Utah FOUNDATION RESEARCH BRIEF

Addressing Utah's Air Quality and Environmental Concerns

October 22, 2008

In Utah Foundation's 2008 Utah Priorities Survey, Utah voters rated the environment as their eighth-highest issue of concern. The environmental issues of most concern were Utah's air quality and the health effects of pollution. Other concerns were environmental effects of pollution and the storage and transport of hazardous waste. This research brief discusses each of these four areas of concern and provides a brief overview of the state's position on climate change.

Air Quality

Air quality is a major environmental concern for Utah. Poor air quality, exacerbated by winter and summer inversions, not only limits visibility but can be hazardous to health. In attempt to mitigate these effects and control air pollution, the Utah Division of Air Quality (DAQ) monitors air pollutants in Utah using National Ambient Air Quality Standards (NAAQS) set by the Environmental Protection Agency (EPA). There are two types of NAAQS: 1) Primary standards are designed to protect public health, particularly the health of sensitive populations such as asthmatics, children, and the elderly; 2) Secondary standards protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings. [1] Currently, there are NAAQS for six criteria pollutants: carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter, and sulfur dioxide. Many of the NAAQS are based on multi-year averages of near-peak levels, rather than actual peak levels. For example, the ozone standard is based on a three-year average of the fourth-highest eight-hour concentrations. This is to ensure that no single time period or concentration unduly affects the overall measure if it is a very rare occurrence.

Carbon Monoxide (CO)

Carbon monoxide is produced from motor vehicle emissions, wood burning stoves and fireplaces, industrial facilities, and construction equipment. Because motor vehicle emissions are the major source of CO, the highest concentrations occur during rush hour near high traffic areas. The effects of carbon monoxide intensify during the winter because vehicles run less efficiently and cold weather inversions trap carbon monoxide near the ground. [2] There are two national standards for CO: 35 ppm (parts per million) averaged over a one-hour period and 9 ppm averaged over an eight-hour period. [3]

Three cities, Salt Lake City, Ogden, and Provo, have been designated as non-attainment areas in the past because their CO levels did not meet the national standards. However, due to improvements in vehicle technology, which reduced CO emissions, Salt Lake City and Ogden were re-designated to attainment status in 1999 and 2001, respectively. Provo was re-designated to attainment status in 2006. These three cities have maintained their attainment status since being re-designated, and all areas in Utah were in compliance with CO standards in 2007. [4]

One concern about Utah's earlier carbon monoxide reduction strategies was the requirement that gasoline be oxygenated during winter months as a way to reduce CO emissions. This was unpopular with many motorists because the fuel was more expensive and had the potential to reduce fuel efficiency. Utah County was the only county in Utah required to use the fuel because of its failure to meet NAAQS for carbon monoxide. As part of Utah County's 1992 State Implementation Plan (SIP), residents purchased oxygenated gasoline (which blends ethanol with gasoline) from November to February each year. In 2004, DAQ voted to eliminate the use of oxygenated gasoline in Utah County after being in compliance with CO standards for several years. This action was approved by EPA in 2006.

Lead (Pb)

For many years, the major source of lead particulate matter was gasoline. Because leaded gasoline was phased out in the United States by the end of 1995, it is no longer a significant problem. [5] While some lead particulate matter is still produced from the extraction and processing of metallic ores and the removal of lead-based paint, Utah has met the health standards for lead every year since the late 1970s. [6] On October 15, 2008, however, EPA set a new standard for lead. This is the first time EPA has changed the standard in over 30 years and the new standard lowers the allowable lead level from 1.5 micrograms per cubic meter (ìg/m3) to

0.15 ìg/m3. It is expected that Utah will be within attainment of new level, but both Salt Lake City and Ogden will be monitored because of their large populations. Utah stopped monitoring lead levels in 2005 after results over several years showed levels about 1/20th of the old national standard. [7]

