

**Appendix C**  
**Background Evaluation Technical Memorandum**

# Estimation of Background Concentration of Metals in Ambient Air in Hayden, Arizona

## ASARCO LLC Hayden Plant Site, Remedial Investigation

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DATE: August 4, 2008

### Introduction and Purpose

A background air monitoring station was not installed as part of the Remedial Investigation (RI). Therefore, an assessment of available background air quality data was conducted for comparison with RI data from the Hayden and Winkelman stations. Data collected from remote locations with minimal anthropogenic (caused or influenced by human activity) contributions can be used to estimate background concentrations of metals in ambient air. Data from several remote monitoring locations in Arizona were reviewed to identify appropriate datasets to provide background concentrations for an area similar to Hayden, Arizona.

### Determining Availability of Ambient Air Quality Data for Arizona

Ambient air quality in Arizona is monitored by state, federal and industrial facilities. The 2007 Air Quality Annual Report (Annual Report) published by the Arizona Department of Environmental Quality (ADEQ) provides a comprehensive list of state, federal and industrial air quality monitoring stations located in Arizona. The air pollution monitoring data from these existing monitors was evaluated for representative background concentration in Hayden based on pollutants monitored, similarity of area soils, weather, and terrain, and proximity of monitor to other sources of air pollution. The main focus of this study was to establish background concentration of metals in PM<sub>10</sub>.

### State Monitoring Stations

The ADEQ conducts monitoring for criteria pollutants throughout the State of Arizona. The ADEQ Annual Report presents the results of air quality monitoring in Arizona from more than 100 monitoring sites. In addition to the ADEQ monitoring network, air quality agencies in Maricopa, Pima and Pinal counties also operate air monitoring networks, as well as several industrial facilities. Their data are also summarized in this report. However, the Annual Report only contains criteria pollutants (ozone, particulate matter, sulfur dioxide,

carbon monoxide, and nitrogen dioxide) and does not include results of any monitoring of metals contained in particulate matter.

The State of Arizona has conducted special studies for measurements of metals in the Hayden area from February 1991 to December 2001. The particulate matter was analyzed for metals using XRF technique for both fine and coarse fraction of PM<sub>10</sub> for this period. This data set is described in the RI Report, but is not useful for determining background concentration of metals because the nearby ASARCO copper smelter and concentrator facilities were in operation during this period.

## Federal Monitoring Stations

In 1985, EPA along with federal land management agencies (FLMs) established a monitoring plan as a part of the Federal Implementation Plan for Visibility in Class I areas, known as the Interagency Monitoring of Protected Visual Environments (IMPROVE). These agencies included the National Park Service (NPS), Forest Service (USFS), Fish and Wildlife Service (FWS), and Bureau of Land Management (BLM). Later, State government agency organizations were also added as IMPROVE agency stakeholders. Representatives from all participating agencies and organizations serve on the IMPROVE Steering Committee. IMPROVE has been collecting data since 1987 in Class I areas nationwide. The data from this monitoring network is available through an online database known as Visibility Information Exchange Web System (VIEWS). The primary aerosol monitoring contractor is the University of California at Davis (U.C. Davis).

In Arizona, IMPROVE sites include 16 ambient monitoring networks. Monitoring has been conducted near or in the following Class I areas:

- Grand Canyon National Park - Hance Camp
- Grand Canyon National Park - Indian Gardens
- Petrified Forest National Park
- Mt. Baldy Wilderness - Greer Water Treatment Plant
- Sycamore Canyon Wilderness - Camp Raymond
- Mazatzal/Pine Mountain Wildernesses - Ike's Backbone
- Sierra Ancha Wilderness - Pleasant Valley Ranger Station
- Superstition Wilderness - Tonto National Monument
- Superstition Wilderness - Queen Valley
- Saguaro National Park - West Unit
- Saguaro National Park - East Unit
- Chiricahua National Monument - Entrance Station
- Galiuro Wilderness - Muleshoe Ranch (Site was closed in June of 2005)
- Hillside (Site was closed in June of 2005)

- Organ Pipe National Monument
- Meadview
- Douglas

Each IMPROVE site includes PM<sub>2.5</sub> sampling with subsequent analysis for the fine particle mass and major aerosol species, as well as PM<sub>10</sub> sampling and mass analysis. More information about the IMPROVE procedures, sites and data can be found on the IMPROVE/VIEWS web site at <http://vista.cira.colostate.edu/improve/>. The PM<sub>2.5</sub> and PM<sub>10</sub> filters from each of the sites are stored at U.C. Davis.

