UTAH

AIR MONITORING

NETWORK REVIEW 2005

Geneva Steel Stacks fall in 2005

Prepared by the Division of Air Quality

Utah State Department of Environmental Quality

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MONITORING NETWORK REVIEW

1.0 INTRODUCTION

The monitoring network has been described in the network reviews from 1982 through 2005. A complete description of each station is located in the station file at the Air Monitoring Center and is available upon request. This network review will focus on the adequacy of the existing network and the changes that are needed.

The existing or proposed monitoring stations are reviewed to see if the objectives are being met. The most recent emissions inventories for each pollutant are reviewed along with ambient data gathered in the area and, when available, a review of current computer air pollution dispersion modeling is also reviewed. The practicality of installing or maintaining a monitoring station at the current or proposed location is then reviewed with respect to the initial monitoring objectives, the available budget for monitoring, and the Division's monitoring priorities. A Network Modification Form is submitted to Region VIII of the Environmental Protection Agency prior to or as part of installing a new station. The network review process follows the requirements of 40 CFR 58.20(d).

1.1 CURRENT UTAH AIR MONITORING NETWORK

Table 1 lists the stations in Utah's current air monitoring network. The indicated location is the actual location address.

Under the listed parameters, a station may be designated NAMS = National Air Monitoring Station, SLAMS = State and Local Air Monitoring Station, or SPM = Special Purpose Monitor. The monitoring objectives (population exposure, source impact, highest expected concentration or background station) and the spacial scale of representativeness (micro, middle, neighborhood, urban or regional scales) are also designated.

Spacial scale of representativeness is described in terms of the physical dimensions of the air parcel surrounding an air monitoring station, throughout which pollutant concentrations are reasonably homogeneous. The scales of representativeness used for Utah's network are in the following ranges:

Micro Scale:	Several meters to about 100 meters
Middle Scale:	About 100 meters to 0.5 kilometers

1.1 Current Utah Air Monitoring Network (Cont)

Neighborhood Scale:	About 0.5 to 4.0 kilometers
Urban Scale:	Overall citywide conditions, usually about 4.0 to 50 kilometers. Requires more than one station to define
Regional Scale:	Defines a rural area, usually of reasonably homogeneous geography, extending for tens to hundreds of kilometers

Table 1
UTAH AIR MONITORING NETWORK

STA., LOC., ARIS#, SAROAD#	SO_2	CO	O_3	NO_2	LEAD	PM_{10}	$PM_{2.5}$
Beach #4 12100 West. 1200 S. GSL Beach Marina, Magna, UT 49-035-2004 460900005FO2	SLAMS High Neigh.		SLAMS* High Neigh.				
Bountiful #2 171 West 1370 North Bountiful, UT 49-011-0004 460060001F01	SLAMS Impact Neigh.	SLAMS Population Neigh.	NAMS* High Neigh.	SLAMS Population Neigh.			SLAMS Population Neigh.
Brigham City 140 West Fishburn Dr Brigham City, UT 49-033-0003			SLAMS Population Neigh.				SPMS Population Neighbor
Cottonwood, 5715 South 1400 East Behind School, Holladay, UT 49-035-0003 4600003F01		NAMS Population Neigh	NAMS* Population Neigh.	SLAMS High Neigh.		NAMS Population Neigh.	SLAMS Population Neigh.
Hawthorne 1675 South 600 East Salt Lake City, UT 49-035-3006		SLAMS* High Neigh.	SLAMS* High Neigh.	SLAMS High Neigh.		SLAMS High Neigh.	SLAMS Population Neigh.
Harrisville 405 West 2550 North Ogden, UT 49-057-1003			SLAMS Population Neigh.				SLAMS Background Regional
Herriman 5600 West 12885 South Herriman, UT 49-035-3008			SLAMS* High Neigh.				SPMS Background Regional

*Indicates Seasonal Monitoring
**Should be re-designated to NAMS

Table 1
UTAH AIR MONITORING NETWORK

STA.,LOC ARIS#, SAROAD#	SO_2	CO	O_3	NO_2	LEAD	PM_{10}	$PM_{2.5}$
Highland 10865 North 6000 West Highland, UT 49-049-5008			NAMS* High Neigh.				SPMS Population Neigh.
Lindon 30 North Main, Lindon, UT 49-049-4001 461220001F01						NAMS Impact Neigh.	SLAMS Population Neigh.
Logan 125 West Center Street Logan, UT 49-005-0004		SLAMS* Pop Neigh.	SLAMS* Pop Neigh.			SLAMS High Neigh.	SPMS Population Neigh.
Magna 2935 South 8560 West, Magna, UT 49-035-1001 460520001F02	NAMS Impact Neigh.				SLAMS Impact Neigh.	NAMS High Neigh.	SPMS Population Neigh
North Provo 1355 North 200 West Provo, UT 49-049-0002 460800002F01		SLAMS* Population Neigh.	NAMS* Population Neigh.	SLAMS High Neigh.		NAMS Population Neigh.	SLAMS Population Neigh.
North Salt Lake #2 1795 North 1000 West Salt Lake City, UT 49-035-0012 460920012F02	SLAMS ** High Middle					NAMS High Middle Co-Loc	SPMS High Middle

*Indicates Seasonal Monitoring
** Should be re-designated to NAMS

TABLE 1
UTAH AIR MONITORING NETWORK

STA., LOC., ARIS#, SAROAD#	SO_2	CO	O_3	NO_2	LEAD	PM_{10}	$PM_{2.5}$
Ogden #2 228 E 32nd Street Ogden UT 49-057-0002				SLAMS High Neigh.		SLAMS High Neigh.	SLAMS High Neigh.
Spanish Fork 50 South Main 49-049-5010			SLAMS* Population Neigh.				SPMS Transport Regional
State Street #3 1400 South State Street Salt Lake City, UT 49-035-0014		NAMS High Micro					
Tooele #3 50 West 434 North Tooele, UT 49-045-0003			SPM Population Neigh				SPM Population Neigh
University Avenue #3 363 North University Avenue Provo, UT 49-049-0005		SLAMS High Micro					
Washington Blvd. #2 2540 South Washington Blvd, In Office Bldg. Ogden, UT 49-057-0006		SLAMS High Micro					
Washington Terrace 4601 South 300 West Washington Terrace, UT 49-057-0007		SLAMS* Pop Neigh.	NAMS* Population Neigh.				SPMS Population Neigh.
West Valley 3100 South 3275 West West Valley City, UT 49-035-3007		SLAMS* Population Neigh.	SLAMS* Population Neigh.				SLAMS Population Neigh.

