

Issues Concerning Water Quality for the Texas High Plains



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23 March 2010



Photographs
Courtesy of TCFA



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Explanation for Missing limbs in deformed amphibians.

B. Ballengée and S. K. Sessions.

Journal of Experimental Zoology Part B: Molecular and Developmental Evolution, June 2009.

Dragonfly naiads ate legs of tadpoles.

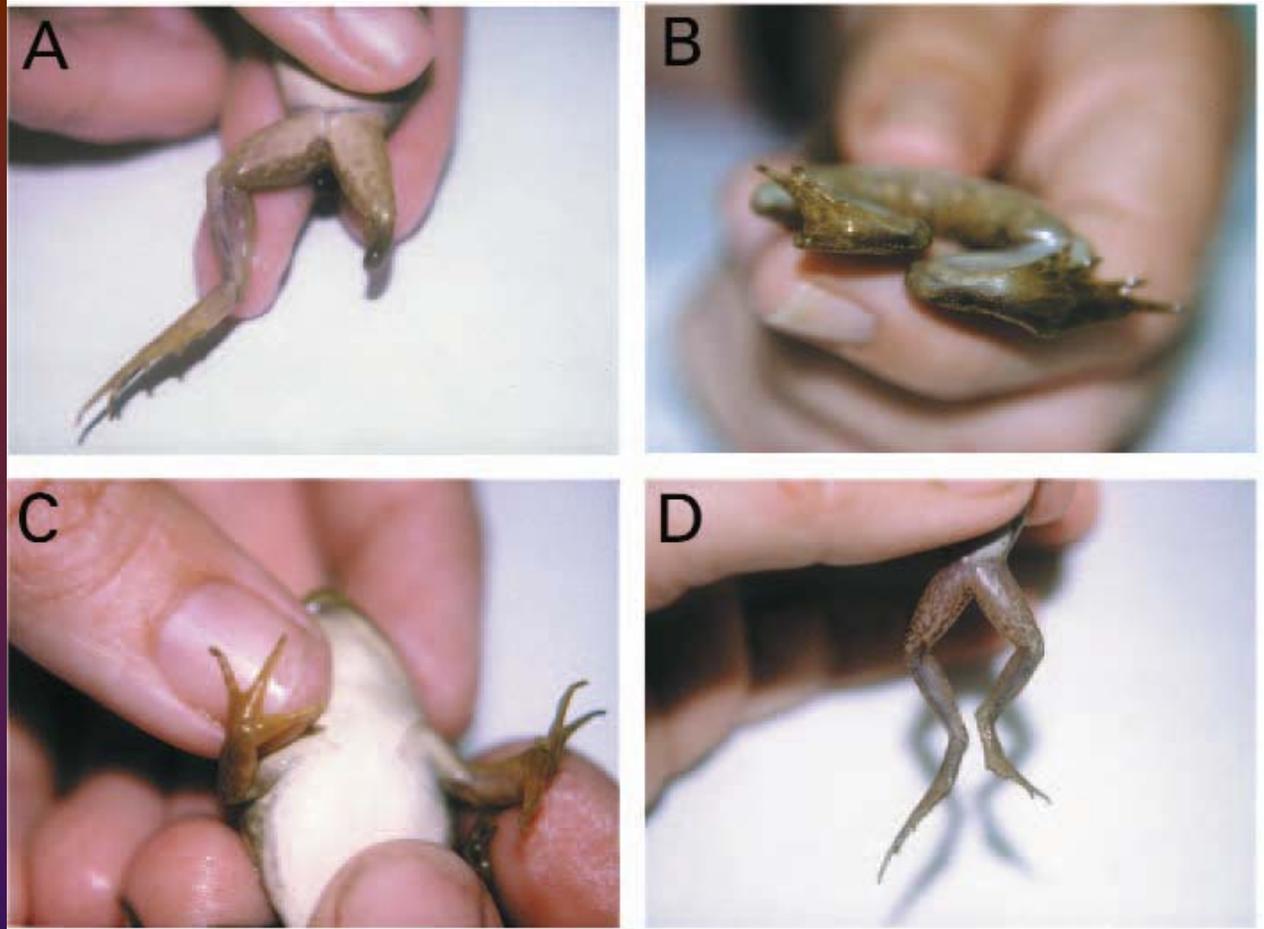
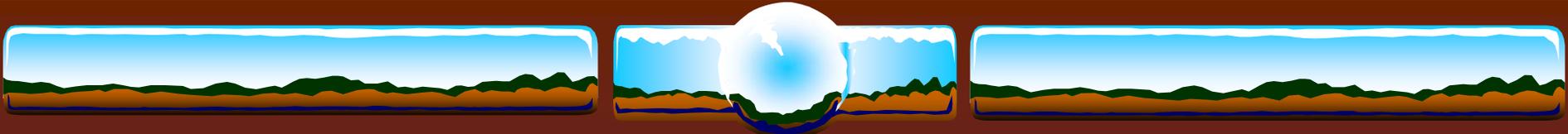


