Oversight Field Hearing of the Committee on Natural Resources
Subcommittee on Water and Power

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"Sustainable Water Supplies for the West: Part 1 – Protecting Groundwater Resources"

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On behalf of the Metropolitan Water District of Southern California (Metropolitan), I wish to thank Chair Napolitano, Representative Baca, and Representative Solis of the Subcommittee on Water and Power for the opportunity to appear before you this morning. My name is Brad Coffey, and I serve as the Water Treatment Manager for Metropolitan.

Perchlorate Background

Ammonium perchlorate is used as a main component in solid rocket propellant, and is also found in some types of munitions and fireworks. Ammonium perchlorate quickly dissolves and becomes highly mobile in groundwater. Unlike many other groundwater contaminants, perchlorate neither readily interacts with the soil matrix nor degrades in the environment. The primary human health concern related to perchlorate is its effects on the thyroid. Perchlorate interferes with the thyroid's ability to produce hormones required for normal growth and development. In 2006, the California Department of Health Services proposed a maximum contaminant level for perchlorate at 6 micrograms per liter (µg/L) or parts per billion (ppb), which is equal to the California Office of Environmental Health Hazard Assessment's public health goal. The public health goal is the concentration that does not pose any significant risk to health. A final maximum contaminant level is expected in 2007.

Metropolitan Background and Regional Water Supply

Metropolitan is the nation's largest provider of treated drinking water. Each day during a normal year, the district moves more than 1.5 billion gallons of water through its distribution system, delivering supplies to 26 member agencies. Those agencies, in turn, sell that water to more than 300 sub-agencies or directly to consumers. In all, over 18 million Southern Californians rely on Metropolitan for some or all of the water they use in their homes and businesses. These people live within Metropolitan's six-county service area, which encompasses 5,200 square miles in Los Angeles, Orange, Riverside, San Bernardino, San Diego and Ventura counties.

Metropolitan imports water from the Colorado River and Northern California through the State Water Project. Metropolitan's member agencies then deliver to their customers a combination of local groundwater, local surface water, recycled water, and imported water purchased from Metropolitan. For some, Metropolitan supplies all the water used within that agency's service area, while others obtain varying amounts of water from Metropolitan to supplement local supplies.

Metropolitan typically provides between 45 and 60 percent of the municipal, industrial, and agricultural water used in its service area. The remaining water supply comes from local wells, local surface water, recycling, and from the city of Los Angeles' aqueduct from the eastern Sierra Nevada.

Perchlorate Discovery

Metropolitan began monitoring for perchlorate in June 1997 when it was detected in the Colorado River Aqueduct. Extensive sampling within the Colorado River watershed in July and August of the same year indicated that the perchlorate originated in the Las Vegas Wash, and the most likely source was the Kerr-McGee (now TRONOX) chemical manufacturing site located in Henderson, Nevada.

Perchlorate levels in Colorado River water at Lake Havasu peaked at 9 ppb in May 1998; however, concentrations have decreased significantly in recent years as a result of aggressive clean-up efforts at Henderson, Nevada. Since October 2002, perchlorate concentrations at Lake Havasu have remained less than the proposed standard of 6 ppb, and the concentration has been consistently non-detectable (less than 2 ppb) since June 2006.

No detectable amount of perchlorate was ever found in the State Water Project system.

Effect on Local Supplies

Water volumes in California are frequently expressed as acre-feet, an agricultural term for the amount of water needed to cover one acre with water one foot deep (326,000 gallons). Translated to domestic use, one acre-ft of water provides the yearly water needs for two families.

Regional groundwater basins yield approximately 1.4 million acre-ft/year, which accounts for 90 percent of Southern California's local supplies. Most of this usage recharges naturally, but approximately 200,000 acre-ft/year are replenished through imported Colorado River and State Water project supplies.

Perchlorate in local groundwater basins originates largely from local sources. The vast majority (approximately 90 percent) of locations where perchlorate has been detected in the groundwater are associated with the manufacturing or testing of solid rocket fuels for the Department of Defense and the National Aeronautics and Space Administration, or with the manufacture, storage, handling, or disposal of perchlorate. Past agricultural practices using fertilizers laden with naturally occurring perchlorate have also been implicated in some areas.

One consequence of perchlorate in local drinking water wells is increased demand for deliveries from Metropolitan, either to off-set lost production or to blend down higher concentrations of perchlorate. To assess these effects, Metropolitan conducted a reconnaissance-level survey of its member and retail agencies to determine the potential impact of a perchlorate standard of 6 ppb. Sixteen (62 percent) out of Metropolitan's

26 member agencies and 32 (18 percent) out of 173 retail/contracting agencies have detected perchlorate in 243 drinking water wells. The survey indicates that 11 (42 percent) of the member agencies and 27 (16 percent) of the retail/contracting agencies have perchlorate detections higher than 6 ppb. While two agencies detected perchlorate in the range of 100-300 ppb, more than 60 percent of the agencies detected perchlorate at less than 10 ppb.

These agencies reported shutting down approximately five percent of their groundwater sources (40 wells out of 819) due to perchlorate contamination and lost at least 70,000 acre-ft/year of groundwater production. Affected agencies also had to increase their purchase of imported supplies for blending. In the longer term, many of these agencies are considering various options for removing or reducing perchlorate concentrations, including blending and treatment, to recover some or all of lost production.

