# Mojave River Pipeline Spill, San Bernardino County, California

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## Abstract

On the stormy evening of November 21, 2004, a 14-inch diameter petroleum multi-product pipeline sprung a leak. The pipeline is owned and operated by the California-Nevada Pipeline Company, a subsidiary of Kinder-Morgan Energy Partners. The pipeline is the main source of petroleum fuel products for Las Vegas, NV. It was transporting gasoline at the time of the release. The spill, an 80 foot geyser, was discovered on the morning of November 22, 2004, after numerous complaints of a strong gasoline odor on Interstate 15 in northern San Bernardino County, California. The release occurred approximately 2,000 feet north of the highway. Air monitoring along the interstate indicated elevated levels of gasoline vapors above safe levels. For safety reasons, the highway was closed for approximately twelve hours by the local fire department and the California Highway Patrol.

Upon discovering the leak, pipeline operations were terminated and the impacted section of pipe (approximately 8 miles) was isolated. Kinder-Morgan responded to the spill site to begin response operations. The spill site was located entirely on public land managed by the U. S. Bureau of Land Management (BLM). The area surrounding the spill site is

habitat for the California Desert Tortoise, a federal endangered species. Response operations included removal of all products from the isolated section of pipe, removal and replacement of the damaged section of pipe, and remediation of contaminated soil. Damage to the pipeline is thought to be from unreported third party mechanical damage. The total quantity of contaminated soil removed was approximately 10,300 tons (362 truckloads).

The emergency phase of the response lasted for three days. It was a unified command between San Bernardino County Fire Department (SBCFD), Kinder-Morgan Energy Partners and California Department of Fish and Game (CDFG). The United States Environmental Protection Agency (USEPA) provided technical support to the Unified Command during the emergency phase including air surveillance capabilities via START, ERT-West and REACT, health and safety oversight, and groundwater sampling of nearby agricultural wells. The recovery phase was a unified command between the BLM and Kinder-Morgan Energy Partners that continued for approximately three months.

Agencies responding to the incident included: SBCFD, CDFG, California Office of Emergency Services (OES), Lahontan Regional Water Quality Control Board, California State Fire Marshals Office, USEPA, BLM, and U.S. Fish and Wildlife Services (USFWS).

This paper describes a successful response in detail, specifically addressing many of the conditions and issues that the unified command dealt with and resolved during the cleanup.

**Introduction**

On the evening of November 21, 2004, during a winter storm event, a 14-inch diameter petroleum product pipeline sprung a leak. The pipeline is owned by the California-Nevada Pipeline Company, a subsidiary of Kinder-Morgan Energy Partners. The pipeline is the main source of petroleum fuel products for the Las Vegas, NV area. The pipeline was transporting gasoline at the time of the release. The spill was discovered early in the morning of November 22, 2004, after numerous complaints by passing motorists of a strong gasoline odor on Interstate 15 in northern San Bernardino County. The release occurred approximately 2,000 feet north of the highway between Basin Road and Rasor Road north of Interstate 15 (near mile post 122 - between the Afton Block valve and the Basin Road Block Valve) (OES Haz Mat Spill Report No. 04-6081; USEPA-R9 POLREP No. 1 KM Pipeline Spill, 2004).

Air monitoring along the interstate indicated elevated levels of gasoline vapors above safe levels. For safety reasons the highway was closed for approximately twelve hours by the local fire department in Baker, CA, and the California Highway Patrol. With the release occurring on the weekend just before the Thanksgiving holiday, traffic on Interstate 15 was fairly heavy with travelers. Because of the closure, traffic had to be

rerouted to the south and east through the Mojave National Preserve and along Interstate 40. This, plus the presence of the winter storm, caused miles of traffic backup and delays in traffic all day on November 22, 2004. This also restricted the responder's ability to access the release until the weather and traffic congestion moderated on November 23, 2004.

The spill site is located along a right of way grant authorized by the Mineral Leasing Act of 1920, as amended, on public land managed by the Bureau of Land Management (BLM) in the Cronese Valley. The Cronese Valley Groundwater Basin, approximately 198 square miles in size, underlies this broad northwest trending valley in central San Bernardino County, California. Elevation of the valley floor ranges from 1,065 feet above mean sea level at West Cronese (dry) Lake to about 2,500 feet. The basin is bounded on the north by non-water-bearing rocks of the Tiefort Mountains, on the east and northeast by the Soda Mountains, and on the south by the eastward extension of the Alvord and Cronese Mountains. A low drainage divide separates Cronese Valley from Langford Valley and defines the western boundary. Most of the bordering Mountains exceed 5,000 feet. Much of the western portion of the basin lies within Fort Irwin National Training Center (DWR 1964, 1967; USGS 1955, 1986).