*Indicates Seasonal Monitoring
**Should be re-designated

UTAH DIVISION OF AIR QUALITY

OFFICIAL AND SPECIAL STUDIES MONITORING NETWORK SUMMARY JUNE 2005

	SITE CODE	TELEMETRY	PM 2.5	#PM2.5	PM10	#PM10	CO	O3	SO2	NO2	SPAN SOURCE	WIND	TEMP/RH	SR/BP*	SG/DT/PRE*	LEAD	AQI
ANTELOPE ISLAND	AI	CAMPBELL										YES	TEMP&RH		SIGMA ONLY		
AMALGA	AG	N/A	3 DAY	1													
BADGER ISLAND	BI	CAMPBELL										YES	TEMP&RH		PRECIP. ONLY		
BEACH	B4	ESC						*SEASONAL/API	TECO		DYNACAL/API	YES	TEMP		SIGMA ONLY		
BOUNTIFUL	BT	ESC	3 DAY	2				*SEASONAL/DASIBI	TECO	TECO	DYNACAL/DASIBI/CYLINDER	YES	TEMP&RH		SIGMA ONLY		SO2/CO/O3
BRIGHAM CITY	BR	ESC	3 DAY	1				*SEASONAL/API			DASIBI	YES	TEMP		SIGMA ONLY		
COTTONWOOD	CW	ESC	3 DAY	1	3 DAY	1	TECO	*SEASONAL/DASIBI		TECO	DYNACAL/DASIBI/CYLINDER	YES	TEMP&RH		SIGMA ONLY		O3/CO
HARRISVILLE	HV	ESC	3 DAY	1				*SEASONAL/DASIBI			DASIBI	YES	TEMP		SIGMA ONLY		
HAWTHORNE	HW	ESC	TEOM & E D	3	TEOM & ED	2	*SEASONAL/ TECO	DASIBI		TECO	DYNACAL/API/CYLINDER	YES	TEMP&RH	SR & BP			TEOM (2.5&10) O3/CO
HERRIMAN	HE	ESC	3 DAY	1				*SEASONAL/DASIBI			DASIBI	YES	TEMP&RH	SOLAR	SIGMA & DT		
HIGHLAND	HG	ESC	3 DAY	1				*SEASONAL/DASIBI			DASIBI	YES	TEMP		SIGMA ONLY		
HYRUM	HY	ESC	3-DAY									YES	TEMP&RH				
LINDON	LN	ESC	TEOM/CL/E D & CL	3	TEOM & ED	2					N/A	YES	TEMP&RH		SIGMA ONLY		TEOM (PM10/2.5)
LOGAN	L4	ESC	TEOM/3 DAY & CL	3	3 DAY	1	*SEASONAL/TECO	DASIBI	TECO	TECO	DASIBI/CYLINDER	YES	TEMP&RH		SIGMA ONLY		TEOM (PM2.5)CO/O3
MAGNA	MG	ESC	3 Day	1	3 DAY	1			TECO		DYNACAL	YES	TEMP		SIGMA ONLY	*HV/CL	SO2
NORTH PROVO	NP	ESC	3 DAY	1	3 DAY & CL	2	*SEASONAL/TECO	*SEASONAL/DASIBI		TECO	DYNACAL/DASIBI/CYLINDER	YES	TEMP		SIGMA ONLY		O3/CO
N. SALT LAKE	N2	ESC	3 DAY	1	E/D &CL	2			TECO		DYNACAL	N/A					SO2
OGDEN #2	O2	ESC	TEOM/3 DAY	2	TEOM/ED	2				TECO	DYNACAL	Yes	TEMP&RH				TEOM (PM10/2.5)
SALTAIRE	SA	CAMPBELL										YES	TEMP&RH	SOLAR	SIGMA ONLY		
1400 S. STATE	S3	ESC					TECO				CYLINDER	N/A					CO
SPANISH FORK	SF	ESC	3 DAY	1				*SEASONAL/API			API	YES	TEMP		SIGMA ONLY		
SYRACUSE	SY	CAMPBELL										YES	TEMP&RH		SIGMA ONLY		
TOOELE	T3	ESC	TEOM/3DAY					*SEASONAL/API			API	YES	TEMP				TEOM/03
UNIVERSITY AVE.	U3	ESC					TECO					N/A					CO
WASH. BLVD	W2	ESC					TECO				CYLINDER	N/A					CO
WASH. TERR.	WT	ESC	3 DAY & CL	2			*SEASONAL/TECO	*SEASONAL/DASIBI			DASIBI/CYLINDER	YES	TEMP&RH		SIGMA ONLY		O3/CO
WEST VALLEY	WV	ESC	3 DAY & CL	2			*SEASONAL/TECO	*SEASONAL/DASIBI			DASIBI/CYLINDER	YES	TEMP				
WEST JORDAN	WJ	ESC										YES	TEMP&RH				
SITES	28	27	20		8		8	14	5	6		23	24	3	19	1	13
REPORTING SMPLRS.				27		13										1	
CO-LOC SMPLRS.				3		2										1	
SEASONAL SMPLRS.							5	11									
TEOM (PM 2.5 & 10)				6		3											

!SPM – SPECIAL PURPOSE MONITOR
ESC - DATA LOGGER

*SEASONAL TECO - COLLECT CO DURING WINTER SEASON (NOV-MAR)
*SEASONAL DASIBI – COLLECT O3 DURING SUMMER SEASON(MAY-SEPT)
*EOD - EVERY OTHER DAY SAMPLING
*ED - EVERY DAY SAMPLING

SR/BP* - SOLAR RADIATION & BAROMETRIC PRESSURE
C/L - CO-LOCATED
H/V – HIGH VOLUME SAMPLER
'SG/DT/PRE*-SIGMA-THETA, DIFFERENTIAL TEMP. & PRECIPITATION

1.2 CURRENT NETWORK MODIFICATION ISSUES:

The following modifications to the monitoring network are anticipated during the next year.

Monitoring for lead has been performed at the Magna monitoring site since 1986. The monitoring is in response to emissions from the Kennecott Copper Smelter. Lead monitoring is required for point sources that emit 5 tons of lead or more per year. Changes in equipment and operations have reduced the annual emissions of lead from the Kennecott copper Smelter below 5 tons per year. A modification form has been submitted to EPA to discontinue lead monitoring at the Magna monitoring site.

