

Water quality has always been a top priority of the Orange County Water District (OCWD). This commitment – along with the need to ensure enough safe, high-quality water for the future – came to the forefront nearly a decade ago when the sponsoring agencies proposed the Groundwater Replenishment (GWR) System.

The GWR System will provide a new supply of reliable, high-quality water for north and central Orange County by purifying highly treated sewer water through state-of-the-art microfiltration, reverse osmosis and ultraviolet light and hydrogen peroxide treatment. The result will be water of near-distilled quality from the GWR System in 2007.

To underscore its commitment to safety and quality, OCWD commissioned water quality studies on the project in 2000. The studies were intended to provide additional information on the proposed treatment processes along with information on how the GWR System water will be used to replenish the groundwater basin underlying north and central Orange County.

The water quality study tested the proposed treatment processes on the same source water as that for the full-scale GWR System. Real operating data (not a textbook study) was used as the basis for the water quality evaluation.

#### **Published Findings Confirm Safety**

In findings released in 2001, the studies concluded that the water produced by this system would be safe for consumers and actually improve the groundwater basin's overall quality. The findings were published in a report called the "Groundwater Replenishment System Water Quality Evaluation – Risk Assessment" (EOA, Inc., November 2000).

---

*The Groundwater Replenishment System  
"will produce very safe, high-quality water  
through a process similar to that used by  
bottled water companies."*

**Sandra Smoley, R.N.**  
**Former Agency Secretary, California Health and Welfare Agency**

---

OCWD and Orange County Sanitation District (OCSD) also appointed an independent advisory committee to provide an additional level of expertise and review of the studies. The advisory committee concurred with the report's findings. The advisory committee was composed of recognized experts in the fields of public health, microbiology, environmental engineering, toxicology and risk assessment, including professors from University of California, Davis; University of California, Berkeley; and the University of North Carolina.

Even before the water quality studies were completed, the GWR System underwent rigorous scrutiny by interested citizens, water experts and local, state and federal officials. The first extensive study, an environmental impact report/statement prepared in 1998-99, found the project will have no significant adverse environmental impacts and noted that "...the quality of the recycled water is expected to be better than that of alternative water supplies" available to Orange County.

Following the environmental review, OCWD decided to further confirm these findings and took the additional step of conducting the water quality studies.

#### **Conducting the Studies**

The purpose of the studies was to compare different water sources representing two alternatives. Under one option ("No Action"), the groundwater basin would continue to receive water from the Santa Ana River and the county's two imported supplies, the Colorado River and Northern California, just as it does today. Under the other alternative ("Proposed Action"), water produced by the GWR System would be added to the existing blend of Santa Ana River and imported water from the two imported supplies.

The experts who conducted the studies employed methods consistent with the U.S. Environmental Protection Agency's guidance for risk assessment. They used estimates of the relative risks to human health associated with each alternate water source. They analyzed samples from the three sources (Santa Ana River, imported water from Northern California and Colorado River) and identified constituents of potential concern in each.

---

*"The Groundwater Replenishment System will greatly reduce Orange County's reliance on imported water by rejuvenating valuable water lost to the ocean as well as provide a creative, new, safe and reliable water supply to meet our growing demand for high-quality water."*

*Hoag Memorial Hospital Presbyterian*

---

### **Conclusions Concerning Public Health**

In keeping with standard practices in such analyses, the studies divided the possible health risks associated with the three water supplies into three categories: non-carcinogenic, carcinogenic and microbiological contaminants. In brief, the conclusions drawn about the three categories follow:

#### ***Risks associated with non-carcinogenic health effects***

Water from any of the three sources should not cause significant non-carcinogenic risk to public health. Indeed, the potential risk posed by GWR System water is lower than the other two sources.

#### ***Risks associated with carcinogenic health effects***

The carcinogenic risks associated with direct consumption of water from the GWR System should be lower than that associated with either Santa Ana River or imported (purchased) supplies from the Colorado River and Northern California.

Arsenic is the constituent that accounts for the majority of the risk in both alternatives ("No Action" and "Proposed Action.") The levels of arsenic in all three water sources, however, are below the existing regulatory minimum levels for public safety.

N-nitrosodimethylamine (NDMA) and 1,4 dioxane – which are used primarily as commercial chemicals – present more carcinogenic risk than any other constituent identified in GWR System water. At the time this study was performed, the California Department of Health Services had not established regulations regarding maximum levels of NDMA or 1,4 dioxane in drinking water. It should be noted, however, that the membrane technologies – microfiltration and thin-film composite reverse osmosis and ultraviolet light and hydrogen peroxide – will remove emerging compounds such as NDMA and 1,4 dioxane. All of these technologies will be used on 100 percent of the water purified by the GWR System.

#### ***Risks associated with microbiological contaminant health effects***

GWR System water is "...projected to pose much less risk than Santa Ana River or imported water supplies from bacteria, parasites and viruses, provided that all processes in the system treatment facility are operating fully and properly," the report said. It is important to note that for purposes of the studies, the experts assumed that each supply was consumed directly, before being used to recharge the groundwater basin. In fact, GWR System product water will be percolated into the groundwater basin where it will remain for at least one year. This will allow the GWR System water to undergo a natural filtering process while blending with water from the Santa Ana River, Northern California and the Colorado River.