The available monitoring data (PM<sub>10</sub> and PM<sub>2.5</sub> metals) for 2004, 2005, and 2006 from the IMPROVE monitoring stations located at Hance Camp, Organ Pipe, Douglas, Queen Creek, Saguaro East, Saguaro West, and Tonto were reviewed for appropriateness as background sites. PM<sub>10</sub> metals data are not available for these stations through the VIEWS web site because these PM<sub>10</sub> filters are not normally analyzed for metals. PM<sub>10</sub> metals data was only available for Hance Camp site from a special study conducted for the period of March 2003 through December 2004 (W.C. Malm et al., 2007). Selected PM<sub>10</sub> samples collected at Organ Pipe were also analyzed for metals for purposes of this RI report. Since the Hayden and Winkelman samples collected during the RI were PM<sub>10</sub> samples, the PM<sub>10</sub> metals data from the Hance Camp and Organ Pipe sites could be used for direct comparison. PM<sub>2.5</sub> metals data are available from the VIEWS web site for all stations, and these data were used to help evaluate relative concentrations to assist in selecting appropriate background sites.

These IMPROVE stations were selected based on their relatively remote location. A map of the location of each of these sites is shown in Figure 1. Samples from each monitoring station are collected every 3 days, resulting in a relatively large dataset (greater than 100 samples per year). The annual mean, minimum, and maximum values for PM<sub>10</sub> and for PM<sub>2.5</sub> metals (arsenic, copper, lead, and chromium) from each selected IMPROVE station are summarized in Table 1. PM<sub>2.5</sub> and PM<sub>10</sub> samples were not analyzed for cadmium from any of the IMPROVE sites because the laboratory X-ray fluorescence (XRF) detection limit does not typically allow for detectable results. Local vegetation and soil data are also included in for each monitoring site in Table 1. The following observations can be made based on PM<sub>10</sub> data from Table 1:

- At all stations, the annual mean PM<sub>10</sub> concentration has increased approximately 20 percent between the years 2004 and 2006.
- The average PM<sub>10</sub> concentration at the Douglas station (31 µg/m<sup>3</sup> for 2006) is considerably higher than the concentrations at the other selected IMPROVE stations, likely due to proximity to industrial facilities and populated areas in Douglas and adjacent Agua Prieta, Mexico and commercial vehicle traffic in this area. This station is not considered useful for background air quality data.
- The average PM<sub>10</sub> concentration at the Hance Camp station (5.6 µg/m<sup>3</sup>) is notably lower than the concentration at the other selected IMPROVE stations, which is likely due to climate differences and the greater distance from population centers. Data from this station was not used as a reference for background air quality data.

## Evaluating Air Quality Data Representativeness of Background Air Quality

The purpose of reviewing available data was to evaluate background metal concentrations in PM<sub>10</sub>. PM<sub>10</sub> metals data for the Hance Camp station were already analyzed by U.C. Davis, and PM<sub>10</sub> filters from Organ Pipe were analyzed for metals for this RI report, as described below. The PM<sub>10</sub> metal data from Hance Camp and Organ Pipe were further evaluated for representativeness of conditions similar to Hayden.

The Organ Pipe and Hayden, Arizona areas are both dominated by the Sonoran Desert scrub vegetation community. The Sonoran Desert scrub vegetation community is dominated by creosotebush, desert broom (*Baccharis sarothroides*), brittlebrush (*Encelia farinosa*), saltbush (*Atriplex* spp.), and triange-leaf bursage (*Ambrosia deltoidea*). They also contain similar soil types. The dominant soil types are Aridisols and Entisols. The soils in the area dominantly have a thermic or hyperthermic soil temperature regime, an aridic soil moisture regime, and mixed mineralogy and formed in alluvium. They are very shallow to very deep and are well drained and somewhat excessively drained (USDA 2006).

The mean July air temperature of both the Organ Pipe NM area and the Hayden area is 85 – 90° F. The mean July air temperature of the Hance Camp/Grand Canyon area is 75 - 80° F (Haney 1985).

The Grand Canyon area also contains a different dominant plant community than the Organ Pipe NM and Hayden areas. The Hance Camp/Grand Canyon area lies within the Pinyon-Juniper woodland vegetation community (Haney 1985). Colorado pinyon pine (*Pinus edulis*) is the most common pine species in this woodland type, and Utah juniper (*Juniperus osteosperma*) is the most common juniper. The higher elevation at Grand Canyon also results in more snow cover and average lower temperatures.

Based on the above comparison of soil type, vegetation, average temperature and elevation the data for PM<sub>10</sub> from Organ Pipe were selected to be more representative of background concentration at Hayden. The other sites were not used primarily because of proximity to urban areas or other air pollution sources, as further described in Table 1.