Proposed construction at the site of the present Ogden monitoring station requires that it be moved to a new location. A new site is being selected for the Ogden monitoring station.

Response to change in EPA Focus

EPA has developed a National Ambient Air Monitoring Strategy. It identifies an increased focus on monitoring non-criteria pollutants. In so doing, EPA is proposing re-allocating funding from measuring criteria pollutants to increased monitoring of Air Toxics. Rules to implement the new monitoring strategy will be promulgated this fall. As EPA changes the monitoring requirements in 40 CFR Part 58 and implements the National Monitoring Strategy, the DAQ monitoring efforts will change. The changes required to the monitoring network will be identified in the next monitoring network review.

Response to New or Proposed NAAQS

No new National Ambient Air Quality Standards (NAAQS) have been promulgated.

DAQ Identified Data Needs

High PM2.5 measurements in Logan indicate additional sampling should be performed. Ammonia and reactive organic compound monitoring is necessary to help characterize the formation of PM2.5 in Cache County. In addition, nitrogen oxide and sulfur dioxide information is necessary in Logan to help characterize PM2.5 precursors. Ammonia and organic compounds are not criteria pollutants but are involved in the formation of secondary PM2.5. Therefore the information is critical.

Additional Monitoring Needs Due to Growth

Utah has experienced significant population growth over the past 15 years. A table showing the growth rate is attached as Appendix B. Changes to the monitoring network the past couple of years have addressed some of the population growth. The area discussed below deserves consideration for future monitoring.

Park City-Snyderville Basin-Summit County: Summit County and Park City have a high population growth. Meteorology is significantly different than Salt Lake Valley but they do have inversion periods, and although the inversions are easier to eliminate than the inversions in Salt Lake Valley, they can be persistent. With a population of 34,000, it is an air shed that needs to be evaluated.

Modifications to Meteorological Monitoring Because of Computer Modeling Needs

Computer modeling is a very important part of evaluating air pollution impacts and the results of control strategies and control measures. Meteorological data is necessary to the computer modeling.

No change has been identified to the meteorological monitoring network.

1.3 REVIEW OF LAST YEAR NETWORK MODIFICATIONS

PM2.5 concentrations in Cache County continue to be a concern. Additional characterization of Cache Valley is needed to determine the extent of the problem area. In response to that need, new PM2.5 monitoring stations were installed in Amalga and Hyrum in Cache County. Amalga is 6 miles north northwest of Logan and the Hyrum site is 6 miles south of Logan in Cache Valley. Network modification forms have been submitted to EPA for the addition of these sites.

Tooele City in Tooele County is now part of the Salt Lake City Metropolitan Statistical Area. Tooele City and the surrounding area is experiencing rapid growth. The population is 48,000 and increasing. In response to that growth and the existing population, a new monitoring site was established in Tooele City to measure PM2.5 meterological data and summer ozone. A network modification form has been submitted to EPA for this new site.

Real time, continuous PM2.5 monitoring using R&P FDMS samplers began at the Lindon station in June 2005 and at Ogden in August 2005.

2.0 UTAH AIR MONITORING NETWORK

The following sections discuss the air monitoring network in Utah for the criteria pollutants identified by EPA that have a National Ambient Air Quality Standard. The need for ambient air monitoring for each criteria pollutant is different, and the requirements for selecting an appropriate monitoring site are identified by EPA in 40 CFR Part 58. In many cases, monitoring for more than one criteria pollutant can be performed at the same monitoring location, which enhances the value of the data and reduces sampling costs to the state.

2.1 SULFUR DIOXIDE

The sulfur dioxide (SO_2) monitoring sites were installed at their present locations based on the emissions inventory and early computer modeling. Siting has also occurred in response to concerns expressed by the public. Computer modeling showed areas of expected high SO_2 concentrations at Magna, in Salt Lake County and the area of North Beck Street in Salt Lake County. The Magna and North Salt Lake SO_2 Monitoring sites were installed in response to that computer modeling. A review of the SO_2 data show no violations of the SO_2 standard since 1978. The control measures identified in the State Implementation Plan have had their intended affect. SO_2 has an important part in the formation of particulate matter through the formation of secondary sulfate particles, therefore, data are needed to assure that control measures continue to be effective and to help understand the formation of particulate matter.

SO_2 NETWORK

Salt Lake County

There are three types of major SO_2 sources in Salt Lake County. They are process industries, refineries and electric power generation. The impact of each of these sources is measured by the existing monitoring stations. The monitoring stations located at Magna, North Salt Lake and at the Great Salt Lake Beach State Park are meeting our needs and objectives.

Davis County

The largest SO_2 sources in Davis County are oil refineries. In recent years, the crude oil being processed by the oil refineries has become increasingly more sour, so the refineries have installed sulfur scrubbing systems to reduce their SO2 emissions. Their emissions are adequately monitored by the North Salt Lake Station near the Salt Lake County-Davis County border. The new Bountiful monitoring station in Davis County is population oriented as was the previous monitoring site. It is the only SO_2 monitoring station in Davis County and is meeting DAQ needs and objectives.

Cache County

SO_2 is being monitored in Logan to help identify SO_2 precursors for $PM_{2.5}$. The information is needed in characterizing $PM_{2.5}$ in the Logan area.

Existing Monitoring Network

The existing SO2 monitoring network meets the federal requirements and State needs.

2.1 Sulphur Dioxide (Cont)

Additional Monitoring

No additional SO_2 monitoring is planned.

Special Studies

No special studies are planned.

Changes To The SO2 Monitoring Network

No changes are planned.

2.2 NITROGEN DIOXIDE

The existing Nitrogen Dioxide (NO_2) monitoring stations were installed at their current locations based on a combination of emissions inventory and population centers. The sites were installed in response to oxides of Nitrogen (NO_x) emissions from automobiles and the involvement of NO_x in the photochemical reaction that produces ozone. Based on that criteria, the sites were located in the center of the major urban areas. EPA's guidance that monitoring should be performed in areas with a population of 200,000 or greater was considered. Even though NO_x monitors are located in cities with populations of less than 200,000, the urban areas have populations over 200,000. The sites were also selected based on the ability to group several different analyzers into one station. Appendix A lists both the point source and area source emissions of NO_x for all counties. The information shows that 37% of NO_x emissions come from automobiles and 41% comes from point source process industries. Sixty percent of point source NO_x emissions are associated with power plants, which are located in rural southern Utah areas and have received Prevention of Significant Deterioration permits. They have also performed post construction monitoring, verifying that the NAAQS is not violated.