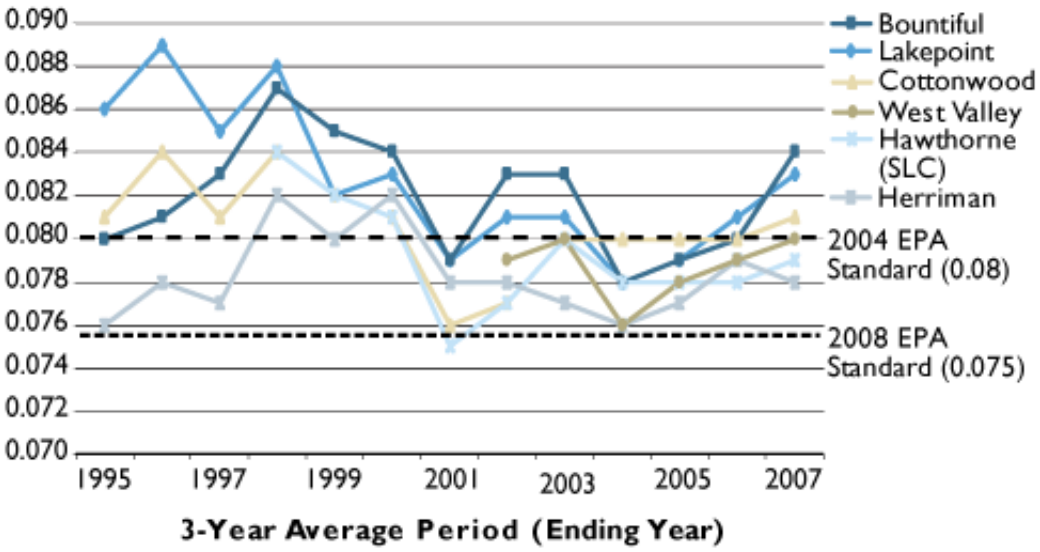
Nitrogen Dioxide (NO2)

The annual average standard for nitrogen dioxide is 0.053 ppm. [8] Los Angeles is the only U.S. city to exceed this standard since 1990. [9] However, because oxides of nitrogen (NOx) react with other air contaminants to form criteria pollutants, Utah's DAQ is mindful of NO2 trends.

Ground-level Ozone (O3)

Ground-level ozone is a gas caused by vehicle and engine exhaust, industrial facility emissions, gasoline vapors, chemical solvents, and biogenic emissions from natural sources. It is formed through a chemical reaction between NOx and Volatile Organic Compounds (VOC) in the presence of sunlight. [10] High ground-ozone levels typically develop during summer months when sunlight is strong and air is trapped in the same region for several days. Because long-term exposures to ozone are more harmful than shorter exposures, the one-hour primary ozone standard of 0.12 ppm was officially replaced by an eight-hour standard of 0.08 ppm in 2004. [11] The standard was based on a three-year average of the annual fourth-highest daily eight-hour concentrations. This standard has recently been tightened to 0.075 ppm.

Figure 1: Ozone Concentrations at Selected Utah Monitoring Stations, Parts Per Million
3-Year Averages of 4th-Highest 8-Hour Concentrations



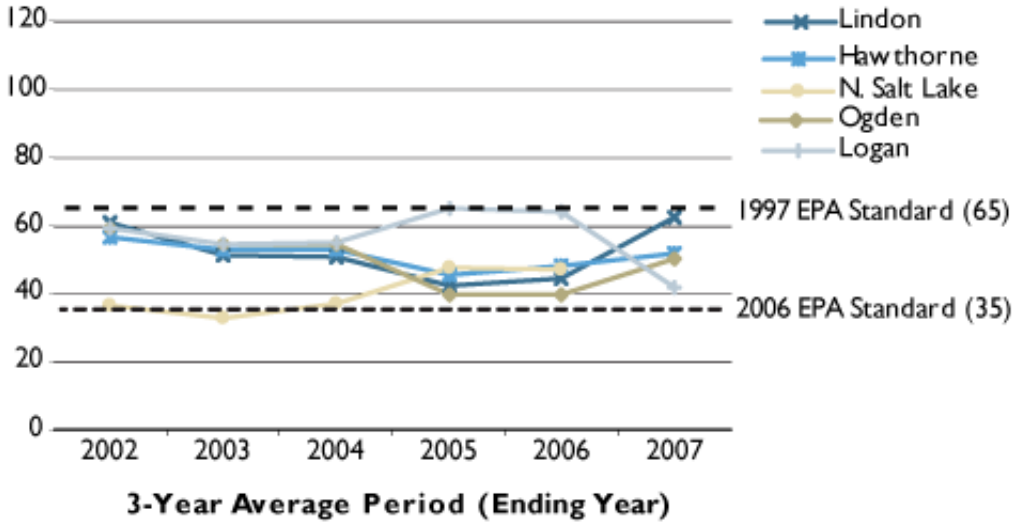
Source: Utah Division of Air Quality. Graph created by DAQ with minor modification by Utah Foundation (formatting and adding 2008 standard line).

