QUALITY ASSURANCE PROJECT PLAN

FOR THE
GARFIELD COUNTY
VOLATILE ORGANIC COMPOUNDS
MONITORING PROGRAM

Prepared for the

Garfield County, Colorado

GARFIELD COUNTY COMMISSIONERS
108 8th Street
Glenwood Springs, CO 81601

COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
4300 Cherry Creek Drive South
Denver, CO 80246-1530

Prepared by

Air Resource Specialists, Inc.
1901 Sharp Point Drive, Suite E
Fort Collins, CO 80525
Phone: 970-484-7941
www.air-resource.com

October 2011

A1 TITLE AND APPROVAL SHEET

QUALITY ASSURANCE PROJECT PLAN
FOR THE
GARFIELD COUNTY
VOLATILE ORGANIC COMPOUNDS
MONITORING PROGRAM

Revision 0

Approved by:

James A Rada — 10/5/11
Garfield County Public Health — Date
Jim Rada, Environmental Health Manager

Paul Reaser — 10/5/11
Garfield County Public Health — Date
Paul Reaser, Sr. Environmental Health Specialist

Gordon G. Pierce — 11/16/2011
Colorado Department of Public Health and Environment — Date
Gordon Pierce, Program Manager

Lincoln Sherman — 11/18/2011
Air Resource Specialists, Inc. — Date
Lincoln Sherman, Project Manager

Gloria Mercer — 11/18/2011
Air Resource Specialists, Inc. — Date
Gloria Mercer, Quality Assurance Manager

ACRONYMS AND ABBREVIATIONS

AC	Alternating Current
APCD	Air Pollution Control Division (Colorado Dept of Public Health and Environment)
ARS	Air Resource Specialists, Inc.
ASCII	American Standard Code for Information Interchange
AVHRR	Advanced Very High Resolution Radiometer
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CAS	Columbia Analytical Services
CD	Compact Disc
CDPHE	Colorado Department of Public Health and Environment
CFR	Code of Federal Regulations
CMC	Colorado Mountain Collect
CSATAM	Community Scale Air Toxics Ambient Monitoring
DNPH	2,4-Dinitrophenylhydrazine
EPA	Environmental Protection Agency
ERG	Eastern Research Group, Inc.
FID	Flame Ionization Detector
GCC	Garfield County Commissioners
GC/FID/MS	Gas Chromatograph/Flame Ionization Detector/Mass Spectrometry
GC/MS	Gas Chromatography/Mass Spectrometry
GCPH	Garfield County Public Health
HAP	Hazardous Air Pollutant
HPLC	High Performance Liquid Chromatography
HPLC/UV	High Performance Liquid Chromatography/Ultraviolet
ID	Identification
LIMS	Laboratory Information Management System
MC	Mass Concentration
MDL	Minimum Detection Limits
MS	Microsoft
NATTS	National Ambient Toxics Trent System
NIST	National Institute of Standards and Technology
NMOC	Non-Methane Organic Compounds
NOAA	National Oceanic and Atmospheric Administration
PAMS	Photochemical Assessment Monitoring Stations
PC	Personal Computer
PDFID	Pre-concentration and Direct Flame Ionization Detection
PM	Particulate Matter
PSD	Prevention of Significant Deterioration
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
SLAMS	State and Local Air Monitoring Stations
SNMOC	Speciated Non-Methane Organic Compound
SOP	Standard Operating Procedure
TI	Technical Instruction
UATMP	Urban Air Toxics Monitoring Program
USB	Universal Serial Bus
USGS	United States Geological Survey
UV	Ultraviolet
VOC	Volatile Organic Compounds

A PROJECT MANAGEMENT

This section describes project management for the Garfield County Volatile Organic Compounds Monitoring Program, a joint Program of the Garfield County Commissioners (GCC), Garfield County Public Health (GCPH) and Colorado Department of Public Health and Environment (CDPHE). It includes Program history and objectives, roles and responsibilities of the participants, and document disposition. This section contains the following subsections:

A1 Title and Approval Sheet
A2 Table of Contents
A3 Distribution List
A4 Program/Task Organization
A5 Problem Definition and Background
A6 Program/Task Description
A7 Quality Objectives and Criteria for Measurement Data
A8 Special Training Requirements/Certification
A9 Documentation and Records

The following guidance has been used in the development of this Quality Assurance Project Plan (QAPP):

- 40 CFR 58:
  - Appendix A. *Quality Assurance Requirements for SLAMS, SPMs and PSD Air Monitoring*
  - Appendix C. *Ambient Air Quality Monitoring Methodology*
  - Appendix E. *Probe and Monitoring Path Siting Criteria for Ambient Air Quality Monitoring*

- 40 CFR 136:
  - Appendix B. *Definition and Procedure for the Determination of the Method Detection Limit*

- *EPA Compendium Method TO-11A: Determination of Formaldehyde in Ambient Air Using Absorbent Cartridge Followed by High Performance Liquid Chromatography (HPLC)*

- *EPA Compendium Method TO-12: Determination of Non-Methane Organic Compounds (NMOC) in Ambient Air Using Cryogenic Pre-concentration and Direct Flame Ionization Detection (PDFID)*

- *EPA Compendium Method TO-14A: Determination Of Volatile Organic Compounds (VOCs) In Ambient Air Using Specially Prepared Canisters With Subsequent Analysis By Gas Chromatography*

- *EPA Compendium Method TO-15: Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS)*

- *EPA Quality Assurance Handbook for Air Pollution Measurement Systems:*
  - Volume I, A Field Guide to Environmental Quality Assurance
  - Volume II, Ambient Air Quality Monitoring Program
  - Volume IV, Meteorological Measurements

- *Meteorological Monitoring Guidance for Regulatory Modeling Applications*

- *Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD)*

- *EPA Guidance for Quality Assurance Project Plans (QAPPs)*

- *EPA Requirements for Quality Assurance Project Plans (QAPPs)*

A2 TABLE OF CONTENTS

A2 TABLE OF CONTENTS (continued)

LIST OF FIGURES

LIST OF TABLES

A3 DISTRIBUTION LIST

The following individuals and/or organizations will receive copies of the approved Quality Assurance Project Plan (QAPP) and any subsequent revisions:

Garfield County Public Health (GCPH)
195 West 14th Street, Rifle, CO 81650

Jim Rada, Environmental Health Manager — Telephone: 970/625-5200 ext. 8113
Paul Reaser, Senior Environmental Health Specialist* — Telephone: 970/625-5200 ext. 8123

Colorado Department of Public Health and Environment
Air Pollution Control Division (CDPHE-APCD)
4300 Cherry Creek Drive South, Denver, CO 80246-1530

Gordon Pierce, Program Manager — Telephone: 303/692-3238
Cindy Wike, QA Specialist — Telephone: 303/692-3227

Air Resource Specialists, Inc. (ARS)
1901 Sharp Point Drive Suite E, Fort Collins, CO 80525

Lincoln Sherman, Project Manager — Telephone: 970/484-7941
Gloria Mercer, Quality Assurance Manager* — Telephone: 970/484-7941

* Indicates individuals who will maintain the official, approved QAPP.

A4 PROGRAM/TASK ORGANIZATION

Garfield County staff are the prime authority for this monitoring effort. They provide collection of the air samples and meteorological data. Prior to 2008, all volatile organic compound (VOC) samples were collected by Colorado Mountain College (CMC) under the direction of CDPHE or GCPH and analyzed by Columbia Analytical Services (CAS). Since 2008, Eastern Research Group, Inc. (ERG) provides canister/cartridge handling and laboratory analysis of the collected samples, and ARS provides regulatory meteorological data analysis and field support.

A program organizational chart is shown as Figure A4-1. Responsibilities of key program participants are listed below.

GCPH and CDPHE fund the program jointly and are the primary users of the data. During the 2005-2007 monitoring period, CDPHE operated the program jointly with GCPH; GCPH took over program management beginning in 2008 with CDPHE acting as an advisor since that time. GCPH is currently the lead agency and is responsible for all aspects of the monitoring program.

Columbia Analytical Services (CAS) – Laboratory staff were responsible for sample canister preparation, shipping of sample canisters to the monitoring sites, receiving and processing samples shipped back from the field, VOC sample analysis, and laboratory data validation during the 2005-2007 monitoring period. They were also responsible for communicating operational problems to GCPH.

Colorado Mountain College (CMC) – Staff at CMC were responsible for several of the initial monitoring locations and instrumentation as well as on-site instrument calibration and maintenance during the 2005-2007 monitoring period.

Eastern Research Group, Inc. (ERG) – Julie Swift and staff are responsible for sample canister/cartridge preparation, shipping of sample canisters and cartridges to monitoring sites, receiving and processing samples shipped back from the field, sample analysis, and laboratory data validation during the 2008 to present monitoring period. They are also responsible for communicating operational problems to GCPH and providing data to the ARS project scientist.

