USGS Surveys Pesticides in Streams and Groundwater

from the U.S. Geological Survey

Last spring, the U.S. Geological Survey released a report describing the occurrence of pesticides in U.S. streams and groundwater from 1992 to 2001. The report concludes that pesticides are typically present throughout the year in most streams in urban and agricultural areas but are less common in groundwater. It also states that pesticides were seldom found at concentrations likely to affect humans, even though in many streams, particularly those draining urban and agricultural areas, they were found at concentrations that may impact aquatic life or fish-eating wildlife. The findings show strong relationships between the occurrences of pesticides and their use, and indicate that some of the frequently detected pesticides, including the insecticide diazinon and the herbicides alachlor and cyanazine, are declining.

The USGS report is based on analysis of data collected from 51 major river basins and aquifer systems across the country, including Hawaii and Alaska, plus a regional study in the High Plains aquifer system. The basins were studied as part of the National Water-Quality Assessment (NAWQA) program designed to address the water quality of U.S. streams and groundwater. Southwestern basins included in the study are: Arizona's central basins (Gila, Salt, Verde, Santa Cruz, and San Pedro rivers), the Rio Grande Valley, Las Vegas Valley, the Carson and Truckee river basins, Santa Ana Basin, San Joaquin-Tulare basins, and the Upper Colorado River Basin.

More than 80 percent of urban streams and more than 50 percent of agricultural streams had concentrations in water of at least one pesticide—mostly those in use during the study period—that exceeded a water-quality benchmark for aquatic life. Water-quality benchmarks are estimates of concentrations above which pesticides may have adverse effects on human health, aquatic life, or fish-eating wildlife. Furthermore, pesticides almost always occurred as complex mixtures. Most stream samples and about half of the well samples contained two or more pesticides.

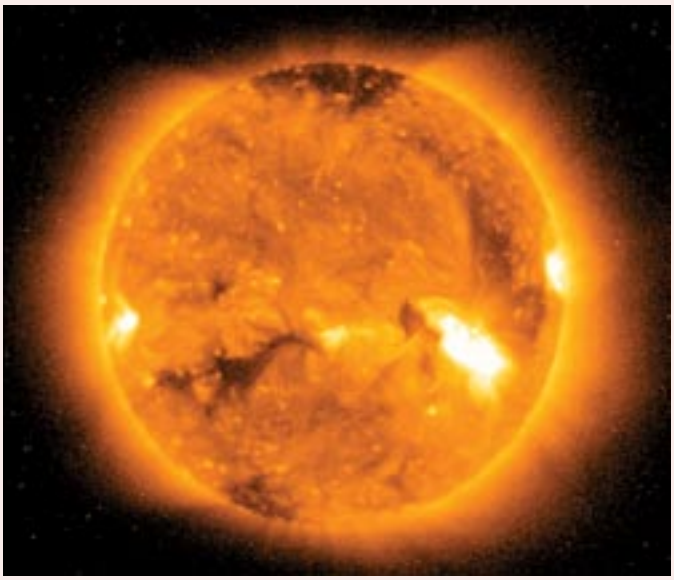
Insecticides, particularly diazinon, chlorpyrifos, and malathion, frequently exceeded aquatic-life benchmarks in urban streams. Most urban uses of diazinon and chlorpyrifos, such as on lawns and gardens, have been phased out since 2001 because of use restrictions imposed by the EPA. The USGS data indicate that concentrations of these pesticides may have been declining in some urban streams even before 2001.

Streams in agricultural areas were most likely to contain chlorpyrifos, azinphos-methyl, p,p'-DDE, and alachlor at concentrations that may affect aquatic life, with each being most important in areas where its use on crops is, or was, greatest.

In addition, DDT, dieldrin, and chlordane—organochlorine pesticide compounds that were no longer in use when the study began—were frequently detected in bed sediment and fish in urban and agricultural areas. Concentrations of these compounds in fish declined following reductions in their use during the 1960s and elimination of all uses in the 1970s and 1980s, and continue to slowly decline. However, these persistent organochlorine pesticides still occur at levels greater than benchmarks for aquatic life and fish-eating wildlife in many urban and agricultural streams.

