



Colorado Department  
of Public Health  
and Environment

# Radionuclides and the Lowry Landfill Superfund Site



JUNE 2001

EPA Region 8

## Introduction

Some members of the public are concerned about the U.S. Environmental Protection Agency's (EPA) decision to pipe treated groundwater from the Lowry Landfill Superfund Site (Lowry) to local Publicly Owned Treatment Works (POTWs or wastewater treatment plants) for further treatment. They fear that radioactive materials (radionuclides) were illegally disposed of at Lowry. They are concerned that water leaving the site is contaminated at levels unsafe for POTW workers, for those people living close to the farmland where POTW sludge is used as fertilizer, and for people who eat food grown on the farmlands.

EPA and Colorado Department of Public Health and Environment (CDPHE) experts have thoroughly reviewed the existing information and are confident that the risk of exposure to manmade radionuclides is similar to that for natural environmental exposures. Nevertheless, because of the concerns expressed, EPA and CDPHE continue to study this issue and have put in place layers of safeguards to make sure that radionuclides from Lowry do not become a problem.

This fact sheet describes why EPA and CDPHE believe that manmade radionuclides are not a threat at Lowry, the additional studies being undertaken, and what safeguards are in place.

## Site Background and History

The Lowry Site is located in Arapahoe County, northeast of the intersection of East

Quincy Avenue and Gun Club Road, approximately 15 miles southeast of downtown Denver and 2 miles east of Aurora.

From the mid-1960s until 1980, the City and County of Denver (Denver) operated an industrial and municipal waste landfill at Lowry. Wastes allowed to be brought to the landfill for disposal included metal-plating wastes; radioactive and non-radioactive medical wastes; radioactive household and industrial waste (such as discarded alarm components, gas lantern mantles, smoke detectors, camera lenses, and anti-static brushes); petroleum products; pesticides; industrial solvents; sewage sludge; paints; tires; animal carcasses; and household hazardous wastes. These wastes were disposed of into about 75 unlined trenches or waste pits. Landfill managers believed that adding refuse, tires, and soils to the pits would absorb the liquids. In 1980, Waste Management of Colorado (WMC) started landfill operations under a contract with Denver. At that time, waste disposal was restricted to municipal waste.

Over time, contaminated liquids seeped out of the waste pits and mixed with surrounding soils, groundwater, and surface water. In 1984, EPA added Lowry to the National Priorities List (the list of sites compiled under Superfund that are high priorities for study and cleanup).

## The Lowry Site Remedy

On March 10, 1994, EPA and CDPHE issued the Record of Decision (ROD) that selected the cleanup plan for Lowry. The

sitewide remedy addresses contaminated groundwater, waste pit liquids, soils, surface water, sediments, landfill gas, landfill solids, and buried drums. This fact sheet focuses on the groundwater components of the site remedy.

In October 1997, EPA and CDPHE published an explanation of significant differences (ESD) to the ROD so that contaminated groundwater would be treated at the onsite water treatment plant to remove organic contaminants. Then, the treated water would be piped offsite for treatment of inorganic and remaining organic contaminants at the Metro Wastewater Reclamation District (Metro) facility and the City of Aurora Sand Creek Wastewater Reclamation Facility (Aurora). Metro and Aurora issued a discharge permit for Lowry with pre-treatment standards for water quality that protect community and worker safety. The onsite treatment plant has been constructed and is monitored regularly to see that the standards are being met.

### **Community Concerns About Sending Lowry Water to the POTWs**

Metro blends and treats the sewage sludge byproducts of the wastewater treatment process, producing an end-product called biosolids. Metro applies biosolids as fertilizer and a soil amendment on its farmlands in eastern Colorado near the town of Deer Trail. The biosolids are also sold commercially as a soil supplement.

EPA's Office of the Inspector General (OIG) received a petition from some concerned citizens requesting an investigation of EPA's decision to pipe treated groundwater from Lowry to the public sewer systems. The OIG released a report on February 29, 2000, which recommended that, although there is no credible evidence that manmade radionuclides were illegally disposed of at the Lowry Site, EPA should perform an

independent radionuclide analysis. The OIG concluded that this analysis "...will help address radionuclide concerns and public criticism of the Agency's decision." EPA remains confident that the decision to send treated Lowry groundwater offsite to the POTWs adequately protects human health and the environment from unsafe levels of radionuclides.

The OIG also recommended that Region 8 produce a fact sheet explaining why radionuclides are not currently a threat at Lowry. This fact sheet is the result of that recommendation.

