

Science for Solutions - Air Quality Project Descriptions

Project	Description	Region	Year
Toxics Study I	Analysis of 8 years of toxics data from West Valley City and Bountiful. Data were compared to comparable data set from Phoenix, Arizona.	Wasatch Front	2014
Results:	<ul style="list-style-type: none"> An overview of the HAPs data in the Salt Lake Valley shows that some HAPs frequently and significantly exceed the one-to-one million cancer risk and chronic exposure thresholds. These pollutants are: 1,3-butadiene, 1,4-dichlorobenzene, acetonitrile, acetaldehyde, acrolein, acrylonitrile, benzene, carbon tetrachloride, dichloromethane, ethylbenzene, ethylenedichloride, formaldehyde, and tetrachloroethylene. <p style="text-align: right;">Public notification of Air Quality conditions.</p>		
Uinta Basin Winter Ozone Studies (UBWOS)	Large-scale field campaign to assess the role of atmospheric chemistry and precursor gases as they interact to create high levels of wintertime ozone	Uinta Basin	2011-2014
Results:	<ul style="list-style-type: none"> DAQ now has a much better understanding of the complex chemistry and meteorology that drives ozone formation in the Uinta Basin. This has enable DAQ to begin to implement more targeted controls (focus on VOC rather than NOx). DAQs permitting of additional oil and gas sources has also benefitted from this increase in knowledge. This information will be invaluable now that the area has been designated non-attainment, and it is more crucial than ever to get a handle on the high ozone levels. <p style="text-align: right;">Rule development and permit control requirements.</p>		
Toxics Study II	Year long study to monitor toxic compounds in Lindon and West Valley City with the permanent toxics monitoring in Bountiful—DAQ & U of U	Wasatch Front	2015
Results:	<ul style="list-style-type: none"> Study was to evaluated the differences in pollutant concentrations that might exist among three urban locations on the Wasatch Front. Variation in pollutant levels were found. Concentrations of lead in the air were observed to be higher at the West Valley monitoring site than in Bountiful or Lindon, the exposure levels are far lower than the National Ambient Air Quality Standard. A follow up suite of measurements could provide important information regarding sources of formaldehyde, acetaldehyde, and methylene chloride. <p style="text-align: right;">Characterized the spatial distribution of Air Toxics.</p>		
West Valley Toxics	Detailed study of large number of multi-pollutant observations combined with meteorology and statistical analyses to look for source regions of monitored pollutants	Wasatch Front	2015
Results:	<ul style="list-style-type: none"> The comprehensive analysis suggests a wide variety of anthropogenic OVOC sources contribute to the observed levels and more stringent regulations on the OVOC sources (that may include solvent usage, paint stripping etc.) are needed. Consistent with the UDAQ's 2015 special air toxics study, this work also saw elevated levels of form- and acetaldehyde in West Valley City. A Positive Matrix Factorization (PMF) analysis was conducted to identify probable sources of the fine particulate material. Five factors were identified in this analysis. Two of the factors were associated with emissions from auto and diesel vehicles. One was associated with emission from the wood combustion. One was associated with fugitive emissions from the copper smelter to the west of NAA (the identification of the source of this factor was greatly aided using back-trajectory information). Factor 5 was associated with the formation of secondary aerosol, dominated by ammonium nitrate. <p style="text-align: right;">Inventory and source identification of Air Toxics that will inform federal regulation development.</p>		
Exceptional Events Modeling	Inventory development; source apportionment; STILT & STILTCHEM model.—U of U	Wasatch Front	2015
Results:	<ul style="list-style-type: none"> Helped to determine whether wind-blown dust caused exceedances of PM_{2.5} during March and April 2011 dust storms. Tool can be used in future analyses to demonstrate the occurrence of exceptional events and their contribution to NAAQS violations. <p style="text-align: right;">Inventory and rule development for fugitive dust sources.</p>		
Vehicle Cold Start Emissions	Comprehensive study of cold start emissions for policy and regulatory purposes.—USU & WSU (NCAST)	Wasatch Front	2015
Results:	<ul style="list-style-type: none"> Better information on how long a catalytic converter can remain at optimal operating temperature under Utah's wintertime and summertime conditions. More accurate information on vehicular emissions to improve DAQ's emission inventories. More accurate information on idling emissions and their impact on Utah's air quality to assess the effectiveness of anti-idling programs to help reduce pollution levels. Emissions data that can be used to update EPA's nationwide mobile-source emissions model. <p style="text-align: right;">Cold start public education and outreach campaigns.</p>		
Non-Combustion Formaldehyde Study	Field study to measure formaldehyde emissions from non combustion sources	Uinta Basin	2015
Results:	<ul style="list-style-type: none"> Emissions from all measured sources were very low, suggesting that emission controls that specifically target these sources may not be effective. Studies to improve model performance and measurements of carbonyl emissions from sources that were not considered in this work, such as natural gas burners, compressor stations, and gas processing plants, are needed to resolve discrepancies between the observations and model results. Better information will help improve understanding of oil- and gas-related emissions that impact Utah's air quality and will assist DAQ in developing more cost-effective emission control strategies. <p style="text-align: right;">Accurate projections of emissions and rule development and permit controls for oil and gas equipment.</p>		
Oil & Gas Projection/Growth & Decline Curve Analysis	Improve assumptions in the projection of Uinta Basin development and emissions growth.—U of U	Uinta Basin	2015

