Environmental Connection Newsletter

Fall 2013

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Cub River Success Story

Changes in Land Use Practices Improve Water Quality

A little less than 20 years ago, phosphorous runoff into the Cub River and its tributaries had seriously impaired the water quality of the river. Thanks to the cooperative efforts of landowners, producers, the Division of Water Quality (DWQ), and the local conservation district, phosphorous levels in the Cub River drainage have been steadily decreasing.

Adoption of new land use management practices by landowners has reduced pollution, improved water quality, and revived riparian areas. Over 20 agricultural producers in the Cub River Watershed have made changes to their land use practices to promote sound stewardship of the area's water resources.

A River in Trouble

High phosphorous levels in the Little Bear River led DWQ to designate the river and its drainages as impaired in 1995. This designation made the Cub River subject to Total Maximum Daily Load (TMDL) requirements. A TMDL is the maximum amount of a pollutant, in this case phosphorous, that a waterbody can receive and still meet water quality standards. The application of TMDL requirements returns waters to their designated beneficial use by reducing pollutant loading. Beneficial use designations on the Cub River protect recreational water activities, warm water game fish and aquatic life, and agricultural uses. High phosphorous loads caused serious impairments to the water quality necessary to protect these uses.

A water quality study found that nonpoint source pollution from agricultural practices was a major source of the phosphorous loading responsible for the impaired water quality. A number of land use practices contributed to the problem.

- Unmanaged livestock grazing in river and creek bottoms damaged riparian areas.
- Improper manure management released pollutants into the river, particularly during spring rains.
- Return flows from flood irrigation discharged excess nutrients from runoff into the Cub River and its tributaries.

DWQ, the North Cache Conservation District, Utah State University, the Natural Resources Conservation Service (NRCS), local landowners, and others teamed up in 1999 to launch the Cub River Water Quality Improvement Project. Partners in this water quality project championed the adoption of best management practices (BMPs) by producers to reduce nonpoint source pollution and the development and implementation of riparian projects to restore the streamside environment. Projects included:

- revegetating riparian areas and rebuilding stream banks,
- relocating animal feeding operations (AFOs),
- shifting from flood irrigation to pressurized sprinkler irrigation, and
- installing fencing to keep livestock out of riparian areas.

This collaborative approach has improved the condition of riparian areas and significantly reduced phosphorous loading in the Cub River.

Restoration of Riparian Areas

Historical livestock use of the Cub River had eroded stream banks, leaving riparian areas with little or no vegetative buffer. The lack of riparian vegetation contributed to sediment loading into the river from runoff. Without the filtration provided by streamside plants, pollutants readily entered the water.

Riparian restoration projects focused on two key areas for improvement to land use practices:

- reducing livestock use of riparian areas
- restoring the stream corridors

Livestock producers installed multiple offsite watering facilities to reduce reliance on riparian areas for water. Producers installed over four miles of fencing to prevent livestock from accessing the river and creeks, with several more fencing projects currently in the design phases. Fencing has allowed riparian areas to rest and regenerate. Producers have also installed 3,100 feet of pipeline to supply water for livestock troughs away from the river and its tributaries. Improved grazing management has reduced the erosion of grazing areas, reducing sediment loading from runoff from rangeland and pastures.

Stream restoration and rehabilitation projects concentrated on stream bank stabilization and revegetation. Riparian projects recontoured stream banks to reduce soil erosion. Willow planting stabilized stream banks and promoted the regrowth and reestablishment of riparian vegetation.

Manure Management

Better management of manure from Animal Feeding Operations (AFOs) significantly reduced phosphorous loading into the Cub River. Since 2001, producers have installed ten solid waste facilities and six liquid waste storage ponds on dairies and feedlots and constructed over 600 feet of berms and diversions in areas where livestock are close to water. In two instances, producers relocated operations off the river. Containing runoff from manure bunkers and wastewater lagoons limits the nutrient loading into waterways.

Producers are also utilizing nutrient management plans to refine nutrient applications on cropland. These plans help farmers determine the appropriate manure application rate for their fields. Soil testing as part of these plans includes estimates of on-farm manure production, crop yield and nutrient uptake, and manure application rates. Farmers apply supplemental commercial nitrogen and phosphorous if nutrients from manure will not satisfy crop needs, reducing unnecessary treatments and excess nutrients in the soil. Limiting or eliminating manure applications on frozen or saturated ground also reduces the potential for nutrient-heavy runoff into the river.