### **Features of the Lowry Groundwater Remedy**

The Lowry groundwater remedy includes containment, collection, and treatment elements, as well as monitoring, to make sure that performance standards and plans to ensure public safety are met. Figure 1 on page 3 shows the elements of the groundwater remedy.

**Containment and Collection.** EPA selected containment to isolate contamination at Lowry from the surrounding areas by controlling the movement of groundwater and surface water, and collecting the water for treatment at the onsite water treatment plant. Groundwater control features have been built along parts of the north, east, west, and south perimeters of the site to act as containment and diversion systems. The North Toe Extraction System will remove groundwater from the area north of the closed landfill. The extracted water will be treated at the new onsite treatment plant after modifications are made to treat additional chemicals found in this water (such as 1,4-dioxane).

#### **Water Treatment**

The onsite water treatment plant is designed to treat up to about 20,000 gallons of contaminated groundwater a day, and is

currently treating about 14,000 gallons daily. The treatment plant uses ultraviolet oxidation and activated carbon to treat organic chemicals such as vinyl chloride.

### Monitoring Programs

Monitoring of groundwater and the water treatment plant effluent provides information about the effectiveness of the

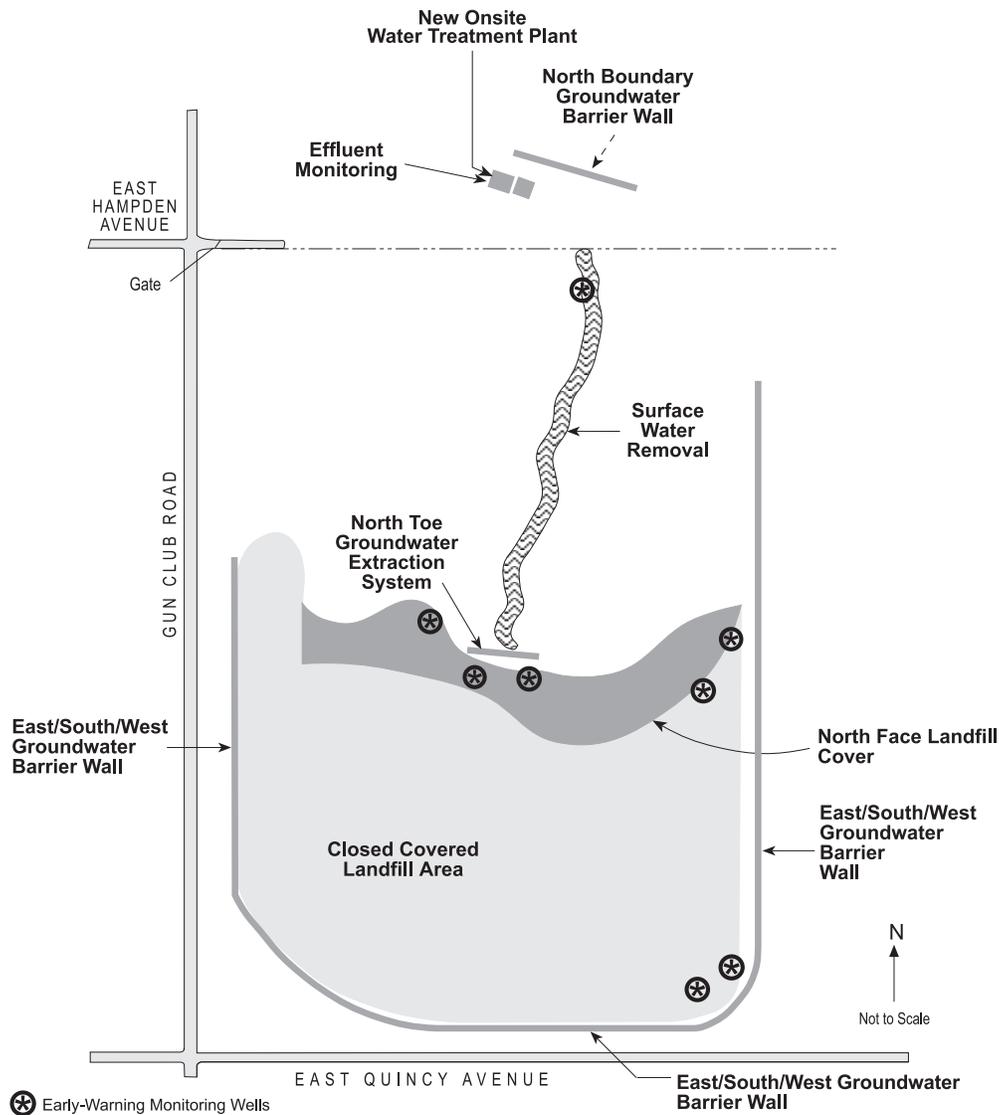
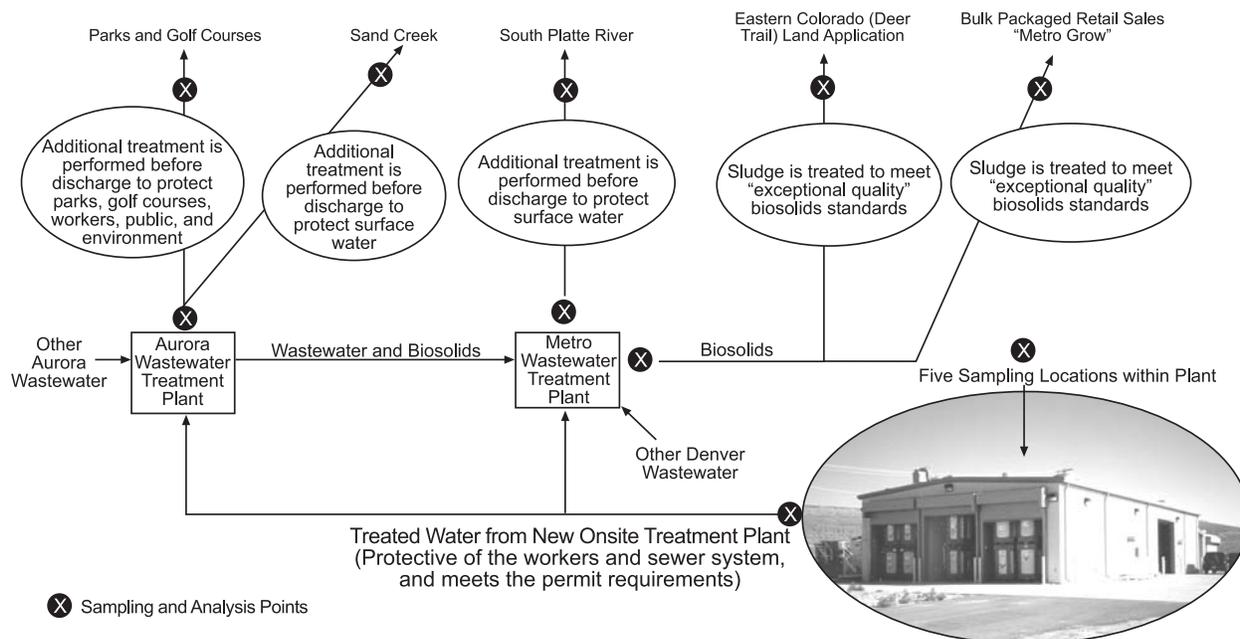