### Organ Pipe National Monument PM<sub>10</sub> Data

The IMPROVE Organ Pipe station contains both PM<sub>10</sub> and PM<sub>2.5</sub> monitors. The samples at both monitors are collected at every third day interval resulting in a relatively large dataset (greater than 200 samples per year). The collected samples are sent to U.C. Davis for analysis. Gravimetric analysis is conducted on both PM<sub>2.5</sub> and PM<sub>10</sub>. However, metals analysis is routinely conducted on only the PM<sub>2.5</sub> filter samples. The samples are stored at the lab after analysis has been completed.

EPA obtained from the IMPROVE Steering Committee selected PM<sub>10</sub> samples from Organ Pipe (stored at U.C. Davis) for analysis of metals concentration. A total of 15 PM<sub>10</sub> samples, collected at 24-day intervals during calendar year 2006, were selected for analysis for metals analysis by EPA Compendium Method IO-3.3 using XRF Spectroscopy. The laboratory

analysis was conducted by Chester LabNet of Tigard, Oregon, which is the same laboratory conducting analysis of the samples from the Hayden and Winkelman RI stations.

A summary of gravimetric and metals analysis of the selected PM<sub>10</sub> samples from Organ Pipe is included in Table 2. Data from this table will be used for comparison with the Hayden and Winkelman RI data, as described in Section 4.5 of the RI Report. The following observations can be made based on Organ Pipe PM<sub>10</sub> data from Table 2:

- All but one PM<sub>10</sub> sample concentration ranged from 6.58 -18.06 µg/m<sup>3</sup>. One sample measured unusually high PM<sub>10</sub> concentration of 71.90 µg/m<sup>3</sup> on August 30, 2006. The reason for this high concentration of PM<sub>10</sub> is not known, but it was possibly caused by an unusual event such as a fire. Concentrations of metals from the August 30, 2006 sample do not show significant increases over other observed values.
- Concentration of chromium in 11 out of 15 PM<sub>10</sub> samples where chromium was detected is higher than the EPA Region IX PRG of 0.00016 µg/m<sup>3</sup>. The chromium concentrations may be due to naturally occurring background levels in the Organ Pipe area.
- Overall, the arithmetic mean concentrations of PM<sub>10</sub>, copper, chromium and lead are relatively low and can be used for direct comparison with arithmetic mean concentrations from the Hayden and Winkelman monitors.
- Although arsenic and cadmium were not found above method detection limit (MDL), these MDL values are still useful for direct comparison against arithmetic mean arsenic and cadmium concentrations from the Hayden and Winkelman monitors.

## References

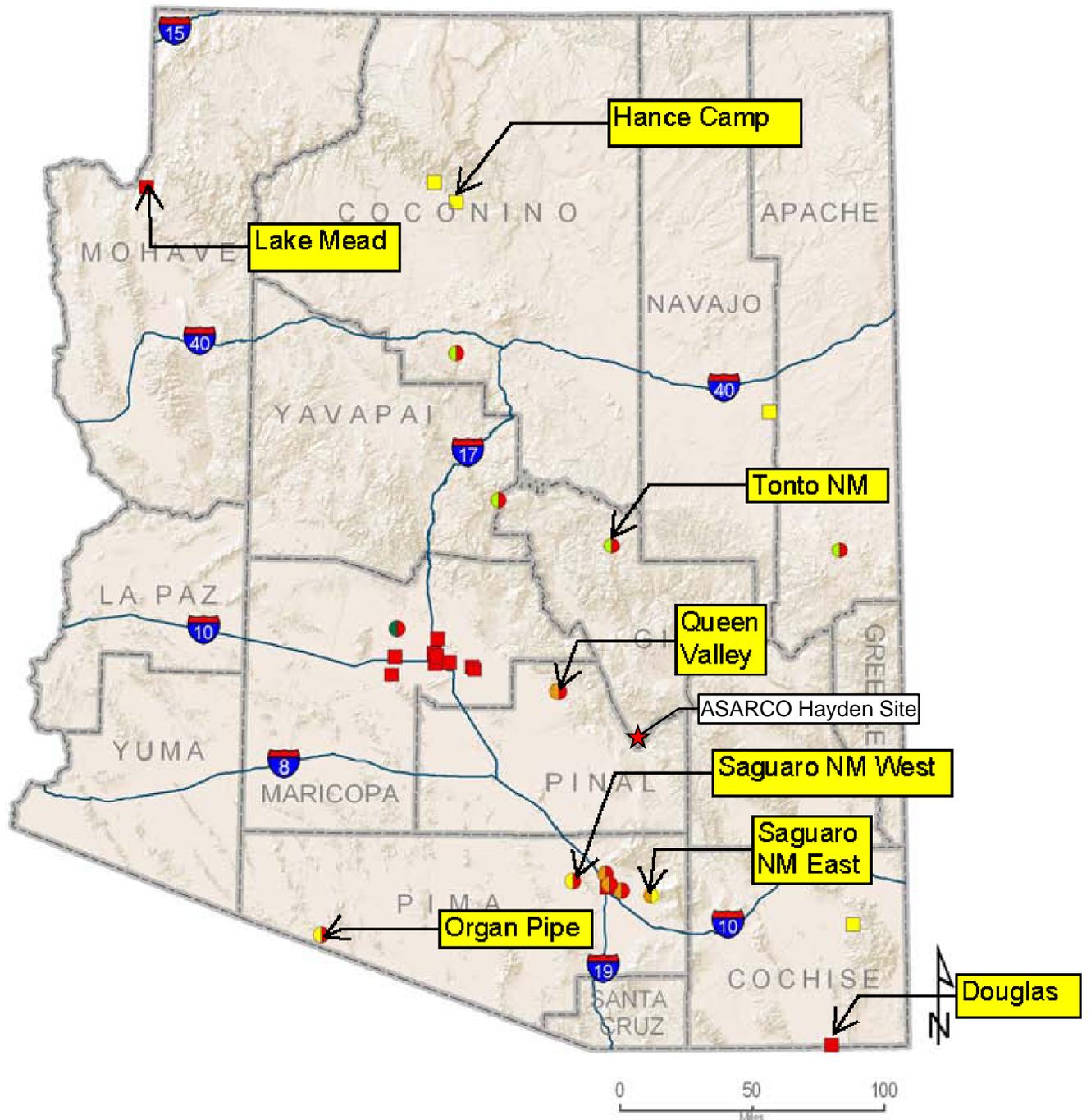
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<http://southwest.library.arizona.edu/azso/index.html>.