In the 1970s and early 1980s, Salt Lake and Davis counties violated the 0.12 ppm one-hour ozone standard. In 1984, Utah submitted and EPA approved a SIP that outlined how the state would develop sufficient control measures to attain the one-hour standard. In 1990, however, Congress amended the Clean Air Act and, and as a result Salt Lake and Davis Counties were again designated "moderate" non-attainment areas. In 1993, Utah submitted a revised SIP which was approved by EPA. [12] In response to the 2004 eight-hour ozone standard, DAQ prepared a new SIP which was submitted to EPA for approval in 2007. In March 2008, however, EPA lowered the primary ozone standard to 0.075 ppm, meaning Utah will again need to revise its ozone SIP. [13]

Particulate Matter: PM10 and PM2.5

Regulated particulate matter (PM) is a complex mixture of extremely tiny particles of solid or semi-solid material suspended in the atmosphere. PM is divided into two categories: PM10 and PM2.5. PM10 is less than 10 micrometers in diameter and can lodge deep in the lungs causing respiratory problems. PM2.5 is less than 2.5 micrometers in diameter; the particles are so small they can become embedded in human lung tissue, causing respiratory and cardiovascular disease. PM2.5 is generally produced from combustion sources and includes fly ash (from power plants), carbon black (from cars and trucks), and soot (from fireplaces and woodstoves). [14] Winter inversions provide ideal conditions for the creation and build-up of PM2.5.

Figure 2: PM2.5 Concentrations at Selected Utah Monitoring Stations, Micrograms per Cubic Meter
3-Year Averages of 98th Percentile 24-Hour Concentrations*



* Concentrations that are higher than 98% of all other measured 24-hour concentrations for that year.
Source: Utah Division of Air Quality. Graph created by DAQ with minor modification by Utah Foundation (formatting).

EPA revised the PM10 and PM2.5 standards in 2006. [15] The 24-hour standard for PM10 is 150 ìg/m3 and is met when the probability of exceeding the standard is no greater than once per year for a three-year period. Utah is currently not in compliance with this standard. The North Salt Lake area failed to meet EPA's PM10 standards in the early to mid 1990s and again in 2005 to 2007. [16] The Provo/Orem area was above EPA standards in the early 1990s, but has since maintained EPA compliance. The 24-hour standard for PM2.5 is 35 ìg/m3 and the annual standard is 15 ìg/m3 averaged over a three-year period. [17] The 24-hour standard is met when the average of the 98th percentile daily values collected for each year over a three-year period is less than or equal to 35 ìg/m3. Figure 2 shows Utah is not in compliance with the new standard, although it was in compliance with the 1997 standard.

Sulfur Dioxide (SO_2)

Sulfur dioxide is primarily emitted from power plants, refineries, and other stationary sources that burn fossil fuels. It is also a byproduct of copper smelting and steel production. There are two primary NAAQS for SO2: a one-year average of 0.03 ppm and a 24-hour average of 0.14 ppm. In addition, there is a secondary standard of 0.5 ppm averaged over a three-hour period. [18] Throughout the 1970s, Magna routinely violated the 24-hour standard. Consequently, all of Salt Lake County and parts of Tooele County above 5600 feet were designated as non-attainment. Technological upgrades at the Kennecott smelter, however, have resulted in continued compliance with the SO2 standard since 1981. After further upgrades at Kennecott, Geneva Steel, and several refineries, Utah submitted a re-designation request for Salt Lake and Tooele Counties in 2005. All areas in Utah have been well below the standard for more than a decade. [19]

While Utah is not in attainment for some criteria pollutants (due to recent changes in the standards), air quality is improving around the state. These improvements are the result of stricter national standards, enhanced vehicle technology, and increased public involvement. DAQ issues frequent air quality alerts when air pollution begins approaching unhealthy levels in order to reduce public exposure and limit activities that contribute to air pollution. The 2030 Regional Transportation Plan, prepared by the Wasatch Front Regional Council, is also expected to reduce NOx emissions by 1.6 tons per day through expanding highway capacity and transit projects which will reduce congestion and idling. [20]