Figure 1  
Lowry Groundwater Remedy

During treatment, the water is softened and, in the process, some inorganic constituents such as metals and radionuclides are also partially removed. Figure 2 on page 4 shows the flow of groundwater from the onsite treatment plant and through the POTWs. It also shows the stages of treatment and testing.

groundwater remedy.

**The performance and compliance groundwater monitoring program** assesses compliance with the site cleanup standards. Samples are collected from wells along the site boundary. These samples are analyzed quarterly for about 200 substances, including radionuclides.



**Figure 2**  
**Sampling Before Discharging to the Environment**

**Eight early-warning monitoring wells** are located upgradient of the groundwater collection features. This system monitors the quality of groundwater before it is extracted to evaluate whether modifications to the water treatment plant are needed. Water from these wells is tested twice per year for many substances, including radionuclides.

**Water treatment plant effluent is monitored** by the Potentially Responsible Parties or PRPs at varying times specified in the site monitoring permit (continuous, daily, monthly, semimonthly, quarterly, twice-quarterly, and annually) to verify that the treatment plant is in compliance with the approved flow and discharge standards in the site discharge permit. (Please see page 5 for more information about the PRPs and their role in site activities.) The discharge permit includes standards for radionuclides. Tests for radionuclides are part of the semimonthly monitoring cycle. In addition, Metro and Aurora sample the

water to assure that discharge and quality standards are met.

**Contingency Measures**

If contaminant levels in the monitoring wells exceed the performance standards at the barrier wall and there is an outward migration of contaminants, measures such as pumping and installation of additional extraction wells or other response actions must be implemented.