Site Operator – Paul Reaser, GCPH Air Quality Program Lead is the site operator for the program. He is responsible for overseeing the servicing of the monitoring sites and is responsible for the routine operation of the monitoring equipment and thorough field documentation of all collected data.

Project Manager – Lincoln Sherman (ARS) is responsible for providing technical assistance to GCPH.

Quality Assurance Manager – Gloria Mercer (ARS), is responsible for developing and maintaining the official, approved QAPP.

Field Specialist – Mike Slate (ARS) is the field specialist for the PSD-grade meteorology sites that began operation in 2008. He is responsible for performing twice-annual calibrations and maintenance of the meteorology sensors.

Site Auditor – Don Cobb (ARS) is the auditor for the PSD-grade meteorology sites that began operation in 2008. He is responsible for performing twice-annual performance audits of the meteorology sensors.

Project Scientist – Cassie Archuleta (ARS) is responsible for the reporting of the collected data. She coordinates all phases of data management and archive with the analytical laboratory.

Data Analysts – Emily Bitler, Laura Mack, and Matt Smith (ARS) are responsible for the daily collection, review, and preliminary meteorological data validation since 2008 of the PSD-grade meteorological monitoring sites. They assist in the preparation of reports, deliverable data files, and are responsible for data archive.

Additional support personnel may be used as necessary upon direction of GCPH.

A5 PROBLEM DEFINITION AND BACKGROUND

A5.1 Problem Definition

The Garfield County Volatile Organic Compounds Monitoring Program is designed to characterize the ambient air quality in Garfield County, Colorado. Data collected are used in a study of the risks to human health for citizens of Garfield County who are exposed to these pollutants. The objectives are to collect samples in towns and other populated areas of the county, and to evaluate whether air contaminants are being transported into the county from other regions. The County and surrounding areas are experiencing heavy oil and natural gas development.

The volatile organic compounds (VOCs) and meteorology monitoring systems adhere to operational protocols established and accepted by the EPA, to provide scientifically defensible air quality data. The network is designed to yield data that will:

- Document and characterize concentrations of local scale VOCs to develop a baseline reference for long-term measuring.
- Build upon a previous monitoring study that identified data gaps for local source emissions.
- Implement a targeted approach to answer questions about the relationship between the air quality in Garfield County and human health risk.
- Develop the basis for decisions on how Garfield County can best manage impacts of air pollution caused by development.
- Establish the basis for a comprehensive community-based air quality management plan and implementation strategy using the best available scientific data and practices.

A5.2 Background

Garfield County and CDPHE developed an Ambient Air Quality Monitoring Study in 2005 to characterize ambient air quality within the County as a whole, in response to local citizen concerns about air pollution in the area and potential health effects, primarily due to the dramatic increase in oil and gas development activities. The two-year study (June 2005 through May 2007) was designed to meet the concerns of County residents, and to fit with and add to CDPHE and local industry air quality sampling efforts in an effort to make strong decisions with regard to managing air quality impacts from growth. During this period, monitoring for 43 specific VOCs was conducted at 14 sites for 24-hours on a once per month or once per quarter basis, and at 6 meteorological stations on a continuous basis. VOCs were collected using a Siltek® canister and analyzed at CAS following the U.S. Environmental Protection Agency's Compendium Methods TO-14A and TO-15.

In 2008, based on findings and recommendations from the 2005-2007 Ambient Air Quality Study and a CDPHE Screening-Level Health Risk Assessment, GCPH modified the Garfield County air quality monitoring program, reducing the number of monitoring sites, modifying the VOC analytical methods, and increasing sampling frequency to increase the amount of data collection and to maximize efficient use of available County funding.

Monitoring beginning in 2008 focuses on better defining VOC issues in the community in the form of non-methane organic compounds (NMOC) and a variety of carbonyl compounds. Data are gathered on some hazardous air pollutants (HAPs) detected in the initial study, as well as several other compounds that have been implicated as ozone precursors (an interest for both Garfield County and the state of Colorado). Carbonyls were added due to implications in the occurrence of eye, skin, and respiratory irritation. Meteorological monitoring continued from the 2008 program to assist in determining the extent of travel of measured pollutants. Monitoring for NMOCs and carbonyl compounds (listed in Appendix A) is conducted at four sites for 24-hours. NMOC samples are collected using Siltek® canisters every 6 days and carbonyl compound samples are collected using DNPH-cartridges every 12 days. All NMOC and carbonyl samples are analyzed at ERG following EPA's Compendium Methods TO-12 and TO-11A.

This QAPP addresses all monitoring and data analysis procedures applied to the Garfield County Volatile Organic Compounds Monitoring Program. These procedures meet the protocols established by EPA and are fully documented in existing SOPs listed in Appendices C and F. Established EPA protocols are listed in the References section. Because of the complexity of this program, this document is organized by first addressing the 2005-2007 monitoring period, then the 2008 to present monitoring period.

A6 PROGRAM/TASK DESCRIPTION

Monitoring systems and parameters specifically include:

2005-2007

Volatile Organic Compounds (VOC) concentrations and meteorology parameters were monitored during 2005-2007 at 14 monitoring locations throughout the county. VOCs were collected through 24-hour integrated canister samples taken once per month or once per quarter according to EPA Compendium Methods TO-14A and TO-15. A list of samples analyzed is presented in Appendix A.

Hourly average temperature, relative humidity, wind speed, wind direction, barometric pressure, and precipitation were monitored to record local atmospheric conditions at each location. Parameters were measured using a comprehensive, professional-grade but non-regulatory-grade weather station.

2008-Present

Non-Methane Organic Compound (NMOC) concentrations, carbonyl compounds, and meteorology parameters are monitored during 2008 through the present at four monitoring locations. NMOCs are collected through 24-hour integrated canister samples taken once every six days according to EPA Compendium Method TO-12. Samples are analyzed for some of the same compounds that were analyzed prior to 2008 (e.g., BTEX compounds), along with a number of additional compounds (listed in Appendix A).

Carbonyl compounds, including formaldehyde, acetaldehyde, acetone, and other aldehydes and ketones, as listed in Appendix A, are collected through 24-hour integrated cartridge samples taken once every 12 days according to EPA Compendium Method TO-11A.

Hourly average temperature, relative humidity, wind speed, wind direction, and precipitation are monitored to record local atmospheric conditions at each location. All of the four monitoring sites continued to operate weather stations installed during the 2005-2007 monitoring period until 2009. The Rifle (Henry Bldg) and Parachute sites converted to regulatory-grade meteorological instrumentation in 2009 and 2010 respectively. These units follow Environmental Protection Agency (EPA) PSD protocols.

A6.1 Description of Work

Work to be performed for the Garfield County VOC Monitoring Program has been divided into four tasks as detailed below:

2005-2007

1) Site Selection and Equipment Procurement – Site selection and project methods were the responsibility of Garfield County in coordination with CDPHE. The Colorado Department of Public Health and Environment – Air Pollution Control Division provided some program support throughout all phases of project work. The 14 monitoring locations were selected to describe the exposure of the general population of Garfield County to VOCs primarily related to urban growth areas and from oil and gas development activities. Sites were selected based on proximity of area and emission sources, accessibility and security, and cooperation of land or building owners. A map of the region with location of the monitoring sites is presented as Figure A6-1. Instrumentation and related equipment procured included sampling canisters, meteorological sensors, and data acquisition systems.

2) Installation – After site selection and land use authorizations were complete, GCPH contracted with Colorado Mountain College (CMC) to perform some equipment installations. CDPHE APCD provided some equipment and performed installations and other tasks. CDPHE field staff installed the instrumentation verified its operation (and compliance with 40 CFR 58, TO-14A, and TO-15), calibrated the systems if required, and trained the site operator. Table A6-1 details the monitoring and support equipment used for the Garfield County VOC Monitoring Program.

3) Field Operations – Garfield County contracted with CMC as the designated site operator. The operator was fully trained and was provided with needed support equipment, forms, and monitoring supplies. Field operations include equipment maintenance and sample changing. CMC and CDPHE staff provided periodic on-site calibrations and maintenance of the instrumentation. VOC samples were retrieved once per month or once per quarter based on the EPA sampling schedule and shipped to the laboratory for analysis. Samples were collected in Siltek® stainless steel canisters and analyzed at CAS using gas chromatograph/mass spectrometer analysis following TO-14A and TO-15 guidelines.

   All meteorological data were retrieved via hand-held computer and were sent to GCPH staff. Meteorological measurements included air temperature, relative humidity, wind speed, wind direction, barometric pressure, and precipitation. CMC performed meteorological data downloads on a routine basis.

4) Data Operations – VOC data were managed at the analytical laboratory (CAS), and the data were reported to GCPH. All meteorological data were collected and managed by GCPH.