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**Figures**

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**FIGURE 1**  
**LOCATION OF SELECTED IMPROVE**  
**MONITORING STATIONS**

State of Arizona

**DRAFT**

**CH2MHILL**

## Tables

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**TABLE 1**  
Air Concentrations of Metals at Selected EPA Monitoring Sites in Arizona - PM<sub>2.5</sub> Samples  
Estimation of Background Concentration of Metals in Ambient Air in Hayden, Arizona  
ASARCO LLC Hayden, Arizona Plant Site

Site and Site Information	Year	Approximate Number of Measurements	Statistic	Units	Arsenic	Chromium	Copper	Lead	PM <sub>10</sub>	Site Description	Description of Applicability as Appropriate Background Station
Organ Pipe Pima County Latitude: 31.95060 Longitude: -112.80160	2006	115	Average	µg/m <sup>3</sup>	0.00018	0.00006	0.00091	0.00107	13.31122	Near Mexican Border; Greener Vegetation; Elevation 504 Meter AMSL. This area lies within the Sonoran Desert scrub vegetation community dominated by creosotebush, desert broom ( <i>Baccharis sarothroides</i> ), brittlebrush ( <i>Encelia farinosa</i> ), saltbush ( <i>Atriplex</i> spp.), and triange-leaf bursage ( <i>Ambrosia deltoidea</i> ). The dominant soil types are Aridisols and Entisols. The soils in the area dominantly have a thermic or hyperthermic soil temperature regime, an aridic soil moisture regime, and mixed mineralogy and formed in alluvium. They are very shallow to very deep and are well drained and somewhat excessively drained.	The site is located a significant distance from metropolitan areas or other sources of air pollution. The Organ Pipe and Hayden areas are both dominated by Sonoran Desert scrub vegetation and similar soil. Based on these reasons, the Organ Pipe site is considered representative of background concentrations for Hayden.
			Minimum	µg/m <sup>3</sup>	0.00005	0.00002	0.00008	0.00017	2.27810		
			Maximum	µg/m <sup>3</sup>	0.00096	0.00047	0.00646	0.00361	71.91310		
	2005	114	Average	µg/m <sup>3</sup>	0.00021	0.00006	0.00085	0.00107	10.28694		
			Minimum	µg/m <sup>3</sup>	0.00005	0.00002	0.00009	0.00004	2.11630		
			Maximum	µg/m <sup>3</sup>	0.00082	0.00030	0.00729	0.00420	22.16290		
	2004	103	Average	µg/m <sup>3</sup>	0.00027	0.00005	0.00084	0.00092	11.36420		
			Minimum	µg/m <sup>3</sup>	0.00006	0.00002	0.00007	0.00008	2.29810		
			Maximum	µg/m <sup>3</sup>	0.00137	0.00019	0.00545	0.00337	75.23830		
Hance Camp at Grand Canyon Coconino County Latitude: 35.97310 Longitude: -111.98410	2006	94	Average	µg/m <sup>3</sup>	0.00009	0.00004	0.00032	0.00061	5.63641	Grand Canyon; Elevation 2267 Meter AMSL. This area lies within the Pinyon-Juniper woodland vegetation community. Colorado pinyon pine ( <i>Pinus edulis</i> ) is the most common pine species in this woodland type, and Utah juniper ( <i>Juniperus osteosperma</i> ) is the most common juniper. The dominant soil types are Alfisols, Aridisols, Entisols, and Mollisols. The soils in the area dominantly have a mesic soil temperature regime; an aridic soil moisture regime or an ustic moisture regime that borders on aridic; and carbonatic, mixed, or smectitic mineralogy. They generally are very shallow to very deep, well drained or somewhat excessively drained, and loamy or clayey.	Though the site is located a significant distance from metropolitan areas and other sources of air pollution, it is located at a significant higher elevation with Pinyon-Juniper woodland vegetation. The site also gets significantly higher amounts of precipitation. The site may not be representative of background concentrations for Hayden.
			Minimum	µg/m <sup>3</sup>	0.00001	0.00001	0.00002	0.00003	0.83060		