For example, pumping at two locations along the eastern boundary of the site began in January 2000, when organic contaminants were detected above performance standards in monitoring wells. In addition, tests showed that water levels were higher in the interior wells than the exterior wells. This indicated a potential for contaminated water to move offsite. Therefore, EPA required implementation of corrective measures, such as installation and pumping of additional monitoring wells. Contaminated water that is pumped from the wells is treated at the onsite water

treatment plant. Pumping will continue until the flow is reversed or contamination concentrations no longer exceed performance standards. If this approach is not effective, alternate extraction methods will be identified and implemented.

## Site Studies of Radioactive Materials

Superfund requires EPA to compel generators, transporters, and former and current owners of a site (PRPs) to pay for and/or conduct studies and undertake cleanup actions at Superfund sites. Since 1990, most of the Lowry investigations and cleanup have been performed by PRPs under EPA supervision.

EPA (1984 through 1989) and various groups of PRPs (1990 and beyond) conducted studies at Lowry called Remedial Investigations/Feasibility Studies (RI/FSs) to evaluate the contaminants present, the extent of the contamination, and the best methods to clean up the site. They performed studies on groundwater, waste pit liquids, soils, surface water, sediments, landfill solids, and landfill gas.<sup>1</sup>

Beginning in 1984, EPA collected samples of naturally-occurring radionuclides from surface water and groundwater. In 1988, EPA expanded the sampling program to include manmade radionuclides.

EPA and the PRPs have performed more than 160,000 groundwater tests, including 12,000 tests for radionuclides. Radionuclide analyses have been performed for more than 1,800 sampling locations in the soils,

<sup>1</sup> The Lowry Coalition (a group of PRPs at Lowry) performed the RI/FSs for Shallow and Deep Groundwater and Subsurface Liquids.

PRPs (Denver, Waste Management of Colorado, and Chemical Waste Management) performed the RI/FSs for Landfill Solids and Landfill Gas.

PRPs (Metro and Denver) performed the RI/FSs for soils, surface water, and sediments.

In 1995, Denver, Waste Management of Colorado, and Chemical Waste Management reached an agreement with other site PRPs to perform the Remedial Design and implement the Remedial Actions for the Sitewide Remedy on their behalf, and are currently performing work at the site under EPA oversight.

groundwater, surface water, sediments, solids, and waste pits.

Sampling and analysis detected low-level radionuclides in groundwater, surface water, soils, and sediments. Naturally-occurring radionuclides found at Lowry include uranium, thorium, tritium, and potassium. Manmade radionuclides found at Lowry (associated with municipal and commercial trash disposal, and fallout from nuclear-processing facilities and aboveground nuclear testing) include plutonium, americium, and strontium. Studies showed that radionuclides at Lowry are present at background levels and are consistent with naturally-occurring radiation and manmade fallout found in the western United States.

In 1991, the group of PRPs known as the Lowry Coalition (and its contractors) prepared a report evaluating radioactive wastes at the Lowry Site. There were several problems with this report: 1) the PRPs did not compare the results to previously collected radionuclide data or to the duplicate quality control samples; and 2) they failed to take into consideration the high counting errors and low recovery rates of the data, which can make the data questionable.<sup>2</sup>

These problems led to false conclusions about the level of manmade radioactive material at Lowry and unnecessarily raised public concerns. The laboratory that performed the analysis of the 1991 data later notified the PRPs that the methods they used may have produced false positive results for americium. EPA was aware of the problems with this report and pointed

<sup>2</sup> The counting errors are an indicator of uncertainty in the measurement. The higher the counting error, the higher the uncertainty. Also, to monitor the efficiency of the sample extraction and analysis processes, a known amount of an indicator isotope is added at the beginning and measured at the end. If the amount of the indicator isotope recovered (recovery rate) at the end is much lower than the original amount, then the entire process is too inefficient to produce accurate data.

these out to the PRPs. Evaluations performed after 1991 provided a clearer understanding about the presence of radionuclides at Lowry.

In 1992, the Lowry Coalition issued another report entitled, *Evaluation of the Data Quality and Occurrence of Transuranic Radionuclides in the Shallow Groundwater and Subsurface Liquids and Deep Groundwater Operable Units*. The same samples that were evaluated for the 1991 report were re-analyzed, and the conclusions were considerably less alarming. The new conclusions confirmed that transuranic (manmade) radionuclides were at background levels.

To keep the public fully informed about Lowry, EPA included results of all of these studies in the Administrative Record, even those we now know contain misleading data and conclusions.

### **Recent Studies 1994 to Present**

The PRPs have continued to conduct studies in conjunction with the engineering designs, water treatment plant construction and operations, and monitoring programs. These studies also show that radionuclide levels continue to be consistent with background concentrations.