The oxidation of Nitric Oxide (NO) to NO_2 takes time, therefore, the highest NO_2 concentrations should be located some distance downwind from major NO sources. The ideal location for NO_2 monitors is at the edge of an urban area.

NO_2 NETWORK

Existing Monitoring Network

The existing NO_2 monitoring stations are Ogden, North Provo, Bountiful, Hawthorne, Logan and Cottonwood. The network is meeting the needs and objectives of DAQ.

Additional Monitoring

No new monitoring for NO_2 has been planned.

Special Studies

No additional studies are necessary.

Changes To The NO2 Monitoring Network

No changes will be made to the NO2 monitoring network.

2.3 CARBON MONOXIDE

The present CO monitoring sites were installed based on emissions from automobiles. Based on that criteria, the sites were located according to traffic patterns and traffic densities. The traffic information used was obtained from the Utah Department of Transportation. The emissions inventory in Appendix A indicates the amount of CO emissions from different sources in Utah. Vehicles generate 64.5% of the Carbon Monoxide emitted.

When Utah's CO network was designed, no modeling data was available to assist in site location, so sites were chosen based on traffic volumes and patterns. Since that time, SIP modeling has been done for the Salt Lake-Davis County area and for the Provo-Orem area in Utah County. Models used under predicted the CO concentrations measured at all of the monitoring sites. The models give a rough estimate of the relative concentrations of CO, which indicates areas of expected maximum CO concentrations.

CO NETWORK

The existing Network CO monitoring stations that operate all year are: Cottonwood, State Street, Washington Blvd., and University Avenue. The CO Monitoring stations that operate seasonally are: Hawthorne, Logan, North Provo and West Valley. This network presently meets the needs and objectives of DAQ.

Additional Monitoring

There has been a dramatic decrease in measured CO concentrations since the early 1990's to the point that CO is no longer an environmental concern. The last time the CO standard was violated was 1993. As a result, no additional CO monitoring is planned.

2.3 CARBON MONOXIDE (Continued)

Changes To The CO Monitoring Network

Due to many years of measuring low CO concentrations, we plan on ending CO monitoring at the Cottonwood monitoring site. The NAMS designation needs to be moved to the Hawthorne CO monitor. No other changes are planned for the CO monitoring network.

Special Studies

No special studies are planned.

Saturation Study

No additional saturation studies are being considered at this time.

2.4 OZONE

Unlike the other pollutants, ozone is not emitted directly into the atmosphere. It is produced in the atmosphere as precursors, nitrogen oxides and hydrocarbons react in the presence of sunlight to form a number of photochemical compounds. The photochemical reaction takes time to occur; therefore, ozone monitoring should be conducted down wind from the sources of precursors.

The valley setting of the major urban areas along the Wasatch front complicates ozone monitoring. Typical ozone monitoring indicates that the peak ozone stations should be located 5 to 7 hours down wind from the urban area, however, summer wind patterns in Utah result in a typical diurnal up valley down valley wind flow. This situation suggests that after 5 to 7 hours the polluted air mass may be right back over the urban area.

Ozone concentrations at all Division of Air Quality monitoring sites fluctuate seasonally, with higher values measured only during the warmer months. Monitoring at all ozone stations in attainment areas is therefore done seasonally, from May through September, unless year round data is requested for modeling.

One and Eight Hour NAAQS

On June 16, 2005, EPA rescinded the one-hour ozone standard. This results in the only time period identified by EPA for evaluating ozone is an eight hour average. The existing monitoring sites are located where the highest hourly ozone concentrations occur, and we anticipate the highest 8-hour averages will occur at the same locations. The 8 hour NAAQS for ozone does not specifically require any new monitoring sites. The impact of the 8 hour standard has been the occurrence of exceedances at stations in more rural locations that did not exceed the 1 hour standard. There are also many more exceedances of the 8-hour ozone standard in the urban areas than the 1 hour standard.

Existing Network

The existing monitoring network for ozone consists of thirteen monitoring sites located primarily in the populated counties along the Wasatch Front. As noted below, this network is meeting most but not all of the data needs for ozone.

Special Studies

No special studies have been conducted since the summer of 1996. None are planned for this next year.

2.4 OZONE (Continued)

Additional Monitoring

We wish to find a site for measuring ozone in the east side of the Sandy/Draper area. Previous modeling suggests that ozone concentrations may be higher in the southeast part of Salt Lake Valley when the afternoon lake breeze pushes the polluted air mass from Salt Lake City into this part of the valley. The mountains partially trap the air mass, allowing the ozone concentrations to build up.

Additional Saturation Studies.

No additional studies are planned.

Changes To The O3 Monitoring Network

Ozone monitoring in Tooele beginning in July 2005, is the only change to the ozone monitoring network.

2.5 LEAD

Utah has established a SLAMS lead sampler using the regulatory guidelines in 40 CFR Part 58 Appendix D. The station is on a six-day sampling schedule.

LEAD NETWORK

Existing Monitoring Network

Presently, lead monitoring is being performed at the Magna air monitoring station. The Magna sampler is near an industrial source that emits 22 tons of lead per year. Most of the measurements made over the past 5 years have been below the detection limits of the measurement method. Lead monitoring, in reality, is now only necessary near industrial lead sources which emit 5 tons or more of lead a year to the atmosphere. Historically there is only one industrial source in Utah that emits more than 5 tons or more of lead a year. That is the Kennecott Copper Smelter. Recent changes in the smelting process at the smelter have reduced the lead emissions from the smelter to less than 5 tons of lead a year. Documentation of that reduction has been submitted to EPA along with a network modification form to discontinue lead monitoring at the Magna air monitoring station.

Additional Monitoring

No additional lead monitoring sites will be installed.

2.6 PM10

The PM_{10} samplers were initially installed at the same sites as the Total Suspended Particulate (TSP) samplers. TSP monitoring had been performed for many years at those locations and has shown many violations of the TSP standard. Computer modeling was not available to assist in locating the PM_{10} samplers, but has now been completed for the PM_{10} SIP. The modeling primarily dealt with source impact identification. There are two types of PM_{10} particles, which complicates PM_{10} monitoring. Primary PM_{10} particles are released from the source as particles and their concentration decreases from the point of release dependent on dispersion characteristics. Secondary particles are released as gases and become PM_{10} particles through chemical reactions in the atmosphere. Secondary particle concentrations are greater some distance from the source or after some time has elapsed from the time of release. Measured PM_{10} concentrations are a combination of both primary and secondary particles. Establishing monitoring sites to measure both types of particles can be a concern. Historically TSP and PM_{10} sites have been located based on primary particulates.

