

Selenium Management



January 14, 2005

Overview

- ◆ **Salton Sea sediment data (Doug Barnum)**
- ◆ **Update on selenium criteria (Harry Ohlendorf)**
- ◆ **Selenium treatment options (Charlie Phillips)**

Selenium Criteria

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EPA's Proposed Selenium Criteria

- ◆ **Published in Federal Register on 12/17/2004 for 120-day review**
 - ⌘ **Major change is that chronic exposure criterion is based on fish tissue concentration**
 - ⌘ **Whole-body fish tissue concentrations for freshwater fish used for criterion**
 - ⌘ **Acute criteria for selenite and selenate (related to sulfate)**
 - ⌘ **Saltwater evaluation limited by few data**

EPA's Proposed Selenium Criteria

◆ **For Freshwater Aquatic Biota (chronic)**

- ⌘ **Concentration of selenium in whole-body fish tissue should not exceed 7.91 $\mu\text{g/g dw}$**
- ⌘ **If whole-body fish tissue concentrations exceed 5.85 $\mu\text{g/g dw}$ during summer or fall, fish tissue should be monitored during the winter to determine whether the selenium concentration exceeds 7.91 $\mu\text{g/g dw}$**
- ⌘ **Results from “appropriate” site-specific studies can be used to modify this criterion**

EPA's Proposed Selenium Criteria

◆ **For Freshwater Aquatic Biota (acute)**

- ⌘ **24-hour average concentration of total recoverable selenium should seldom (e.g., not more than once in 3 years) exceed 258 µg/L for selenite**
- ⌘ **Also should seldom exceed the numerical value given by $\exp(0.5812[\ln(\text{sulfate})]+3.357)$ for selenate. For example, at a sulfate concentration of 100 mg/L, the 24-hour average selenate concentration should not exceed 417 µg/L.**

EPA's Proposed Selenium Criteria

◆ **For Saltwater Aquatic Biota (chronic)**

⌘ **Because selenium might be as chronically toxic to saltwater fishes as it is to freshwater fishes, the status of the fish community should be monitored if selenium exceeds 5.85 µg/g dw in summer or fall or 7.91 µg/g dw during any season in the whole-body tissue of salt water fishes.**

EPA's Proposed Selenium Criteria

◆ **For Saltwater Aquatic Biota (acute)**

⌘ **Saltwater aquatic life should be protected from acute effects if the 24-hour average concentration of selenite seldom exceeds 127 µg/L.**

EPA's Proposed Selenium Criteria

- ◆ **EPA is working with USFWS to develop an approach for deriving nationally applicable pollutant criteria for protection of wildlife.**
- ◆ **Specifically for selenium, EPA is working with the USFWS and other federal agencies to develop criteria to protect wildlife within California.**
- ◆ **Both of those activities are separate from this notice, and in the initial phases of development.**

EPA's Proposed Selenium Criteria

◆ EPA is requesting comments on the draft criteria recommendations, especially:

- ❖ The appropriateness of basing the freshwater chronic criterion on a tissue concentration;
- ❖ Studies of freshwater aquatic life effects and chronic effect concentrations;
- ❖ Alternative values for the freshwater criterion;
- ❖ Site-specific factors affecting the freshwater chronic criterion;
- ❖ Saltwater chronic criterion; and
- ❖ Acute criteria concentrations.

Selenium Treatment

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Overview

- ◆ **Rationale for treating selenium**
- ◆ **Water quality goals for the Salton Sea**
- ◆ **Approach for evaluating treatment options**