The PRPs have collected an additional 700 groundwater samples since the ROD was issued in 1994. These samples were analyzed for radionuclides, among other substances. Wells were sampled during the design of the water treatment plant and during annual compliance monitoring. The early-warning monitoring wells are sampled semiannually for radionuclides. Effluent from the water treatment plant is sampled and analyzed twice a month for radionuclides, including plutonium and americium.

### **Baseline Risk Assessments**

Using the data collected from site investigations conducted before 1993, EPA conducted a Baseline Risk Assessment, which is a scientific process used to estimate the potential adverse effects on human health and the environment from exposure to chemicals. A Baseline Risk Assessment evaluates risks based on a reasonable maximum exposure scenario or RME. The RME is defined as the highest exposure that is reasonably expected to occur at the site under current and future land-use conditions.

EPA uses the same risk assessment process at all Superfund sites. The results of the risk assessment are used to:

- Help determine whether additional response actions are needed;
- Develop or modify cleanup goals; and
- Document the magnitude and causes of risk at a site.

Risks are estimated by evaluating the chemical concentrations, the likelihood of exposure to chemicals, and the toxicity of the chemicals.

### **Site Groundwater Risk Calculations**

Both naturally-occurring and manmade radionuclides were detected at Lowry in groundwater, soils, surface water, and sediments. The risks from exposure to naturally-occurring background radiation, such as cosmic rays from space and naturally-occurring radioactive materials in rocks and soil, are largely unavoidable. An evaluation of the risk from exposure to average levels of background radiation establishes a benchmark for judging the additional risk from releases of radionuclides to the environment.

To estimate the risk from possible groundwater consumption, the Lowry

Baseline Risk Assessment used the assumption that an individual would drink two liters of contaminated waste pit water every day for 30 years. This is a hypothetical and conservative scenario. Since some uncertainty about risk estimates is unavoidable, a large margin of safety is used to prevent underestimation of risk. No one currently drinks water from the waste pits and there are safeguards in place to prevent this from happening.

EPA estimated the risk from Lowry that could be caused by ingesting untreated water from the Lowry waste pits containing radionuclides (under this theoretical scenario) to be about six in 10,000. This means if 10,000 people would drink two liters of contaminated groundwater per day for 30 years, the incidence of cancer would increase by about six cases over the United States average cancer risk (estimated at one in four at that time). Major contributors to this risk include radium-226, lead-210, and potassium-40, naturally-occurring radionuclides typically found in groundwater in Colorado.

The Baseline Risk Assessment concluded that naturally-occurring radionuclides contribute a relatively small amount to the overall site risk (about 3 percent). Manmade radionuclides such as plutonium and americium accounted for less than one-third of 1 percent of the site risk. This risk is comparable to the risks for background levels.

Organic chemicals such as vinyl chloride are by far the largest contributors to the overall Lowry groundwater risk (about 37 percent of the overall risk). The risk from organic chemicals represents an additional cancer risk of one case of cancer for every 100 people who would be exposed under the hypothetical risk assessment assumptions.

As a result, EPA did not consider radionuclides the most critical problem, but, nevertheless, required a remedy that will provide protection from radionuclides.

### **Safeguards in the Lowry Remedy**

There are numerous safety factors built into the remedy to protect human health and the environment from exposure to unsafe levels of radionuclides. Metro and Aurora issued an industrial wastewater discharge permit (Permit I-118) that requires the water discharged from the Lowry water treatment plant to meet specific standards. These standards (for radionuclides and other chemicals of concern) were designed so that the water can be safely sent through the sewer system and treated at the POTWs. The new onsite water treatment plant was built to meet the requirements of this permit.

Only low levels of radionuclides, consistent with background levels, have been found in the effluent of the onsite water treatment plant. Nonetheless, there is an onsite early-warning groundwater monitoring system that alerts the PRPs if unacceptable levels of radionuclides appear in the groundwater before the water is collected and treated (see Figure 1 on page 3). If this occurs, the wells would be re-sampled to confirm the presence of radionuclides. If confirmed, the onsite water treatment plant would be re-evaluated and upgraded to remove radionuclides. Lowry water would not be sent offsite until the levels of radionuclides are reduced to the discharge permit standards.

For instance, in June 2000, americium-241 was detected in samples from two of the eight early-warning wells at levels approximately double the permit standard of 0.2 picocuries (pCi) per liter. EPA required additional sampling of these wells and the later samples did not show elevated levels of americium. The results in

the same wells were significantly below the permit standard. EPA will continue to closely watch the early-warning monitoring results to see if changes to the treatment system are needed.