The report, "Pesticides in the Nation's Streams and Groundwater, 1992-2001," Circular 1291, is available at pubs.usgs.gov/circ/2005/1291/.

GOES Goes Live



On May 24, 2006, NOAA launched the GOES-N satellite. Having successfully reached its proper orbit, it has been renamed GOES-13. The spacecraft carries a solar x-ray imager to monitor the sun's x-rays for the early detection of solar flares, coronal mass ejections, and other phenomena that impact the geospace environment or communications and power grids. This is among the first solar images obtained, from July 6, 2006. (From the NOAA Space Environment Center, www.sec.noaa.gov/sxi/.)

New Data on Past Drought, Flow in Upper CO Basin

Research published in the May edition of *Water Resources Research* indicates that while the long-term annual mean flow of the Colorado River at Lees Ferry, as determined by a tree-ring reconstruction, may be slightly higher than previously estimated, the period of flow upon which the Colorado River Compact was based was indeed one of the wettest in the last five centuries. Further, droughts in the more distant past have included some more severe than those experienced in the last century.

Researchers from the National Climatic Data Center in Boulder, the Desert Laboratory of the U.S. Geological Survey in Tucson, and the University of Arizona Laboratory of Tree-Ring Research updated tree-ring reconstructions

continued on next page

of streamflow using undepleted flows from four USGS stream gauges in the Upper Colorado River Basin: the Green River at Green River, Utah; the Colorado River near Cisco, Utah; the San Juan River near Bluff, Utah; and Lees Ferry in Arizona. Tree-ring data available for all sites covered the period from 1569 to 1997; data from some individual sites went further back.

An earlier streamflow reconstruction at Lees Ferry, published by Stockton and Jacoby in 1976, is often cited for its findings that the early 20th century was one of the wettest in the past 400 years and that droughts worse than any yet seen had occurred in the late 1500s. However, that study covered only the period from 1520 to 1961; the authors of the new study wanted to update that work to reflect an additional 36 years of stream gauge data now available, new and updated tree ring collections from the basin, and improved reconstruction methods. As the dividing point between the Upper and Lower basins, Lees Ferry records reflect the overall condition of the Upper Basin. Additional reconstructions of the three major subbasins also allowed researchers to investigate the magnitude and extent of extreme flow events across the entire basin.

The new research generally corroborated the findings of Stockton and Jacoby, although it suggests a long-term annual mean flow at Lees Ferry of about 14.5 million acre-feet (maf). That amount is 1.0 maf (7 percent) greater than Stockton and Jacoby's estimate, but unfortunately not enough to solve the river's overallocation problems. The timing and duration of severe droughts lasting several years to a decade appeared to be consistent across the Upper Basin, although some variation in the magnitude of the events was observed between sub-basins.

In comparing the 2000-2004 drought experienced in the Upper Basin to the long-term record, the researchers found that the 21st century event was indeed severe, and the likelihood was extremely low that any other five-year period in the last 150 years has been as dry at Lees Ferry. Going further back, the data showed eight five-year periods between 1536 and 1850 with at least a 10 percent probability of being as dry as 2000-2004. In addition, the reconstruction showed periods of six, eight, and 11 consecutive years during which streamflow for each year was less than the 1906-1995 average flow.

See Stockton, C.W., and G.C. Jacoby, 1976, Long-term surface-water supply and streamflow trends in the Upper Colorado River Basin, Lake Powell Res. Proj. Bull. 18, Natl. Sci. Found., Arlington, VA; and Woodhouse, C.A., S.T. Gray, and D.M. Meko, 2006, Updated streamflow reconstructions for the Upper Colorado River Basin. Water Resour. Res., 42, W05415. doi:10.1029/2005WR004455.