Results:	<ul style="list-style-type: none"> • Estimates the number of wells that might be drilled in the Uinta Basin in the future. • Estimates production rates from both existing and new wells. • This information is used to estimate emissions from oil and gas operations that lead to high ozone levels in the Uinta Basin during winter. • This analysis helps to examine the most cost-effective emission regulations that help maintain regulatory ozone standards while minimizing the economic impact on the oil and gas industry. • Enables examination of impacts of continued permitting. 		
Chemistry Mechanisms at Low Temperatures	Addresses temperature dependent reactions or organic nitrate. Builds upon the work of Dr. William Carter done for UGR Wyoming. Add SAPRC chemistry and speciation profile to CMAQ.—USU/BYU	Uinta Basin	2015
Results:	<ul style="list-style-type: none"> • Improvements to the model have helped DAQ evaluate the impact of oil and gas emissions on wintertime ozone formation in the Uinta Basin. • Improvements have assisted DAQ in the cost-benefit analysis for new regulations. 		
CAMx Snow Cover Treatment	A different approach from the SAPRC mechanism but important because it can apply to summer O ₃ modeling. Includes consulting for implementation of the HONO chemistry improvement.—ENVIRON	Wasatch Front, Uinta Basin	2015
Results:	<ul style="list-style-type: none"> • DAQ will use model updates in the development of future State Implementation Plans (SIPs). • Updates to the model improve ozone prediction in the Uinta Basin but are insufficient to reproduce the observed high ozone levels. Improvements to the oil and gas emissions inventory are needed to better predict and control ozone in the Basin. Improvements include accounting for missing sources, such as flanges, valves and storage tanks, and better representation of emission sources such as engines, compressors, and pumps, in the inventory. 		
Winter Atmospheric Modeling Improvements	Incorporate model improvements for winter conditions that were developed for the Uinta Basin into Wasatch Front cold pool conditions.—U of U	Wasatch Front, Northern Utah	2015
Results:	<ul style="list-style-type: none"> • Improved modeling of wintertime events with the photochemical model CAMx, allowing the air-quality model to reproduce pollutant build-up near the ground for long periods of time. This is consistent with observations from DAQ monitoring instruments. • The ability to capture these effects in a model have improve DAQ's ability to test the effects of newly proposed regulations. • More accurate information has assisted DAQ in the cost-benefit analysis for new rules. 		
Wasatch Front Wood Burning Emissions	What would be the effect of a two-stage program that would reduce emissions from wood-burning stoves while at the same time maximizing the number of days that EPA-certified stoves and other devices could be used for home heating. Second, what would be the impact of a program that would encourage individuals and families to replace older stoves and fireplaces with new, clean burning devices.	Wasatch Front	2015
Results:	<ul style="list-style-type: none"> • Determined how important wood-burning is to elevated PM_{2.5} levels. • Analyzed the impact of a program to encourage people to replace older stoves and fireplaces with EPA certified and other low-emission devices in their homes. • Helped to develop more effective control regulations that target significant contributors to PM_{2.5}. 		
Northern Utah Wood Burning Survey	Survey of residential wood burning emissions; ground truth area-source inventory.—ICF/DAQ	Northern Utah	2015
Results:	<ul style="list-style-type: none"> • The most popular primary home heating sources are natural gas and electricity. These are collectively used by 96.2-percent of households, while wood is only used by 0.9-percent of households as a main heating source. • 25- to 38-percent of households in Northern Utah own a wood-burning appliance. • Fireplaces are mostly used for enjoyment, while inserts, wood stoves, and other wood appliances are mainly used as a backup heating source. • Data from the survey and the EPA method on wood-burning emissions and amount of wood used were generally in agreement. • Survey data will be used in future analyses on wood-burning activity in order to determine the contribution of wood smoke emissions to PM_{2.5} levels in Northern Utah. 		
Great Salt Lake Summer Ozone Study	Atmospheric boundary layer analysis; air quality model conceptual understanding & model verification; mobile/van surface ozone monitoring on lake perimeter; stationary monitors to compare against mobile data.—U of U/DAQ	Wasatch Front	Summer 2015
Results:	<ul style="list-style-type: none"> • The Great Salt Lake influenced ozone concentrations along the Wasatch Front through several mechanisms. (1) Lake-induced wind systems modulated the transport and exchange of background ozone and ozone precursors between the lake and urban environments, with nocturnal land breezes from the Wasatch Front towards the Lake transporting ozone precursors towards the Lake; and afternoon lake breezes transporting at times air with higher ozone and precursor concentrations towards the Wasatch Front while at other times advecting cleaner air into the urban corridor. (2) Lake-modulated boundary-layer depth affecting pollutant vertical mixing over the Lake and along the Wasatch Front. For example, the relatively cool Lake surface in early June led to a shallow boundary layer over the Lake then. Other lake factors hypothesized to influence ozone concentrations include: diminished Lake level exposing highly reflective surfaces aiding ozone production photochemistry, and potential biogenic precursor sources in the wetlands surrounding the southeastern portion of the Lake. • Rule and SIP development to assure cost effective controls. 		
Great Salt Lake Ambient Hydrochloric Acid Study	Contour analysis of HCl concentrations surrounding the GSL and Salt Lake Valley; point source emissions allocation; ambient HCl monitoring	Wasatch Front	2015
Results:	<ul style="list-style-type: none"> • Results suggest that the Great Salt Lake (GSL) itself, the exposed shoreline and salt flats, and the local refineries are not dominant sources of the observed HCl. The magnesium refinery on the lake's western shore, on the other hand, may strongly influence HCl concentrations in the Salt Lake Valley. • Rule and SIP development to assure cost-effective controls. 		