Existing Monitoring Network (See Table 1)

The existing PM_{10} monitoring network meets the minimum requirements for PM_{10} data for state and federal government needs. The existing network is not keeping pace with population growth.

Additional Monitoring

No additional PM_{10} monitoring is necessary at this time.

Saturation Studies

No saturation studies are planned for the next year.

Special Studies

No special studies are planned for the next year.

Changes To The PM10 Monitoring Network

No changes are planned in the PM10 monitoring network.

PM2.5

On July 18, 1997, the Environmental Protection Agency promulgated a NAAQS for particulate matter measured as $PM_{2.5}$. Particulate sampling has been conducted first for TSP and then PM_{10} at several locations in each county. In addition, computer modeling for TSP and PM_{10} and some limited PM_{10} saturation sampling have shown the existing particulate sampling sites are located in the areas of high concentrations for particulates. Previous particulate monitoring has also shown the existing locations to have elevated particulate concentrations. There are two types of particles that form $PM_{2.5}$ particles. Primary $PM_{2.5}$ particles are released from the source as particles and their concentration decreases from the point of release dependent on dispersion characteristics. Secondary particles are released as gases and become $PM_{2.5}$ particles through chemical reactions in the atmosphere. Secondary particle concentrations are greater some distance from the source or after some time has elapsed from the time of release. Measured $PM_{2.5}$ concentrations are a combination of both primary and secondary particles. Establishing monitoring sites to measure both types of particles can be a concern. Historically, TSP, PM_{10} sites have been located based on primary particulates. Initially $PM_{2.5}$ will be located based on concentrations of PM_{10}. IMPROVE samplers are operated by the National Park Service and are included as part of the $PM_{2.5}$ monitoring network. The IMPROVE samplers are located in the National Parks in Utah.

EXISTING PM2.5 MONITORING NETWORK

With the inclusion of the Amalga, Hyrum and Tooele $PM_{2.5}$ monitoring sites, the existing $PM_{2.5}$ monitoring network is adequate and meets the needs of DAQ and EPA.

ADDITIONAL STUDIES

A special study is planned for the winter of 2005-06 in Cache County to help characterize $PM_{2.5}$ formation. The study will look at ammonia and VOC in the winter inversions. The data will help determine the most important precursors to the secondary $PM_{2.5}$.

Changes to the PM2.5 Monitoring Network

PM2.5 concentrations in Cache County continue to be a concern. Additional characterization of Cache Valley is needed to determine the extent of the problem area. In response to that need new PM2.5 monitoring stations were installed in Amalga and Hyrum in Cache County. Amalga is 6 miles north northwest of Logan and the Hyrum site is 6 miles south of Logan in Cache Valley. Network modification forms have been submitted to EPA for the addition of these sites.

PM2.5 (Continued)

Changes to the PM2.5 Monitoring Network

Tooele City, in Tooele County, is now part of the Salt Lake City Metropolitan Statistical Area. Tooele City and the surrounding area is experiencing rapid growth. The population is 48,000 and increasing. In response to that growth and the existing population, a new monitoring site was established in Tooele City to measure PM2.5 and summer ozone. A network modification form has been submitted to EPA for this new site.

No additional changes are planned to the $PM_{2.5}$ network.

2.8 METEOROLOGICAL DATA

By measuring surface wind speed and direction, one can attempt to determine where a pollutant-laden air mass has come from and where it is going. This information is essential any time an attempt is made to determine the cause of high pollution periods.

The wind patterns in the mountainous terrain of Utah can be very difficult to analyze. Winds affected by geographical features can, and often do, control air mass movement in the mountain valleys where most industrial and urban activities are concentrated.

Because of these complex wind patterns, it has been the policy of the Division of Air Quality that many major air monitoring stations of middle scale or larger should record meteorological data. Each station must be evaluated separately because of the complex micrometeorology in Utah. Because the terrain produces the complex wind patterns, there are not enough monitoring sites that measure meteorological parameters.

Existing Monitoring (See Network Summary Table 1)

The importance of measuring meteorological parameters has increased as a result of more complex computer modeling. Modifications to the meteorological monitoring network have occurred as a result of a report prepared by the Technical Analysis Section. A computer model called Urban Airshed Model requires an extensive amount of meteorological information. Some sites have been discontinued because they were redundant and new sites have been installed in locations where no data were available.

Additional Monitoring

No additional meteorological monitoring is planned.

Changes To The Meteorological Monitoring Network

The Syracuse wind tower was relocated to a safer location, approximately 500 feet west of the original site.

2.9 AIR TOXICS

The category of toxic air pollutants encompasses literally thousands of different compounds, including organic and inorganic particulate compounds and volatile and semi-volatile organic compounds. It would be an impossible task to monitor for every known toxic compound. The list of known toxic compounds is growing, with dozens of compounds being added yearly.

The Clean Air Act of 1990 identified 189 toxic air pollutants, which are now the immediate focus of the toxic monitoring program. That list has since been modified to 188 Toxic Air Pollutants. EPA has chosen 33 toxic air pollutants to focus on in its Integrated Urban Air Toxics Strategy.

Sampling Locations

Specific sources of toxic pollutants have been identified using SARA 313 information and a toxic air pollution survey conducted by Radian for the Division. Toxic monitoring at these sources was not isolated for the initial sampling phase of the program; rather a general survey of the air contaminants was initiated. Monitoring near specific sources is being performed based on identified need. Historic sampling has been performed at Salt Lake City, Lindon, and North Provo stations. DAQ has been part of the EPA funded Urban Air Toxics Monitoring Program since a site was installed at West Valley in October 1999.

In January 2003 the air toxics monitoring was moved to the Bountiful monitoring station so Urban Air Toxics equipment would be co-located with the PM2.5 speciation equipment. This will give a more complete evaluation of the air mass being monitored. An Athelometer has been added to measure ambient carbon particles was purchased with EPA funds and located at the Bountiful monitoring site. In addition sampling for chrome 6 was started in 2005.

Existing monitoring

The one Urban Air Toxics monitoring site provides a baseline for air toxics data in the urban areas along the Wasatch Front. It is a minimal effort that currently meets the needs of the division.