Leviathan Mine Overflowed in Spring Runoff

In mid-April, the Lahontan Regional Water Quality Control Board reported that a combination of acid mine drainage and rainwater stored in ponds at the Leviathan Mine Superfund Site in Alpine County, California, started overflowing into Leviathan Creek, a tributary to the East Fork of the Carson River. The drainage is a dilute sulfuric solution containing arsenic, copper, nickel, aluminum, and iron. The overflow was blamed on the wettest winter in the last 10 years, and overflow was expected to last several days until an emergency treatment system could be installed to neutralize the acid mine drainage and then discharge the treated water to Leviathan Creek.

Leviathan Mine is an abandoned sulfur mine about 30 miles southeast of Lake Tahoe. The State of California acquired the mine in 1984 to clean up water quality problems caused by historic mining. The Water Board completed a pollution abatement project at the mine in 1985, and since 1999 has continued to actively treat acidic waters discharged from the mine site (see *Southwest Hydrology*, Sept/Oct 2004). The mine was designated a federal Superfund site in 2000. Acid mine drainage is collected and stored in five lined evaporation ponds at the site. Treating the acidic water helps prevent the ponds from overflowing into Leviathan Creek by increasing the storage capacity in the ponds.

The State of California had been able to avoid pond overflows during the last six winter seasons by treating the stored acid mine drainage each summer. The ponds usually have capacity to store acid mine drainage and rainwater during wetter than normal winters until the site becomes accessible and pond water treatment is initiated in the summer. Emergency pond water treatment was planned and financed to begin by mid-April this year to avoid pond overflow, as it was anticipated that pond capacity would be reached by late April 2006. However, heavy late-season precipitation overfilled the ponds earlier than expected.

The emergency treatment operation was conducted under approval from the U.S. EPA, which has jurisdiction over operations at this Superfund site. The flow in Leviathan Creek at the time of overflow was approximately 2,000 gallons per minute (gpm), including approximately 50 gpm of acid mine drainage from two sources not contained by the ponds. The pond overflow added approximately 50 gpm of acid mine drainage.

Visit www.waterboards.ca.gov/rwqcb6/Leviathan/LEVI_Index.htm.

Restoration Project Critical to Salton Sea's Future

from the Pacific Institute

The Salton Sea is shrinking, and without a restoration project, California's largest lake will be transformed into an economic, health, and environmental hazard. The Sea's 75-year crash course is detailed in "HAZARD: The Future of the Salton Sea with No Restoration Project," a report by the Oakland, California-based Pacific Institute.

According to the report, the level of the Salton Sea will drop by more than five feet in just the next 12 years. In 2018, due to the 2003 water-transfer agreements and changes in Mexico, flow to the sea could decrease by 40 percent, and the sea will reach its critical tipping point. In addition, the report predicted:

- between 2018 and 2030, the sea will drop an additional 20 feet;
- by 2021, rising lake salinity will mean the loss of nearly all fish. Tens of thousands of resident and migratory birds will lose breeding and roosting habitats and food sources;
- by 2036, the southern shore will recede four to five miles, and the shrinking sea will expose more than 130 square miles of dusty lakebed to the desert winds—an area nearly three times the size of San Francisco;
- in 60 years, the sea will be nothing more than a shallow algal/bacterial soup.

"Exposing 134 square miles of lakebed to desert winds could kick up an average of 86 tons per day of talcum powder-like dust into the region's air," said HAZARD co-author Karen Hyun. "This dust is a respiratory irritant, and Imperial County is already home to the highest childhood asthma hospitalization rate in California."

According to Julia Levin, State Policy Director for Audubon California, the impact on fish and birds will be staggering. "This analysis demonstrates that we must do something to protect the Salton Sea," she said. "Without restoration, we will lose almost all fish life and tens of thousands of resident and migratory birds."

The California Resources Agency is required to submit a preferred alternative, among many being prepared by different groups, to the California Legislature by the end of this year.

The 60-page report is available at www.pacinst.org/reports/saltonsea/.

