definitive (sand)		<80	80	<80	41
<i>Lactuca sativa</i>	Nov 98	Chronic definitive (soil) ²		40	80	56.6	30
<i>Lactuca sativa</i>	Nov 98	Chronic definitive (sand) ²		20	40	28.3	34.3
<i>Selenastrum capricornutum</i>	Sep 99	Definitive		500	1200	775	615 (96 hr)
<i>Hyallela azteca</i>	Oct 00	Chronic definitive		>1000	>1000	>1000	>1000
<i>Pimephales promelas</i>	Oct 00	Chronicdefinitive	>490	>490 larval surv >490 mean dry wt <28 larval effects	>490	>490	>490

¹ 7-day/14 day

² Second set of lettuce growth tests initiated since NOEC was not identified in initial tests.

Site-Specific (Biotransport) Studies

At the Little Rock meeting, there was a discussion of sites that would be appropriate for the field studies. The following list of sites (in no particular order) was developed:

1. Lake Mead/Las Vegas Wash, NV
2. Indian Head, MD (Navy)
3. Lower Colorado, AZ
4. McGregor, TX (Navy)
5. Holloman AFB/White Sands Natl Monument (AF and NPS site)

Selection criteria included known occurrence of perchlorate, site accessibility, site control, known or suspected exposure of ecological receptors, and community/political/regulator/site manager interest. The AF secured DOD funds to support field work at five sites. The AF was able to coordinate with 4 of the 5 site managers and get permission to conduct field activities at their sites. The Navy site in Texas came with too much political baggage and the AF was unable to get permission to conduct field activities there. The IPSC was asked to support cleanup programs at 2 additional sites, Allegany Ballistics Laboratory, WV (Navy) and Longhorn Army Ammunition Plant, TX. Those sites were added to the workplan for a total of six sites to be included in this effort. Funds to support the additional work at a sixth site were secured. The contract to conduct the site-specific studies was finalized in February 2000. The site visits for the study, which was titled the *Perchlorate Biotransport Study*, were conducted from March to May 2000. A workplan was developed outlining timelines, field activities and deliverables for the project.

Generally, this effort can be described as a "survey of occurrence" of perchlorate in ecological receptors. It is not a pilot study - nor is it an ecological risk assessment. Tissues are not processed for histological or biochemical analysis. Anomalies observed in field collected specimens were recorded. Data on the toxicity of perchlorate to ecological receptors is being developed as a separate effort in a number of laboratories.

Simply put, there are two basic questions that this effort will attempt to answer.

1. *Using the best available technology for analysis of perchlorate in environmental media and biological tissues, can perchlorate be detected in organisms collected from sites with known contamination?* (primary goal)
2. *At sites where perchlorate is detected in biological samples, is there a discernible relationship between the concentration of perchlorate in the samples and the concentration of perchlorate in the environmental media at the sample location?* (secondary goal)

Process

A preliminary site visit was made to each of the sites. Team members included wildlife biologists, ecological risk assessors, engineers, and toxicologists. Professional ecologists and biologists familiar with the ecosystems particular to each site participated in developing the workplan for each sampling location. Site managers led site tours during which potential ecological receptors were identified, catalogued, and categorized using guild-like groups as discussed by Glenn Suter (*Ecological Risk Assessment*, 1993). The approach used in conducting the contaminant pathway analysis was that recommended by James Maughan (*Ecological Assessment of Hazardous Sites*, 1993). See Figure 1.

This effort will follow the process through the 4th box. The activities in the 5th and 6th boxes are occurring concurrently as separate efforts. A collection of all the data will be forwarded to EPA. In order to enhance any statistical analyses that may be done, similar species will be collected across sites, when possible. For example, mourning doves will be collected (as available) at each site. The receptors that are identified in the work plan were **recommended** - changes were made in the field to collect the most appropriate species available. Professional judgement was used to determine the need for combining some of the sample locations and or some of the sample matrices.

The number of samples to be collected at each site is limited by the monies that are available for fieldwork and laboratory analysis. Our original estimate (based on nothing in particular) of \$250K (\$50K per site) for this effort has grown to a total of \$760K.

Field Modifications

An objective of the field effort was to collect identified biological samples from areas of known perchlorate contamination. Media samples, including soil, water, and sediment, were co-located with the biological samples where practical. Target species were those identified in the preliminary site visits based on their ease of collection, relative abundance, and suspected exposure to perchlorate. A conceptual site model was developed for each site. During the actual sampling events, substitutions for some of the plants and animals were made based on the professional judgement of the sampling team. Some of the targets were not present, some were present but in low numbers, and others were deemed unsuitable for collection because of resource limitations (time, cost, etc). Every effort was made to identify target species closely related to and occupying the same ecological niche as those originally identified. Examples include substituting white winged doves for mourning doves, mullet for carp, and ravens for blackbirds. Additionally, the sampling team consulted with local and state natural resource experts to choose appropriate surrogates.