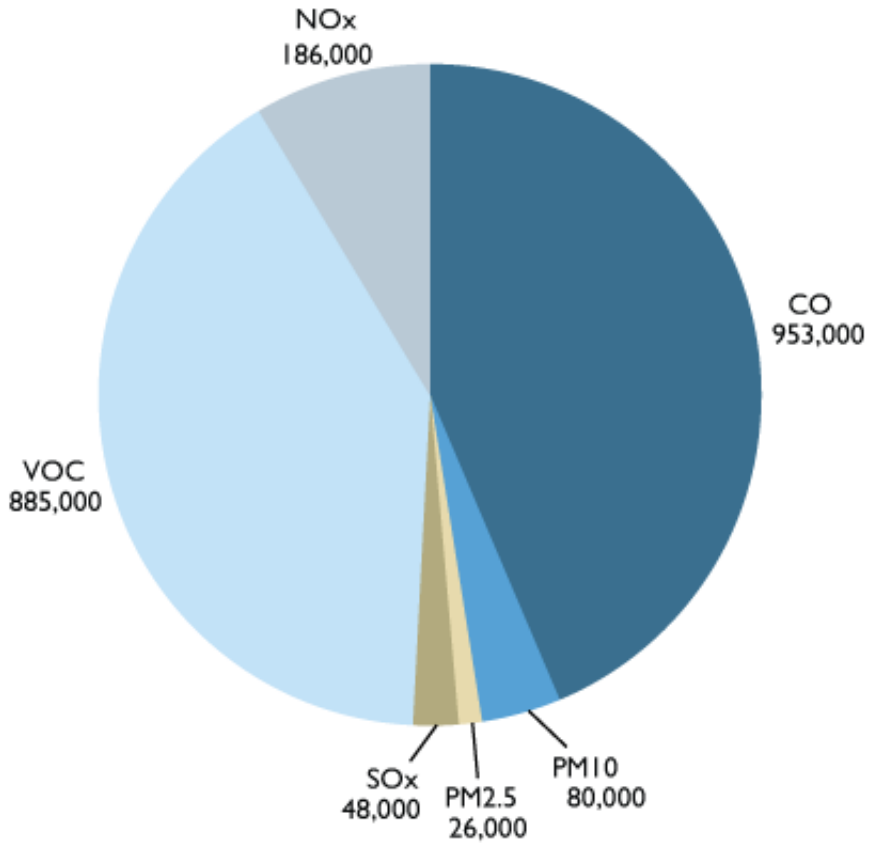
Figure 3: Utah Emissions Inventory by Pollutant, Top Five Ranked Counties, 2005

Top Five	CO	NOx	PM10	PM2.5	SOx	VOC
1	Salt Lake	Salt Lake	Salt Lake	Salt Lake	Emery	San Juan
2	Utah	Emery	Utah	Washington	Carbon	Washington
3	Washington	Millard	Box Elder	Box Elder	Salt Lake	Millard
4	Davis	Utah	Washington	Utah	Millard	Kane
5	Box Elder	Davis	Tooele	Tooele	Davis	Salt Lake

NOx refers to compounds of oxygen and nitrogen. SOx refers to compounds of oxygen and sulfur.
Source: Utah Division of Air Quality.

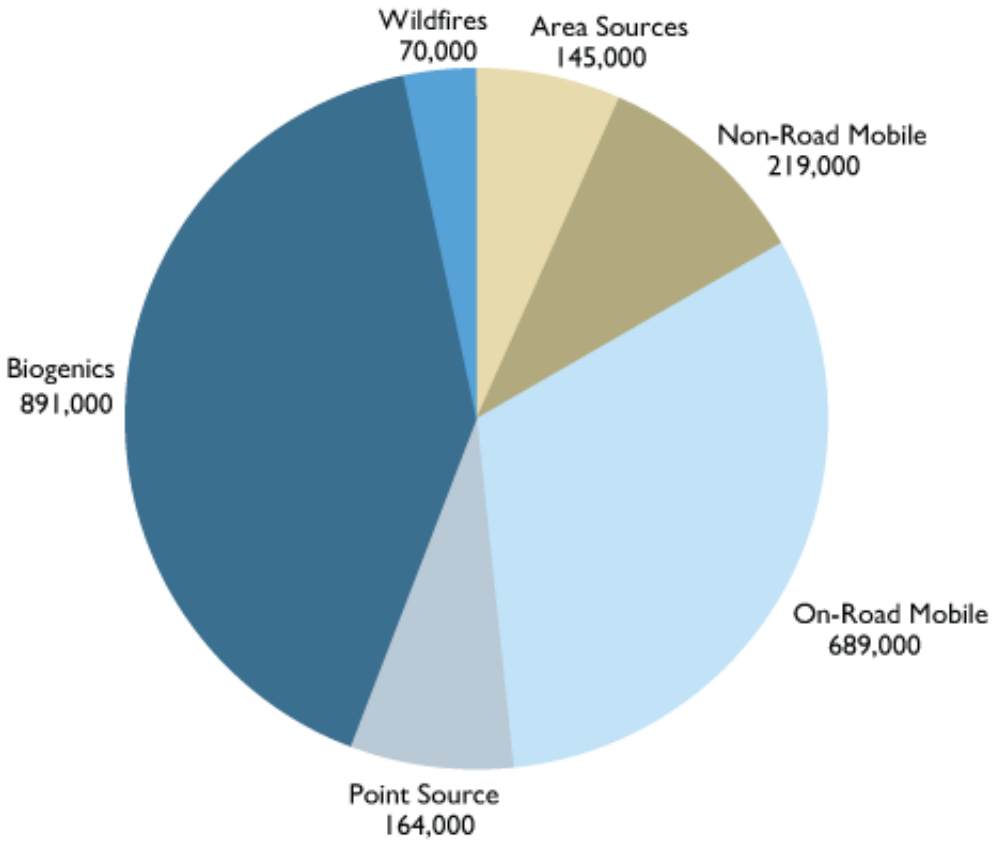
Both urban counties, with large mobile populations, and rural counties, with large power plants, contribute to the state's pollution levels. Figure 3 ranks the top five counties for each pollutant in 2005. However, even though these counties have the highest emissions, the levels are within attainment for some of the pollutants.