2008-Present

1) Site Selection and Equipment Procurement – Program methods are the responsibility of Garfield County Public Health (the lead agency), with CDPHE as an advisor in the program. Four of the initial monitoring locations continued through this newly revamped program, to describe the exposure of the general population of Garfield County to NMOCs and carbonyl compounds related to urban growth and oil and gas development activities. One of the four sites is designated to be a mobile station that will change locations on an as-needed basis. A map of the region with location of the monitoring sites is presented as Figure A6-1. Instrumentation and related equipment procured includes sampling canisters and cartridges, sampling pumps, meteorological sensors (air temperature, wind speed, wind direction, barometric pressure, and precipitation), data acquisition systems, and support systems. Two monitoring sites replaced their meteorological weather stations with PSD-grade meteorological sensors in 2009 and 2010.

2) Installation – Four of the existing sites were selected to remain in operation for this program. Field staff installing new instrumentation verified its operation (and compliance with 40 CFR 58, TO-12 and TO-11A) calibrated the systems if required, and trained the site operator. Table A6-1 details the monitoring and support equipment used for the Garfield County VOC Monitoring Program. Weather stations were replaced with PSD-grade meteorological sensors at two monitoring locations, one in 2009 and another in 2010.

3) Field Operations – A local site operator was provided by GCPH. The operator was fully trained and provided with support equipment, forms, and monitoring supplies. The site operator performs field operations including equipment maintenance and sample changing. NMOC samples are collected during a 24-hour period every six days. Samples are collected in Siltek® stainless steel canisters and analyzed at ERG using GS/FID/MS analysis following TO-12 guidelines. Carbonyl samples are collected during a 24-hour period every 12 days and are shipped to the ERG laboratory for analysis. Samples are collected in DNPH-cartridges following TO-11A guidelines, using High Performance Liquid Chromatography (HPLC).

   Meteorological measurements at the two non-PSD-grade stations include air temperature, relative humidity, wind speed, wind direction, barometric pressure, and precipitation. The GCPH site operator provides periodic maintenance and performs meteorological data downloads on a routine basis. These meteorological stations were replaced in 2010 and 2011 with newer, all-in-one meteorology sensors, yet they remain non-PSD-grade. Meteorological measurements at the two PSD-grade stations include air temperature, relative humidity, wind speed, wind direction, and precipitation, and are maintained and calibrated twice-annually by ARS field staff. Data from PSD-grade stations are downloaded daily by ARS staff via cell phone communications for validation and archive.

4) Data Operations – All NMOC and carbonyl data are managed at the ERG analytical laboratory. The laboratory forwards an electronic file of data and analyses to the ARS Project Scientist, who prepares reports for GCPH staff. Meteorological data for the two PSD-grade monitoring stations are validated according to PSD guidelines at ARS. ARS applies fully documented data management techniques to yield the highest quality data collection and validation. Reporting includes quarterly and annual reporting, and data archive.

A6.2 Measurements

Table A6-1 summarizes instrumentation and measurement protocols that have been adopted by the EPA, are implemented throughout the United States, and are used in the Garfield County Volatile Organic Compounds Monitoring Program. Measurements for each parameter are summarized below:

2005-2007

Sampling for the VOCs of concern requires both whole air and sorbent sampling techniques. Siltek® canisters collected integrated samples collected over a period of 24 hours, once per month or once per quarter at 14 locations.

Meteorological monitoring was performed at 6 stations using RainWise® model MK-III RTR stations for air temperature, relative humidity, wind speed, wind direction, barometric pressure, and precipitation. The stations were located on top of a tripod tower approximately 3 meters above the ground (the precipitation sensor was located at ground level). Data were stored on a 30-minute basis on a RainWise® CC-2000 computer interface were downloaded bi-weekly. Due to funding and location constraints, the meteorological monitoring did not meet EPA recommendations for regulatory requirements.

2008-Present

NMOCs are collected over a sampling period of 24 hours on the EPA national 1-day-in-6 schedule, at four locations. In addition, carbonyl compounds collected on DNPH-coated silica gel sorbent cartridges using active sampling methodology are collected over a sampling period of 24 hours, on a 1-day-in-12 basis at the same four locations. The site operator installs the canisters and sorbent filters every 6 or 12 days according to the program schedule. They are retrieved and forwarded along with associated documentation to the analytical laboratory as soon after sampling as practical, typically within 24 hours. ARS obtains the validated data from ERG, applies appropriate calibrations, and includes the resulting concentration data in the program database. Data plots are prepared to graphically display the data.

Meteorological data at the two non-PSD-grade monitoring sites are collected similar to the 2005-2007 monitoring period, but their instrumentation was upgraded. Data are retrieved from each station's data logger onto a flashcard, which is then downloaded onto PC for data review. For the two PSD-grade sites, ambient temperature, relative humidity, wind speed, wind direction, and precipitation hourly average data are retrieved daily from each on-site data logger, and are reviewed daily and weekly to identify operational problems or data inconsistencies. Data are appended daily to the program database and are reduced to yield a Level-1 quality assured data set, as described in SOP 3450, *Ambient Air Quality and Meteorological Monitoring Data Validation.* Monthly plots of all meteorological parameters are supplemented with data summary statistical tables and monthly, quarterly, and annual wind rose plots.

A6.3 Assessment Requirements

2005-2007

Program assessments include routine, periodic site operator servicing (once per month or once per quarter) to change the sample canisters, periodic field technician calibration/maintenance, and download of meteorological data.

2008-Present

NMOC canisters and carbonyl cartridges are assessed prior to and following the scheduled 24-hour sampling period (every 6 days or every 12 days, respectively) by the site operator. The operator performs a physical inspection and determines if the systems have functioned properly over the previous 24-hour sampling period. Assessment includes verifying sorbent filter flow and canister/cartridge on/off times for the previous sampling period and recording on a chain-of-custody log sheet (see Appendix B). Log sheets accompany canisters and cartridges to the laboratory and are reviewed upon receipt. A physical inspection of the instruments is performed and the chain-of-custody log sheets are reviewed for thoroughness of information and data completeness.

ERG performs standard laboratory assessments upon canister preparation (pre-sampling), canister return (post-sampling), and upon analysis. Complete procedures can be found in ERG's document, *Support for the EPA National Monitoring Programs* (see Appendix C).

Meteorological data from the two non-PSD sites are collected periodically using a flashcard plugged into the stations' data loggers, then downloaded to a PC for review. Since data are non-PSD grade, they are not collected following any standard protocols. Meteorological data from the two PSD-grade sites are downloaded daily by ARS where they are reviewed to assess the operational integrity of the systems. This review includes an operational assessment of data completeness. In addition, an operator site visit occurs every six days to check the operational status and provide routine maintenance to all systems. An ARS field specialist travels to the site twice-annually to maintain and calibrate the meteorological sensors and systems according to EPA guidelines. Routine, scheduled maintenance is performed to assure quality data.

For data collected by ARS, any monitoring inconsistency noted by any assessment initiates immediate corrective action. ARS logs the noted meteorological data collection problem and the corrective action timeline in the project Site Status Log. ARS reviews and assesses the problem and possible solution. Some problems are addressable through remote access to the site instrumentation or systems, while some require that ARS contact the site operator and guide them through system troubleshooting and repair, including individual component replacements. If a problem cannot be resolved remotely or with site operator assistance, ARS makes an emergency remedial repair visit to the site to isolate and correct the problem.

A6.4 Schedule

2005-2007

Samples were collected once a month or once per quarter at each of the 14 monitoring locations following a defined project schedule. Appendix D presents the project schedules.

2008-Present

Samples are collected once every 6 or 12 days at each monitoring location. Appendix D includes example sample changing schedules for the period.

A6.5 Reporting Requirements

2005-2007

A data summary report for data collected between 2005 and 2007 was prepared by CDPHE.

2008-Present

Reporting requirements for the Garfield County VOC Monitoring Program include quarterly data submittals and annual reports specified by Garfield County. In general, reports include narratives describing the monitoring sites (including instrument location and configuration), data summaries, and general interpretation. Monthly progress reports are also prepared for the PSD stations, which contain summaries of instrument operation and data collection statistics.

A7 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

A7.1 Data Quality Objectives

The minimum data recovery objective for the Garfield County VOC Monitoring Program is 90% per calendar quarter for each parameter. Actual data recovery is subject to instrument performance. There are no backup systems for any of the site instrumentation; catastrophic failure of a system could cause an extended downtime for an individual parameter. Measurement quality objectives for the 2008 to present monitoring period are provided in the *Support for the EPA National Monitoring Programs* document (see Appendix C). All laboratory procedures follow EPA Compendium Methods TO-14A and TO-15 (2005-2007), and TO-12 and TO-11A (2008-present).

A7.2 Criteria for Measurement Data

General guidance for the monitoring program will follow EPA documents listed in the References section.

A7.2.1 Measured Parameters

Each parameter has specific measurement performance criteria, which is generally applied during data validation. Table A7-1 presents sampling ranges and specifications for each measured parameter.