### **Additional Safeguards**

**Land-Use Controls.** Public access to the Lowry Site is prohibited. In addition, the selected sitewide remedy calls for numerous well, deed, and development restrictions to limit future use of the property in the vicinity of the site. Fences and warning signs have also been erected to limit access to the site to protect people from exposure to site contaminants.

**U.S. Geological Survey (USGS) Sampling in the Deer Trail Area.** The USGS is sampling stream sediments, soils, groundwater, biosolids, and crops on and around Metro's farmlands near Deer Trail, Colorado. USGS analyzes samples for inorganics and organics including dioxins, polychlorinated biphenyls (PCBs), and radionuclides. This will help determine whether Metro's application of biosolids is increasing the concentrations of these chemicals in the soil. The Deer Trail monitoring program began in January 1999 and will continue through 2005. USGS publishes a quarterly newsletter with the sampling results. Interested persons can contact Tracy Yeager at USGS (303-236-4882 ext. 225) to be included on the newsletter mailing list.

**Additional Lowry Radionuclide Evaluations.** EPA has contracted with the USGS to develop an additional study to reassess the radionuclide levels at the site. This investigation is being conducted in response to ongoing citizens' group concerns that there may be plutonium above the levels found in previous studies. USGS is reviewing the existing site data and sampling the effluent from the new onsite water treatment plant.

**Radionuclide Work Group.** EPA has formed a work group to discuss radionuclide issues at Lowry. The group consists of representatives from EPA Region 8; CDPHE; the PRPs and their contractors; the City of Aurora; Metro; Arapahoe County; USGS; CH2M HILL (EPA's contractor at Lowry); EPA's Environmental Response Team; Citizens for Lowry Landfill Environmental Action Now (CLLEAN); EPA's National Air and Radiation Environmental Laboratory; and eastern Colorado. The work group will review radionuclide sampling plans and results, and discuss radionuclide issues.

**The Five-Year Review.** Every five years, EPA will review all aspects of the Lowry remedy to determine if it is working. If not, EPA will require changes be made to the remedy to assure protection of human health and the environment. In September 2000, EPA began the first Five-Year Review at Lowry. EPA will review the performance of each component of the sitewide remedy. EPA has mailed a separate fact sheet that describes the Five-Year Review to those people on the site mailing list.

### **Questions and Answers**

This section presents answers to some frequently asked questions about radioactive materials and Lowry.

#### ***What are radionuclides?***

A radionuclide is an unstable atom that undergoes a spontaneous transformation (radioactive decay process) to a different atom (decay product). Each radionuclide has a unique, identifying half-life, the time it takes for one-half (50 percent) of the radioactive atoms to be reduced through radioactive decay to its decay product.

Radionuclides can be grouped into two categories: naturally occurring and manmade. Naturally-occurring radionuclides are those that have existed

since the creation of the Earth or are continuously formed in the Earth's upper atmosphere. Examples are uranium, thorium, tritium, and carbon-14. Manmade radionuclides are those formed by nuclear power reactors, accelerators, or nuclear weapons testing. Examples of these manmade radionuclides include cesium-137, strontium-89/90, and plutonium isotopes.

Studies at Lowry show that radionuclides found in the groundwater are consistent with background levels. These levels are similar and consistent with concentrations found throughout the Denver/Colorado Front Range area from naturally-occurring radionuclides and from manmade background concentrations caused by atomic weapons testing, the Ukraine's Chernobyl reactor accident, and other manmade fallout. We do not currently see any release of radionuclides above background and permitted levels from the Lowry Landfill.

#### ***How are radioactivity results reported?***

The quantity of a radionuclide is reported in units of curies or fractions of curies. For environmental radioactivity issues, the unit of common usage is the picocurie (pCi). A picocurie is one-trillionth of a curie.

The units for concentrations of radionuclides in environmental samples (water and soil) are activity (pCi) per unit weight (milligram [mg] of soil) or unit volume (liter [L] of water). For example, a radionuclide concentration in a water sample is reported as pCi/L.

Concentration results for total uranium in water and soil samples are an exception to this reporting procedure. Total uranium concentrations are reported in activity units as well as mass units; that is, pCi per unit weight or unit volume and/or micrograms

(or milligrams) per unit weight or unit volume.

The quantitative data presentation of radionuclide concentration results includes values less than Minimum Detectable Concentrations (MDCs) and values equal to or greater than MDCs with associated counting errors (statistical uncertainty). Radionuclide measurements are unable to determine concentration values with absolute certainty or zero concentrations (total absence from the sample). Instead, a radionuclide measurement determines the concentration range with high certainty, which includes the "true" concentration of the radionuclide in the sample. For example, a plutonium-239/240 result of 0.1+/-0.1 pCi/L shows the true concentration in the sample lies within the range of 0 to 0.2 pCi/L (with 95 percent probability or confidence the true concentration does not exceed 0.2 pCi/L).