Average annual precipitation ranges from 3 to 5 inches. Runoff from the north, northwest, and west drains towards West Cronese Lake, runoff from the south and southeast drains towards East (dry) Cronese Lake (Jennings and others, 1962).

Recharge to the basin is derived principally from percolation of runoff through alluvial deposits at the base of the Tiefort and Soda Mountains and the infiltration of precipitation that falls to the valley floor. Subsurface inflow from the Red Pass Valley Ground water Basin on the north and Soda Lake Valley Ground water Basin on the south also contributes to the recharge of the basin. Ground water in the younger and underlying older alluvium moves towards West Cronese Lake (USGS 1955; DWR 1964).

The area around the spill site is category 3 habitat for the California Desert Tortoise, a Federal Endangered Species. Category 3 designation is the lowest priority habitat for the tortoise. Category 3 habitat is characterized as habitat area not essential to maintenance of viable populations; habitat where most conflicts are unresolvable; habitat where low to medium density is not contiguous with medium or high density; and habitat where there is a stable or decreasing population (LFR Levine Fricke, May 2005).

The BLM's Cronese Lake Area of Critical Environmental Concern (ACEC) and the Soda Mountain Wilderness Study Area lie just to the west and north of the pipeline, and this area is also designated critical habitat for the threatened desert tortoise. BLM's Rasor Off-Highway Vehicle Open Area, which is approximately 22,500 acres, lies on the other side of the Interstate to the south, while the Mojave National Preserve boundary is about 5 miles to the east.

The Cronese Lakes ACEC was designated by the BLM to protect important cultural and wildlife resource values associated with the two playas and adjacent wetlands. The

distribution of cultural materials is nearly continuous around these two ancient lakes. More than 35 distinct sites, including habitation sites, have been identified. In the years that the Mojave River flows, East Cronese Lake is used by large numbers of wintering and migrant birds, especially shorebirds, ducks, and pelicans. Mesquite hummocks and washes surrounding the playas are important for wildlife, especially songbirds. The area is also important for wildlife species like the Mojave fringe-toed lizard that are associated with the sand dunes (BLM 1985, 1999).

Agencies responding to the incident included: SBCFD, CDFG, OES, Lahontan Regional Water Quality Control Board, California State Fire Marshals Office, USEPA, BLM, and USFWS (USEPA-R9, POLREP No. 1 – KM Pipeline Spill, 2004).

**The Spill Response Phases**

The spill response consisted of two phases: the emergency response phase and the spill recovery phase. The emergency response phase of the spill response was a unified command between SBCFD, Kinder-Morgan and CADFG. The spill recovery phase was a unified command between the BLM and Kinder-Morgan. The USEPA provided technical support to the Unified Command during the emergency response phase including air surveillance capabilities via START, ERT-West and REACT, health and safety oversight, and groundwater sampling of nearby agricultural wells (OES Haz Mat Spill Report No. 04-6081; USEPA-R9 POLREP No. 1 KM Pipeline Spill, 2004).

**The Emergency Response Phase**

Upon discovering the leak, pipeline operations were terminated and the impacted section of pipe was isolated (approximately 8 miles). Kinder-Morgan responded to the spill site to begin response operations. Local officials evacuated nearby residents and the interstate highway was closed both ways. There had been heavy rain and snow in the desert area just prior to the break that hampered responders from accessing the release site. Emergency response operations included removal of all products from the isolated section of pipe, transportation of those products by truck to Las Vegas, NV, the removal and replacement of the damaged section of pipe, and remediation of contaminated soil surrounding the pipeline. The initial hot zone was about 100 feet by 400 feet. It was established in a zone with readings of more than 300 parts per million (ppm) for volatile organic compounds (VOC's) remote air monitoring equipment was initially placed along the interstate highway; some of these instruments were moved closer to the release site to surround the hot zone as the winter storm passed the area and the vapors trapped by an inversion layer escaped the area – shrinking the size of the hot zone. Working on the pipeline was complicated by the fact that the 14-inch multi-fuel pipeline had an adjacent 8-inch jet fuel (JP-4) pipeline close-by. The 14-inch multi-fuel product pipeline was initially suspected to have released diesel and jet fuel and later to have released gasoline, which could explain the high VOC readings.