2005-2007

Sampling with a Siltek® canister and passive collection provide a time-integrated sample. Analysis of the sampling canisters was performed by gas chromatography using method TO-14A

and GC/MS using method TO-15. See Appendix C for a summary of the analytical procedures. A chain-of-custody form and field procedure are presented in Appendix B.

2008-Present

Sampling with a Siltek® canister and passive collection provide a time-integrated sample. Detection by mass spectrometer provides definitive identification of NMOCs. Analysis of sampling canisters is performed by GC/FID/MS according to TO-12. Appendix A is a list of compounds analyzed and measured for this program. Complete laboratory methods are provided in ERG's document, *Support for the EPA National Monitoring Programs* (see Appendix C).

Using a low flow, constant voltage vacuum pump, carbonyl samples are collected on DNPH-coated sorbent cartridges. Sampling manifolds with data logger-controlled valves that allow for integrated sampling are used to collect the sorbent samples. Flow rate through the cartridge is computed by measuring the temperature of the cartridge and the pressure drop across it. The resulting calibration is applied to the data to determine concentrations. Cartridges are desorbed in the laboratory using a solvent, and the extract is analyzed by HPLC/UV. Carbonyls are analyzed following TO-11A. Appendix A provides a list of compounds analyzed and Appendix C contains a summary of analytical procedures.

The network currently consists of two monitoring stations that do not follow any standard protocols for meteorology and two stations that converted their meteorological instrumentation to PSD-grade. Detailed discussions of the operational criteria for each are presented in SOP 3150, *Calibration and Routine Maintenance of Meteorological Monitoring Systems.* Data are validated to Final (Level-1) validation as described in SOP 3450, *Ambient Air Quality and Meteorological Monitoring Data Validation.*

A7.2.2 Data Collection System

Data collection systems for the program include sample collection canisters, sample collection cartridges, and meteorological stations and sensors.

2005-2007

VOCs were collected directly from Siltek® canister samples. All sampling media were shipped to the analytical laboratory by traceable carrier in laboratory-supplied containers that fully meet sample handling and transport requirements. Chain-of-custody accounting was fully documented by shipping records, shipping logs, and field sampling log sheets. Temperature, cartridge pressure drop, and sample on/off times were recorded by the on-site data collection system.

All meteorological data were captured on-site by the data collection system, consisting of a RainWise® weather station and data logger. Data were downloaded bi-weekly using a Palm Pilot and software; see Appendix E, *Garfield County Ambient Air Monitoring Field Protocol*, for complete procedures.

2008-Present

NMOCs and carbonyl compounds data are collected directly from Siltek® canisters and sorbent cartridges, respectively. All sampling media are shipped to the analytical laboratory (ERG) by traceable carrier in laboratory-supplied containers that fully meet sample handling and transport requirements. Chain-of-custody accounting is fully documented by shipping records, shipping logs, and field sampling log sheets. Temperature, cartridge pressure drop, and sample on/off times are recorded on chain-of-custody log sheets.

Meteorological data for the non-PSD-grade sites were captured on-site by the data collection system, consisting of a RainWise® weather station and data logger. Data were periodically downloaded using a Palm Pilot and software. (see Appendix E). In 2010 and 2011, the instrumentation was upgraded to a Climatronics All-in-One weather sensor. Data are periodically downloaded from the stations' data loggers to a flashcard.

Meteorological data for the PSD-grade sites are captured on-site by the data collection system consisting of a data logger and cellular modem. The cellular modem provides a remote link to the site for data/documentation collection and operational status assessment. The data logger is capable of storing a minimum of 30 days of continuous data for all parameters and can be polled on-site if the cellular modem fails.

A8 SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

Laboratory analysts hold academic degrees in a related field and are fully trained in the use of laboratory equipment and procedures.

ARS staff working on this project are experienced in ambient air quality and meteorological monitoring systems. The project manager is responsible for verifying all staff members are fully informed on the specific monitoring and data management configurations for this project. Staff are informed/trained on a one-to-one basis. Site operators are fully trained on-site by ARS field staff.

ARS data analysts are fully trained by the project manager on operational properties and expectations of all monitoring instrumentation, data acquisition systems, and calibration and maintenance procedures. Data analysts are also trained on all data collection, validation, and reporting software tools used in network data management. Their primary expertise resides in their ability to review data for quality and completeness and to perform the highest quality validation. No specific professional certifications of data analysts are required, but data analysts are thoroughly trained in all aspects of their job requirements.

A9 DOCUMENTATION AND RECORDS

All hardcopy records, digital data, and other documents reside at the analytical laboratories, GCPH, and in the ARS project database for the life of the program or at least for five years, whichever is greater. All raw and validated data are duplicated quarterly and delivered with the quarterly reports to designated recipients. At the end of the program all data and records

will be turned over to program participants or their designee. The following types of documentation and records are used in the Garfield County VOC Monitoring Program:

- Field documentation including log sheets, instrument printouts, calibration results, quality control checks, laboratory procedures, and maintenance performed will be delivered to program participants upon program termination. The site operator completes instrument-specific log sheets (manual or digital) during each site visit.

- Program data (raw and validated) reside in the laboratory's LIMS database and in ARS' project database, and are available for use during the life of the program. A digital copy on compact disc (CD) of raw and validated data is delivered quarterly to the program participants. Upon program termination, all data will be archived on CD and delivered to program participants.

- Program reports (quarterly and final) are produced by ARS according to the needs of program participants. These reports are produced in digital format in Microsoft Word and printed as hardcopy for distribution. Upon program termination all reports and associated graphical products will be archived on CD and delivered to program participants.

