

Uranium Toxicity in Wyoming Livestock and Wildlife



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Methodology



- Data is derived mainly from peer-reviewed journals, clinical reports and to a limited extent clinical data
 - Mainstream journals
 - Clinical reports
 - Professionals in the field
- No “Uncertainty Factor” used in the development of this document
 - Difficult to determine the level of “acceptable risk”
 - Allows individuals the ability to make judgment calls based upon the level of risk **THEY** are willing to take!

Health Effects



- **Chemical toxicity of natural U is much more likely to be a risk to animal health than radiation from naturally occurring U**
 - ÷ Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for uranium. Atlanta GA: U.S. Department of Health and Human Services, Public Health Service.
 - ÷ Garner, R. 1965. Natural Uranium in grazing animals. *Health Phys.* 11, 323.
 - ÷ Sheppard et.al. 2005. Diversion of ecotoxicity thresholds for uranium. *Journal of Environmental Radioactivity.* 79, 55-83.
- **Kidney damage is a more sensitive indicator than effects on growth and reproduction**
- **Damage occurs due to the removal of U from blood via the kidney**
 - ¡ Biochemical indicators of tubular damage
 - ¡ Necrosis of the proximal tubules
 - ¡ Damage to the glomerular basement membrane (reduced glomerular filtration)

Sources of Dose-Response Data



- **Virtually no large mammal experimental studies exist**
 - Typically $n=1-3$, very weak experimental designs
 - Large discrepancies exist in the limited data that is available
- **Great majority of experimental data consists of rodent studies**
 - Injections
 - Feeding studies
 - Enriched/depleted U studies
- **Scaled from rodent to ungulates allometrically, then cross checked results against other (smaller) studies**

Recommendations



- Based upon limited toxicity data, we believe that water containing less than 0.065 mg/L uranium should not have negative physiological effects upon wildlife and livestock.
- Toxic water concentration derived from rodent data and a scaling formula published by Sheppard et.al (2005)
- Water intake value based upon a yearling steer, consuming water at a conservative rate of 20% body weight
- Further uranium toxicity (especially exposure from water) studies are warranted

Other Livestock Health Issues



- Due to the possible release of other harmful water contaminants during the in situ mining process, we believe that other toxicological problems may arise.
- Possible contaminants include:
 - Selenium
 - Arsenic
 - Sulfates
 - etc.
- Release of these contaminants due to in situ mining processes could possibly pose a greater risk to livestock and wildlife than U

Acknowledgements



– Graduate Committee

- ┆ Dr. Mike Smith
- ┆ Dr. Bruce Culver
- ┆ Dr. Cynthia Tate

– WYDEQ

- ┆ Jennifer Zygmunt

– UW Veterinary Sciences Department

- ┆ Kaitlin McDaniel

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