It was discovered that the ground at the release site was frozen and it was thought that the product could be contained and removed from the surface. Kinder-Morgan completed excavation surrounding the pipeline on November 23, 2004. The pipeline showed extensive damage. Inspection of the damaged section of pipe revealed that the damage to the pipeline causing the leak came from old third party mechanical damage by equipment, such as a backhoe operating to close to the pipeline. Although anyone who hits a pipeline is supposed to report it, many go unreported. Once the protective sheath on the pipe is damaged, the pipe becomes subject to corrosion. California Department of Fish and Game has custody of the damaged section of pipe which is being subjected to further metallurgical testing (The Pacific States/British Columbia Oil Spill Task Force Newsletter, 2004).

Two local livestock water wells located about a mile down gradient from the release were inspected and sampled. Ground water levels were found to be about 30 feet below the surface (USEPA-R9 POLREP No. 1 KM Pipeline Spill, 2004).

When the damaged section of the pipe had been replaced, the welds were x-rayed to determine completeness of the pipe welts, the pipeline was sand blasted with an organic grit material, rewrapped and the pipeline was pressure tested to determine the pipe's ability to withstand the pipeline pressure. After a successful pressure test, the pipeline was put back into use on November 24, 2005. This ended the emergency phase of the response.

**The Spill Recovery Phase**

The spill recovery phase started on November 29, 2005 under the unified command of BLM and Kinder-Morgan Energy Partners. BLM served as the lead federal agency, CDFG was the lead state agency, and Kinder-Morgan Energy Partners was the responsible party as the owner of the pipeline. San Bernardino County Fire – Hazardous Materials Division, Lahontan Regional Water Quality Control Board, USFWS, USEPA, and Mojave Desert Unified Air Management District participated in regulatory oversight of the recovery activities (USEPA-R9 POLREP No. 1 KM Pipeline Spill, 2004).

The objectives for the spill recovery phase included the following:

- Assess the lateral and vertical extent of released fuel.
- Evaluate and mitigate potential habitat impacts resulting from the release and response activities.
- Develop and implement an emergency response remedial action plan.
- Develop and implement a demobilization and site rehabilitation plan.
- Maintain open communications with state, federal, and local regulatory agencies and property trustees.

The extent of the release was initially determined from visual observations and later confirmed by using a photo ionization detector (PID). Once the extent of the surface was delineated, it was marked out using engineer surveying stakes and yellow warning tape. Following this delineation, confirmatory soil samples were collected in a 100-foot grid

pattern. These samples were transported to a state-certified analytical laboratory for analysis using EPA Method 8015M and EPA Method 8021B (LFR Levine-Fricke, 2004).

Two surveys for the desert tortoise were conducted following USFWS protocols on November 30, 2004 and December 1, 2004 (LFR Levine Fricke, 2005). These tortoise surveys were conducted by a BLM and USFWS approved biologist and field checked by USFWS and CDFG personnel – no tortoises or their burrows were found to be located within a mile of the release area. Tortoise monitoring continued throughout the duration of the project until all of the heavy equipment had left the project. A cultural resource survey and monitoring was conducted mainly along the access routes which passed through the Cronese Lake Area of Critical Environmental Concern. Attention was given to the soil excavation areas. No impacts were noted during the duration of the project. A biological monitor was onsite during all field activities and an archeological monitor was onsite during excavation activities.

Due to the review of ground water literature pertaining to the site (DWR 1964, 1967; USGS 1955, 1986), and the measurements of the two existing livestock water wells, ground water was suspected to be at 30 feet of the surface; installation and construction of ground water monitoring wells became a high priority. On November 29, 2004, two ground water monitoring wells were constructed followed by a third on December 1, 2004. Depths to ground water were about 110 feet. Groundwater monitoring well locations and elevations were surveyed so that the localized groundwater gradient could be determined. Groundwater monitoring and sampling was completed on December 22,

2004. Exploratory soil borings indicated that soil contamination was to 50 feet in depth near the release point. The ground water wells were sampled during September 29, 2005 and December 16, 2005. No analytes were detected in samples collected from any of the three ground water wells (Levine-Fricke, 2006).