			Maximum	µg/m <sup>3</sup>	0.00044	0.00028	0.00135	0.00180	25.28020		
	2005	103	Average	µg/m <sup>3</sup>	0.00013	0.00004	0.00030	0.00070	5.15669		
			Minimum	µg/m <sup>3</sup>	0.00001	0.00001	0.00002	0.00003	0.16530		
			Maximum	µg/m <sup>3</sup>	0.00052	0.00025	0.00132	0.01193	18.26320		
	2004	103	Average	µg/m <sup>3</sup>	0.00013	0.00004	0.00027	0.00063	5.13126		
			Minimum	µg/m <sup>3</sup>	0.00005	0.00001	0.00003	0.00010	0.58220		
			Maximum	µg/m <sup>3</sup>	0.00057	0.00012	0.00117	0.00542	18.65550		
Queen Valley Pinal County Latitude: 33.29390 Longitude: -111.28580	2006	119	Average	µg/m <sup>3</sup>	0.00054	0.00008	0.00395	0.00283	17.29789	East of Apache Junction, between Superior and Florence Junction; Elevation 661 Meter AMSL. The vegetation community is the Sonoran Desert Scrub dominated by creosotebush, desert broom ( <i>Baccharis sarothroides</i> ), brittlebrush ( <i>Encelia farinosa</i> ), saltbush ( <i>Atriplex</i> spp.), and triange-leaf bursage ( <i>Ambrosia deltoidea</i> ). The dominant soil types in this area are Aridisols, Entisols, Alfisols, and Mollisols. The soils in the area dominantly have a thermic soil temperature regime, an aridic or ustic soil moisture regime, and mixed mineralogy and formed in alluvium. They are very shallow to very deep and are well drained and somewhat excessively drained.	The site is located east of and relatively close to the Phoenix metropolitan area. Air quality may be impacted from the motor vehicle and industrial sources of air pollution in the Phoenix area. The site is not considered useful for background air quality data.
			Minimum	µg/m <sup>3</sup>	0.00006	0.00002	0.00016	0.00019	2.71840		
			Maximum	µg/m <sup>3</sup>	0.00311	0.00044	0.02212	0.01527	71.33130		
	2005	106	Average	µg/m <sup>3</sup>	0.00049	0.00018	0.00331	0.00230	14.12766		
			Minimum	µg/m <sup>3</sup>	0.00006	0.00002	0.00025	0.00036	1.79980		
			Maximum	µg/m <sup>3</sup>	0.00319	0.00423	0.01535	0.01085	36.74360		
	2004	112	Average	µg/m <sup>3</sup>	0.00077	0.00006	0.00330	0.00248	12.58554		
			Minimum	µg/m <sup>3</sup>	0.00005	0.00003	0.00007	0.00011	1.52940		
			Maximum	µg/m <sup>3</sup>	0.00317	0.00023	0.01724	0.01677	68.42320		
Saguaro NM/East Pima County Latitude: 32.17460 Longitude: -110.73710	2006	116	Average	µg/m <sup>3</sup>	0.00025	0.00006	0.00162	0.00121	13.94927	Adjacent to Tucson, a major metropolitan area; Elevation 941 Meter AMSL. This area lies within the Desert Grassland community. This habitat is dominated by grasses such as black grama, tobosa, sacaton, and curly mesquite. The dominant soil types in this area are Aridisols, Entisols, Alfisols, and Mollisols. The soils in the area dominantly have a thermic soil temperature regime, an aridic or ustic soil moisture regime, and mixed mineralogy and formed in alluvium. They are very shallow to very deep and are well drained and somewhat excessively drained.	The site is located relatively close to the Tucson metropolitan area. Air quality may be impacted from the motor vehicle and industrial sources of air pollution in the Tucson area. The site is not considered useful for background air quality data.
			Minimum	µg/m <sup>3</sup>	0.00006	0.00002	0.00028	0.00005	2.09710		
			Maximum	µg/m <sup>3</sup>	0.00136	0.00043	0.01285	0.00707	40.14630		
	2005	120	Average	µg/m <sup>3</sup>	0.00029	0.00005	0.00139	0.00121	11.60084		
			Minimum	µg/m <sup>3</sup>	0.00005	0.00002	0.00024	0.00004	1.98870		
			Maximum	µg/m <sup>3</sup>	0.00176	0.00032	0.00519	0.00359	26.07610		
	2004	117	Average	µg/m <sup>3</sup>	0.00030	0.00007	0.00110	0.00107	9.46864		
			Minimum	µg/m <sup>3</sup>	0.00007	0.00003	0.00009	0.00009	0.71120		
			Maximum	µg/m <sup>3</sup>	0.00138	0.00093	0.00444	0.00353	19.42020		