#### ***What radionuclides have been found in Lowry groundwater?***

As expected for all groundwater within Colorado and other locations throughout the United States, naturally-occurring radionuclides have been analytically detected in the groundwater samples taken at Lowry. The list of detected naturally-occurring radionuclides includes uranium isotopes (U-238, U-234, U-235), thorium isotopes (Th-228, Th-230, Th-232, Th-234), radium isotopes (Ra-226, Ra-228), tritium (H-3), and potassium-40 (K-40). For each of these radionuclides, the analytical measured concentrations have been within the corresponding range of concentrations observed for Colorado-wide groundwater.

The manmade radionuclides of greatest concern to the general public at the Lowry Site seem to be plutonium isotopes and americium-241 (transuranics). By employing very low detection limits for the laboratory measurement procedures,

quality-assured results for the groundwater samples have shown that the concentrations of plutonium isotopes and americium-241 are generally less than 0.1 pCi/L. Some recent samples have shown results as low as 0.01 pCi/L. These very low concentrations are over 100 times less than the drinking water levels that are protective of human health.

***What are the effects of exposure to radiation?***

The effects of exposure to radiation depend upon many other factors, which include the size and duration of radiation exposure; the type of radiation (alpha, beta, or gamma photon exposure); the area or organ of the body exposed to radiation; and a person's age, sex, and physical condition. It has been estimated by various scientific committees that the life-time risk of cancer to each person from low-level radiation exposures ranges from five to eight additional cancers per 1,000 people above the normal cancer rates for unexposed people. Currently, two in five males and one in three females in the United States are diagnosed with cancer.

There have been numerous studies of health effects from radiation exposure, including studies of uranium mine workers; survivors of Hiroshima/Nagasaki; physicians and radiologists; radium-dial painters; and animals. The studies show that skin cancers, leukemia, thyroid cancers, immune system impairment, cataracts and, in some cases, mental impairment are caused by large doses of radiation administered over a short period. However, these same studies have shown that human cells can repair some damage caused by ionizing radiation. It is also difficult to tell whether cancer was caused by radiation exposure or by one of more than 300 other carcinogens in our environment, genetic disposition, environmental factors, or other unknown factors.

***What is plutonium?***

Plutonium is a manmade radioactive metal developed in nuclear reactors for use in nuclear weapons. Plutonium has four major isotopes: Pu-238, Pu-239, Pu-240, and Pu-241. All but Pu-241 emit alpha particles as the principal form of radiation. Pu-241 emits beta particles. Alpha particles travel only an inch or so through the air and cannot penetrate the outer layer of our skin. Beta particles travel several inches through the air and cannot penetrate a thin layer of plastic. Plutonium metal is very chemically unstable. The metal will spontaneously corrode upon exposure to water or oxygen and fine metal powder will ignite and produce fire in the presence of oxygen.

***How are people exposed to plutonium?***

Plutonium enters the body through inhalation, ingestion, or open wounds in the skin. Plutonium toxicity is determined both by its radiological and chemical characteristics. Toxicity studies in animals have shown that plutonium's health effects are dependent upon several factors, such as metal solubility, routes through which plutonium enters into the body, organs affected by the metal, the rate which the body removes plutonium, the energy of the radioactive particles emitted, and the half-life of the plutonium isotope taken in the body.

No information indicates exposure to plutonium (above background levels) from Lowry groundwater.

Plutonium ingested in water is normally not absorbed by the body due to the metal's chemical and physical properties, dietary and stomach properties, and gastrointestinal absorption insensitivities. In studies involving plutonium ingested by humans, over 98 percent of the plutonium was excreted in five to six weeks.

***Can you prove that plutonium has never been disposed of at Lowry?***

Because of the size of the Lowry Site (about 480 acres) and the large volume of wastes, it is not technically feasible to be absolutely certain of everything disposed at the site. However, EPA has extensively researched the allegations that plutonium was illegally disposed of at Lowry. To determine what hazardous wastes were sent to Lowry from Rocky Flats, EPA compiled a master list of all hazardous wastes generated by the Department of Energy at Rocky Flats from 1965 to 1980. Although Rocky Flats disposed of some wastes at Lowry (such as paint sludge, solvents, and waste oil), the documentation indicated that the facility's radioactive wastes were sent to the Nevada Test Site and the Idaho National Engineering Laboratory for storage or disposal. These documents have also been reviewed by numerous outside parties. Data collected during the site studies have not confirmed the allegations of plutonium disposal.

