

## **Selenium Q&A for Bird Exposure at the Great Salt Lake**

### **Why is selenium an issue for birds at the Great Salt Lake?**

Birds who feed at the Great Salt Lake ingest selenium through their diet, including brine shrimp and brine flies. Selenium exposure can cause reproductive deformities and present problems with the hatching of bird eggs. Selenium is both an essential element in bird diets and can also be toxic to birds, with only a narrow range in dose levels between safe and toxic.

### **What is selenium?**

Selenium is a naturally occurring trace mineral that can concentrate in the water. In small amounts, it is good for bird health but can be toxic in large doses.

### **Why is the Great Salt Lake the point of study?**

The lake is a critical ecological resource and home to hundreds of thousands of birds each year. More than 250 species have been sighted, many stopping through as the lake is an important migratory stop between North and South America.

### **What is being done to address this issue?**

The Great Salt Lake Science Panel is developing a water quality criterion for selenium that protects the birds that feed in the open waters of the Great Salt Lake. The Panel has studied the how selenium moves from water into brine shrimp and brine flies then into birds and their eggs. Through the study, the Science Panel recommended that the safe level for selenium in within the following ranges:

- Diet – between 3.6 and 5.7 mg/kg dry wt.
- Egg – between 6.4 and 16 mg/kg dry wt.

### **How did they arrive at these recommended levels?**

Laboratory studies of mallard ducks have been conducted to determine how much selenium can be in the mallard diet before effects such as reduced hatching success occur. The mallard is one of the most sensitive known bird species to selenium so it is likely that most of the Lake birds would not respond as much to the same amount of exposure to selenium.

### **Most Science Panel members have recommended that a 10% effects concentration is protective of birds. Are these acceptable levels?**

Questions to the Science Panel reflect concerns that a 10% reduction in hatchability with mallards does not sufficiently protect the birds and that use of these values suggests that potentially affecting 10% of the birds using the GSL is acceptable. The laboratory-based toxicity data for mallard hatchability are specific to the studies from which they were derived and it cannot be assumed that they are directly translatable to a 10% decline in bird reproductive output at the GSL. In other words, if dietary or egg selenium levels in the GSL birds were equivalent to the above thresholds it does not mean that the number of birds using the GSL would decline by 10% due to selenium or that there would be 10%

fewer chicks. (Please see Kennecott's position on selenium for additional scientific detail in this area.)

### **What other factors influence the bird population?**

Other factors can influence bird population so it cannot be assumed that a reduction in reproduction due to a chemical will translate into an equal reduction in population numbers. The reduction in number of offspring due to chemical exposure is not completely additive to other factors that cause early bird deaths, such as bad weather or predation. Also, birds can compensate to some extent for reduced chick numbers, such as by laying additional nests. So, while exposure above the threshold value *may* result in reduced reproductive output, it is not possible to precisely quantify how much it will impact the overall population.

### **How are these levels measured?**

It is very difficult to precisely measure biological effects at very low doses. In any biological study there is inherent variability among individual organisms and how they respond to the stressor of interest (in this case, selenium) and the testing conditions. Even the performance of control animals (i.e., those not exposed to selenium) can be highly variable among individuals in the same study.

### **Could a diet deficiency occur if the levels were too low?**

Because selenium is both an essential element in bird diets and a toxic element to birds, with only a narrow range in doses between the two, development of very low selenium thresholds is not useful for developing water quality criteria as a diet deficiency may result (or the threshold may be unachievable and the result undesirable). Given the narrow range between background selenium and potential toxicity, the lower end of the proposed selenium thresholds for bird diets and eggs may fall at or only slightly above "normal" background selenium levels.

### **How does Kennecott Utah Copper impact selenium levels?**

Kennecott has a permit through the Utah Department of Water Quality Division of Water Quality to discharge water with selenium into the Lake. This is water comes from the process where Kennecott is cleaning up the groundwater in the Southern part of the Salt Lake Valley. The permit allows for a concentration of 54 parts per billion in the water discharged to Great Salt Lake; this permit has never been exceeded.

### **Who is on the science panel making these decisions?**

William J. Adams, Ph.D., Rio Tinto Health, Safety, and Environment

Anne Fairbrother, Ph.D., US EPA

Don Hayes, Ph.D., University of Utah, Department of Civil Engineering

Brad Marden, M.S., Parliament Fisheries, L.L.C.

Theron Miller, Ph.D., Utah Division of Water Quality

William Moellmer, Ph.D., Utah Division of Water Quality

Therresa Presser, Ph.D., USGS

Joseph Skorupa, Ph.D., US Fish and Wildlife Services

William Wuerthele, M.S., US EPA

Once the Science Panel makes a recommendation, the Steering Committee and the Water Quality Board will review the recommendations and determine how to proceed.

For more information about the panel, recommendations and meetings, visit:  
[http://www.deq.utah.gov/Issues/GSL\\_WQSC/index.htm](http://www.deq.utah.gov/Issues/GSL_WQSC/index.htm)

Questions or concerns can also be directed to Kelly Payne at 801-569-7128.