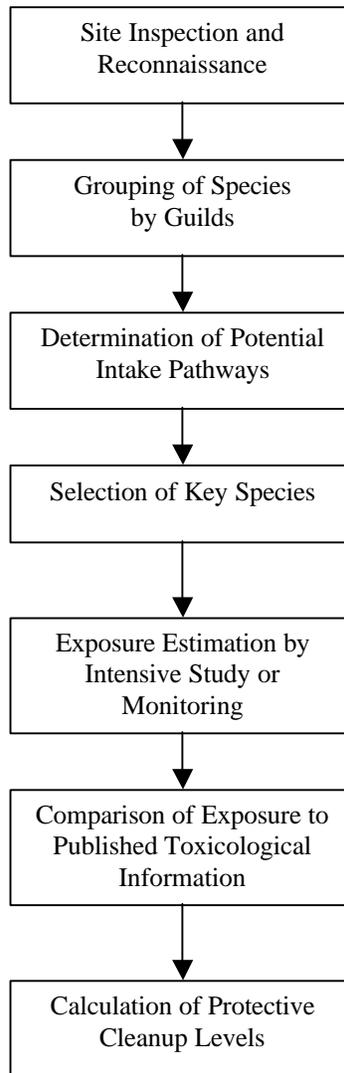


Figure 1

Analytical Considerations

When this project began, there was only one approved method for perchlorate analysis, EPA Method 314.0, Determination of Perchlorate in Drinking Water by Ion Chromatography. As a result, and since there is no official SW-846 method, RSRE has worked to ensure that methods used in support of this project adhere as closely to Method 314.0 as possible, with little modifications. RSRE secured the services of Clayton Analytical Group, a certified laboratory which provided acceptable performance data in the Spring 2000 Perchlorate PT study and met the requirements for approval to conduct perchlorate analysis in support of UCMR List 1 Assessment Monitoring. Unfortunately, Clayton has had to develop methods for soil, sediment, vegetation and animal tissues, resulting in the following investigations:

- Cleanup methods for all matrices. This has included adaptation of a number of different protocols, including a method offered by USEPA/NERL/ERD, and consultation with the instrument manufacturer, Dionex.
- Eluent solution. Clayton has spent a considerable amount of time working on method development using the 50 mM sodium hydroxide eluent solution as prescribed in EPA method 314.0. However, this has resulted in co-elution of perchlorate with other compounds in some of the more complex matrices. In late September 2000, Clayton adjusted the eluent to 25 mM and has started to achieve better separation. Previous method validations will be re-accomplished with the lower eluent concentration.
- Method detection limits (MDL). As prescribed by standard protocol for new methods, Clayton has had to perform MDL studies for all matrices on each instrument to be used in production analytical work for the project.
- Detection limits. In order to achieve the lower detection limits necessary to evaluate the occurrence of perchlorate in the biological tissues, validation studies were performed to ensure accuracy, precision and reproducibility.

Additionally, Clayton's primary investigator for the perchlorate project was recently terminated. His replacement, a PhD analytical chemist, started work on the project at the end of September. There has been an expected decrease in validation work as the new chemist becomes familiar with the project.

Clayton's recent accomplishments:

- Completed validation studies for soils, sediments and plant tissues.
- Method validation for animal tissues was begun on 10 Oct 00--projected completion 24 Oct 00

For this project, detection limits will be as low as possible for each tissue type. Wet weight detection limits for vegetation begin at 400 ug/kg (which corresponds to 4 ug/L in water at the instrument level) and vary based on water content. We estimated a total of over 1100 samples for this effort. Storage time for the sample extracts will be 30 days past project completion, which should provide sufficient time for any samples requiring re-analysis.

Schedule

The initial estimated completion date for the project was 30 Nov 00. The draft workplan, released 7 July 00, revised that to 23 Dec 00. However, a number of factors have contributed to a delay in project completion:

1. An additional site was added to the list of five. This added not only a minimum of two weeks for site visit and sample collection, but also 3-4 weeks for sample preparation, analysis and QA/QC.
2. Although preliminary site visits were completed in early May 00, field studies could not begin until late July 00 after the workplan was written and reviewed, and necessary federal and state collecting permits could be obtained.
3. Lab analysis is approximately 4-6 weeks behind schedule due to matrix problems and method validations (initial projected completion date for lab analysis was 11 Oct 00).

Since lab analysis may not be complete until late November 00, this has a negative impact on project completion, which will probably not occur until mid-January 01.

The workplan, which was submitted in draft form in Jun 00, is currently being finalized for submission to RSRE on 13 Oct 00.

Here are the expected milestones for the next couple of months:

- | | |
|---------|--|
| Oct 13: | Receive final workplan from contractor
Receive final bioassay reports from laboratory |
| Oct 24: | Method validation for animal tissues complete |
| Nov 30: | Projected completion of laboratory analysis for biotransport studies |
| Dec 1: | Addendum to Eco Subcommittee report "Perchlorate Ecological Risk Studies", Nov 1998 (will incorporate recent bioassay results) |
| Jan 8: | Draft biotransport study report from contractor |
| Feb 16: | Final report from contractor |

Product

A final report of this project will include tabular results and statistics of data collected, illustrations with significant results by field site, and figures showing highest perchlorate concentrations for each media (biological and environmental) at each location. A separate appendix with all lab data and QC summary will be available.