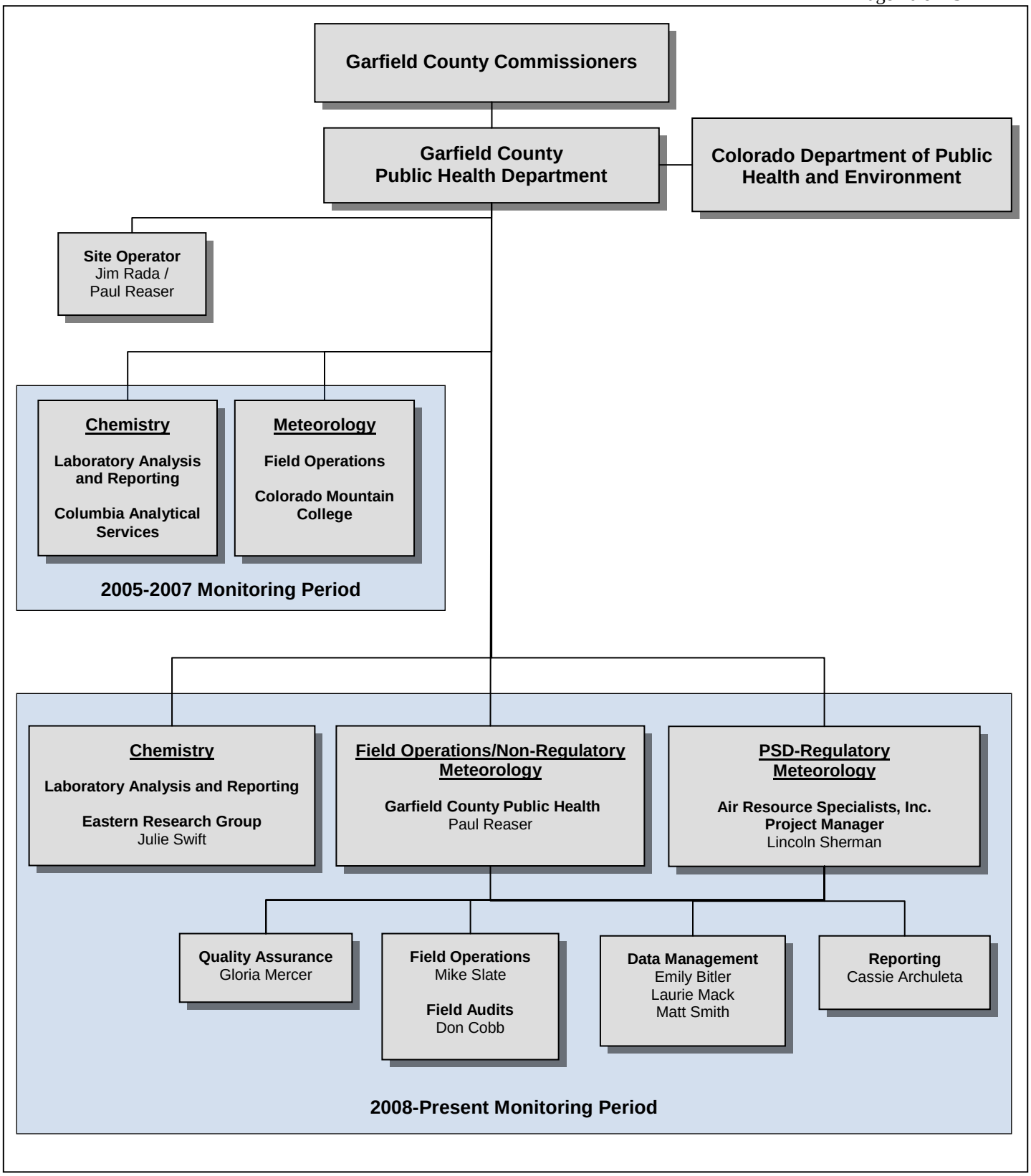
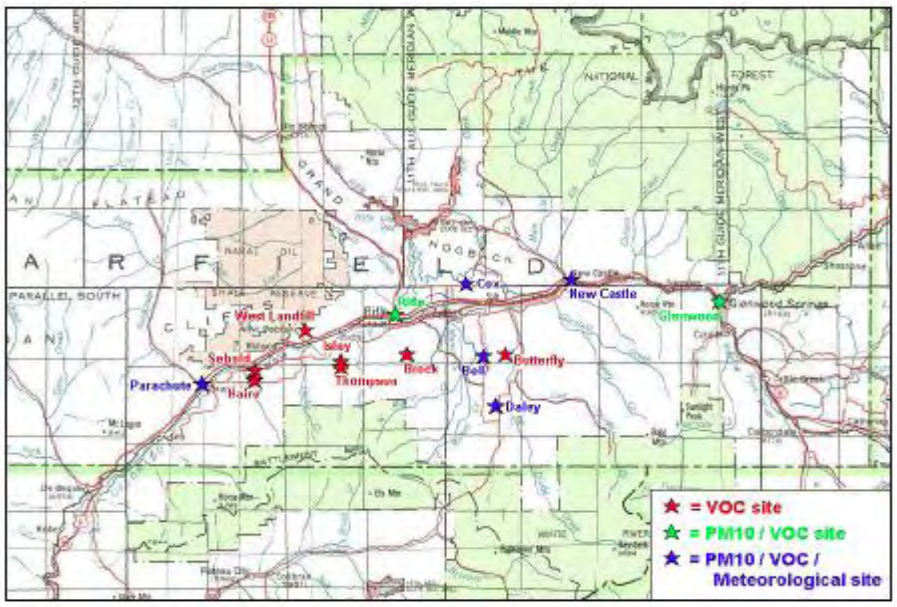
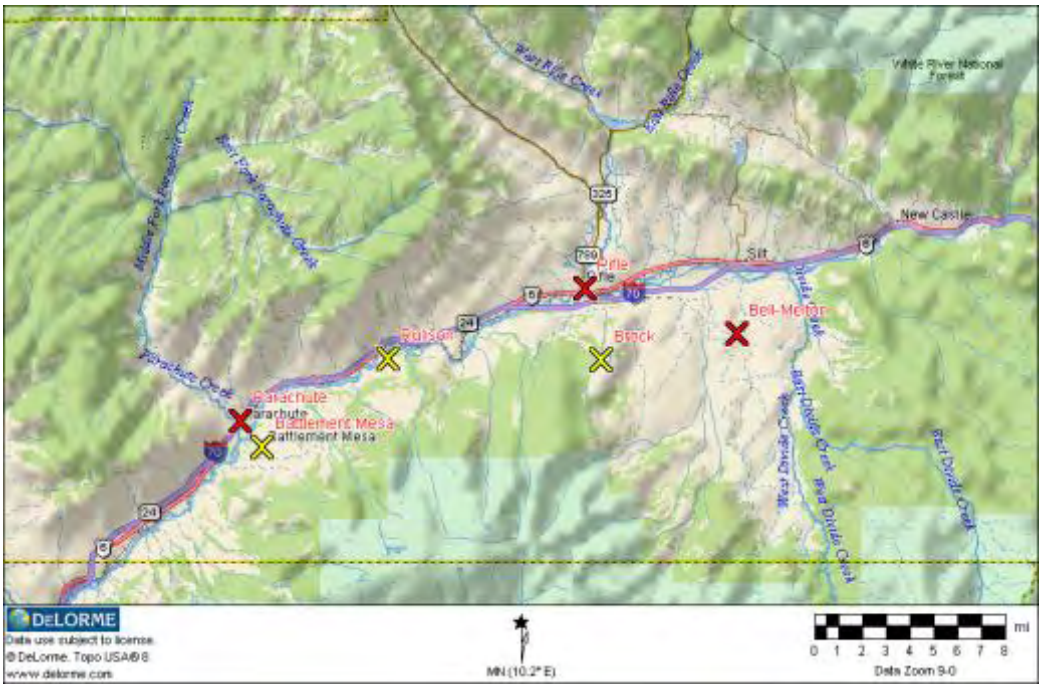


Figure A4-1. Garfield County VOC Monitoring Program Organizational Chart.



Monitoring Locations During 2005-2007



Yellow = mobile stations

Red = fixed stations

Monitoring Locations Beginning 2008

Figure A6-1. Maps of Garfield County VOC Monitoring Program Site Locations.

Table A6-1. Garfield County VOC Monitoring Program Instrumentation and Support Equipment.

Equipment Type	Manufacturer and Model	Sampling Frequency	Parameter
VOC/NMOC			
Air toxics canister	Siltek®	Quarterly/monthly (prior to 2008) 24-hour averages on 1-day-in-6 EPA schedule (beginning 2008)	Data derived from laboratory analysis of canisters
Flow controller	Veriflo SC423XL		
Carbonyls (beginning 2008)			
DNPH-cartridges	SKC 224-PCXR8 Series	24-hour averages on 1-day-in-12 EPA schedule (beginning 2008)	Data derived from laboratory analysis of cartridges
Gas flow calibrator	Bios Defender 500 Series		
Sorbent tubes	Waters Sep-Pak XPoSure WAT047205		
Ozone scrubber cartridges	Waters WAT054420		
Sampling pumps			
Meteorology			
Non-PSD-grade weather station: Ambient temperature Relative humidity Wind speed and direction Barometric pressure Precipitation	RainWise MK-III RTR	Continuous	Hourly averages
Data logger	RainWise		
PSD-grade sensors (beginning 2008)			
Ambient temperature	Vaisala HMP45C aspirated	1-second samples; hourly averages	
Relative humidity	Vaisala HMP45C aspirated	1-second samples; hourly averages	
Wind speed and wind direction	R.M. Young 5305	1-second samples; hourly average with 15-minute subintervals (900 samples per subinterval)	
Wind Direction Sigma Theta	R.M. Young 05305	1-second samples; hourly average with 15-minute subintervals (900 samples per subinterval)	Data logger derived
Precipitation	MetOne Model 385	Hourly accumulation	

Table A7-1. Monitoring Sensor and Sampling Specifications.

Parameter	Sensor	Units and Range	Sample Frequency	Notes
VOCs	Siltek® canister	µg/m^3	24-hour averages on 1-day-in-6 EPA schedule	Data derived from laboratory analysis of canisters
NMOCs	Siltek® canister	µg/m^3	24-hour averages on 1-day-in-6 EPA schedule	Data derived from laboratory analysis of canisters
Carbonyls	Sorbent filters	µg	24-hour averages on 1-day-in-12 EPA schedule	Data derived from laboratory analysis of cartridges
Weather Station: Air temperature Relative humidity Wind speed Wind direction Barometric pressure Precipitation	RainWise MK-III RHR	 °C 0% to 100% 0° to 360°	Continuous	
Air Temperature	Vaisala HMP45C	°C -30°C to +50°C	1-second samples; hourly averages	
Relative Humidity	Vaisala HMP45C	0% to 100%		
Wind Speed and Wind Direction	R.M. Young 05305	m/s and degrees true 0° to 360°	1-second samples; hourly average with 15-minute subintervals (900 samples per subinterval)	
Wind Direction Sigma Theta	R.M. Young 05305	Degrees	1-second samples; hourly average with 15-minute subintervals (900 samples per subinterval)	Data logger derived
Precipitation	MetOne 385		Hourly accumulation	

B MEASUREMENT/DATA ACQUISITION

This section describes the program design and implementation of the Garfield County VOC Monitoring Program, including collecting, handling, and analyzing the data; using data from other sources; and managing and validating the data. This section includes the following subsections:

B1 SAMPLING PROCESS DESIGN

The Garfield County VOC Monitoring Program sampling process was designed to collect adequate samples and data in populated areas of the county sufficient to describe the exposure of the general population of the county to VOCs, and to evaluate whether air contaminants are being transported into the county from other regions. Measurement methods meet EPA's *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air* performance criteria and provide detailed documentation for determining minimum detection limits (MDL) for each of the compounds. MDL development is performed in accordance with 40 CFR 136, Appendix B requirements.

These standard protocols were specified by Garfield County to assure data collected by the program are scientifically defensible. Sampling frequencies and instrumentation used in the program are described in Section A6. All measurements described in Section A6 are critical to achieve program objectives.