Figure 2. Examples of limb malformations from *R. catesbeiana* (A–C) and *R. clamitans* (D) metamorphs. Malformations are (A) ectromelia of left hindlimb, (B) ectrodactyly of right hindlimb, (C) ectrodactyly of right front limb, and (D) asymmetrical development of hindlimbs.

From: Limb Malformations and Abnormal Sex Hormone Concentrations in Frogs

Stacia A. Sower, Karen L. Reed, and Kimberly J. Babbitt; Environmental Health Perspectives • VOLUME 108 | NUMBER 11 | November 2000

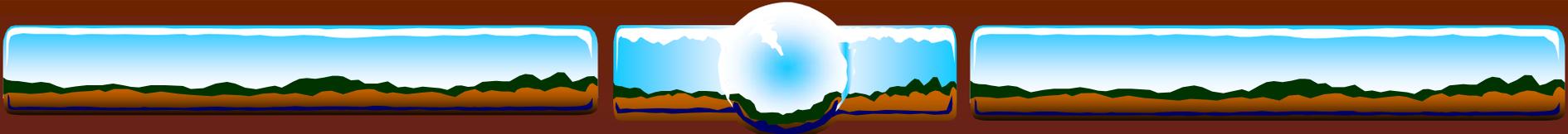


Research Rules

- Develop working hypothesis
 - What causes the observed effect?
 - What is the theoretical support for the hypothesis?
- Develop a rigorous test of the hypothesis
 - Institute proper controls
- Correlation does not equate with causation



Photographs
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Texas High Plains Water

□ Water availability

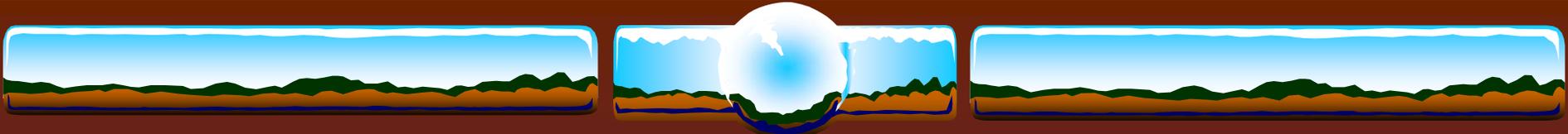
- Surface water impoundments
 - Lake Meredith
 - Greenbelt Lake
 - Lake Alan Henry
- Groundwater
 - Ogallala (High Plains)
 - Dockum (Santa Rosa)

