EXECUTIVE SUMMARY

An outbreak of waterborne disease associated with *Salmonella* in drinking water struck Alamosa, Colorado during March and April 2008. The city of Alamosa's public water system that supplies drinking water to the community became contaminated with *Salmonella* bacteria. Alamosa's population is about 8,900 people. The outbreak resulted in 442 reported illnesses, 122 of which were laboratory-confirmed, and one death. Epidemiological estimates suggest that up to 1,300 people may have been ill. Details on the epidemiological investigation are pending publication by the CDPHE Disease Control and Environmental Epidemiology Division.

Alamosa's drinking water comes from deep artesian wells in an aquifer considered to be a protected groundwater source. Prior to the outbreak, the city's drinking water was not chlorinated for disinfection. A waiver from the statewide requirement for disinfection was granted to Alamosa in 1974. In general, the city was historically in compliance with all health-based drinking water standards, with the exception of the arsenic standard.

A statewide response to the outbreak lasting about one month involving numerous responders was coordinated using the National Incident Management System (NIMS) and Incident Command System (ICS). The Safe Drinking Water (SDW) program within the Colorado Department of Public Health and Environment is responsible for implementing the federal Safe Drinking Water Act in Colorado. During the outbreak, the SDW program responded as part of the ICS to protect public health and provide technical support to the city and to other emergency responders.

During the outbreak residents were advised to drink bottled water, and then the entire water system was flushed and disinfected with chlorine to kill the *Salmonella* bacteria. A boil water order followed the bottled water order, and it remained in place until tests confirmed that the city's water was safe to drink again. Because of the quick operational response and the changes made to the physical infrastructure of the Alamosa public water system, the water in Alamosa has been safe to drink since April 2008. The city has since installed advanced treatment processes and improved system operations.

The investigation involved a detailed review of the water system, historical records, and interviews with city of Alamosa personnel, local health officials and responders to the outbreak. Although there were several possible causes of the outbreak, our conclusion is that an animal source of fecal contamination entered the Weber Reservoir, and then spread throughout the entire system. The Weber Reservoir is a ground-level water storage reservoir near the Weber Well, which was the primary water well in use by the city, prior to the outbreak. The Weber Reservoir had several small cracks and holes that likely allowed the contamination to enter. These breaches may have existed for a relatively long period of time.

The SDW program strives to prevent disease outbreaks. A team of experts is on call 24 hours a day, 7 days a week, 365 days per year to respond to events that may put public health at risk and help public water systems correct the problems that can lead to disease outbreaks. Typically, this

team responds to about 50 acute risk events per year. It is not possible to directly state that the team has prevented disease outbreaks, but the actions taken by the team, including issuing bottled or boil water orders, reduce the risk of waterborne disease. However, severe personnel limitations at the state level have resulted in an inability to address every potential area of risk associated with drinking water in Colorado. This is well-documented, and extends to the 1970s at the SDW program's inception.

As recently as the early 1980s, disease outbreaks associated with drinking water were relatively common in Colorado, often occurring more than once a year. The documented disease outbreaks in the 1980s primarily occurred at systems that failed to adequately treat water from rivers or streams. As a result, the SDW program focused its resources on establishing and enforcing adequate treatment requirements for these systems. Since the 1980s, improvements to physical, regulatory, and human infrastructure dramatically reduced the potential for drinking water supplies to become contaminated and cause disease.

Although the SDW program's resources have increased in recent years, the increases have generally been tied to implementing new regulations, and the emphasis on treatment during inspections remained. Unfortunately, the city had not addressed integrity issues at the Weber Reservoir and those issues were not detected during inspections of the Alamosa water system conducted by the SDW program during the decade prior to the outbreak, including an inspection in August 2007.

The SDW program has developed and is implementing several strategies to further reduce the likelihood of waterborne disease outbreaks in Colorado. These strategies include:

- Prioritize responding to deficiencies at water systems that do not disinfect;
- Review disinfection waivers and withdraw them when needed to protect public health;
- Enhance oversight of sampling, water storage and distribution piping during inspections;
- Update and modify regulations related to disinfection waivers and groundwater disinfection;
- Ensure compliance with requirement for water systems to maintain residual chlorine levels in water distribution systems;
- Revise regulations associated with controlling hazardous cross connections at water systems;
- Ensure that deficiencies identified during inspections are corrected in a timely fashion;
- Launch training initiatives to help public drinking water systems to optimize water storage tank and distribution system operating and maintenance practices; and,
- Develop strategies to enhance response capabilities to drinking water emergencies.

This report provides a comprehensive documentation of the events in Alamosa associated with the disease outbreak including the response, cause, and lessons learned. It is hoped that an improved understanding of this event will help all those involved in the serious business of providing safe drinking water to prevent waterborne disease outbreaks.