The 2005-2007 monitoring period included 14 monitoring locations, 4 of which continued monitoring in 2008. Table B1-1 presents geographic specifications of the Garfield County monitoring locations. Figures B1-1 through B1-15 present a satellite image and cardinal direction photographs (if available) of each monitoring location.

B2 SAMPLING METHODS REQUIREMENTS

Sampling methods for data collection for the Garfield County VOC Program are discussed below.

2005-2007

VOC canisters were changed every month or every quarter by the site operator, as defined by the program schedule. The schedule followed the EPA protocol schedule as great an

extent as possible. A supply of canisters was shipped directly to the site operator from the analytical laboratory (CAS) between sample days. The site operator exchanged exposed canisters with new ones without handling samples directly. In addition to shipping full canisters to the analytical laboratory, the operator was also responsible for measuring and recording vacuum readings before and after Siltek® canister changes, and documenting the elapsed time of the data collection period.

Meteorological data were retrieved bi-weekly via Palm Pilot and software from the on-site RainWise data logger. The site operator delivered the data to Garfield County staff for review. These data were not regulatory-compliant; however, they did provide an understanding of meteorological conditions during the sampling period.

2008-Present

NMOC canisters are exchanged every 6 days by the site operator. The systems run on a standard EPA schedule of operating for 1 day every 6 days. Canisters are turned on manually between 8:00 and 11:00 am on the scheduled sampling day and run for 24 hours. A supply of canisters is shipped directly to the site operator from the analytical laboratory (ERG) between sample days. The canisters contain 4 to 6 liters of sampled air over a 24-hour period using a vacuum range of 29.9 to 7 inHg. The site operator retrieves the exposed canisters immediately after the 24-hour sampling period. In addition to shipping full Siltek® canisters to the analytical laboratory, the operator also measures and records vacuum readings before and after canister changes, and documents the elapsed time of the data collection period. Canisters are shipped back to the laboratory along with their chain-of-custody forms within 24 hours of sampling. Canisters are evacuated at the laboratory within 30 days of sample collection. Specific sampling protocols are documented in the *GARCO 2008 Ambient Air Monitoring Field Protocol* document (See Appendix E). Appendix B is an example chain-of-custody log sheet the operator completes for each station visit and canister exchange.

Carbonyl cartridges are exchanged every 12 days by the site operator. The systems run on a standard EPA schedule of operating for 1 day every 12 days. They are turned on manually between 8:00 and 11:00am on the scheduled sampling day and run for 24 hours. A supply of cartridges is shipped directly to the site operator from the analytical laboratory (ERG) between sample days. Cartridges sample air over a 24-hour period using a flow rate of 600 to 800 mL/min. The site operator exchanges the exposed cartridges with new ones without handling the samples directly. In addition to shipping exposed cartridges to the analytical laboratory, the operator also measures and records flow rates before and after cartridge changes, and documents the elapsed time of the data collection period. Cartridges are shipped to the site in a cooler maintaining 4°C temperature. After sampling, the cartridges are again kept under refrigerated conditions, and are refrigerated upon receipt at the laboratory until analysis is performed. Specific sampling protocols are documented in the *GARCO 2008 Ambient Air Monitoring Field Protocol* document (see Appendix E). Appendix B is an example chain-of-custody log sheet the operator completes for each station visit and cartridge exchange.

Meteorology parameter data for the two non-PSD sites (RainWise-instrumented sites) are collected similarly to the 2005-2007 period. Data are retrieved bi-weekly via Palm Pilot and software from the on-site RainWise® data logger. These data are not regulatory-compliant; however, they do provide an understanding of meteorological conditions during the sampling period. In 2010 and 2011, these stations were upgraded to a Climatronics All-in-One sensor

system with data logger. Data are retrieved periodically on flashcard and downloaded to a personal computer for review. This new sensor system is also a non-regulatory-compliant system.

Meteorology parameter data for the two PSD-grade sites are automatically retrieved daily via cellular telephone modem from the on-site data logger. If necessary, ARS data analysts collect data from the sites if the automatic process fails. Data are stored in the ARS Air Quality Database. Any data collection problems are immediately reported to the ARS project manager who immediately implements corrective actions. Data are collected according to EPA protocols and are detailed in SOP 3350, *Collection of Ambient Air Quality and Meteorological Monitoring Data and Site Documentation.*

B3 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

2005-2007

Sample handling and custody procedures for VOC canisters and data were defined by the analytical laboratory (CAS). VOC sampling was performed with 6-liter Siltek® canisters to provide time-integrated samples. Prepared canisters were shipped to the site operator via overnight delivery service by the analytical laboratory. Collection occurred unattended and required only a clean, evacuated Siltek® canister and a mass flow controller. A valve on the inlet manifold on the canister was opened at the start of the sampling period. At the end of the sample collection period, the valve was closed and the canister was shipped back to the laboratory for analysis. No preservation was required during shipping, and sample hold time was 30 days. The operator set up sample media on the specified sample date and completed a sample-specific log sheet. The canister was also tagged to identify the canister, site, and sample date. All media were shipped to the analytical laboratory by traceable carrier in laboratory supplied containers that fully met sample handling and transport requirements. Chain-of-custody accounting was fully documented by shipping records, shipping logs, and field sampling log sheets. Canisters were cleaned prior to reuse according to standard laboratory procedures.

Meteorological data were non-PSD-grade and were collected directly from each site from data logger download by the site operator or CMC. The data were then delivered to Garfield County staff for review.

2008-Present

NMOC sampling is performed with 6-liter Siltek® canisters to provide time-integrated samples. Prepared canisters are shipped to the site operator via overnight delivery service by the analytical laboratory. Collection occurs unattended and requires only a clean, evacuated Siltek® canister and a mass flow controller. A valve on the canister's inlet manifold is operated at the start of the sampling period. At the end of the sample collection period, the valve is closed and the canister is shipped back to the laboratory by traceable carrier in laboratory-supplied containers that fully meet sample handling and transport requirements. No preservation is required during shipping; sample hold time at the laboratory is 30 days. The operator exchanges the sample media between sample days and completes a sample-specific log sheet (see Appendix B). The canister is also tagged to identify the canister, site, and sample days. All media is shipped to the analytical laboratory by traceable carrier in laboratory supplied containers that

fully meet sample handling and transport requirements. Chain-of-custody accounting is fully documented by shipping records, shipping logs, and field sampling log sheets. Canisters are cleaned prior to reuse per SOP ERG-MOR-062.

Carbonyl samples are collected on DNPH-coated sorbent cartridges. Cartridges are shipped to the site operator via overnight delivery service in coolers maintaining a temperature of 4°C by the analytical laboratory. Collection information includes cartridge temperature and pressure drop. After collection, the site operator exchanges sample media on the designated day and completes a sample-specific log sheet (see Appendix B). The operator ships the samples back to the laboratory via shipping carrier in the coolers they came in by traceable carrier in laboratory-supplied containers that fully meet sample handling and transport requirements (samples are shipped back to the laboratory at approximately 4°C). Sample hold time at the laboratory is two weeks. Chain-of-custody accounting is fully documented by shipping records, shipping logs, and field sampling log sheets. Samples received at the laboratory are logged into the Laboratory Information Management System (LIMS) database according to SOP ERG-MOR-045 and ERG-MOR-079. After sample identification number, date received, sample date, etc. is reviewed for discrepancies. ERG contacts the site operator for resolution of any sample issues.

ERG provides validated data files to GCPH, who in turn, provides files to ARS for quarterly and annual reporting purposes.

Meteorological data at the non-PSD-grade sites are collected directly from each site from data logger download by the site operator. The data are then delivered to Garfield County staff for review. Meteorological data retrieval at the PSD-grade sites is performed automatically via cellular telephone modem from the data logger to ARS; data values are stored in the ARS Air Quality Database. Data are also stored on the data logger for 30 days, and may be retrieved via portable computer.

B4 ANALYTICAL METHODS REQUIREMENTS

Analytical methods for data collection for the Garfield County VOC Monitoring Program are discussed below.

2005-2007

Samples were collected using Siltek® canisters and analyzed at the CAS laboratory to provide definitive identification of specific VOCs. CAS performed analysis of the sampling canisters using GC/MS by method TO-15, as summarized in Appendix F. A list of the compounds analyzed is presented in Appendix A.

Meteorology instruments and data required no analytical methods. Standard operating procedures for data collection and validation of the PSD-grade instruments are listed in Appendix G.

2008-Present

NMOC samples are collected with a Siltek® canister and analyzed at ERG laboratories to provide definitive identification of specific NMOCs; a complete list of chemicals analyzed in samples for this program is presented in Appendix A. ERG performs analysis of the sampling canisters within two weeks of sample collection using GC/FID/MS by Method TO-12 (see Appendix F) and ERG SOP-MOR-046.