□ Water use

- Irrigated agriculture
- Livestock production
- Municipal
- Industry



Photographs
Courtesy of TCFA



Threats to Water Quality

□ Lake Meredith

- Declining water levels

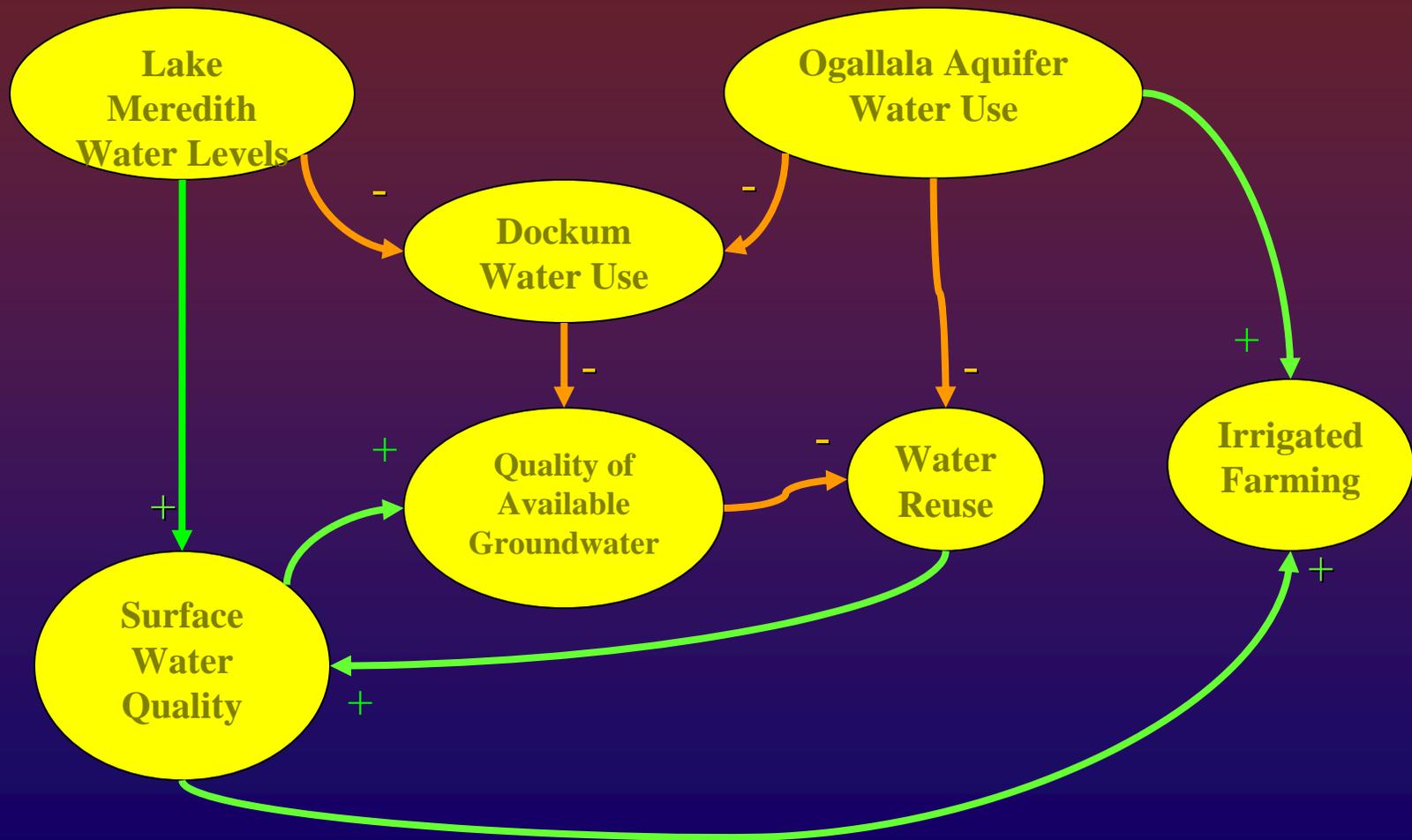
□ Ogallala

- Reduction in recoverable water
- Reduction in irrigated agriculture
- Increase in Dockum production
 - Poorer quality than Ogallala



Photographs
Courtesy of TCFA

What happens to water quality?



