USGS 2003

DRAFT

The Salton Sea Science Office hosted a meeting of 13 selenium experts on March 11, 2003, in Sacramento, California. The goal of the meeting was to assess what is known about selenium in the Salton Sea and predict potential changes if any of the restoration proposals are implemented. Specific objectives were: 1) review what is known about selenium in the Salton Sea; 2) predict fate and impact of selenium resulting from the restoration scenarios; and 3) review technologies for removal of selenium from aquatic systems. The group documented current selenium levels in various components of the Salton Sea ecosystem and predicted levels for the various restoration proposals. Results are provided in the attached table.

General consensus of the group concerning selenium in the Salton Sea follows:

Current inflows to the Sea contain low-moderate levels of selenium. However, total selenium burden to the Salton Sea annually is equivalent to that of Kesterson Reservoir.

The existing Sea appears to accommodate selenium. Water borne levels are lower than the inflows (either by dilution, incorporation into sediments, or some unknown process).

Phytoplankton and algae take up selenium, but the absence of vascular plants in the Sea reduces its bioavailability.

However, selenium levels in fish (human health advisories) and some birds are of concern.

Selenium is currently bioavailable through invertebrate and fish consumption of bacteria and algae in the water column or in shallow sediments. However, the greatest portion of this selenium appears to become incorporated into deep anoxic sediments as the algae and bacteria die, becoming a detrital rain. These deep sinks have with little or no biological activity, and thus for all practical purposes the selenium is biologically unavailable once it reaches these areas so long as the deep water and anoxic sediment conditions are maintained.

Increased levels of selenium in most components of the ecosystem are expected as a result of the three restoration proposals because of the reliance on desalination by reverse osmosis.

Levels in the playas (area surrounding the brine pool) would be expected to be very high, in some cases >1000ppb in puddle water from irrigation practices or rainfall. Group consensus was that irrigation practices associated with vegetation for dust control would create selenium remobilization conditions far exceeding Kesterson Reservoir conditions.

Situations with a fresh-water component would support vascular vegetation and hence increase the bioavailability of selenium.

For the three restoration scenarios, selenium treatment and removal would be required.

Selenium treatment and removal technology, either chemically or biologically, is available and currently being tested.

Tailwater reduction along drains tributary to the New and Alamo Rivers will increase Se concentrations to roughly 12 ppb, then desalination will concentrate some of that inflow by a factor of 3, to 36 ppb flowing into the North Lake version, or at the 12 ppb increasing to 15 ppb (through evapo-concentration) for the US Filter version.

Selenium is of concern in the water column and sediments, but is also of concern in exposed sediments which may become fugitive dust, in the exposed sediment playas irrigated for vegetation establishment and especially in areas of the northern ½ of the seabed if exposed

The general conclusions are: 1) We would experience higher levels of selenium in most elements of the ecosystem if any of the three restoration scenarios are implemented; 2) some type of selenium treatment removal would be required; and 3) treatment and removal technologies are available for aquatic systems, but none are proven technologies scaled to the volume of water of the Salton Sea. Nanofiltration of waters post-desalination as well as combinations of nutrient reduction and selenium treatment appear promising.

SELENIUM

	CURRENT CONDITIONS	US FILTER					NORTH SEA						REGIONAL BOARD			
		RIVER EAST	RIVER WEST	BRINE POOL	PLAYA	SEA	RIVER EAST	RIVER WEST	BRINE POOL	SHALLOW WETLANDS	PLAYA	SEA	BRINE POOL	HOLDING BAY	PLAYA
Water (ppb)	1.5	10-12	6-15	15-50	200-1000(S)	4-5	30-36	4-5	5-50	2-5	± 500	<1	potentially very high	10-12	± 500
Sediment (ppm)	± = 2.7 (0.2-11)	incr	incr	incr	incr	no ch	incr	incr	incr	incr	incr	no ch	incr	incr	incr
Vegetation (ppm)															
Algae	0.5-2	incr	incr	incr	na	incr	incr	incr	incr	incr	na	no ch	incr	incr	na
Vascular	N.A.	incr	na	na	incr	na	na	na	na	na	incr	na	na	incr	incr
Invertebrates (ppm)															
Benthic	med. 3.5 (1-9)	incr	incr	incr	incr	incr	incr	incr	incr	incr	incr	incr	incr	incr	incr
Water Column	med 2.5 (1-3)	incr	incr	incr	na	incr	incr	incr	incr	incr	na	no ch	incr	incr	na
Fish (ppm)	med. 9 (6-24) dry weight	incr	incr	na	na	incr	incr	incr	na	na	na	no ch	na	incr	na
Birds (ppm)	Stilts 50% eggs > 6	incr	incr	na	incr	incr	incr	incr	na	incr	incr	no ch	na	incr	incr
Air Quality	N.A.	na	na	na	incr	na	na	na	na	na	incr	na	na	na	incr
Humans	Se advisories (at threshold)	incr	incr	na	na	incr	na	na	na	na	na	no ch	na	incr	na

SELENIUM

REGIONAL BOARD

with Selenium Treatment

	SEA	BRINE POOL	HOLDING BAY	PLAYA
Water (ppb)	<1	potentially very high	10-12	± 500
Sediment (ppm)				
Vegetation (ppm)				
Algae				
Vascular				
Inver Benthic				
Water Column				
Fish (ppm)				
Birds (ppm)				
Air Quality				
Humans				

SELENIUM

NORTH SEA

	SEA	RIVER EAST	RIVER WEST	BRINE POOL	SHALLOW WETLANDS	PLAYA
Water (ppb)	4-5	30-36	4-5	5-50	2-5	± 500
Sediment (ppm)						
Vegetation (ppm)						
Algae						
Vascular						
Invertebrates (ppm)						
Benthic						
Water Column						
Fish (ppm)						
Birds (ppm)						
Air Quality						
Humans						

SELENIUM

US FILTER

	RIVER EAST	RIVER WEST	BRINE POOL	WETLANDS	PLAYA
Water (ppb)	10-12	6-15	15-50		200-1000(S)
Sediment (ppm)					
Vegetation (ppm)					
Algae					
Vascular					
Invertebrates (ppm)					
Benthic					
Water Column					
Fish (ppm)					
Birds (ppm)					
Air Quality					
Humans					