**TABLE 1**  
Air Concentrations of Metals at Selected EPA Monitoring Sites in Arizona - PM<sub>2.5</sub> Samples  
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ASARCO LLC Hayden, Arizona Plant Site

Site and Site Information	Year	Approximate Number of Measurements	Statistic	Units	Arsenic	Chromium	Copper	Lead	PM <sub>10</sub>	Site Description	Description of Applicability as Appropriate Background Station
Saguaro West Pima County Latitude: 32.24860 Longitude: -111.21780	2006	117	Average	µg/m <sup>3</sup>	0.00027	0.00014	0.00178	0.00153	18.24164	Adjacent to Tucson, a major metropolitan area; Elevation 714 Meter AMSL. This areas lies within the Sonoran Desert scrub vegetation community dominated by creosotebush, desert broom (Baccharis sarothroides), brittlebrush (Encelia farinosa), saltbush (Atriplex spp.), and triange-leaf bursage (Ambrosia deltoidea). The dominant soil types are Aridisols and Entisols. The soils in the area dominantly have a thermic or hyperthermic soil temperature regime, an aridic soil moisture regime, and mixed mineralogy and formed in alluvium. They are very shallow to very deep and are well drained and somewhat excessively drained.	The site is located relatively close to the Tuscon metropolitan area. Air quality may be impacted from the motor vehicle and industrial sources of air pollution in the Tucson area. The site is not considered useful for background air quality data.
			Minimum	µg/m <sup>3</sup>	0.00002	0.00002	0.00037	0.00031	1.99030		
			Maximum	µg/m <sup>3</sup>	0.00178	0.00285	0.01030	0.00907	48.43000		
	2005	116	Average	µg/m <sup>3</sup>	0.00028	0.00006	0.00153	0.00149	15.18902		
			Minimum	µg/m <sup>3</sup>	0.00006	0.00002	0.00034	0.00013	2.29210		
			Maximum	µg/m <sup>3</sup>	0.00156	0.00034	0.00636	0.00766	31.40220		
	2004	121	Average	µg/m <sup>3</sup>	0.00035	0.00007	0.00130	0.00126	13.93285		
			Minimum	µg/m <sup>3</sup>	0.00012	0.00003	0.00031	0.00009	1.22050		
			Maximum	µg/m <sup>3</sup>	0.00144	0.00033	0.00552	0.00455	49.35080		
Tonto NM Gila County Latitude: 33.65480 Longitude: -111.10680	2006	114	Average	µg/m <sup>3</sup>	0.00041	0.00007	0.00317	0.00235	11.46038	South of Lake Roosevelt; Elevation 775 Meter AMSL. This area lies within the Pinyon-Juniper woodland vegetation community. Colorado pinyon pine (Pinus edulis) is the most common pine species in this woodland type, and Utah juniper (Juniperus osteosperma) is the most common juniper. The dominant soil types are Aridisols, Alfisols, and Mollisols. The soils dominantly have a thermic or mesic soil temperature regime, an aridic or ustic soil moisture regime, and smectitic or mixed mineralogy and formed in alluvium. They are very shallow to very deep and are well drained and somewhat excessively drained.	The site is located a significant distance from metropolitan areas or other sources of air pollution. Similar Sonoran Desert soil and vegetation cover makes it a good choice for background concentration for Hayden. This site was considered, but was not used for background air quality data.
			Minimum	µg/m <sup>3</sup>	0.00002	0.00002	0.00021	0.00032	1.99150		
			Maximum	µg/m <sup>3</sup>	0.00302	0.00033	0.02624	0.01309	82.65410		
	2005	120	Average	µg/m <sup>3</sup>	0.00041	0.00006	0.00386	0.00243	9.61494		
			Minimum	µg/m <sup>3</sup>	0.00004	0.00002	0.00006	0.00004	0.79770		
			Maximum	µg/m <sup>3</sup>	0.00359	0.00034	0.02510	0.01891	27.44620		
	2004	35	Average	µg/m <sup>3</sup>	0.00067	0.00005	0.00462	0.00369	8.84806		
			Minimum	µg/m <sup>3</sup>	0.00006	0.00002	0.00016	0.00011	0.78430		
			Maximum	µg/m <sup>3</sup>	0.00287	0.00021	0.02017	0.02802	29.61600		
Douglas Cochise County Latitude: 31.34920 Longitude: -109.53970	2006	120	Average	µg/m <sup>3</sup>	0.00172	0.00010	0.00653	0.00340	31.00191	SE corner of Arizona; adjacent to Mexican Border and other sources of dust and pollutants; near an old copper smelter site; Elevation 1230 Meter AMSL. The dominant vegetation community is Chihuahuan desert scrub. Species typical of this habitat include Honey Mesquite, Ocotillo, Snakeweed, Bush Muhly, Sand Dropseed and Mesa Dropseed. The dominant soil types in this area are Aridisols, Entisols, Alfisols, and Mollisols. The soils in the area dominantly have a thermic soil temperature regime, an aridic or ustic soil moisture regime, and mixed mineralogy and formed in alluvium. They are very shallow to very deep and are well drained and somewhat excessively drained.	The site is located close to the Mexican border and near an old copper smelter site. Air quality may be impacted from the air pollution sources resulting from vehicle traffic, industrial activities along and across the border, and deposited metals from past smelter operation. This site is not considered useful for background air quality data.
			Minimum	µg/m <sup>3</sup>	0.00006	0.00002	0.00059	0.00021	7.41740		
			Maximum	µg/m <sup>3</sup>	0.01568	0.00080	0.04128	0.03288	74.75380		
	2005	112	Average	µg/m <sup>3</sup>	0.00377	0.00030	0.01012	0.00351	29.60728		
			Minimum	µg/m <sup>3</sup>	0.00007	0.00003	0.00078	0.00055	4.10720		
			Maximum	µg/m <sup>3</sup>	0.02735	0.00623	0.07925	0.01462	82.31200		
	2004	7	Average	µg/m <sup>3</sup>	0.00161	0.00044	0.00413	0.00263	25.97680		
			Minimum	µg/m <sup>3</sup>	0.00027	0.00005	0.00096	0.00049	2.09120		
			Maximum	µg/m <sup>3</sup>	0.00837	0.00099	0.01749	0.00643	58.38920		