Opportunities

□ Reclamation

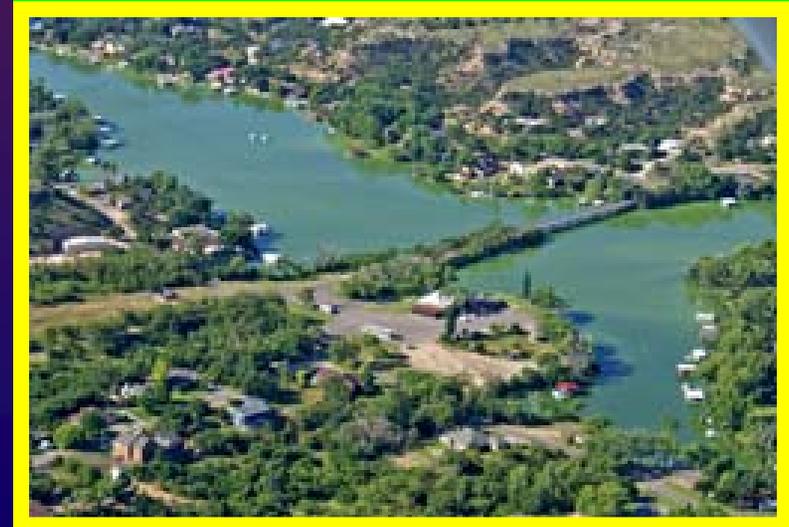
- Secondary treatment to meet TMDL
- Tertiary treatment to potable quality

□ Amarillo Waste Water

- Xcel Energy – cooling water
- Lake Tanglewood – recreation

□ Impediments

- Short term costs



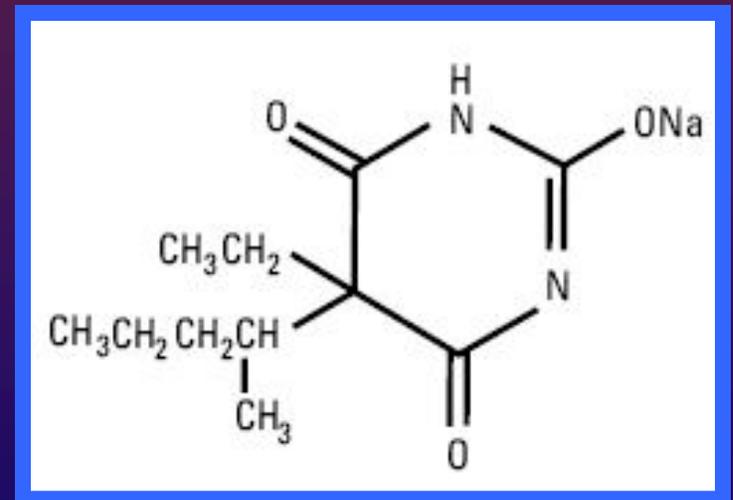
Water Quality Concerns

□ Pharmaceutical contamination

- Hormonally active agents (HAA)
- Antimicrobials
 - Antibiotics
 - Pesticides
- Euthanizing agents
 - Sodium pentobarbital



Photographs
Courtesy of TCFA



Euthanized Animals

- ❑ 2007 – last equine packing plants in US close
- ❑ 200,000 plus unwanted horses per year
 - Euthanized with sodium pentobarbital

- Persistent in environment

(Cottle, 2008; Peschka et al., 2006)

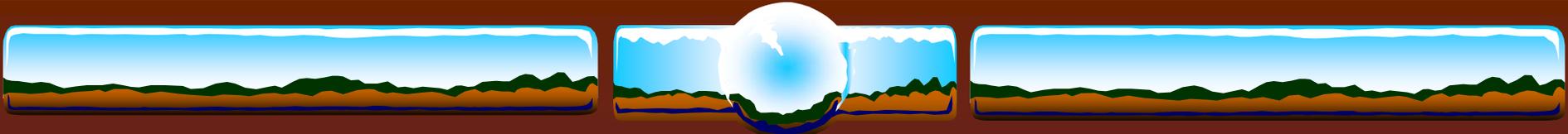
- Disposal options

- ❑ Burial
- ❑ Land fill
- ❑ Compost

- ❑ Companion animals



Photographs
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So what?