Figure 4: Emissions by Pollutant, 2005 (tons/year)
Total Emissions = 2.18 million tons/year



Source: Utah Division of Air Quality.

Figure 5: Emissions by Source, 2005 (tons/year)
Total Emissions = 2.18 million tons/year



Source: Utah Division of Air Quality.

Figure 5 shows the amount of emissions from each type of pollutant source. Mobile sources are those related to highway, rail, air, and other traffic. Biogenic sources are the primary source of VOCs and naturally occur in forests, vegetation, and soils. Point sources are stationary commercial and industrial sources that emit more than 100 tons/year. Area sources are stationary or non-road mobile sources (such as a portable gravel operation) that emit less than 100 tons/year. According to DAQ, these are too small and numerous to be treated as point sources, so the totals are compiled into the area source category. Biogenics are the largest source of Utah's emissions, followed by mobile sources.

Effects of Pollution

Health Effects of Air Pollution

The 2008 Utah Priorities Survey showed that voters are quite concerned about the health effects of pollution and rank the issue second among their environmental concerns. For Utah, air pollution is a more significant issue than water pollution and is responsible for the majority of health issues related to pollution. Caused by the presence of criteria pollutants like particulate matter, sulfur dioxide, and carbon monoxide, poor air quality causes and aggravates asthma, emphysema, bronchitis, influenza, and cardiovascular disease by affecting the body's immune system and causing damage to lung tissue. Carbon monoxide reduces oxygen-delivery capabilities of the bloodstream and some studies suggest particulate matter, specifically, "decreases the heart's ability to respond to physical stress." [21] Children and the elderly are at particularly high risk for the health conditions associated with poor air quality.

Some clean-air groups argue EPA's standards are not strict enough to maintain good health. According to the Government Accountability Office (GAO), EPA's current National Ambient Air Quality Standards fail to meet recommendations made by its Clean Air Science Advisory Committee and the Children's Health Protection Advisory Committee. [22] For instance, EPA's eight-hour primary standard for ground-level ozone of 0.075 ppm is higher than the both the Clean Air Science Advisory Committee's standard of 0.06-0.07 and the Children's Advisory Committee's standard of 0.06. Because many areas in Utah are still trying to meet the most recent EPA standards for ozone and particulate matter, the state is not in compliance with the recommendations made

by these two committees.

Figure 6 shows the largest counties in Utah, and except for Cache and Washington Counties, none are in compliance with the new EPA standards for ozone, and none of them meet the standards recommended by either of the advisory committees mentioned above.

Figure 6: Ozone Levels in Utah's Largest Counties
3-Year Averages of 4th-Highest 8-Hour Concentrations

Utah Counties	2005-2007 3-Year Average Ozone Concentrations (ppm)	Monitor Location & Comments
Salt Lake	0.083	Beach & Cottonwood
Davis	0.085	Bountiful
Weber	0.083	Harrisville
Utah	0.079	Spanish Fork
Box Elder	0.078	Brigham City
Tooele	0.078	Based on 2007 data only
Cache	0.072	Logan
Washington	0.071	St George

Source: Utah Division of Air Quality.