2.9 AIR TOXICS (Continued)

Additional Monitoring

EPA has indicated a desire to increase monitoring for non-criteria pollutants. EPA is re-allocating $6.3 million from existing funds for measuring criteria pollutants to increased monitoring of Air Toxics. As more guidance comes from EPA, that information will be used to assess needed changes in air toxics monitoring.

Additional Studies

No additional studies are planned for next year.

Changes to the Air Toxics Monitoring Network

EPA's National Monitoring Policy recommends increasing the number of sites and number of parameters being measured as part of identifying toxic air pollutants in the urban areas. As regulations are promulgated that implement the National Monitoring Policy, we will identify needed changes to our toxics monitoring network.

3.0 EMERGENCY EPISODE MONITORING

One of the responsibilities of the Division is to assure that the public is protected from air pollution concentrations that will cause immediate damage or impact to their health. Section 5.1 of the Utah Air Conservation Regulations establishes emergency response criteria in accordance with Subpart H and Appendix L of 40 CFR 51. Whenever air pollution concentrations meet or exceed the Alert, Warning, or Emergency levels, an Emergency Episode is determined to exist and actions are taken to reduce the
emissions of air pollutants. It is the responsibility of the monitoring section to collect the air pollution data used to determine when an Emergency Episode exists. The data collection telemetry system is alarmed and the monitoring staff is alerted whenever the Alert, Warning, or Emergency levels are approached. The monitoring staff has the primary responsibility to notify the director of the Division that an emergency episode exists. This is a critical function that is required by State and federal law. The telemetered stations along the Wasatch Front are included in the Emergency Episode network.

No changes have been identified in the emergency episode monitoring effort.

4.0 NETWORK MODIFICATION FORMS

Network modification forms have been prepared for submittal to EPA Region VIII for new sites in Amalga, Hyrum and Tooele.

5.0 SUMMARY AND CONCLUSIONS

The minimum monitoring requirements identified by federal regulation are being met
with the existing monitoring network in Utah. The procedures that are being used and the instruments that are being operated meet the standards that have been established by EPA.

The monitoring network provides, with the exceptions noted, the data necessary to meet the needs of the Utah Division of Air Quality.

APPENDIX A
EMISSIONS INVENTORY

The completed Emissions Inventory for 1999 is included in this appendix. It is the most recent revision of the Emissions Inventory available.

99 State Summary of Emissions by Source (tons/year)

COUNTY		CO	NOx	PM10	PM2.5	SOx	VOC
Beaver	Area Source	2,778.60	739.84	952.84	NA	71.90	9,564.29
	On-Road Mobile	7,801.64	1,369.90	280.45	NA	33.02	431.31
	Point Source	9.53		19.02	9.72	2.10	1.94
	Biogenics	0.00	0.00	0.00	0.00	0.00	8,985.67
	Total	10,589.77	2,133.19	1,252.31	9.72	107.02	18,983.21
Box Elder							
	Area Source	17,656.37	1,358.61	4,138.04	NA	220.77	12,029.87
	On-Road Mobile	32,166.12	5,180.24	1,186.47	NA	134.04	1,782.89
	Point Source	1,935.74	545.58	1,079.80	565.49	91.46	608.14
	Biogenics	0.00	0.00	0.00	0.00	0.00	8,555.68
	Total	51,708.23	7,084.43	6,404.31	565.49	446.27	22,976.58
Cache							
	Area Source	18,120.77	1,384.61	3,035.77	NA	444.81	16,156.44
	On-Road Mobile	26,303.32	2,126.34	1,056.29	NA	94.12	1,970.15
	Point Source	58.71	88.48	53.76	14.76	59.96	144.15
	Biogenics	0.00	0.00	0.00	0.00	0.00	12,282.25
	Total	44,482.80	3,599.43	4,145.82	14.76	598.89	30,552.98
Carbon							
	Area Source	2,625.10	838.91	483.28	NA	146.88	11,590.67
	On-Road Mobile	1,1678.01	1,001.22	481.61	NA	43.59	844.62
	Point Source	248.30	3,612.34	455.84	202.97	5,491.96	88.07
	Biogenics	0.00	0.00	0.00	0.00	0.00	10,915.10
	Total	14,551.41	54,52.47	1,420.73	202.97	5,682.43	23,438.46
Daggett							
	Area Source	529.14	20.56	252.47	NA	4.78	4,653.56
	On-Road Mobile	811.33	115.98	35.61	NA	4.05	56.90
	Point Source	67.41	772.06	0.00	0.00	0.00	65.94
	Biogenics	0.00	0.00	0.00	0.00	0.00	4,487.32
	Total	1,407.88	908.60	288.08	0.00	8.83	9,263.72
Davis							
	Area Source	15,054.93	1,504.72	1,371.05	NA	74.84	8,894.87
	On-Road Mobile	57,269.20	6,101.23	1,680.07	NA	236.51	3,848.09
	Point Source	1,685.02	2,278.44	489.10	203.08	2,112.24	1,576.48
	Biogenics	0.00	0.00	0.00	0.00	0.00	2,647.19
	Total	74,009.15	9,884.39	3,540.22	203.08	2,423.59	16,966.63