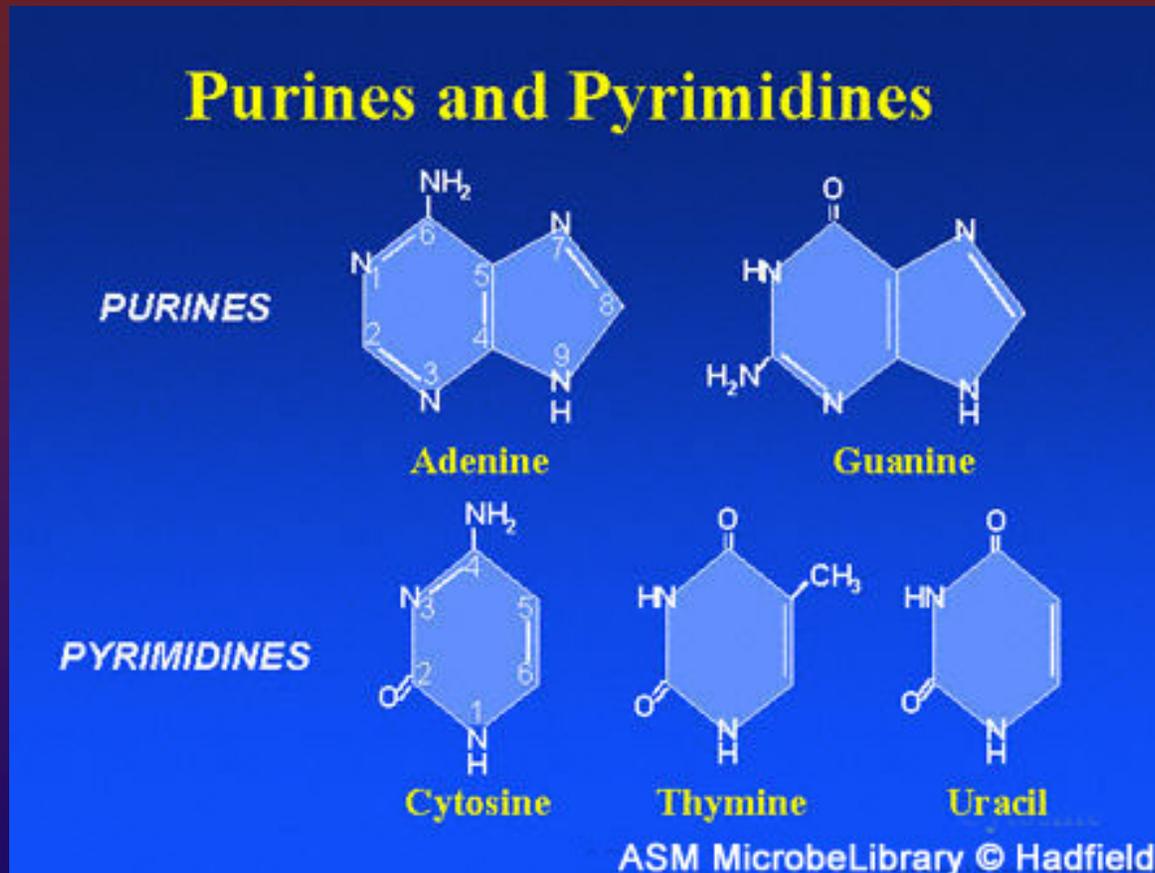
- Where do sodium pentobarbital residues go?
 - Waterways?
 - Impact on aquatic life?
 - Impact on watering animals?
 - Plants?
 - Absorbed through plant?
 - Impact on grazing animals?
 - Compost fertilizer
 - Is handling safe?
 - Is food safe?



Photographs
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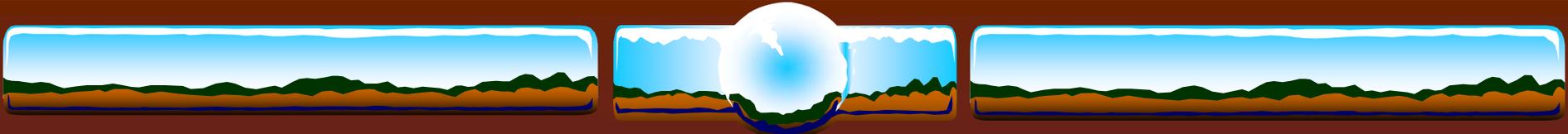
Pyrimidines

Figure 2. Purines and Pyrimidines. There are two classes of nitrogenous bases found in DNA and RNA. Adenine and guanine are purines. Cytosine, thymine and uracil are pyrimidines. Thymine is found only in DNA; uracil is found only in RNA. One base attached to a pentose sugar and a phosphate group creates a nucleotide, the primary building block of nucleic acids. The bases are often represented by their first letters only as A, G, C, T or U.