Other Health and Environmental Effects of Pollution

Another pollution-related health concern is wildlife contamination resulting from polluted waters. One challenge Utah is currently dealing with is the high levels of mercury that are found in certain fish species. [23] Mercury occurs naturally in the environment but is also released into the air from coal-fired electric power plants and mining. Gold mines in northeastern Nevada, which is located upwind of Salt Lake City, have reported releasing large amounts of mercury. Airborne mercury contaminates water sources and collects in the tissue of fish. [24] Mercury can be extremely harmful, and even fatal, when consumed in large quantities. The Utah Department of Health regularly issues mercury advisories in Utah's counties and fishing areas and the most recent advisories were issued September 30, 2008. [25]

Toxic waste pollution is another contributor to health problems and in the past has been a major concern in Utah. Nuclear testing in the 1950s and 1960s has been suggested as the cause for many cancer- and leukemia-related deaths in areas downwind from the nuclear test sites. Uranium and other mine tailings have polluted ponds and other waterways. As a result of increasing awareness of the dangers toxic materials present when improperly handled, the U.S. Congress established the Comprehensive Environmental Response, Compensation, & Liability (Superfund) Act in 1980. This act provided for the cleanup of the nation's worst hazardous waste sites. EPA maintains a National Priority Listing (NPL) of the most urgent Superfund sites. There are 24 sites in Utah on this list, nine of which have completed full remediation. Thirteen sites are in various stages of remediation and two new sites have been proposed. [26] Before 2005, Utah ranked third in the nation in terms of the amount of toxic chemicals that were released to the environment. Recent improvements, however, moved the state from third to sixth in the nation. [27]

The environmental quality of land largely depends on the prevention, management, control, and cleanup of these toxic chemicals. About 2.5 million tons of municipal solid waste was disposed of in properly-engineered landfills in 2006 and another 127,415 tons of municipal waste was incinerated. [28] The Department of Environmental Quality is currently focusing on land pollution prevention with waste tire and used oil recycling programs, as well as voluntary cleanup programs for chemically contaminated sites. In 2007 and 2008, Utah's Division of Natural Resources rehabilitated more than 350,000 acres of land that had been damaged by wild fire and restored 120,000 acres of watershed. [29]

Hazardous Waste Storage and Transport

Storage Issues

There are six commercial and three federal facilities in Utah that store and/or dispose of hazardous waste: Clean Harbors Aragonite, LLC, Clean Harbors Grassy Mountain, LLC, Northeast Casualty Real Property, LLC, EnergySolutions, LLC, Safety-Kleen, Inc., Ashland Chemical, Inc., Tooele Army Depot, Utah Test and Training Range, and Hill Air Force Base. Each of these facilities is regulated by the Department of Environmental Quality (DEQ), which administers permits, supervises compliance, provides oversight for corrective action, and manages facility closure. [30] DEQ has set strict standards to ensure that both the environment and the

population are safe from exposure and contamination. [31] It regulates the type of hazardous waste stored in Utah, sets storage and/or disposal standards, and imposes penalties for violations.

Transport Issues

A major concern with hazardous waste transport is the possibility of an accident that would lead to harmful exposure. However, there are strict regulations in place for all transportation of hazardous and radioactive materials. For instance, the federal government has outlined safety measures for railway transportation to Yucca Mountain, a national nuclear waste storage facility that has not yet begun operation and is the subject of litigation and political efforts to block its operation. Studies done for the Nuclear Regulatory Commission (NRC) and other federal agencies have found that containers meeting NRC's standards would survive nearly all transportation accidents without releasing large amounts of radioactive material. The shipping containers are designed to remain completely intact during both normal transportation conditions and potential accident conditions. The containers have been tested to withstand: a 30-foot free fall on to an unyielding surface, a puncture test allowing the container to free-fall 40 inches onto a steel rod six inches in diameter, a 30-minute, all-engulfing fire at 1475 degrees Fahrenheit (800 degrees Celsius), and an eight-hour immersion under three feet of water. [32] However, the NRC's standards and the federal safety studies have been criticized by some groups, including the State of Nevada, who argue the tests do not adequately represent a number of credible accident scenarios, and severe accidents could release hazardous levels of radioactivity.