COUNTY		CO	NOx	PM10	PM2.5	SOx	VOC
Duchesne	Area Source	8,388.95	461.71	1,902.65	NA	74.92	31,115.58
	On-Road Mobile	6,319.97	550.80	254.91	NA	23.38	426.00
	Point Source	722.30	1,418.30	5.41	0.74	2.50	360.34
	Biogenics	0.00	0.00	0.00	0.00	0.00	29,327.45
	Total	15,431.21	2,430.54	2,162.97	0.74	100.80	61,229.37
Emery							
	Area Source	2,108.88	410.19	1,101.14	NA	72.06	9,958.51
	On-Road Mobile	12,372.13	1,598.43	472.77	NA	49.19	760.98
	Point Source	1,801.69	32,949.19	1,945.40	352.39	18,985.77	220.05
	Biogenics	0.00	0.00	0.00	0.00	0.00	9,349.50
	Total	16,282.70	34,957.81	3,519.31	352.39	19,107.02	20,289.05
Garfield							
	Area Source	8,371.01	293.21	1,652.19	NA	27.85	29,632.20
	On-Road Mobile	4,600.86	415.83	184.49	NA	17.24	295.80
	Point Source	1.76	3.06	1.06	0.27	0.95	1.12
	Biogenics	0.00	0.00	0.00	0.00	0.00	27,618.52
	Total	12,973.63	712.10	1,837.74	0.27	46.04	57,547.64
Grand							
	Area Source	3,499.95	408.54	633.96	NA	63.28	11,957.83
	On-Road Mobile	9,831.36	1,598.93	373.70	NA	41.99	615.10
	Point Source	410.69	526.22	19.03	5.37	7.84	72.46
	Biogenics	0.00	0.00	0.00	0.00	0.00	10,981.26
	Total	13,742.00	2,533.69	1,026.69	5.37	113.11	23,626.65
Iron							
	Area Source	6,848.11	1,326.66	1,745.65	NA	229.90	18,898.18
	On-Road Mobile	20,386.07	3,183.61	747.07	NA	83.40	1,191.52
	Point Source	9.32	33.76	6.34	1.95	6.18	138.63
	Biogenics	0.00	0.00	0.00	0.00	0.00	17,232.64
	Total	27,243.50	4,544.03	2,499.05	1.95	319.48	37,460.97
Juab							
	Area Source	10,038.39	1,093.92	2,202.47	NA	93.69	9,101.56
	On-Road Mobile	12,262.13	2,116.59	451.18	NA	52.35	681.08
	Point Source	13,364.13	1,397.78	183.20	137.51	40.03	78.53
	Biogenics	0.00	0.00	0.00	0.00	0.00	7,155.46
	Total	35,664.65	4,608.28	2,836.85	137.51	186.07	17,016.62

COUNTY		CO	NOx	PM10	PM2.5	SOx	VOC
Kane	Area Source	2,064.37	80.35	892.89	NA	31.13	11,666.87
	On-Road Mobile	4,088.31	378.74	174.04	NA	16.14	290.06
	Point Source	0.00	0.00	0.00	0.00	0.00	0.00
	Biogenics	0.00	0.00	0.00	0.00	0.00	11,091.51
	Total	6,152.68	459.09	1,066.93	0.00	47.27	23,048.44
Millard							
	Area Source	7,438.65	843.37	2,472.73	NA	96.29	15,294.33
	On-Road Mobile	15,181.16	2,483.89	557.84	NA	63.52	857.14
	Point Source	1,754.34	25,471.18	525.65	257.05	4,170.46	281.99
	Biogenics	0.00	0.00	0.00	0.00	0.00	13,274.53
	Total	24,374.16	28,798.44	3,556.22	257.05	4,330.27	29,708.00
Morgan							
	Area Source	4,183.70	195.89	661.03	NA	36.72	8,112.95
	On-Road Mobile	4,332.52	762.80	154.68	NA	18.25	232.43
	Point Source	1,547.90	1,280.55	247.89	63.12	278.29	4.50
	Biogenics	0.00	0.00	0.00	0.00	0.00	7,144.43
	Total	10,064.12	2,239.24	1,063.60	63.12	333.26	15,494.31
Piute							
	Area Source	3,490.15	46.15	281.67	NA	11.22	6,833.93
	On-Road Mobile	1,048.21	90.73	42.58	NA	3.89	73.43
	Point Source	0.00	0.00	0.00	0.00	0.00	0.00
	Biogenics	0.00	0.00	0.00	0.00	0.00	5,380.37
	Total	4,538.36	136.88	324.25	0.00	15.11	12,287.73
Rich							
	Area Source	6,055.27	188.73	1,226.65	NA	14.31	6,451.47
	On-Road Mobile	1,736.75	148.36	65.63	NA	6.08	103.12
	Point Source	0.00	0.00	0.00	0.00	0.00	0.00
	Biogenics	0.00	0.00	0.00	0.00	0.00	4,762.95
	Total	7,792.02	337.09	1,292.28	0.00	20.39	11,317.54
Salt Lake							
	Area Source	84,596.78	20,691.99	4,156.99	NA	777.83	32,028.44
	On-Road Mobile	188,740.98	18,452.70	6,405.24	NA	832.67	13,991.01
	Point Source	3,385.52	8,676.12	3,119.62	1,128.42	4,939.23	2,621.96
	Biogenics	0.00	0.00	0.00	0.00	0.00	9,581.04
	Total	276,723.28	47,820.60	13,681.85	1,128.42	6,549.73	58,222.45

COUNTY		CO	NOx	PM10	PM2.5	SOx	VOC
San Juan							
	Area Source	4,480.60	299.55	1,205.64	NA	77.15	24,462.02
	On-Road Mobile	8,429.03	774.26	358.57	NA	33.12	595.81
	Point Source	646.10	596.13	17.19	6.10	1,367.47	132.28
	Biogenics	0.00	0.00	0.00	0.00	0.00	23,009.92
	Total	13,555.73	1,669.94	1,581.40	6.10	1,477.74	48,200.03
Sanpete							
	Area Source	6,678.19	355.05	1,458.01	NA	111.58	26,305.99
	On-Road Mobile	7,856.38	683.92	321.29	NA	29.39	559.00
	Point Source	11.90	26.48	46.32	20.90	2.32	2.05
	Biogenics	0.00	0.00	0.00	0.00	0.00	24796.03
	Total	14,546.47	1,065.45	1,825.62	20.90	143.29	51,663.07
Sevier							
	Area Source	9,321.59	414.29	1,566.65	NA	93.37	21,986.16
	On-Road Mobile	13,980.08	2,167.83	511.51	NA	57.01	814.93
	Point Source	56.49	134.62	152.09	64.52	7.74	11.87
	Biogenics	0.00	0.00	0.00	0.00	0.00	19,988.97
	Total	23,358.16	2,716.74	2,230.25	64.52	158.12	42,801.93
Summit							
	Area Source	8,051.32	520.32	1,201.58	NA	143.93	35,624.25
	On-Road Mobile	22,355.46	3,480.43	796.29	NA	89.72	1,245.19
	Point Source	349.78	659.16	54.34	30.86	104.94	304.80
	Biogenics	0.00	0.00	0.00	0.00	0.00	34,024.26
	Total	30,756.56	4,659.91	2,052.21	30.86	338.59	71,198.50
Tooele							
	Area Source	10,809.73	3,453.54	2,424.07	NA	384.98	9,355.29
	On-Road Mobile	22,602.97	3,500.52	862.23	NA	94.69	1,396.19
	Point Source	702.97	1,699.93	1,723.99	916.08	169.58	619.10
	Biogenics	0.00	0.00	0.00	0.00	0.00	6,262.40
	Total	34,115.67	8,653.99	5,010.29	916.08	649.25	17,632.98
Uintah							
	Area Source	12,547.05	548.90	2,504.73	NA	126.22	16,168.12
	On-Road Mobile	9,468.50	801.59	379.61	NA	34.50	668.26
	Point Source	180.61	200.45	73.81	28.68	8.14	104.88
	Biogenics	0.00	0.00	0.00	0.00	0.00	13,616.32
	Total	22,196.16	1,550.94	2,958.15	28.68	168.86	30,557.57