Key Drivers of Ozone Formation Along the Wasatch Front	Project to determine the relative importance of NOx and VOC emissions in ozone formation along the Wasatch Front.	Wasatch Front	2015
Results:	<ul style="list-style-type: none"> • Ozone levels did not significantly decrease over the last 20 years in Salt Lake City. • Ozone levels slightly increased on weekends, although levels of NOx and VOCs decreased. This is because ozone production depends on the relative availability of these gases rather than their levels. • Ozone levels are not very sensitive to large changes in NOx emissions, suggesting that reducing onroad NOx emissions will not lead to ozone reduction. • VOCs, specifically light alkanes, are the most important species driving ozone formation in Salt Lake City. • The most effective strategy for reducing ozone is to reduce light alkanes such as ethane and propane. • Further work is needed to characterize the sources of alkanes along the Wasatch Front. <p style="text-align: right;">Rule and SIP development to assure cost-effective controls.</p>		
Modeling of 3 Wintertime Episodes	Improved SIP modeling - better understanding of episode specific meteorology	Wasatch Front	2016
Results:	<ul style="list-style-type: none"> • The purpose of this was to model three past inversion episodes using the model improvements that resulted from the original study. The study was completed with excellent results and a direct application to the technical work requirements of the PM2.5 State Implementation Plan (SIP). Air quality modelers at DAQ have evaluated the performance of the air quality model using each of the three episodes and chose, after consultation with the regional modeler at EPA, the most appropriate episode (2011) to use for Serious PM2.5 SIP. <p style="text-align: right;">Rule and SIP development to assure cost-effective controls.</p>		
Storage Tank Emissions Pilot Project (STEPP)	Informed DAQ and Public about how many controlled tank facilities are leaking on State jurisdiction in the Uinta Basin. Gave information about what type of components are leaking, the types of repairs needed, and how difficult/costly repairs might be.	Uinta Basin	2016
Results:	<ul style="list-style-type: none"> • 0.43 emission plumes per pad were detected, most of these were associated with the storage tanks. • 74% of the detected plumes appeared to be emitting from the thief hatch or the pressure relief valve. • 39% of all pads visited had detectable plumes. • This data has helped and will continue to help DAQ improve it's oil and gas emissions inventory. • DAQ can use this data to develop better rules and regulations at equipment we know to have issues with leaks. <p style="text-align: right;">Rule and permit control requirements for leak detection and repair.</p>		
Salt Lake Valley Winter PM2.5 Study	Project to collect mobile and aerostat measurements of chemical and meteorological parameters to improve the scientific understanding of severe wintertime pollution episodes in the Salt Lake Valley. - UofU and WSU	Wasatch Front	2016
Results:	<ul style="list-style-type: none"> • Improvements allowed the air-quality model to better reproduce pollutant build-up near the ground for long periods of time. This is consistent with observations from DAQ monitoring instruments. • The ability to capture these effects in a model will improved DAQ's ability to test the effects of newly proposed regulations. • More accurate information has assisted DAQ in the cost-benefit analysis for new rules. 		
Toxics Study III	Toxics analysis and comparison to metropolitan cities outside of Utah. Follow-up to Toxics Study I, compare concentrations found in Utah to 5 other cities in the United States - DAQ	Wasatch Front	2016
Results:	<ul style="list-style-type: none"> • This study identified where Bountiful fits among other metropolitan areas across the continental United States with respect to Hazardous Air Pollutants (HAPs) concentration and trends. • Methylene chloride levels in Utah rose in 2008 after which they remained consistently above the cancer screening level, interjected with occasional extremely high concentration samples. The likely source is located near the monitor and has low impact on anything but the neighborhood scale. • 2014-2015 formaldehyde and acetaldehyde annual levels (driven by the uncharacteristic increase in their wintertime concentrations) were observed significantly above those recorded in 2012. It is likely that the wintertime formaldehyde and acetaldehyde emissions are due to some anthropogenic activity. <p style="text-align: right;">Inventory and source identification of Air Toxics that will inform federal regulation development.</p>		
Toxics Study IV	Evaluate elevated concentrations of formaldehyde methylene chloride found at the Bountiful monitoring site - DAQ	Wasatch Front	2017
Results:	<ul style="list-style-type: none"> • Report in progress. Identification of sources and controls to reduce Air Toxics. 		
ULend Program	Provides information about whether the controlled tank leak rate in the Uinta Basin is consistent over time and across jurisdictions. Also provides the benefit of use of an IR camera to small businesses. Enables companies currently not capable, to identify and repair leaks. Lower emissions from O&G facilities.	Uinta Basin, Statewide	2017
Results:	<ul style="list-style-type: none"> • Improves the rate of leaks being identified and repaired. • Enables small operators that can't afford and IR camera to implement an Leak Detection and Repair (LDAR) program using a borrowed IR camera. • Provides DAQ better information about the types of emission leaks being identified, and the specific repairs and cost associated with stopping the leaks. This enable DAQ to develop better informed rules and more accurate emission inventories. <p style="text-align: right;">Rule and permit control requirements for leak detection and repair for oil and gas equipment.</p>		
Utah Winter Fine Particulate Study (UWFPS)	Increase scientific understanding of the complex atmospheric chemistry that drives the formation of unhealthy levels of particulate matter (PM) in Utah's nonattainment areas. The UWFPS will supplement ground monitoring data with atmospheric data from aloft where the particulate formation occurs.	Wasatch Front	2017