**Table Notes:**

<sup>1</sup> Source: Interagency Monitoring of Protected Visual Environments (IMPROVE) Aerosol Network <http://vista.cira.colostate.edu/improve/>

<sup>2</sup> Latitude and Longitude reported in NAD 27

<sup>3</sup> Hayden, AZ elevation at about 2,044 ft. AMSL.

<sup>4</sup> Metals analysis from PM<sub>2.5</sub> samples

<sup>5</sup> AMSL = above mean sea level

<sup>6</sup> µg/m<sup>3</sup> = micrograms per cubic meter

**TABLE 2**Summary of PM<sub>10</sub> Air Filter Sampling Laboratory Data

Organ Pipe National Monument

Estimation of Background Concentration of Metals in Ambient Air in Hayden, Arizona

ASARCO LLC Hayden, Arizona Plant Site

Analyte	Arizona Ambient Air Quality Standards <sup>1</sup> (µg/m <sup>3</sup> )	EPA Region IX Preliminary Remediation Goal <sup>2</sup> (µg/m <sup>3</sup> )	Number of Analyses	Number of Detections	Frequency of Detection	Percentage of Detections (%)	Number of EPA Region IX Preliminary Remediation Goal <sup>2</sup> Exceedances	Minimum Detected Value (µg/m <sup>3</sup> )	Maximum Detected Value (µg/m <sup>3</sup> )	Arithmetic Mean Value (µg/m <sup>3</sup> )
PM <sub>10</sub>	150 <sup>3</sup> /50 <sup>4</sup>	--	15	15	15/15	100	0	6.58	<b>71.9</b>	16
Aluminum	--	5.1	15	15	15/15	100	0	0.188	2.74	0.503
Antimony	--	--	15	0	0/15	0	0	ND	ND	ND
Arsenic	--	0.00045	15	0	0/15	0	0	ND	ND	ND
Barium	--	0.52	15	12	12/15	80	0	0.0025	0.022	0.00486
Bromine	--	--	15	15	15/15	100	0	0.0007	0.007	0.00288
Cadmium	--	0.0011	15	0	0/15	0	0	ND	ND	ND
Calcium	--	--	15	15	15/15	100	0	0.253	1.15	0.468
Chlorine	--	--	15	13	13/15	87	0	0.0056	1.73	0.291
Chromium	--	0.00016	15	11	11/15	73	11	<b>0.0003</b>	<b>0.0017</b>	<b>0.000493</b>
Cobalt	--	0.00069	15	0	0/15	0	0	ND	ND	ND
Copper	--	--	15	14	14/15	93	0	0.0005	0.0043	0.00142
Gallium	--	--	15	3	3/15	20	0	0.0002	0.0006	0.000187
Germanium	--	--	15	0	0/15	0	0	ND	ND	ND
Indium	--	--	15	0	0/15	0	0	ND	ND	ND
Iron	--	--	15	15	15/15	100	0	0.132	1.47	0.332
Lanthanum	--	--	15	0	0/15	0	0	ND	ND	ND
Lead	1.5 <sup>5,6,7</sup>	--	15	14	14/15	93	0	0.0008	0.0027	0.00133
Magnesium	--	--	15	15	15/15	100	0	0.0367	0.299	0.0862
Manganese	--	0.051	15	15	15/15	100	0	0.0028	0.0444	0.00832
Mercury	--	0.31	15	0	0/15	0	0	ND	ND	ND
Molybdenum	--	--	15	0	0/15	0	0	ND	ND	ND
Nickel	--	0.008	15	15	15/15	100	0	0.0004	0.0021	0.000907
