

Heavy Metals

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Outline

- What are Heavy metals?
- Effects on Amphibians
- Maternal Transfer
- Sources of heavy metals
- Effects on Salamanders

What are Heavy Metals

- Toxic metals, including "heavy metals," are individual metals and metal compounds that negatively affect people's health.



Classification of naturally occurring metals by toxicity and hydrologic availability

[Metals that normally do not exist as dissolved species in natural waters or are very rare in crustal rocks are in *italics*]

Nonhazardous		Low toxicity			Moderate to high toxicity			
Aluminum	Magnesium	Barium	<i>Praseodymium</i>	<i>Actinium</i>	Iodine	Polonium	Uranium	
Bismuth	Manganese	Cesium	<i>Promethium</i>	<i>Astatine</i>	<i>Indium</i>	<i>Radium</i>	Vanadium	
Calcium	Molybdenum	<i>Dysprosium</i>	<i>Rhenium</i>	Beryllium	Lead	<i>Francium</i>	Zinc	
Cesium	Potassium	<i>Erbium</i>	<i>Rhodium</i>	Boron	Mercury	Silver	Zirconium	
Iron	Strontium	<i>Europium</i>	<i>Samarium</i>	Cadmium	Nickel	<i>Tantalum</i>		
Lithium	Rubidium	<i>Gadolinium</i>	Scandium	Chromium	<i>Niobium</i>	Thallium		
	Sodium	Caesium	<i>Zerbium</i>	Cobalt	<i>Germium</i>	Thorium		
		Germanium	Thallium	Copper	Palladium	<i>Titanium</i>		
		Gold	Tin	Hafnium	Platinum	<i>Tungsten</i>		
		Holmium	<i>Yttrium</i>					
		<i>Neodymium</i>	Yttrium					

U.S. GEOLOGICAL SURVEY CIRCULAR 1133, 1995

Which metals are the most Harmful



Sources of Heavy metals

On December 22, 2008 5.4 million yards of coal ash spilled from the TVA Kingston fossil plant in Tennessee

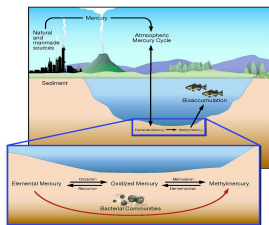
How are Heavy Metals Introduced

- Mining
- Coal Burning Plants
- Research Facilities(Oak Ridge Laboratory)
- Atmospheric deposition
- Coal Ash Spill
- Farms

Effects of Heavy Metals

- Lowered Reproduction Success rates
- Lower survival rate especially in Larvae
- Lower recruitment into populations
- Hormone production
- Lower clutch size

Mercury



The effects of Hg on Salamanders

- Mercury largely enters an area through rain. Areas that have coal burning facilities have a higher potential for greater amounts of Hg.
- Once on the ground and in the water, bacteria and chemical reactions convert Hg to its biologically active form of methylmercury (MeHg).
- From this point Hg moves up and accumulates in the food chain.
- Salamanders that are affected by Hg were less responsive to prey

Effects of Hg on Amphibians

American Toad

American toad tadpoles from females exposed to Hg, swam significantly slower than those from controls.

Northern two-lined salamander

Responsiveness and speed to capture prey were decreased in northern two-lined salamanders with elevated Hg levels

Maternal Transfer

- Amphibians that live in contaminated areas may pass on trace amounts of elements to their offspring.
- A recent study conducted by the American Chemical Society in 2013 found: female southern toads accumulated select trace elements from exposure to CCW, and subsequent maternal transfer of some of these elements was associated with reductions in hatching success (Ni), offspring viability (Ni, Se), and overall reproductive success (Se, Cu).

Maternal Transfer

Eastern narrowmouthed toads

- Females pass on Cu, Pb, and Sr.
- Offspring have a 19% reduced viability
- Lower recruitment into population

Southern Toads

- Pass on trace metals Ni and non metals like Se.
- Have a 27% reduction in reproductive success
- Lower recruitment into population