Available Treatment Technologies

The physical and chemical nature of the perchlorate ion precludes the effectiveness of typical groundwater treatment technologies such as air stripping, carbon adsorption, or ultraviolet light oxidation. Perchlorate treatment technologies may be classified into two main categories of destructive or removal technologies. The main destructive process is biological reduction, which can be accomplished either within the soil formation (*in-situ*) or at a pump-and-treat facility (*ex-situ*). Typical physical removal processes include ion exchange, membrane filtration (including reverse osmosis and nanofiltration), and electrodialysis. Physical removal processes all require subsequent disposal of removed perchlorate.

The optimum treatment technology depends on the perchlorate concentration, the presence and concentration of co-contaminants, and other water quality parameters. For example, nitrate—which is also widely present in the region—influences the perchlorate treatability because of its similar chemical structure and its occurrence at concentrations thousands of times greater than perchlorate. For biological destruction of perchlorate contamination within the groundwater formation, site-specific hydrogeologic conditions such as depth, soil permeability, and groundwater flow velocity are also important.

In general, biological destruction is less expensive than physical removal processes. For example, the cost of *ex-situ* biological reduction is approximately $100/acre-ft for a low-nitrate site and $400/acre-ft for a higher nitrate site. In contrast, ion exchange ranges from $150/acre-ft to greater than $500/acre-ft. Compared to the operations and maintenance cost of groundwater from a typical domestic well ($125/acre-ft), perchlorate treatment can increase the cost five-fold.

Thus, treatment options are available to recover groundwater supplies contaminated with perchlorate. However, it is impossible to predict whether treatment will be pursued to recover all lost production since local agencies will make those decisions based largely on cost considerations, ability to identify potentially responsible parties for cleanup, and the availability of alternative supplies.

Metropolitan's Response

Metropolitan's mission to provide its service area with adequate and reliable supplies of high-quality water resulted in a number of related efforts that mitigate the impact of perchlorate contamination in the region. These efforts are described below.

Henderson, Nevada, Cleanup. Once perchlorate was detected in the Colorado River in 1997, Metropolitan began working with the U.S. Environmental Protection Agency, the Nevada Department of Environmental Protection, and the Southern Nevada Water Authority to advocate for a rapid and complete cleanup of perchlorate at the Henderson, Nevada site. Remediation activities began in 1998 and will continue for decades. As a result of the cleanup, the mass loading of perchlorate entering the Colorado River has been reduced by 80-85 percent and perchlorate has not been detected in Colorado River water at concentrations greater than 2 ppb since June 2006. Thus, the public health implications are reduced and less water is required by the agencies for blending down local contributions of perchlorate.

Perchlorate Action Plan. In January 2002, the U.S. Environmental Protection Agency released a draft risk assessment for perchlorate that led to the eventual public health goal and draft maximum contaminant level for perchlorate of 6 ppb. In June 2002, Metropolitan responded by initiating Perchlorate Action Plan to comprehensively address perchlorate. Elements of the plan included: monitoring, resource assessment, tracking health effects studies, tracking remediation efforts, modeling, legislative and regulatory strategies, and outreach activities.

Groundwater Conjunctive Use. One of the strategies employed by Metropolitan's Integrated Resources Planning is storage of surplus water available during wet years in groundwater basins for use during water supply shortages. The target for this dry-year conjunctive use is 300,000 acre-ft/year of water supply by 2020. To make this strategy feasible in a number of groundwater basins with perchlorate contamination, Metropolitan has funded ion exchange treatment to ensure that stored groundwater can be pumped and used for municipal water supply. Metropolitan has invested nearly $100 million in groundwater conjunctive use projects within its service area in partnership with its member agencies and groundwater basin managers

Groundwater Recovery. Groundwater recovery projects use a variety of treatment technologies to remove undesirable constituents such as nitrates, volatile organic chemicals, perchlorate, color and salt. In many cases, expensive processes are required, and agencies are reluctant to make the capital investments necessary to recover the degraded water. In those cases, agencies typically seek financial assistance to offset costs to the extent that recovering degraded water has a regional benefit. Once treated, however, recovered groundwater may be delivered to potable water systems.

Metropolitan currently funds recycling and groundwater recovery projects through the Local Resources Program. The Local Resources Program is a performance-based incentive program instrumental in helping the region implement local resource targets.

Metropolitan has invested over $121 million and partnered with member agencies on dozens of recycling groundwater recovery projects.

Summary

Perchlorate contamination of local groundwater basins remains a serious threat to local water supplies. Some agencies, particularly those who rely heavily on groundwater or are not within Metropolitan's service area, find that mitigation for perchlorate—though technically feasible—induces a large financial burden. The Metropolitan Water District, through its regional approach to water supply planning has helped to mitigate the perchlorate issue by advocating for rapid cleanup of the Colorado River, planning for water quality uncertainties, and funding local groundwater recovery projects. Though much work remains to be done, the supply impacts from perchlorate contamination have been planned for or addressed to minimize the threat to the region's overall supply.