Soil excavation activities continued near the pipelines under the supervision of Kinder-Morgan pipeline personnel. Priority was give to the areas surrounding the actual leak and then in the wash where the release had occurred. Excavated material was stockpiled on plastic and covered daily with plastic to minimize being blown by the wind and transported by rain water off site. Characterization samples were collected for waste determination. Soil screening levels developed by the Los Angeles Basin Regional Water Quality Control Board in the Interim *Site Assessment and Cleanup Guidebook* (LABRWQCB, 1996) were used for general guidance during the clean-up/removal action. Using site-specific data, soil screening levels for initial evaluation used were 500 milligrams per kilogram (mg/kg) for total petroleum hydrocarbons as gasoline, 1,000 mg/kg for diesel, 33 microgram per kilogram (µg/kg) for benzene, 2,000 µg/kg for toluene, 7,000 µg/kg for ethyl benzene, and 20,000 µg/kg for total xylenes (Levine-Fricke, February 2005).

Based upon the initial surface delineation, the soil excavation, and the prioritization of areas, further assessment of the lateral and vertical extent of the release was conducted by collecting 18 soil borings in a grid pattern using a hollow-stem auger drill rig at five foot intervals. These borings were described using the Unified Soil Classification System,

vapor head-space readings were made using a PID, and confirmatory soil samples were collected for laboratory analysis. Only three samples exceeded the soil screening level for benzene. The remaining soil samples had levels for total petroleum hydrocarbons (gasoline) that ranged from 530 mg/kg to 9,700 mg/kg, with the highest levels nearest the release point (Levine-Fricke, February 2005).

Transport of hydrocarbon impacted soil to the TPS Inc., thermal processing facility in Adelanto, CA, began on December 7, 2004, and continued through December 23, 2004. Access roads were flagged and monitored daily to reduce impacts to habitat and sensitive environments. Road traffic from the Interstate to the site was managed to keep traffic to a minimum. A total of 362 truck loads of soil were transported offsite (approximately 10,300 tons). Clean back fill material was sampled for contamination and weeds; it was found to be clean and weed free and was approved for use.

Because of the extent of the vertical soil contamination, a soil vapor extraction pilot was initiated to determine the feasibility of using this technique to remediate the site (LFR Levine-Fricke, 2004). Soil vapor extraction (SVE) pilot test activities were initiated on December 7, 2004, and continued using of six of the seven vapor extraction wells. Four new SVE wells were installed by December 10, 2004. Four additional SVE wells were installed on December 20 and 21. Based upon the success of the pilot system, a new vapor extraction was installed and came on line on January 13, 2005. The new system was capable of producing higher flows from the subsurface. A fenced enclosure was constructed around the perimeter of the new SVE system and associated support

equipment to protect the equipment from vandalism. Based upon monitoring results over more than twelve months, the soil vapor extraction system was progressively reduced to six wells. This unit is still working and pulling vapors from six vapor extraction wells.

**Conclusion**

The primary objective of the clean-up/removal action was to prevent the released petroleum products (predominantly gasoline) from reaching the ground water and East Cronese (dry) Lake. To achieve this objective, it was necessary to determine the lateral and vertical extent of released fuel. This included soil sampling and installation of ground water monitoring wells. Next, the more grossly contaminated soil was removed from the surface of the spill area and the ephemeral desert wash, transported to a permitted treatment facility and replaced with clean back fill material. To remove soil contamination at depth, a pilot soil vapor extraction system was tested – results were favorable and fourteen soil vapor extraction wells were installed and brought on-line. Based upon monitoring results over more than twelve months, the soil vapor extraction system was progressively reduced to six wells, which are still on-line. Monitoring results to-date has indicated that contamination has not reached the ground water at the site. These results are encouraging.

The pipeline owner, Kinder-Morgan Energy Partners under terms and conditions of the pipeline right-of-way and temporary use permit issued by BLM for clean-up/removal activities outside the right-of-way, paid for the clean up and remediation of the site as

well as for project oversight. The case file for this incident is currently under review by the San Bernardino County District Attorney's Office and the State Attorney General's Office.

**Lessons Learned:**

- Maintain open communications with state, federal, and local regulatory agencies, property trustees, and the responsible party.
- Involve regulatory agencies early on in the process; brief them on the status of project.
- Divide the work among the agencies involved.
- Keep surprises to a minimum.

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