### **Recommendations Concerning Operations**

The conclusions about public health risks assume that the full-scale GWR System produces water of a quality similar to that evaluated in the studies. To ensure such production, the study concludes that the system should incorporate a detailed monitoring program to ensure ongoing, reliable operations in both treatment and pipeline conveyance. The program should include a plan to dispose of water that does not meet standards, the study said (the GWR System will include constant monitoring programs).

---

*"The project will produce the safest and highest quality water available from any source – imported or local."*

*Taiwanese Medical and Dental Association  
of Orange County*

---

## Conclusion of Independent Advisory Committee

The independent advisory committee reviewed the report and summarized its findings. The committee agreed with the report's findings and concluded that "...the health risk associated with the quality of recharge water expected under the 'Proposed Action' (GWR System) will be less than or equal to that associated..." with the existing water supplies.

## Preparation of Risk Assessment

EOA Inc., an environmental and public health engineering firm based in Oakland, Calif., conducted the risk assessment studies. In addition, OCWD organized the independent advisory committee. The committee members were:

- Robert C. Cooper, Ph.D., professor at University of California, Berkeley (microbiology, virology, public health)
- George Tchobanoglous, Ph.D., P.E., professor at University of California, Davis (environmental engineering)
- Eddie Wei, Ph.D., professor at University of California, Berkeley (toxicology)
- Douglas Crawford-Brown, Ph.D., professor at University of North Carolina (environmental science)
- Margie Nellor, M.S., Los Angeles County Sanitation District (health effects)

OCWD also assembled a group of six ex-officio advisors to ensure that local stakeholders and staff from the appropriate health and regulatory agencies understood and accepted the assessment. The advisors represented the California Department of Health Services, the Santa Ana Regional Water Quality Control Board, the City of Anaheim and also included a congressional fellow.

To see a copy of the Executive Summary of the report, please contact the Orange County Water District public affairs department at 714-378-3206. Copies of the full report are in the OCWD Technical Library.

---

*The Groundwater Replenishment System  
"...will provide a long-term public health  
benefit to Orange County residents."*

*John Balbus, M.D., M.P.H.  
Director, Environmental Health Program  
Environmental Defense*

---

## How the System Works

The Groundwater Replenishment System, a joint project of the Orange County Water District and the Orange County Sanitation District, will use state-of-the-art membrane technology and ultraviolet light to produce water of near-distilled quality that exceeds state and federal drinking water standards. The water will then be used as another source to replenish Orange County's groundwater basin, along with water from the Colorado River, Northern California and the Santa Ana River.

The process will begin with highly treated sewer water from OCSD's Fountain Valley facility. This water will undergo several additional treatment steps, also referred to as an "integrated treatment process," that includes microfiltration, thin-film composite reverse osmosis and ultraviolet light and hydrogen peroxide treatment.

After undergoing this additional treatment, the water will be used to replenish the groundwater basin underlying north and central Orange County. The purified water will be pumped to spreading basins and travel the same natural filtering path that rainwater takes as it moves underground. It also will be used to expand the Seawater Intrusion Barrier that keeps the Pacific Ocean out of the groundwater basin.

Once in the basin, the purified water will blend with other groundwater from the Santa Ana River and imported sources.

**What Other Public Health, Medical Professionals and Scientists  
Have Said About the Groundwater Replenishment System**

*"I am confident that on balance, the System will make a substantial contribution to the prevention of disease transmission and maintenance of overall public health within the county."*

**Sanford Brown, M.P.H., Ph.D.**  
**Professor Emeritus of Health Science, California State University, Fresno**

*The Groundwater Replenishment System "will be approved and monitored by the California Department of Health Services, the Regional Water Quality Control Board and Orange County Health Agency...this should provide adequate oversight and public health protection."*

**Christine L. Moe, Ph.D.**  
**Associate Professor, Rollins School of Public Health, Emory University**

*"I am confident that the advanced treating technologies that will be applied to previously treated wastewater – microfiltration, reverse osmosis and ultraviolet light and hydrogen peroxide – will produce output flows of clean, high-purity water."*

**H. John Blossom, M.D.**  
**Director, California Area Health Education Center, University of California, San Francisco-Fresno**

*"The Groundwater Replenishment System will provide ample protection from waterborne disease for Orange County residents."*

**Ralph Morris, M.D., M.P.H.**  
**Public Health Physician**

*"Hospitals in Orange County are significant users of water..." The Groundwater Replenishment System "will help assure the availability of this valuable resource in the future."*

**Hospital Association of Southern California**

*"Having completed my assessment, I wish to commend the Orange County Water District and Orange County Sanitation District for moving forward with this project."*

**Kellogg J. Schwab, Ph.D.**  
**The Center for Water and Health, Johns Hopkins Bloomberg School of Public Health**