Carbonyl samples are collected on DNPH-coated sorbent cartridges. Sampling manifolds with data logger controlled valves are used to collect the sorbent samples. The flow rate through the cartridge is calculated using the temperature of the cartridge and the pressure drop across it. The resulting calibration is applied to the data to determine concentrations. Cartridges are stored in a refrigerator prior to analysis and are analyzed within 30 days of sampling collection. The cartridges are desorbed in the ERG laboratory using a solvent, and the extract is analyzed by HPLC/UV. Specific carbonyls are analyzed by TO-11A (see Appendix F) and ERG SOP-MOR-047.

Meteorology instruments and data require no analytical methods. PSD-grade meteorology instruments undergo calibration twice-annually using National Institute of Standards and Technology (NIST)-traceable standards that receive annual certifications from individual manufacturers.

B5 QUALITY CONTROL REQUIREMENTS

Quality control requirements for the Garfield County VOC Monitoring Program are discussed below. They are also discussed in Sections B2, B3, B4, and B6.

2005-2007

VOC canisters were checked for leaks and cleaned prior to sampling. Compendium Method TO-15 includes provisions for inherent quality control in the analysis laboratory.

Meteorological stations were calibrated upon installation and checked for operation by the site operator upon every site visit.

2008-Present

NMOC canisters and sampling devices are checked for proper operation every six days by the site operator. At the laboratory, internal analytical standards and frequent verification of analytical system performance are used to control the analytical system. Compendium Method TO-12 includes provisions for inherent quality control in the analysis laboratory. Refer to the laboratory's SOP for *Standard Preparation Using Dynamic Flow Dilution System*, ERG-MOR-061) (see Appendix C). A 3-copy chain-of-custody form is shipped with each canister or cartridge to a site. Upon laboratory receipt, sample canister vacuum/pressure is compared against field documentation to ensure the canister remained airtight during transport. If any leaks are detected the sample is voided. Specific procedures are outlined in the SOP for *Sample Receipt at the ERG Chemistry Lab*, ERG-MOR-045.

Samples are logged into the LIMS database following SOP ERG-MOR-079, *Sample Login to the Laboratory Information Management System*. Carbonyl tubes are extracted within 14 days of the sampling day and are refrigerated until analysis, which occurs within 30 days after extraction. Detailed sample receipt and acceptance policies are in SOP-MOR-045.

Carbonyl sampling devices are checked for proper operation every 12 days by the site operator. At the laboratory, internal analytical standards and frequent verification of analytical system performance are used to control the analytical system. Compendium Method TO-11A includes provisions for inherent quality control in the analysis laboratory (see Appendix F).

Non-PSD-grade meteorological stations are calibrated upon installation and checked for operation by the site operator upon every site visit. PSD-grade station sensors are serviced upon acceptance testing of a new instrument, upon installation or removal from a monitoring location, whenever control limits are exceeded, prior to any corrective action or maintenance that affects its operation, or at a maximum interval of six months. All meteorological systems are checked for proper operation every 12 days by the site operator. Specific control limits are described in SOP 3150, *Calibration and Routine Maintenance of Meteorological Monitoring Systems.* Quality control of the data is achieved through daily data review.

B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

B6.1 Inspection and Acceptance Testing

2005-2007

VOC Siltek® canisters were inspected at the analytical laboratory before shipment to a monitoring location. They were accepted if no physical damage was present and if the canisters held a pressure/vacuum. When canisters were purchased they were cleaned, certified, and verified as meeting laboratory acceptance criteria.

Each Siltek® canister and its associated flow controller were vacuum-tested by the site operator for leaks. Prior to deployment for sampling the flow controller was mounted to its canister, the system inlet was capped, and a vacuum was applied by momentarily opening (then closing) the canister valve. If leaks were present that were not resolved, the canister and gauge were not used and were returned to the laboratory.

The meteorological station was calibrated at time of installation, and accepted if calibration resulted in normal parameter ranges of the instrument as defined by the manufacturer.

2008-Present

NMOC Siltek® canisters are inspected at the analytical laboratory before shipment to a monitoring location. They are accepted if no physical damage is present and if the canisters hold a pressure/vacuum. When canisters are purchased they are cleaned, certified, and verified as meeting laboratory acceptance criteria. Each Siltek® canister and its associated flow controller are vacuum-tested by the site operator for leaks. Prior to deployment for sampling the flow controller is mounted to its canister, the system inlet is capped, and a vacuum is applied by momentarily opening (then closing) the canister valve. If leaks are present that are not resolved, the canister and gauge are not used and are returned to the laboratory.

Carbonyl cartridges are inspected at the analytical laboratory before shipment to a monitoring location. They are accepted if no physical damage is present. The sampling pumps and flow calibrators receive an annual calibration, and the sample tubing is replaced as needed, or a minimum of twice each year.

Non-PSD-grade meteorological stations were calibrated at time of installation, and accepted if calibration resulted in normal parameter ranges of the instrument as defined by the manufacturer. PSD-grade meteorological sensors are calibrated at the manufacturer. Sensors are accepted if documentation of the calibration and calibration results are received with the sensor. Refer to SOP 3150, *Calibration and Routine Maintenance of Meteorological Monitoring Systems*, for calibration procedures. These sensors are also audited twice-annually by an ARS auditor.

B6.2 Maintenance

Tables B6-1 through B6-3 summarize maintenance procedures for the measurement systems.

2005-2007

Regular maintenance of the canister systems was performed upon scheduled site operator visits. Meteorological stations received no periodic, scheduled maintenance.

2008-Present

Regular maintenance of canister and cartridge systems is performed every 6 days and 12 days, respectively, as scheduled by the site operator. Tables B6-1 and B6-2 summarize the maintenance procedures for canister and sorbent cartridge systems, respectively. Calibration of laboratory GC/FID/MS instrumentation is performed quarterly.

Non-PSD-grade meteorological stations receive no periodic, scheduled maintenance. PSD-grade maintenance is performed every 6 to 12 days, as scheduled by the site operator, and twice-annually by a field specialist. These maintenance procedures are detailed in SOP 3001, *Procedures for Quarterly Maintenance to an Ambient Air Monitoring Station* and SOP 3150, *Calibration and Routine Maintenance of Meteorological Monitoring Systems.* Table B6-3 summarizes maintenance procedures for meteorological sensors.

B7 INSTRUMENT CALIBRATION AND FREQUENCY

2005-2007

Calibration of the analysis instrumentation was performed using generally accepted laboratory procedures. Siltek® canister samples were handled and analyzed by the analytical laboratory (CAS). Meteorological station calibrations were performed upon station installation at each location.

2008-Present

Calibration of the instrumentation used to analyze the Siltek® canister samples is handled by the analytical laboratory (ERG) and calibration is performed quarterly. Carbonyl analysis instruments receive daily calibration checks. Similarly, calibration of the instrumentation used to analyze the sorbent filter cartridges is also handled by the analytical laboratory.

Non-PSD-grade meteorological station calibrations are performed upon station installation at each location. Table B7-1 provides calibration acceptance criteria. PSD-grade meteorological sensor calibrations are performed twice-annually and after sensor repair or maintenance, according to SOP 3150, *Calibration and Routine Maintenance of Meteorological Monitoring Systems*, and include:

- Ambient Temperature – The temperature probe is calibrated on-site by comparing to a collocated reference temperature probe.
- Relative Humidity – The relative humidity sensor is calibrated using an audit sensor and portable data logger. The audit sensor is placed in an aspirator housing adapter and placed next to the existing station sensor, which ensures both probes are subjected to the same air stream. The audit sensor is left in place for several hours and data from both audit and station sensor are compared.
- Wind Speed – The wind speed sensor is calibrated at four shaft revolution speeds. The equivalent wind speed is calculated corresponding to the manufacturer's specified values for shaft rpm versus wind velocity and compared to readings obtained from the on-site data logger. A bearing integrity check is performed with a torque wheel or a vane torque gauge.
- Wind Direction – The wind direction sensor is calibrated using a minimum of eight reference landmarks separated by approximately 45 degrees. Accuracy of the landmark bearings is verified by a minimum of two methods. In addition to sensor orientation and linearity checks, sensor bearings are tested using a torque wheel or a vane torque gauge.
- Precipitation – The tipping bucket rain gauge calibration is checked using a known volume of water introduced slowly into the gauge with a manufacturer-produced graduated cylinder. The designated value is compared with the recorded value.

PSD-grade meteorological sensors are also audited twice-annually by ARS.

B8 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES AND CONSUMABLES

2005-2007

VOC canisters and chain-of-custody forms were provided by the analytical laboratory (CAS). They also provided chain-of-custody forms. No consumables were required for meteorological stations.

2008-Present

Canisters, cartridges, hang tags, and chain-of-custody forms are provided by the analytical laboratory (ERG). No consumables are required for non-PSD-grade meteorological stations. For PSD-grade meteorological stations, certain components are replaced during each semiannual field specialist calibration visit. These include the bearings and potentiometer in the wind sensors. Operator log sheets are provided by ARS (see Appendix B).