Yucca Mountain and Skull Valley

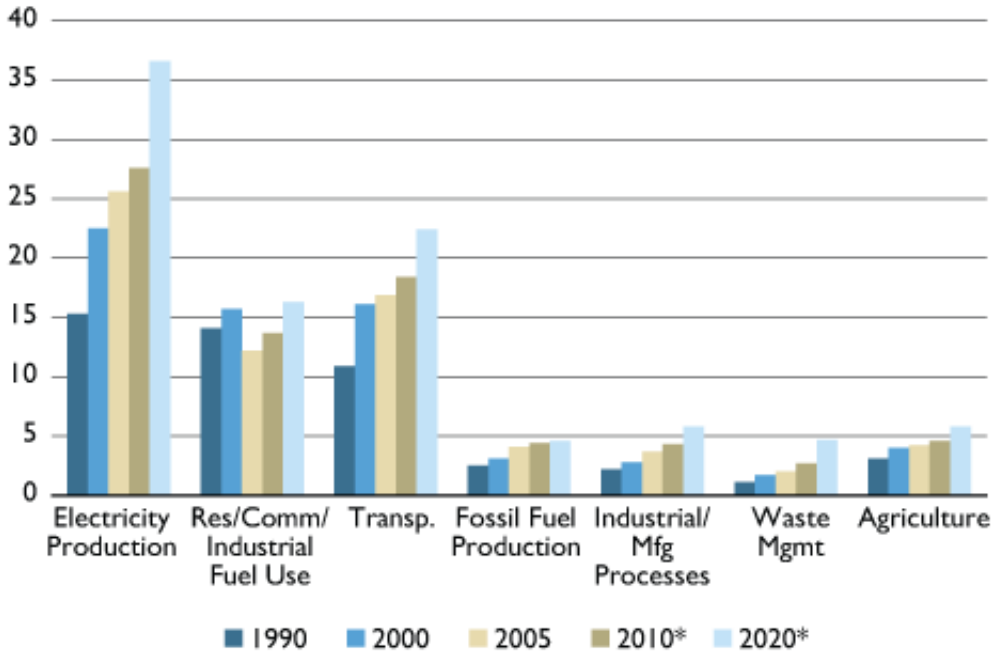
Yucca Mountain is the proposed national site for long-term storage of high-level radioactive waste and spent nuclear fuel. Located about 100 miles northwest of Las Vegas, Yucca Mountain is located in Nye County, Nevada and has been considered as a potential site since 1978. Many Utah politicians and voters oppose the Yucca Mountain proposition, however, due to concerns about transportation paths through Utah.

Skull Valley is a Goshute Reservation 70 miles southwest of Salt Lake City. The Goshute Tribe has a pact with Private Fuel Storage to temporarily store up to 40,000 tons of nuclear waste. Because it is on an Indian reservation, this facility is not under the supervision of DEQ. The Tribe has faced enormous opposition from the state of Utah regarding this decision, including legal opposition, but has filed a suit to protect its license. Utahns are concerned about the proximity of the high-level radioactive waste storage site to major metropolitan areas and the transportation of waste through Utah.

Climate Change

The effects of global warming received an average score of 3.38 out of five on the 2008 Utah Priorities Survey, where five was "very concerned." This was the lowest score of any of the environmental questions asked in the survey, perhaps reflecting some skepticism among Utahns about climate change. The potential effects of climate change in Utah range from severe droughts, to less snowpack, to an increased rate of wildfires. [33] Data compiled for DEQ by the Center for Climate Strategies show Utah's historical and projected Greenhouse Gas (GHG) Emissions (Figure 7). These data show increasing GHG emissions for every economic sector and rapidly increasing emissions from electricity production and transportation. [34]

Figure 7: Utah Historical and Projected Greenhouse Gas Emissions, by Economic Sector, 1990-2020 (Million Metric Tons CO2e)



* Projected.
Carbon Dioxide Equivalent (CO2e) is the internationally recognized measure of greenhouse emissions.

Source: Data prepared for Utah Department of Environmental Quality by the Center for Climate Strategies.