Improved Irrigation Practices

A growing number of agricultural operators in the Cub River drainage are switching from flood irrigation to pressurized sprinkler irrigation. Flood irrigation creates runoff that washes phosphorous in manure and commercial fertilizers into waterways. Center-pivot spray irrigation systems allow operators to set the timing and amount of irrigation water applied across their fields. Irrigation scheduling prevents the overapplication of water. This reduces the runoff of sediments and excess nutrients into waterways from irrigation.

Partners and Funding

Collaborative efforts to improve the water quality on the Cub River have yielded impressive results. Local conservation districts have worked with producers to make water quality a high priority and educate landowners on the ways they can improve their operations to protect the waterways. DWQ supplied monitoring equipment and lab analysis support for water sampling. The NRCS entered into contracts with individual landowners to install BMPs. The NRCS also provided planning and engineering support. Utah State University Extension worked side by side with the local conservation districts and NRCS to provide technical support and outreach and educational efforts to raise awareness of water quality issues in the Bear and Cub River watersheds.

Since 2001, NRCS contracts have totaled over $1,092,000. The Clean Water Act Section 319 program provided an addition $330,100. Producers provided in-kind matching funds of $212,400. Together, water quality improvement projects on the Cub River have totaled approximately $1.9 million to date.

These restoration efforts, combined with increased outreach and education for landowners and operators, have resulted in better land use practices and reduced pollutant loading to the Cub River. The sustained application of these management practices and ongoing restoration efforts will improve water quality in and around the Cub River. The cooperative efforts of landowners and operators, the conservation district, DWQ, and their partners demonstrate the options available to agricultural producers in the state to protect water quality and successfully reduce nutrient pollution from nonpoint sources.

Construction Moves Forward on Ronald McDonald House Expansion

Division of Environmental Response and Remediation Finds Remedy for Soil Contamination at Building Site

Earlier this year, it looked like the "the house that love built" would have to put its expansion plans on hold after contractors for Ronald McDonald House Charities (RMHC) discovered gasoline contamination on property slated to house their new 38,000 square foot facility. The Division of Environmental Response and Remediation (DERR) assisted RMHC by facilitating the installation of a vapor barrier so construction could proceed.

A Tradition of Caring

"For families across the Intermountain West, the Ronald McDonald House is a place to call home when a child is seriously ill or injured, "explained Carrie Romano, Executive Director of RMHC of the Intermountain Area. Since it opened its Salt Lake facilities in 1988, RMHC has provided thousands of families with comfortable, affordable accommodations and a supportive environment while a child is in the hospital or receiving extensive medical care. Demand, however, has outstripped RMHC's resources. "Last year, we had to turn away 588 families because we did not have the rooms to accommodate them," stated Romano.

Ronald McDonald House Charities developed a long-term plan to almost triple the number and variety of rooms available to families and create healing gathering spaces for patients and their families. RMHC decided to purchase property adjacent to their current facility on South Temple Street in Salt Lake City to expand their campus to serve 46 additional families.

Unexpected Setback

In 2005, RMHC purchased the Sinclair gas station located next to their current building. Older underground storage tanks (USTs), such as those found under the Sinclair station, were used to store gasoline and diesel and had the potential to leak into the soil and groundwater. Soil and groundwater samples often show low levels of gasoline contamination at gas stations, but these sites do not always require additional remediation if the contamination poses no current or future threat to human health. To account for this possibility, RMHC leased the station back to the station operator under the condition that he remediate the site at the conclusion of his lease.

Although the operator agreed to this remediation, he left town before his lease expired. RMHC then became responsible for the tank removal and remediation of any contaminants found on the property. RMHC hired environmental contractors to remove the station and underground storage tanks and perform site remediation. Certified soil and groundwater samplers working for the environmental contractors took soil samples of the site. DERR inspected the site and issued "no further action" (NFA) notices based on the soil sampling and assessment of the soil and groundwater pathways for contaminants on the site. Following receipt of these NFAs, RMHC obtained the necessary funding and clearances to begin construction of its new facilities.