Palladium	--	--	15	0	0/15	0	0	ND	ND	ND
Phosphorus	--	--	15	0	0/15	0	0	ND	ND	ND
Potassium	--	--	15	15	15/15	100	0	0.0944	1.11	0.261

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ASARCO LLC Hayden, Arizona Plant Site

Analyte	Arizona Ambient Air Quality Standards <sup>1</sup> (µg/m <sup>3</sup> )	EPA Region IX Preliminary Remediation Goal <sup>2</sup> (µg/m <sup>3</sup> )	Number of Analyses	Number of Detections	Frequency of Detection	Percentage of Detections (%)	Number of EPA Region IX Preliminary Remediation Goal <sup>2</sup> Exceedances	Minimum Detected Value (µg/m <sup>3</sup> )	Maximum Detected Value (µg/m <sup>3</sup> )	Arithmetic Mean Value (µg/m <sup>3</sup> )
Rubidium	--	--	15	15	15/15	100	0	0.0003	0.0058	0.00107
Selenium	--	--	15	7	7/15	47	0	0.0002	0.0003	0.00019
Silicon	--	--	15	15	15/15	100	0	0.499	5.87	1.23
Silver	--	--	15	0	0/15	0	0	ND	ND	ND
Sodium	--	--	15	13	13/15	87	0	0.128	1.63	0.393
Strontium	--	--	15	15	15/15	100	0	0.0016	0.0106	0.00365
Sulfur	--	--	15	15	15/15	100	0	0.137	0.697	0.383
Tin	--	--	15	6	6/15	40	0	0.0008	0.0012	0.000563
Titanium	--	31	15	15	15/15	100	0	0.0135	0.141	0.0329
Vanadium	--	--	15	8	8/15	53	0	0.0011	0.0091	0.00201
Yttrium	--	--	15	9	9/15	60	0	0.0002	0.002	0.000393
Zinc	--	--	15	15	15/15	100	0	0.0018	0.0114	0.00436
Zirconium	--	--	15	15	15/15	100	0	0.0003	0.005	0.00116

**Table Notes:**<sup>1</sup> Arizona Department of Environmental Quality Ambient Air Quality Standards, Title 18 Chapter 2 Article 2, December 2007<sup>2</sup> EPA Region IX Preliminary Remediation Goals, Ambient Air, October 2004<sup>3</sup> The averaging time for the criteria is 24 hours.<sup>4</sup> The averaging time for the criteria is the annual arithmetic mean.<sup>5</sup> The averaging time for the criteria is the quarterly average.<sup>6</sup> Only the PM<sub>10</sub> fraction is being measured not the total suspended particulates.<sup>7</sup> On May 20, 2008, EPA proposed to revise the National Ambient Air Quality (NAAQS) for lead to within the range of 0.1-0.3 mg/m<sup>3</sup>.<sup>8</sup> The data is based on analysis of 15 PM<sub>10</sub> filter samples collected at a 24-day interval from January 2, 2006 to December 4, 2006 at Organ Pipe National Monument.<sup>9</sup> Bold values with bold outline indicate the result exceeds one or more of the comparison criteria.