The current gubernatorial administration has placed a high priority on addressing climate change and reducing growth in GHG emissions. Along with joining the Western Climate Initiative (WCI) in May 2007, Utah agreed to implement a vehicle emission standard, a state GHG emissions goal, and a market-based strategy to reach a Western regional GHG reduction goal. Utah's GHG emissions goal, announced June 20, 2008, is to reduce GHG emissions to 2005 levels by 2020. In order to achieve this goal, the state is planning to increase the use of renewable energy, implement mass transit policies, increase energy efficiency and reduce demand by 25%, impose a clean car emission standard beginning in 2012, and involve Utah in WCI's greenhouse gas cap-and-trade program. [35]

Conclusion

Promoting a clean and healthy environment is necessary for maintaining a strong quality of life in Utah. Poor air quality can result in serious medical conditions such as asthma, emphysema, bronchitis, influenza, and cardiovascular disease, particularly in sensitive populations like children and the elderly. Fortunately, the state is either currently meeting or working to meet national air quality standards. It is also working to implement a vehicle emission standard, a state GHG emissions goal, and a market-based strategy to reduce Western GHG emissions. Maintaining a healthy environment must continue to be a long-term priority for the state as its population continues to grow.

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[1] "National Ambient Air Quality Standards (NAAQS)," *U.S. Environmental Protection Agency (EPA)* (March 28, 2008); http://www.epa.gov/air/criteria.html.

[2] "2007 Annual Report" *Utah Division of Air Quality (DAQ)* (February 2008).

[3] "National Ambient Air Quality Standards (NAAQS)," *EPA* (March 28, 2008); http://www.epa.gov/air/criteria.html.

[4] "2007 Annual Report" *DAQ* (February 2008).

[5] "Lead (Pb) NAAQA Implementation," *EPA* (September 26, 2007); http://www.epa.gov/ttn/naaqs/pb/index.html.

[6] "2007 Annual Report" *DAQ* (February 2008).

[7] Dina Cappiello, "EPA Aims to get the Lead Out," *The Salt Lake Tribune* (October 17, 2008).

[8] "National Ambient Air Quality Standards (NAAQS)," *EPA* (March 28, 2008); http://www.epa.gov/air/criteria.html.

[9] "2007 Annual Report" *DAQ* (February 2008).

[10] Ibid. VOCs are released from burning fuels, solvents, paints, and glues.

[11] Ibid.

[12] Ibid.

[13] "National Ambient Air Quality Standards (NAAQS)," *EPA* (March 28, 2008); http://www.epa.gov/air/criteria.html.

[14] "2007 Annual Report" *DAQ* (February 2008).

[15] Ibid.

[16] Ibid.

[17] "National Ambient Air Quality Standards (NAAQS)," *EPA* (March 28, 2008); http://www.epa.gov/air/criteria.html.

[18] Ibid.

[19] "2007 Annual Report" *DAQ* (February 2008).

[20] "Air Quality Newsletter—2008," *Wasatch Front Regional Council* (February 2008).

[21] "Health Effects of Pollution Trapped in Inversions," *Utah Department of Environmental Quality (DEQ)* (2008); http://www.deq.utah.gov/references/FactSheets/AQ_Health_Effects.htm.

[22] "EPA Efforts to Address Children's Health Issues Need Greater Focus, Direction, and Top-level Commitment." *Unites States Government Accountability Office* (September 18, 2008); http://www.gao.gov/new.items/d081155t.pdf.

[23] Utah Report on the Environment 2007," *DEQ* (2008).

[24] Patty Henetz, "Mercury too High in Utah Test Fish," *The Salt Lake Tribune* (October 25, 2007).

[25] For up-to-date advisories in Utah, see http://fishadvisories.utah.gov/advisories.htm.

[26] "Superfund," *EPA* (September 19, 2008); http://www.epa.gov/region8/superfund/.

[27] "Utah Report on the Environment 2007," *DEQ* (2008).

[28] Ibid.

[29] "2007/2008 Annual Report" *Utah Department of Natural Resources* (2008).

[30] Background information and compliance history for each of these facilities is available at: http://www.hazardouswaste.utah.gov/HWBranch/CFFSection/CommercialFederalFacilitiesSection.htm.

[31] The complete copy of the rules regulating hazardous waste is available at: http://www.deq.utah.gov/envrpt/index.htm.

[32] "Transportation of Spent Nuclear Fuel," *Office of Civilian Radioactive Waste Management, Office of National Transportation* (February 2005); http://www.ocrwm.doe.gov/factsheets/doeymp0500.shtml.

[33] "Utah Report on the Environment 2007," *DEQ* (2008).

[34] Stephen Roe, Randy Strait, Alison Bailie, Holly Lindquist, and Alison Jamison, "Final Utah Greenhouse Gas Inventory and Reference Case Projections, 1990-2020," *Center for Climate Strategies* (February 2007).

[35] "Utah's Greenhouse Gas Goal," *DEQ* (2008); http://www.deq.utah.gov/Climate_Change/GHG_goal.htm.

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