While excavating for a footing for one of the walls, contractors unearthed an old residential oil tank and found contaminated soil located more than 20 feet below the ground level. The residential oil tank had probably provided oil for the houses that occupied the property around the turn of the twentieth century. Although the tank was empty, contractors found soil containing high levels of gasoline contamination at this location. Apparently, gasoline from one of the excavated UST systems had leaked and traveled along piping trenches and fill material to the oil tank and collected there. Because the oil tank was located at a greater depth than the shallow lines of the known UST systems, it had escaped earlier detection.

Sampling of the deeper soil in the location of the old oil tank showed the surrounding soils tested high for benzene. The benzene levels found around the heating oil tank were higher than would typically be found near an old heating oil tank. It was determined that the benzene was from the former gasoline UST system.

While benzene evaporates quickly when exposed to air, it breaks down more slowly in soils and water. Exposure to benzene can cause serious health effects, particularly for sensitive populations.

Construction stopped. RMHC still had to pay the contractors for every day they were idle. Total site remediation to remove all possible benzene on the property would be impractical and prohibitively expensive. RMHC came close to abandoning the project as costs mounted and a solution seemed nowhere in sight.

Vapor Barrier a Win-Win Solution

RMHC approached the environmental scientists in the Underground Storage Tank Branch in DERR for assistance. The Leaking Underground Storage Tank program (LUST) of DERR oversees remediation of contamination from USTs.

"LUST scientists and engineers review and establish cleanup guidelines, define the degree of hazard, and take action to abate the hazard and remediate the site," explained Brent Everett, director of the Division of Environmental Response and Remediation. "Responsible parties such as RMHC seek the guidance of the LUST staff to ensure cleanup in a timely and economical manner."

The environmental scientists from the LUST program also determined that some of the remediation efforts at the RMHC site could be funded by the Petroleum Storage Tank (PST) fund. The PST fund is a trust fund administered by the DERR. Many gas station owners use the fund to help pay for eligible environmental cleanup costs.

DERR scientists and RMHCs consultant, IHI, determined that it would not be feasible to remediate the entire property to the depth of the contamination and keep the RMHC expansion on a reasonable timetable. The majority of the contamination is located outside the building footprint, where bacteria in the soil breaks down the contamination so it can degrade naturally until it is no longer considered a threat to human health or the environment. Unfortunately, it can take many years for the bacteria to break down these contaminants.

RMHC removed the contaminated soils around the tank and backfilled with clean soil. The extent of the benzene contamination underneath the building footprint was unknown. Placing a facility on top of potentially contaminated soils could lead to benzene vapor intrusion into the building, since vapors trapped below the building could eventually migrate to the surface and enter into the housing through the foundation. What RMHC needed was a way to protect the residents in the new facility, particularly sensitive populations, from vapor intrusion from the underlying soils.

The solution was to install a vapor barrier and passive venting system in the foundation of the new building. Since this type of ventilation system is most effective when integrated into new construction, the timing was ideal.

Installation Process

Contractors used strips of plastic vapor conduit to direct the vapors to specific venting points. The vapor barrier installation took place in stages over several days:

1. Workers laid the conduit in a crosshatch pattern inside the footprint of the building, covered it with sand and a liner, and sealed it with asphalt material.
2. The conduit connected to a venting pipe that runs through the outside walls of the building and vents any vapors out through the roof.
3. Workers conducted several "smoke tests" to detect any leaks in the liner before placing an additional liner and sand on top of the first liner.
4. Workers poured concrete over these layered liners, and proceeded to lay the floor of the foundation.

After the RMHC contractor installed the vapor barrier, construction continued as planned. "We were thrilled and relieved," exclaimed Romano.

Happy Ending

Construction on the new facility is proceeding smoothly. RMHC will conduct periodic indoor air testing and water monitoring at the site to protect the health and safety of the residents of the Ronald McDonald House and the surrounding neighborhood.

"The Board and staff are grateful that the planned housing expansion is moving forward. Further delays would have meant fewer families could access the critical housing RMHC provides," said Romano. "We can't thank the staff at DERR enough for their help and support."

"We are happy we could find a solution that ensures that the facility and its surroundings are environmentally safe for the families housed there," added Everett, " so the "house that love built" can continue to serve families in need."