Results:	<ul style="list-style-type: none"> • PM2.5 mass was dominated by ammonium nitrate during high pollution events, with an average contribution based on aircraft data of 75%. Other components of PM2.5 that are common in other urban areas, such as organic species (composed of carbon, oxygen and hydrogen) and sulfate (composed of sulfur and oxygen) made up the remaining mass (<20% and <5% on average). • Limiting Reagents in Ammonium Nitrate Formation - Cache Valley is nitrate limited. Both Salt Lake and Utah Valleys are predominantly nitrate limited, but may also have periods of reduced nitrogen limitation. For Utah Valley and especially Salt Lake Valley reductions in either reagent (nitrate and/or ammonia) may be effective in leading to reductions in ammonium nitrate aerosol. • Emissions - Observed a high spatial variability of ammonia is in disagreement with the current inventory. Study also indicates the importance of inter-basin exchange processes, potential transport of ammonia from Utah Valley to Salt Lake Valley. Distributions of nitrogen oxides, the precursors to secondary nitrate, are similar to those found in the emissions inventory. • Residential Wood Combustion - The major emissions from wood smoke include carbon containing compounds that are thought to contribute mainly to the organic component of PM2.5, contribute less than 20% to the final particulate mass in the aircraft observations during high pollution episodes. This figure represents a preliminary upper limit to the contribution of wood combustion to regional fine particulate mass as other sources such as vehicular emissions can also contribute. <p>Rule development and cost-benefit analysis of control strategies in State plans.</p>
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Science for Solutions - Water Quality Project Descriptions