Jillaine Hadfield - University of Maryland

<http://www.microbelibrary.org/microbelibrary/files/ccImages/Articleimages/Hadfield/Images/Purines%20Pyrimidines%20fig2.jpg>



Natural Screening of Microbes

□ Pyrimidine Ring

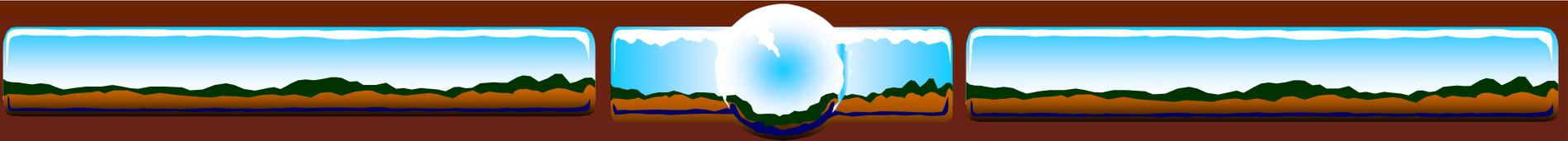
- Common in nature
- Microbial degradation – carbon source

□ Treat compost with sodium pentobarbital

- Look for microbial communities that flourish (or at least survive)
- Cultivate micro organisms



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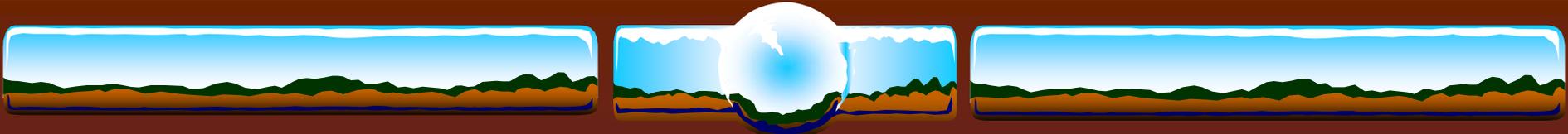


What happens to pharmaceuticals?

- Batch equilibrium tests
 - Do the drugs dissociate and bind to soil?
- Column leachate tests
 - Do the drugs migrate through the soil column to groundwater?
 - Are there precipitates?
- Plant absorption studies
 - Controlled greenhouse studies



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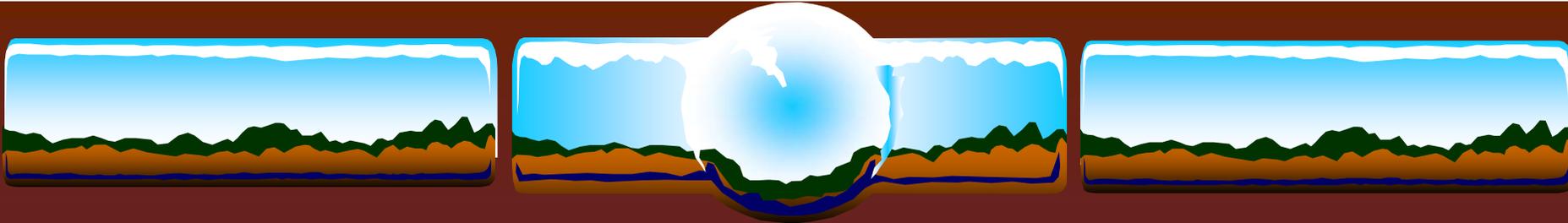


Applications

- Treat existing sodium pentobarbital contaminated sites
- Modify composting process to favor microbes that degrade sodium pentobarbital
- Apply to other polar organic compounds
- Apply to other pharmaceuticals
 - Antibiotics / Pesticides / HAAs



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Thank you



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