State Throws Support Behind Stricter Emission Standards

Tier 3 Vehicle Emission and Fuel Standards Crucial to Attaining and Maintaining Air Quality Standards

Governor Herbert and the Air Quality Board (AQB) submitted letters of support this summer to the EPA for its proposed Tier 3 vehicle emissions standards. Emission reductions from the Tier 3 program are an important component of Utah's efforts to improve air quality and reduce particulate pollution.

State officials and the Division of Air Quality (DAQ) continue to explore options for emissions reductions to

meet the national PM2.5 health-based standard. Since mobile emissions account for a majority of the precursor emissions responsible for winter PM2.5 in Utah, reductions in vehicle emissions are critical to the success of the state's PM2.5 State Implementation Plan (SIP).

Proposed changes by the Environmental Protection Agency (EPA) to the vehicle and fuel emission standards promise to deliver substantial emissions reductions of these precursor pollutants. New tailpipe standards for all light-duty vehicles and some heavy-duty trucks would result in an 80 percent reduction in combined volatile organic compound (VOC) and NOx emissions on a fleet average basis and a 70 percent reduction in direct particulate (PM) emissions on a per vehicle basis.

Tier 3 vehicle emission standards would help Utah attain and maintain National Ambient Air Quality Standards (NAAQS) for PM2.5 and protect the health and quality of life of the residents of the state.

Significant Emission Reductions from New Standards

Tier 3 emissions standards for new vehicles, combined with lower sulfur fuel standards, would dramatically reduce tailpipe emissions from cars and trucks across the United States. The new standards, slated to take effect in 2017, integrate emission controls with low sulfur fuels to optimize catalytic converter performance, reducing emissions.

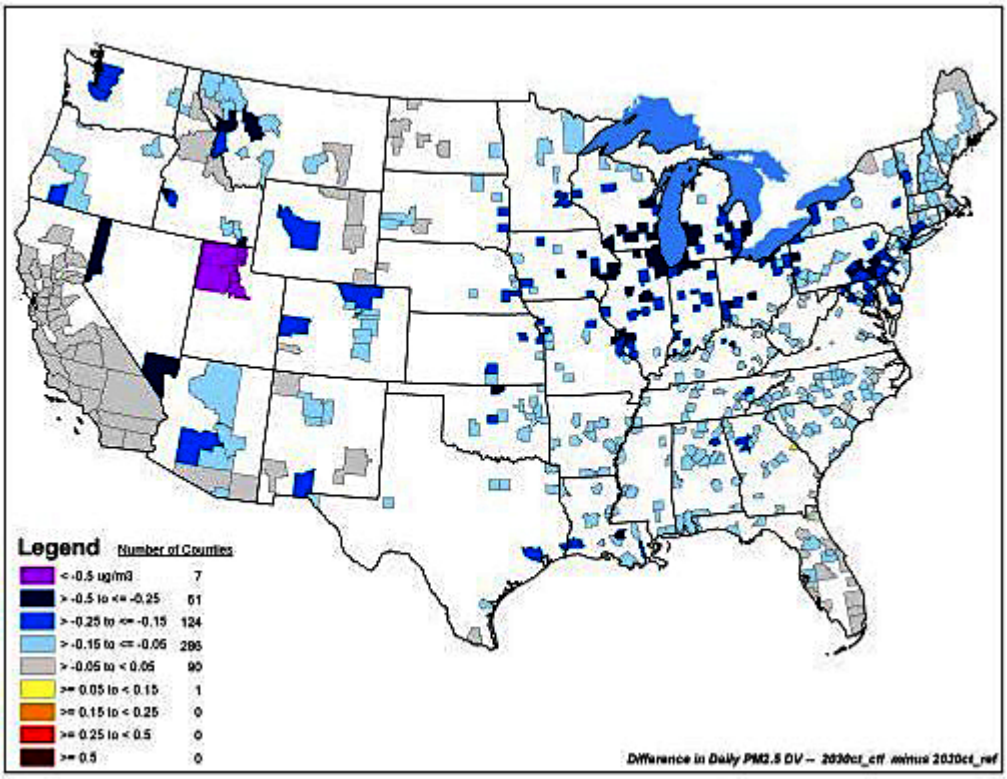
The Tier 3 program builds on the successful emissions reduction strategy of the EPA's Tier 2 program, which introduced the emissions model that treated the vehicle and fuel as a single system. Reducing the sulfur content in gasoline and diesel helps emissions control technology operate more effectively, decreasing emissions on existing vehicles as well as newer vehicles subject to the more stringent emissions standards. Lower sulfur fuel facilitates the development of lower cost emissions control and fuel efficiency technologies.

