**Background:**
Environmental contamination with ammonium perchlorate (AP) is present in soil and water in a number of areas of the United States, especially in association with military bases that have used AP as an inorganic oxidizer in solid rocket fuel systems. AP also is used in a variety of commercial applications, manufacturing processes, and as an additive to lubricating oils. AP is persistent, water soluble and readily ionized, thus it is highly labile in environmental waters. Perchlorate effects on thyroid function are fairly well understood in laboratory mammals and in certain human clinical contexts. However, there is essentially no information about the effects of perchlorate in birds.

**Objective:**
The objectives of this research were to: (1) establish safe exposure levels of perchlorate for embryos, chicks and adults based on the effects of AP on thyroid function, growth and development, and (2) evaluate measurements of thyroid function that may be used as assessment endpoints for determining the impact of perchlorate exposure in birds.

**Process/Technology Description:**
Because perchlorate effects on birds had not been studied previously, this project included fundamental investigations of both the nature and dose-response characteristics of effects resulting from AP exposure. These investigations addressed different doses, exposure times, and developmental stages (embryos, chicks, adults) in two avian wildlife species, Bobwhite quail (*Colinus virginianus*) and Mallard ducks (*Anas platyrhynchos*). Since the thyroid gland was known to be a key target of perchlorate anion, studies evaluated multiple indicators of thyroid development and function as well as endpoints that reflect effects on organismal growth and development. Studies also emphasized AP effects during development because adequate amounts of thyroid hormones are required for the normal development and later function of many critical body systems. This project then used the comprehensive data to evaluate which endpoints could be used in field studies to assess environmental perchlorate exposures.

**Results:**
This project addressed the data gap in understanding the effects of perchlorate exposure in birds, a key wildlife group. Results show that measurement of thyroidal T4 content is the most sensitive indicator for assessing thyroid disruption and suggest that a protocol for using this measure as an assessment tool should be developed. The project also established Lowest Observed Effect Levels (LOEL) for AP in Bobwhite quail chicks and Mallard ducklings. Based on their 2-week LOEL of 50 grams per liter, quail living on military bases would be likely to experience thyroid disruption from drinking AP-contaminated local water sources given published data of AP measurements from a number of bases (Urbansky 1998; Smith et al. 2001). The Final Report for this project is available in the SERDP and ESTCP Online Library at http://docs.serdp-estcp.org/.

**Benefits and Implications:**
Based on an array of endpoints measured in the laboratory, this project provides comprehensive information, about the effects of perchlorate on avian thyroid function, growth and development at three life stages of two avian wildlife species. This information is of direct use to federal agencies in developing standards that will protect birds as part of the goal to “establish standards that are protective not only for humans but for the environment as a whole.” This project also evaluated practical assessment endpoints that can be used in field studies to assess environmental perchlorate exposures. (Project Completed – 2003)

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