Air Force

Institute for
Environment, Safety, and Occupational Health
Risk
Analysis

Ecological Impact: Transport and Transformation of Perchlorate

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Ecological Impact/Transport and Transformation Subcommittee

- Formed in Jan 98 as subcommittee to IPSC
- Members - USEPA (2), USAF (2)
- Participated in stakeholder meetings, May and August 98, May 99
- Apr 99 - “eco summit” to prioritize future activities

Purpose of Subcommittee

- Identify and fill data gaps related to direct effects of perchlorate on ecological receptors
- Assess movement of perchlorate through ecosystems (biotransport)
- Determine levels of perchlorate in agricultural products
- Correlate movement of perchlorate in sub-surface soils to particular soil types

Ecological Impact/Transport and Transformation Subcommittee

- DOD funding to fill data gaps
  - USEPA NERL
  - Texas Tech University
  - Contractor laboratories
- 00-01 focus on site-specific biotransport studies

Literature Search: Bioassay Results

Test Species	Salt Form	Endpoints (ppm) LC_{50}	NOEC	LOEC
Xenopus laevis	$KClO_4$			50-100
Bufo arenarum	$KClO_4$			340
Petromyzon marinus	$KClO_4$			100
Hydra attenuata	AP			350
Salmonidae	$NaClO_4$	6000-7000		
Daphnia magna	$KClO_4$	670		
Agricultural crops	AP		<80	80
Ceriodaphnia dubia	AP	78	10	
Pimephales promelas	AP	270	10	
Xenopus laevis	AP	496	203	

Rationale for Bioassay Selection

- Numerous gaps on existing data
- “Tier I” screening level tests
  - well established
  - rapid turnaround
  - Quantitative
- Assays represent potential ecological receptors
- Sodium salt selected to eliminate ammonia toxicity confounder

IPSC Bioassay Results

Test Species	Endpoints (ppm)		
	LC_{50}	NOEC	LOEC
Daphnia magna	**490**		
Pimephales promelas	**1655**		
Eisenia foetida	**4450**		
Ceriodaphnia dubia	**66**	**10**	**33**
Pimephales promelas	**614**	**155**	**280**
Lactuca sativa (soil)	**670**	**40**	**80**
Lactuca sativa (sand)		**20**	**40**
Selenastrum sp		**500**	**1,200**

Ongoing Toxicity Tests

- Chronic *Pimephales* (fathead minnow)
- Chronic *Hyallela azteca* (sediment invert)
- Developmental *Xenopus* (frog)
- Acute and chronic *Gambusia* (mosquitofish)

Analysis of Perchlorate in Tissues

- The Institute for Environmental and Human Health (Texas Tech University)
  - Fish
  - Amphibians
  - Small/large mammals
  - Aquatic invertebrates

Analysis of Perchloratein Tissues

- Air Force Research Laboratory (Wright-Patterson AFB)
  - Blood
  - Thyroid
  - Muscle
  - Liver

Analysis of Perchlorate in Tissues

- Clayton Laboratories (Novi, MI)
  - Fish
  - Birds
  - Small/large mammals
  - Aquatic and terrestrial invertebrates
  - Aquatic and terrestrial plants
  - Amphibians
  - Reptiles

Current Attenuation Studies

- Phytoremediation of perchlorate being examined at USEPA, Office of Research and Development, Athens, GA
  - Plant uptake and translocation
  - Accumulation
  - Enzymatic breakdown
  - Analytical tests to directly measure ClO_4 in plant tissues

Points of Contact

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