	Project	Description	Region
Utah Lake Water Quality Study	Research to support establishment of numeric nutrient water quality criteria that are protective of recreation, aquatic life, and agricultural uses in Utah Lake; Development of a watershed implementation plan to achieve and/or maintain protective water quality that balances costs and benefits.	Utah County	2018 - 2021
Results:	Results will be used to: *Develop protective UPDES permits for wastewater and storm water discharges to Utah Lake *Identify voluntary load reductions from other sources (e.g., agricultural, septic, forest, natural) and lake treatments that should be subsidized with public funding *Protect public health and the environment, provide regulatory certainty, allocate public financing resources, and integrate water quality decisions with other agency management objectives (e.g., recreation, fishery, and water management)		

Science for Solutions - Drinking Water Project Descriptions

Project	Description	Region	Year
Water Use Data (\$1,500,000)	This is authorization to use DDW existing State SRF funds for water use data. \$1,000,000 was allotted to give water systems as a loan to install meters and monitoring systems to collect water use data. \$500,000 was allotted to DDW to provide support to water systems and research new sizing standards.	entire state	2017 - present
Results:	<ul style="list-style-type: none"> • Commissioned development of guidance document to design and install metering equipment (\$32,418) — completed the Metering Equipment Alternatives and Analysis Report in April 2017 for water systems and consultants to use for meter upgrade projects. • Billed staff time to do: outreach, existing data collection and review, and conduct work group of large water systems (\$40,000) — staff determined statewide standards are not appropriate and recommended system specific strategy recommended in December 2017 Audit Update. • Returned \$978,388 to SRF fund when no loans were requested by water systems. 		

Science for Solutions - Environmental Response and Remediation Project Descriptions

Project	Description	Region	Year
Underground Petroleum Storage Tank Financial Viability Study	H.B. 241 sponsored by Rep. Eliason in the 2013 General Session required the Department of Environmental Quality (through the Division of Environmental Response and Remediation) to conduct a study of the financial viability of the Environmental Assurance Program and the Petroleum Storage Tank Trust Fund; to specifically study the adverse selection of participants in the program and the actuarial deficit of the fund; obtain an actuarial study and related consultation that provided the necessary calculations to minimize adverse selection in the program and the actuarial deficit of the fund; develop a risk characterization profile for participants in the program and recommend a fee schedule based on fair market rates; and develop a strategy to reduce the negative equity balance of the fund.	State	2013
Results:	The division commissioned a financial viability study and actuarial review of the PST Trust Fund and presented the findings to the Natural Resources, Agriculture and Environmental Interim Committee meeting of November 20, 2013. Based on the findings of the study, Rep. Eliason sponsored H.B. 138 in the 2014 General Session that: moved the balance of the UST Loan fund into the PST Trust Fund, slightly raised the Environmental Assurance Fee paid by PST Trust Fund participants, created a risk-based tiered rebate structure to encourage infrastructure improvements at higher risk facilities, and changed the fee structure for tanks participating on the PST Trust Fund more inline with market insurance rates. The bill also authorized interest free loans out of the PST Trust Fund to further encourage the replacement of aging UST infrastructure. These modifications were done to reduce adverse selection and decrease the negative equity balance of the fund.		