COUNTY		CO	NOx	PM10	PM2.5	SOx	VOC
Utah	Area Source	26,598.16	2,748.52	3,536.93	NA	141.22	41,900.60
	On-Road Mobile	71,675.89	8,379.79	2,463.25	NA	343.96	5,852.33
	Point Source	8,733.99	2,142.09	885.78	394.43	952.12	1,359.39
	Biogenics	0.00	0.00	0.00	0.00	0.00	32,754.31
	Total	107,008.04	13,270.40	6,885.96	394.43	1,437.30	81,857.63
Wasatch							
	Area Source	2,979.59	285.83	499.97	NA	79.25	28,012.30
	On-Road Mobile	8,296.58	746.52	337.91	NA	31.35	552.24
	Point Source	2.89	16.54	7.52	0.17	0.02	0.02
	Biogenics	0.00	0.00	0.00	0.00	0.00	27,067.25
	Total	11,279.06	1,048.89	845.40	0.17	110.62	55,631.81
Washington							
	Area Source	19,427.79	983.15	1,191.95	NA	442.72	16,055.88
	On-Road Mobile	29,030.04	3,860.62	1,136.75	NA	118.12	2,172.79
	Point Source	48.86	222.35	28.35	18.90	10.83	27.68
	Biogenics	0.00	0.00	0.00	0.00	0.00	12,271.22
	Total	48,506.69	5,066.12	2,357.05	18.90	571.67	30,527.57
Wayne							
	Area Source	929.18	56.38	503.61	NA	13.14.	7,205.70
	On-Road Mobile	1,339.71	120.08	56.83	NA	5.21	101.85
	Point Source	0.00	0.00	0.00	0.00	0.00	0.00
	Biogenics	0.00	0.00	0.00	0.00	0.00	6,934.95
	Total	2,268.89	176.46	560.44	0.00	18.35	14,242.50
Weber							
	Area Source	13,779.20	2,686.00	1,451.71	NA	148.63	13,441.07
	On-Road Mobile	42,061.63	3,977.63	1,342.39	NA	170.47	3,042.67
	Point Source	2,513.96	589.32	429.31	300.70	21.14	218.49
	Biogenics	0.00	0.00	0.00	0.00	0.00	8,412.35
	Total	58,354.79	7,252.95	3,223.41	300.70	340.24	25,114.58
Statewide Totals							
	Area Source	319,451.52	44,239.28	46,708.31	NA	4,255.37	494,458.93
	On-Road Mobile	653,976.34	76,169.51	23,171.25	NA	2,760.97	45,452.89
	Point Source	40,249.91	85,363.30	11,569.81	4,724.18	38,833.28	9,044.85
	Biogenics						409,901.88
	Totals	1,013,677.78	205,772.09	81,449.38	4,724.18	45,849.62	958,858.54

%	CO	NOx	PM10	PM2.5	SOx	VOC
Area Source	31.51%	21.50%	57.35%	NA	9.28%	51.57%
On-Road Mobile	64.52%	37.02%	28.45%	NA	6.02%	4.74%
Point Source	3.97%	41.48%	14.20%	100.00%	84.70%	0.94%
Biogenics	0.00%	0.00%	0.00%	0.00%	0.00%	42.75%
Totals	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

APPENDIX B

POPULATION GROWTH IN UTAH

This table of population growth in Utah shows the areas.

County, Urban area or City	Population 2000 Census	% Change Since 1990	# Monitoring Stations In Area
Salt Lake County	898,387	+24%	8 (5)*
Utah County	368,536	+40%	6 (9)
Davis County	238,994	+27%	1
Weber County	196,533	+24%	5
Cache County	91,391	+30%	1
Uintah County	25,224	+14%	(1)
Box Elder County	42,745	+17%	1 (1)
Tooele County	40,735	+53%	1 (1)
Washington County	90,354	+86%	2 (1)
Iron County	33,779	+63%	(3)
Carbon County	20,422	+1%	(1)
San Juan County	14,413	+14%	1 (2)
Duchesne County	14,371	+14%	(1)*

*( ) *Indicates monitoring done in the past.-

Source: U.S. Bureau of the Census

CENSUS 2000 CITY PERCENT POPULATION CHANGE 1990 TO 2000

CITIES > 9,000	1990 CENSUS	2000 CENSUS	PERCENT CHANGE 1990-2000	RANK
Draper city	7,275	25,220	247.50	1
South Jordan city	12,220	29,437	140.9	2
Lehi city	8,475	19,028	124.5	3
Riverton city	11,261	25,011	122.1	4
Syracuse city	4,658	9,398	101.8	5
Spanish Fork city	11,272	20,246	76.6	6
St. George city	28,502	49,663	74.2	7
Pleasant Grove city	13,476	23,468	74.1	8
Tooele city	13,887	22,502	62.0	9
West Jordan city	42,892	68,336	59.3	10
Clinton city	7,945	12,585	58.4	11
Cedar City city	13,443	20,527	52.7	12
Springville city	13,950	20,424	46.4	13
Kaysville city	13,961	20,351	45.8	14
Layton city	41,784	58,474	39.9	15
American Fork city	15,696	21,941	39.8	16
Farmington city	9,028	12,081	33.8	17
Payson city	9,510	12,716	33.7	18
Roy city	24,603	32,885	30.7	19
Logan city	32,762	42,670	30.2	20
North Ogden city	11,668	15,026	28.8	21
Centerville city	11,500	14,585	26.8	22
West Valley City city	86,976	108,896	25.2	23
Orem city	67,561	84,324	24.8	24
Clearfield city	21,435	25,974	21.2	25
Provo city	86,835	105,166	21.1	26
Ogden city	63,909	77,226	18.9	27
South Ogden city	12,105	14,377	18.8	28
Sandy city	75,058	88,418	17.8	29
Salt Lake City city	159,936	181,743	13.6	30
Bountiful city	36,659	41,301	12.7	31
Brigham City city	15,644	17,411	11.3	32
Murray city	31,282	34,024	8.8	33