In a cooperative effort begun in 1995, the U.S. Department of the Navy and the U.S. Environmental Protection Agency (USEPA) Region 9 Biological Technical Assistance Group (BTAG) developed an avian cadmium low toxicity reference value (TRV) of 0.08 mg/kg body weight per day (BWd) (Engineering Field Activity West, 1997). This no observable adverse effect level (NOAEL) was derived by applying an uncertainty factor of 10 to an unbounded lowest observable adverse effect level (LOAEL) of 0.8 mg/kg BWd (Cain et al., 1983) for kidney degeneration in mallards. The Cain et al. (1983) study was selected over other studies because the mallard was considered to be a sensitive species, and the kidney was a known target organ for cadmium toxicity. The TRV-high as a mid-range adverse effect level was established at 10.43 mg/kg BWd based on decreased body weight and testes weight in Japanese quail exposed to cadmium chloride (Richardson and Spivey Fox 1974).

The current understanding of cadmium impacts to avian species has been improved by recent studies and the extensive literature review completed during the development of the USEPA Ecological Soil Screening Levels (Eco-SSLs). However, the cadmium Eco-SSL TRV for birds was derived as the geometric mean of NOAEL values for reproduction and growth (1.47 mg/kg BWd; USEPA, 2005). BTAG members other than USEPA do not concur with some of the methodology used to develop this Eco-SSL including: limiting the selection of a TRV-Low to reproduction, growth and mortality endpoints; calculating a geometric mean TRV based on different endpoints, studies, and species; and excluding unbounded LOAELs. Therefore, we sought to update the cadmium TRV for birds used by regulatory agencies and resource trustees in California for predictive ecological risk assessments.

METHODS

We surveyed the available secondary and primary literature sources to identify the lowest, ecologically relevant NOAELs for oral exposure of birds to cadmium. Review focused on evaluating TRVs between the original BTAG TRV (0.08 mg/kg BWd) and the Eco-SSL TRV (1.47 mg/kg BWd), considering the application of an updated ingestion rate models (Nagy et al., 2001) and uncertainty factors.

The newly selected Cd TRVs are based on exposure to Cd chloride, a soluble and bioavailable form of Cd. If Cd has hazard quotients above one during the screening level ecological risk assessment using the updated avian TRV-Low, the form(s) of Cd present on-site and their site-specific bioavailability or bioaccessibility relative to Cd chloride should be determined.