Tier 3 standards would also decrease 24-hour design values. The design value is the pollutant concentration a particular area must reduce to meet National Ambient Air Quality Standards (NAAQS) to demonstrate attainment. A design value is a statistic that describes the air quality status of an area relative to the NAAQS. A reduction in the design value means the pollutant reductions required to demonstrate attainment decrease as well. Projected decreases in direct PM2.5 and precursor NOx and VOC emissions from the implementation of Tier 3 standards would result in decreases in the design value for PM2.5.

Benefits for Utah

Projected emissions reductions for 2019 resulting from the implementation of Tier 3 would result in a 10.1 percent reduction in NOx emissions and a 3.9 percent reduction in VOC emissions. Direct PM2.5 reductions, although modest at first, would reach 10.4 percent by 2030.

Tier 3 emission standards on new vehicles, combined with fleet turnover, would help offset emissions from the growth in vehicle miles traveled (VMTs) projected by the state's metropolitan planning organizations (MPOs).



Utah nonattainment areas would receive the greatest benefit nationally from implementation of Tier 3 standards. Utah has a projected decrease in 2030 of more than 0.5µ/m3 for the 24-hour PM2.5 design value, the largest decrease in the country. In 2017, the first year Tier 3 standards would be in place, the maximum projected decrease in the country for a 24-hour PM2.5 design value would occur in Tooele County. The EPA predicts that without the proposed standards or other additional controls in place, 21 counties nationwide, including Cache County and Salt Lake County, would have 24-hour PM2.5 design values above the NAAQS in 2030, making attainment even more difficult.

Because the rules for Tier 3 standards have not become final, emission reductions from the standards cannot be included in the Motor Vehicle Emission Simulator (MOVES) modeling for the current PM2.5 SIP. Over the long term, however, these reductions will help the state attain and maintain the NAAQS for PM2.5.

Emission reductions from Tier 3 standards would also attenuate health issues associated with vehicle emissions. Motor vehicles are an important source of air pollution exposure, particularly in Utah's urban areas. Decreases in emissions will improve air quality and reduce the adverse effects of unhealthy levels of air pollutants on both children and adults.

State Commitment to Stricter Emission Standards

Although the Tier 3 standards won't be finalized in time to be included in the current PM2.5 SIP, implementation of these stricter emission standards will significantly improve air quality in the state over time.

As Governor Herbert stated in his letter to the EPA, "while Utah has made significant progress in improving air quality and our emissions are steadily declining, certain areas of the state exceed the NAAQS... For the sake of our health, economy, and quality of life, we are committed to do better... (T)he Tier 3 Program appears to be a viable strategy for attaining and maintaining the NAAQS in Utah and, therefore, Utah supports the proposed Tier 3 Program."

Point Sources to Provide Additional Emission Reductions

Division of Air Quality Increases Emission Controls for Major Sources

Planned emission reductions by 2019 of over 4,500 tons per year (tpy) from stationary sources in nonattainment areas will provide a significant decrease in PM2.5 and PM2.5 precursor pollutants emitted by these facilities. Under the final PM2.5 State Implementation Plan (SIP), the Division of Air Quality (DAQ) evaluated thirty point sources to ensure that their emission controls will meet the Reasonably Available Control Technology (RACT) standard. Emission reductions identified at these sources will improve air quality in the nonattainment areas in the state.

What Is RACT?

Under the Clean Air Act (CAA), areas in nonattainment for the National Ambient Air Quality Standards (NAAQS) must ensure RACT is applied on stationary sources when developing a SIP. The Environmental Protection Agency (EPA) defines RACT as "the lowest emission limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility."

While many large sources in Utah's nonattainment areas already operate with a high degree of emission controls, a RACT analysis can supersede the emission control technology authorized by existing permits. The RACT process takes advantage of the fact that emissions control technology is constantly improving and ensures that stationary sources continue to upgrade their emission controls over time.

RACT Analysis

RACT analysis consists of three steps:

1. Identify technologically and economically feasible options.
2. Evaluate these options collectively in the air quality model.
3. Select the candidate control measures to include in the overall SIP strategy.

