NEVADA DIVISION OF ENVIRONMENTAL PROTECTION

Bureau of Water Quality Planning

Fact Sheet: Site-Specific Standards for Selenium in Las Vegas Wash (R116-22)

Background on the Las Vegas Wash

The Las Vegas Wash is the main drainage of the Las Vegas Valley; it is divided into three reaches. The upper reach begins at the origin and ends at the confluence of Sloan Channel and Las Vegas Wash; this upper reach does not yet have its own water quality standards (WQS) table, so the standards from the middle reach (Nevada Administrative Code [NAC] 445A.2156) are applied via the tributary rule (NAC 445A.1239). Downstream from the confluence with Sloan Channel, discharges from several wastewater treatment plants (WWTPs) dilute the poor-quality water from the upper reach, and create a perennial, effluent-dominated stream with habitat for fish. The middle reach begins at the confluence of Sloan Channel and Las Vegas Wash and extends to a feature known as the "Historic Lateral." The third reach (NAC 445A.2158) begins at the Historic Lateral and extends downgradient (and in pipes beneath Lake Las Vegas) to Lake Mead.

Nevada's Water Quality Standards for Selenium to Protect Aquatic Life

In 2016, the U.S. Environmental Protection Agency (EPA) published an updated criterion for selenium* to protect aquatic life. A modified version of EPA's 2016 criterion was adopted as a statewide WQS for Nevada's surface waters in December 2019. However, the Las Vegas Wash was given a three-year delay in effective date for the implementation of this statewide standard (NAC 445A.1237). The delay in implementation was needed so that the naturally high background concentrations of selenium in the Colorado River Basin, including the Las Vegas Wash could be taken into account by conducting a site-specific study of selenium in water and fish tissue collected from the Las Vegas Wash. The site-specific WQS for selenium proposed here, are a result of this study.

Natural Background Conditions

EPA (1997) defines "natural background" as the "*…background concentration due only to non-anthropogenic sources*" and recognizes that *"… there may be naturally occurring concentrations of pollutants which may exceed the national criteria published under section 304(a) of the Clean Water Act*." In the Las Vegas Valley, the poor quality of shallow groundwater in the Las Vegas Valley is a result of the water interacting with geologic materials and becoming mineralized by evapotranspiration. The geologic deposits in the basin contain high concentrations of sulfate, selenium, boron, and other constituents common to a playa-type environment. The shallow groundwater dissolves these deposits, then discharges via springs and seepage into the Las Vegas Wash and its tributary channels. The concentration of dissolved solids in the shallow groundwater ranges from 2,000 to more than 7,000 milligrams per liter (mg/L). Selenium in the shallow groundwater averaged 19 micrograms per liter (µg/L), with concentrations ranging from <2 µg/L to 45 µg/L in the wells sampled (Wild 1990).

The channels tributary to the Las Vegas Wash contain low flows of extremely poor-quality water that reflects the natural chemistry of the shallow groundwater. These channels contribute only about 8 percent of the flow in the Las Vegas Wash, while the discharge of highly treated effluent contributes more than 90 percent of the in-channel flow downstream of the discharges. The low-selenium water from the WWTPs effectively dilutes the low volume of high-selenium waters from the tributary channels. However, even with this dilution, the natural background levels are still elevated, and the new statewide WQS for selenium are not appropriate. A study was conducted by sampling fish tissue and water from the wash in 2021. These new data, along with existing data (2002 through 2019), were used to derive site-specific WQS for selenium in the Las Vegas Wash.

*EPA (2016). *Aquatic Life Ambient Water Quality Criterion for Selenium – Freshwater.* June. EPA 822-R-16-006

In terms of the downstream waterbody, the Las Vegas Wash contributes only about 2 percent of the water in Lake Mead (the Colorado River contributes about 97 percent, and the Muddy and Virgin Rivers together contribute about 1 percent). As a result, the Colorado River overwhelmingly controls the chemical composition of the water in Lake Mead. According to Engberg (1999), the load of selenium entering Lake Powell, upstream of Lake Mead, is nearly 30 million tons of selenium per year. In contrast, the Las Vegas Wash has been estimated to provide between 1,430 pounds (Zhou et al. 2004) and 1,890 pounds (Ryan and Zhou 2010) of selenium per year to Lake Mead. The load of selenium entering Lake Mead from the Las Vegas Wash is insignificant relative to the contribution from the Colorado River.

What Changes are in the Proposed Regulation?

The regulation proposes to adopt site-specific water-column values for selenium for segments of the Las Vegas Wash. The statewide standards (adopted December 2019) for selenium in fish tissue apply to the Las Vegas Wash and are not proposed for site-specific revision. However, the appropriate values for selenium in the water column were calculated using a bioaccumulation factor approach, as described in Appendix K of EPA, 2016. Site-specific conditions that may affect the bioaccumulation of selenium include (1) species acclimation to naturally high levels of selenium, (2) the mitigating effects of high concentrations of sulfate, which competes with the similarly sized selenate ion, and (3) other factors. The exact mechanisms leading to lower levels of bioaccumulation were not examined in this study. This is Nevada's first study to derive appropriately protective WQS for selenium that support aquatic life use for a specific waterbody. The site-specific values for the Las Vegas Wash are provided below.

Tissue Type	Criterion Value	Water-Column Type	Criterion Value (µg/L)
Fish egg or ovary	19.0 mg/kg dw	***30-day average, lentic water***	***6.0 µg/L***
Fish muscle (fillet)	13.1 mg/kg dw	***30-day average, lotic water***	***6.3 µg/L***
Fish whole body	9.5 mg/kg dw	***Intermittent, lentic water***	$(6.0-C_{bkgd}(1-f_{int}))/f_{int}$
		Intermittent, lotic water	$(6.3-C_{bkgd}(1-f_{int}))/f_{int}$

Where: C_{bkgd} = average daily ambient concentration over 30 days, and f_{int} means the fraction of any 30-day period during which concentrations are elevated. "**Lentic water**" means still water (e.g., ponds); "**lotic water**" means flowing water (e.g., streams); "mg/kg dw" means "milligrams per kilogram, dry weight" for fish tissue.

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