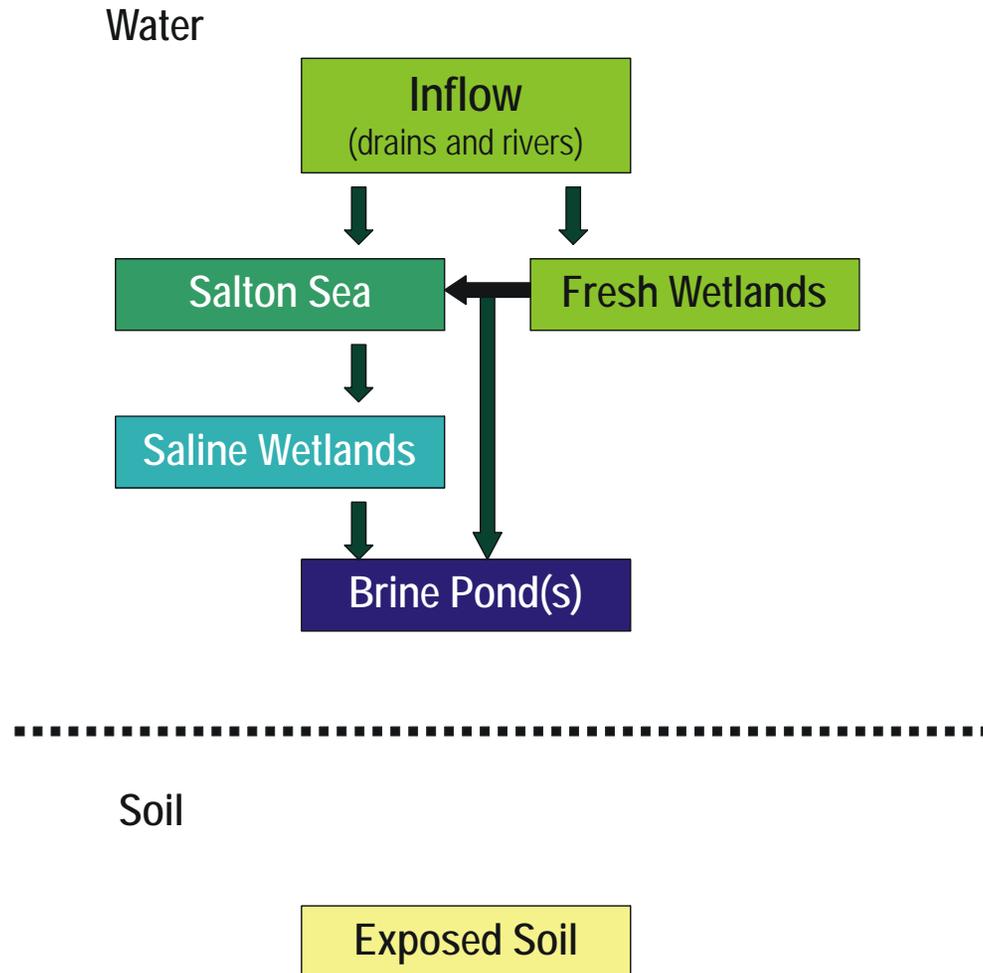
Why Control and Treat Selenium?

- ◆ **Selenium concentrations in inflows are sufficient to be a concern**
- ◆ **Selenium is accumulating in Salton Sea sediments**
- ◆ **Adverse effects from selenium have been demonstrated elsewhere**
- ◆ **Scoping comments on the PEIR identified selenium as an issue of concern**

Water Quality Goals for Salton Sea

- ◆ **Reduce or eliminate risks to human health and the environment**
- ◆ **Water treated to levels that allow for beneficial use (e.g., fishing/swimming)**

Conceptual Salton Sea Selenium Transport Model Elements



Selenium Treatment Options

◆ Physical (Engineering)

- ⌘ Reverse Osmosis

- ⌘ Nanofiltration

- ⌘ Evaporation

◆ Biological

- ⌘ Anaerobic Bacterial Removal (e.g., ABMet)

- ⌘ Algal Bacterial Removal

- ⌘ Agroforestry

- ⌘ Constructed Wetlands (e.g., New River Wetlands)

◆ Chemical

- ⌘ Ferrous Hydroxide

Evaluation of Selenium Treatment Options

- ◆ **Technical feasibility of individual options**
- ◆ **Technical feasibility of combined options (treatment systems)**

Treatment Evaluation Considerations

- ◆ **Source of water treated**
- ◆ **Water quantity and quality**
- ◆ **Effectiveness for achieving treatment objectives**
- ◆ **Land requirements**
- ◆ **Ease of implementation**
- ◆ **Reliability under changing inflows**
- ◆ **Unintended consequences (e.g., wildlife exposures)**

Integrated Treatment Approach

- ◆ **To achieve the water quality goals, must consider selenium treatment within the context of a broad range of treatment options for existing pollutants such as**
 - ⌘ **Nutrients (NO_3 , NH_3 , PO_4)**
 - ⌘ **Organics (including raw sewage)**
 - ⌘ **Metals (e.g., arsenic)**

Integrated Treatment Approach

◆ **Need to integrate selenium treatment options with other treatment strategies**

- ⌘ Some options require pre-treatment
- ⌘ Some could unintentionally increase the amount of available selenium
- ⌘ Some may reduce selenium as well as other pollutants
- ⌘ Options may be integrated into treatment systems

Next Step: Feasibility Study

- ◆ **Develop conceptual designs based on water quality requirements and infrastructure constraints**
- ◆ **Evaluate concepts for initial feasibility**
- ◆ **Develop layout and design criteria for each treatment option to estimate costs**
- ◆ **Assess performance characteristics for treatment systems**

Conclusions

- ◆ **Selenium at Salton Sea poses risk**
- ◆ **Distribution of selenium in Salton Sea sediment will influence future management**
- ◆ **Water quality criteria for selenium are changing**
- ◆ **Treatment of selenium should be considered in the context of overall water quality goals**
- ◆ **Treatment options cannot be developed in isolation**