It is impossible to determine by analysis of water samples that plutonium-bearing wastes were never disposed of at the Lowry Site. Radioactivity analyses frequently cannot determine a "zero" or "absence-from-the-water-sample" concentration. Because groundwater always has radiation in it from both naturally-occurring and manmade radionuclides, we will always have detections of radiation in groundwater. What we can reliably say is that the currently measured levels of radiation (whether caused by natural processes or potential disposal) are significantly lower than our regulatory or action levels that cause human health concerns.

We can also compare our groundwater sample to the laboratory minimum detectable plutonium concentration. This means that we are certain 95 percent of the

time that if plutonium is in the water sample at a concentration equal to or greater than the minimum detectable concentration, we can measure it reliably and accurately. We have lowered the laboratory analytical detection level from previous sampling events down to levels where we can now detect plutonium and americium-241 concentrations equal to or greater than 0.1 pCi/L.

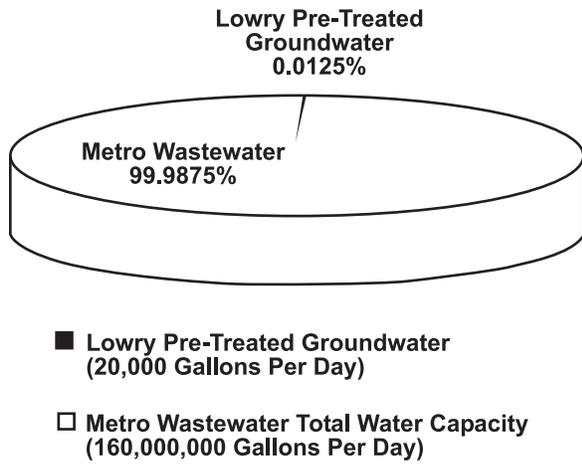
***Are there radionuclides in the treatment plant effluent discharged to Metro?***

Yes, the same radionuclides, naturally occurring and manmade, that occur in the groundwater will be present in the effluent from the Lowry water treatment plant. This is because the treatment process is not designed to remove radionuclides.

Groundwater leaving Lowry must meet the standards (including standards for radionuclides) in the site discharge permit. If these standards are exceeded, the discharge of treated Lowry water to the POTWs will be stopped. Monitoring of the water treatment plant effluent shows that results are below the permit levels.

***Will the water from the Lowry Landfill Site affect the quality of water discharged from Metro's or Aurora's sewer system?***

There will be no measurable changes in the radionuclide concentrations in the sewage influent to the Metro plant attributable to the pre-treated groundwater from the Lowry Site. The comparative flows are 160,000,000 gallons per day of total sewage influent and 20,000 gallons per day of pre-treated Lowry groundwater (equivalent to the water volume of a small backyard swimming pool). Evaluations by EPA and CDPHE showed the addition of this small volume from the Lowry Site to the large sewage inflow will have no measurable effect on the quality of the water discharged to the South Platte River or the quality of the biosolids (see Figure 3).



**Figure 3**  
**Contribution of Lowry Pre-Treated Groundwater to Metro's Wastewater Treatment Plant**

Aurora's wastewater treatment system treats approximately 25,000,000 gallons of water per day. The contribution from Lowry is still only a minute percentage. Ninety percent of Aurora's water is diverted to Metro. The remainder undergoes additional treatment before being discharged to Sand Creek or used as irrigation for parks and golf courses.

## Where to Get More Information About the Lowry Landfill Site

Documents used by EPA to make a decision on the selection of the Lowry Site remedy are available for review at the following locations:

EPA Superfund Records Center  
999 18<sup>th</sup> Street  
Denver, CO 80202  
303/312-6473



Aurora Public Library  
14949 East Alameda Drive  
Aurora, CO 80012  
303/739-6600

Many site documents can also be seen at the Deer Trail Public Library, Bennett Public Library, and Byers Public Library.

Additional information about the Lowry Site can be obtained on the Internet at:  
<http://www.epa.gov/region8/superfund/sites/co/lowry.html>

## Key Contacts

If you have questions about radionuclides, the Lowry Site remedy, the site cleanup, or would like to be added to (or removed from) the mailing list, please contact any of the following individuals:

### **EPA**

Gwen Hooten  
Remedial Project Manager  
1-800-227-8917 ext. 6646 or 303/312-6646  
hooten.gwen@epa.gov

Nancy Mueller  
Community Involvement Coordinator  
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### **CDPHE**

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State Project Officer  
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State Community Relations Manager  
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