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New Study to Benchmark Home Water Usage

How much water do residents of new homes consume? No one knows for sure, so EPA and six water districts in the West and three in the South plan to find out. The 10 agencies have announced a 33-month study to collect detailed information about how much water is consumed in "standard" new homes versus "high-efficiency" ones.

The $530,000 study will be performed by collecting data from billing records, surveys, and meter measurement of usage signifying faucet, clothes washer, toilet, and other household uses. EPA will invest $350,000, with the other agencies contributing $20,000 each.

The study will help establish voluntary targets for builders who want to provide buyers with alternate water-efficiency options; develop criteria for water-efficient homes based on water-using products and building design or on average gallons used per resident per day; and create special certification marks to help consumers identify water-efficient new homes. The study results will aid states and water utilities in making local decisions on establishing water-use criteria for new homes, planning water-efficiency programs, and projecting future needs.

The project will demonstrate how advanced technologies, such as water-efficient landscape designs, weather-based irrigation controllers, and high-efficiency toilets and faucets can reduce water use below current levels. Relationships between household indoor-water use and variables such as the number of residents, home size, and types of fixtures and appliances present will be studied. Outdoor water use will be quantified from total annual use, rates of application, local plant water requirements, lot size, landscape design, and type of irrigation system controller.

The water systems involved in the study are in eight states: Arizona, California, Colorado, Florida, Nevada, North Carolina, Oregon, and Utah. The Salt Lake City Water Department will cooordinate the effort among the participating state agencies. Forty standard and 20 higher efficiency homes will be selected in each city.

Visit www.epa.gov/owm/water-efficiency/.

Arsenic, continued from page 25

operation and maintenance impacts are vitally important to ensure the continued successful operation of treatment facilities. Estimated annual combined capital and operation and maintenance (O&M) costs nationwide to comply with the new standard range from $22.2 billion (EPA estimate) to $65.5 billion (AWWA estimate). These estimates were based on similar unit-cost curves from credible industry sources, but assumptions regarding the treatment technologies utilized and the support facilities necessary varied significantly.

The Arizona Department of Environmental Quality (ADEQ) commissioned a study in 2003 which culminated in the Arizona Arsenic Master Plan. The report focused on developing costs for funding mitigation projects for arsenic-impacted systems serving fewer than 10,000 persons, which are generally simple groundwater systems with wells, storage tanks, and hydropneumatic control systems. Of the 287 small systems estimated to be required to reduce the arsenic content in their water, 174 (61 percent) serve less than 500 people. An additional 84 systems (29 percent) serve between 500 and 3,300 people. The remaining 29 systems (10 percent) serve fewer than 10,000. The statewide estimate for arsenic treatment for systems serving less than 10,000 persons was $109 million with an annual O&M cost of $14 million.

Several Arizona water systems recently implemented arsenic treatment; their capital costs are shown in the table on page 24.

In May 2006, a request for proposals was issued by Arsenic Remediation Coalition (ARC), a group of small Arizona utilities, for providing arsenic treatment systems for 46 separate small water systems. As reflected by the proposals, design and construction costs vary according to the size of the system. Estimated annualized costs ranged from $0.30 to $1.30 per 1,000 gallons of water treated.

A point-of-use (POU) removal system was proposed for seven of the small ARC systems (with 7 to 92 connections) and yearly O&M costs were $100 per connection, with capital costs of $443 per connection. POU treatment is significantly more expensive than central treatment on a unit cost basis, however they treat only the water used for cooking and drinking—less than 1 percent of the total water system flow— and are therefore more economical.

Compliance Extensions

The SDWA allows water systems that can prove inability to comply to request a time extension, or "exemption." Exemptions may provide up to nine extra years for compliance as long as the arsenic level "will not result in an unreasonable risk to health." A specific strategy for compliance, including a time frame, must be presented, along with documentation of the factors that make it impossible to immediately comply with the arsenic rule.

Requests for exemptions are not limited to small systems. Many large systems have requested exemptions for specific water sources that are only operated during times of peak demand and thus have a lower priority. The larger systems have constructed treatment systems for the sources that supply the average and maximum day requirements.

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