RACT Analysis Process
Identify major point sources and source categories.
Identify probable RACT emission units. Emission units include all individual pieces of equipment that emit air pollutants at a stationary source. Eliminate emission units too small for the application of RACT.
Identify potential emission controls and eliminate technologically infeasible controls.
Estimate cost and emission reduction potential for each control technology.
Rank feasible controls. Feasibility ranking identifies the costs for technologies, emission reduction potential, and cost effectiveness based on cost per ton. Other factors considered include energy impacts, environmental impacts, and the control implementation schedule.

Evaluate the effectiveness of the potential measures in the air quality model. RACT controls are part of an overall SIP strategy to reach the federal health standard as quickly as practicable.
Determine if some of the more costly emission controls may not be needed because they do not help advance the date of attainment.

Identify Technologically and Economically Feasible Options

DAQ specifically evaluated each of the thirty point sources as part of its control strategy analysis for the PM2.5 SIP to identify technologically and economically feasible control options. Using the 2008 baseline emissions inventory as a starting point, DAQ compiled a list of all equipment at sources and identified the probable emissions from the equipment. The Division eliminated certain emission units from further consideration because their emissions were insignificant. These emission units included emergency generators, intermittent units, and those with actual or potential emissions of less than 5 tons per year (tpy).

The Division developed a list of potential control options for each targeted emission unit using information from point sources and independent DAQ analysis. DAQ submitted a preliminary draft of the resulting recommendations for public comment in October 2012. The Division used an outside contractor to review fifteen of the more complicated point sources to provide an independent third-party analysis of the available options and control costs. DAQ based its final RACT list on comments and information from the EPA, stakeholders, and the independent contractor.

These control options were then evaluated using economic, energy, and other environmental considerations. DAQ also considered timing constraints for the implementation of controls, the amount of emissions reduced, and incremental savings and costs.

Evaluate These Options Collectively in the Air Quality Model

The Division conducted air quality model runs to evaluate the cumulative effects of candidate emission controls relative to the attainment dates for the SIP.

The 2008 inventory of actual emissions with existing emission controls was the baseline for this analysis. The inventory was "trued-up" to reflect significant modifications to the sources and to account for any changes to the source list from the addition or closure of sources. This became the starting point for projecting emissions to 2014, 2017, and 2019. Each of these subsequent projections included both growth and potential emission controls and considered the practical timing for implementation of controls.

Modelers used data from the Regional Economic Models, Inc. (REMI), the Bureau of Economic Analysis (BEA), and the Governor's Office of Management and Budget (GOMB) to project the RACT-adjusted, 2008 actual point source emissions to future years. DAQ also contacted point sources to determine if site-specific growth data would be more valid than the REMI and BEA and GOPB data when projecting to future years.

Modelers tested projections that included RACT controls against similar projections with growth but no RACT.

Select the Candidate Control Measures to Include in the Overall SIP Strategy

Based on its modeling and attainment analysis, DAQ retained a collection of emission controls at specific emission units to represent the RACT portion of its overall SIP strategy. The tables below show the combined emission reductions by 2019 from control measures for large stationary sources for each nonattainment area.

Salt Lake City Nonattainment Area: 2019			
Particulate Matter (PM2.5)	**Sulfur Dioxide (SO2)**	**Nitrogen Oxides (NOx)**	**Volatile Organic Compounds (VOCs)**
237.8 tpy	1,718.1 tpy	1,370.7 tpy	1,020.2 tpy
Provo Nonattainment Area: 2019			
0.0 tpy	0.0 tpy	28.1 tpy	192.8 tpy
tpy = tons per year			

Several sources categories were subject to source specific emission control strategies.

The Division developed general requirements for all petroleum refineries located in the nonattainment areas. These general requirements set limits on cracking units, fuel gas, heat exchangers/cooling towers, and require flare gas recovery, as well as imposing work practice standards on tank degassing and leak detection and repair.

Bingham Canyon Mine was the only minor source required to meet RACT/BACT. Since tail pipe emissions from haul trucks are the largest source of PM2.5 and PM2.5 precursors from the mine, Kennecott will establish a replacement schedule to exchange its haul trucks for higher tier vehicles with stricter emission standards.

RACT analysis is an important component of the SIP development process. Implementation of controls from the RACT analysis for the PM2.5 SIP will lead to significant emission reductions from point sources and improve state air quality over the long term.