B9 DATA ACQUISITION REQUIREMENTS FOR NON-DIRECT MEASUREMENTS

No non-direct measurements are currently used for the program. Information and non-direct measurements that may be used in conjunction with direct measurements may include aerial photographs of the western United States, and meteorology and visibility data collected in nearby areas. Satellite images may be taken with the National Oceanic and Atmospheric Association (NOAA) polar orbiter Advanced Very High Resolution Radiometer (AVHRR) satellites and are available on the World Wide Web.

B10 DATA MANAGEMENT

2005-2007

VOC canisters were mailed directly to the site operator by the analytical laboratory. The site operator exchanged canisters without handling internal filters directly. Canisters were changed according to the program schedule by the site operator, who shipped exposed canisters back to the analytical laboratory for analysis. The operator also measured and recorded vacuum readings before and after the canister changes, and documented the elapsed time of each data collection period. Validation was performed by the analytical laboratory (CAS). All VOC data were provided by CMC to GCPH on a monthly basis in an electronic file format.

Meteorological data were collected via Palm Pilot and downloading software. The site operator collected the data bi-weekly and delivered it to GCPH staff, where it was loaded onto a personal computer for review. These data were collected via professional-grade, but non-regulatory instruments.

2008-Present

NMOC canisters and carbonyl cartridges are mailed directly to the site operator from the analytical laboratory. The site operator exchanges the canisters and cartridges without handling internal filters directly. The site operator changes canisters and cartridges every 6 or 12 days, respectively, according to the program schedule, and ships the exposed units to the analytical laboratory. The operator also measures and records vacuum readings before and after canister changes, and documents the elapsed time of each 24-hour data collection period. The operator records the temperature and cartridge pressure drop for existing and new cartridges. Validation is performed by the analytical laboratory (ERG) following the data processing steps summarized in Figure B10-1. The laboratory delivers digital data files to ARS for inclusion in reports and data archive.

At the two non-PSD-grade stations, meteorological data are collected via Palm Pilot and downloading software. The site operator periodically collects the data and delivers the data set to GCPH staff, where it is loaded onto a personal computer for review. These data are collected via professional-grade, yet non-regulatory instruments. At the two PSD-grade stations, meteorological data are collected daily via cellular modem. ARS data analysts verify that all data are collected. Data are appended to the program database daily, and nightly backups of the database are performed. Data are reviewed daily to identify operational problems; data inconsistencies and complete validation is performed on a monthly basis. Archiving of raw data is performed on a monthly basis and archiving of all processed data is performed after data have

been finalized and reported. All files are in American Standard Code for Information Interchange (ASCII) format. Files are stored in their original formats (non-compressed) on computer hard drives and CD and at least three copies of CDs are created. Hard copies of supporting documentation are archived on a continual basis. Complete procedures for data collection, processing, and archiving are presented in SOP 3350, *Collection of Ambient Air Quality and Meteorological Monitoring Data and Site Documentation*, and SOP 3450, *Ambient Air Quality and Meteorological Monitoring Data Validation.*

Table B1-1. Garfield County VOC Monitoring Program Geographic Specifications of the Monitoring Sites.

Site Name and Abbr.	Elev. (ft)	Latitude	Longitude	Land Use
2005-2007 Monitoring Period (VOC and Meteorology Monitoring Stations)				
Glenwood Springs – Courthouse	5823	39° 32.843'N	107° 19.578'W	Urban
New Castle – Library	5574	39° 34.301'N	107° 32.080'W	Urban
Silt-Cox Ranch	5643	39° 33.976'N	107° 40.993'W	Rural
Butterfly	5981	39° 29.246'N	107° 37.693'W	Rural, Oil/Gas
Silt-Bell Ranch	5869	39° 29.148'N	107° 39.584'W	Rural, Oil/Gas
Silt-Daley Ranch	6378	39° 25.765'N	107° 38.464'W	Rural
Rifle	5351	39° 31.911'N	107° 46.932'W	Urban
Brock	6135	39° 29.306'N	107° 46.194'W	Rural, Oil/Gas
Isley	5833	39° 28.435'N	107° 51.528'W	Rural, Oil/Gas
Thompson	5951	39° 28.297'N	107° 51.561'W	Rural, Oil/Gas
West Landfill	5499	39° 30.895'N	107° 54.596'W	Rural, Oil/Gas
Sebold	5850	39° 27.886'N	107° 58.725'W	Rural, Oil/Gas
Haire	6017	39° 27.499'N	107° 58.742'W	Rural, Oil/Gas
Parachute	5125	39° 27.219'N	108° 03.196'W	Urban, Oil/Gas
2008-Current Monitoring Period (NMOC, Carbonyl Compounds, and Meteorology Monitoring Stations)				
Rifle Henry Building 144 3rd Street	5351	39° 31.911'N	107° 46.932'W	Urban
Parachute Old High School 100 E. 2nd Street	5125	39° 27.219'N	108° 03.196'W	Urban
Silt Bell-Melton Ranch 512 Owens Drive	5869	39° 29.148'N	107° 39.584'W	Rural, Oil/Gas
Mobile station:				
Brock (1/14/09 – 2/18/09)	6555	39° 29.305'N	107° 46.194'W	Rural , Oil/Gas
Rulison (1/22/09 – 2/12/10)	5183	39° 29.324'N	107° 56.219'W	Rural, Oil/Gas
Battlement Mesa (9/18/10 – current)	5402	39° 26.125'N	108° 2.172'W	Urban, Oil/Gas

Figure B1-1. Site Photographs – Glenwood Springs Courthouse. 6/2005-5/2007

Glenwood Springs Courthouse

VOC Canister, looking northeast

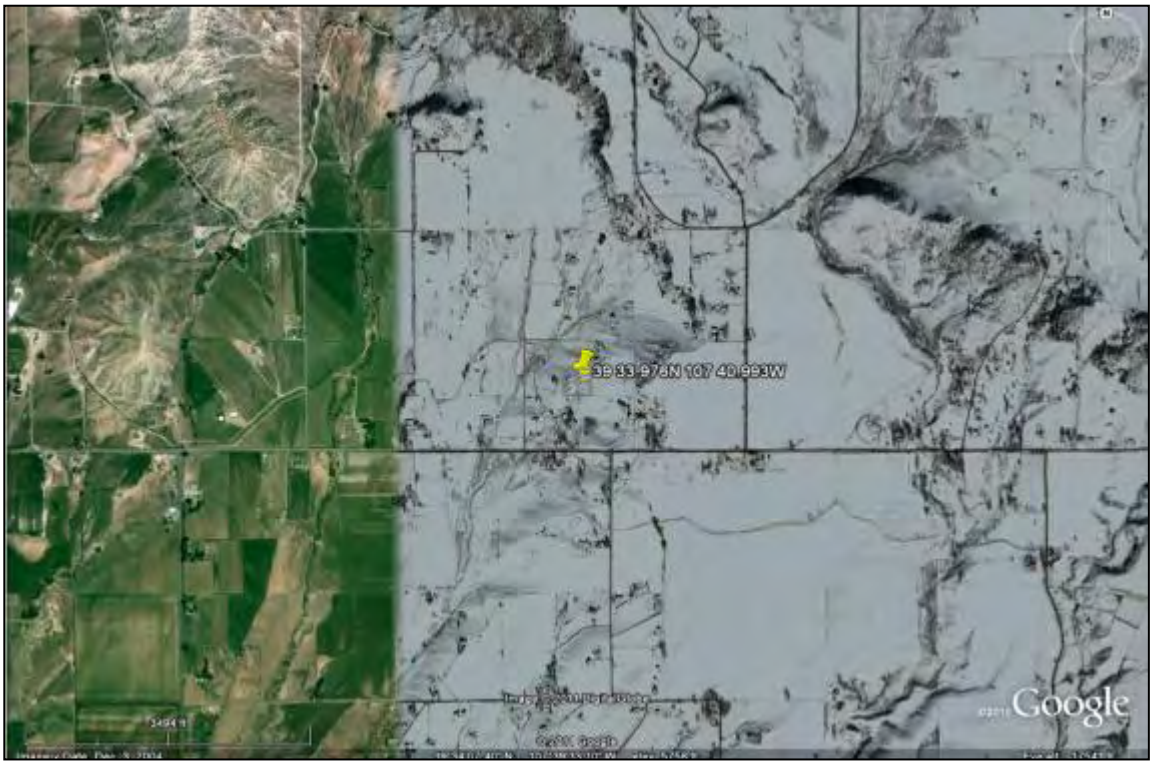
Figure B1-2. Site Photographs – New Castle – Library. 6/2005-5/2007

New Castle - Library

VOC Canister, looking west-southwest

Figure B1-3. Site Photographs – Silt – Cox Ranch. 6/2005-5/2007

Silt – Cox Ranch



VOC, Particulate Matter (PM), and Meteorology looking west

Figure B1-4. Site Photographs – Butterfly. 6/2005-5/2007

Butterfly

Figure B1-5. Site Photographs – Silt – Bell Ranch (6/2005 – present)

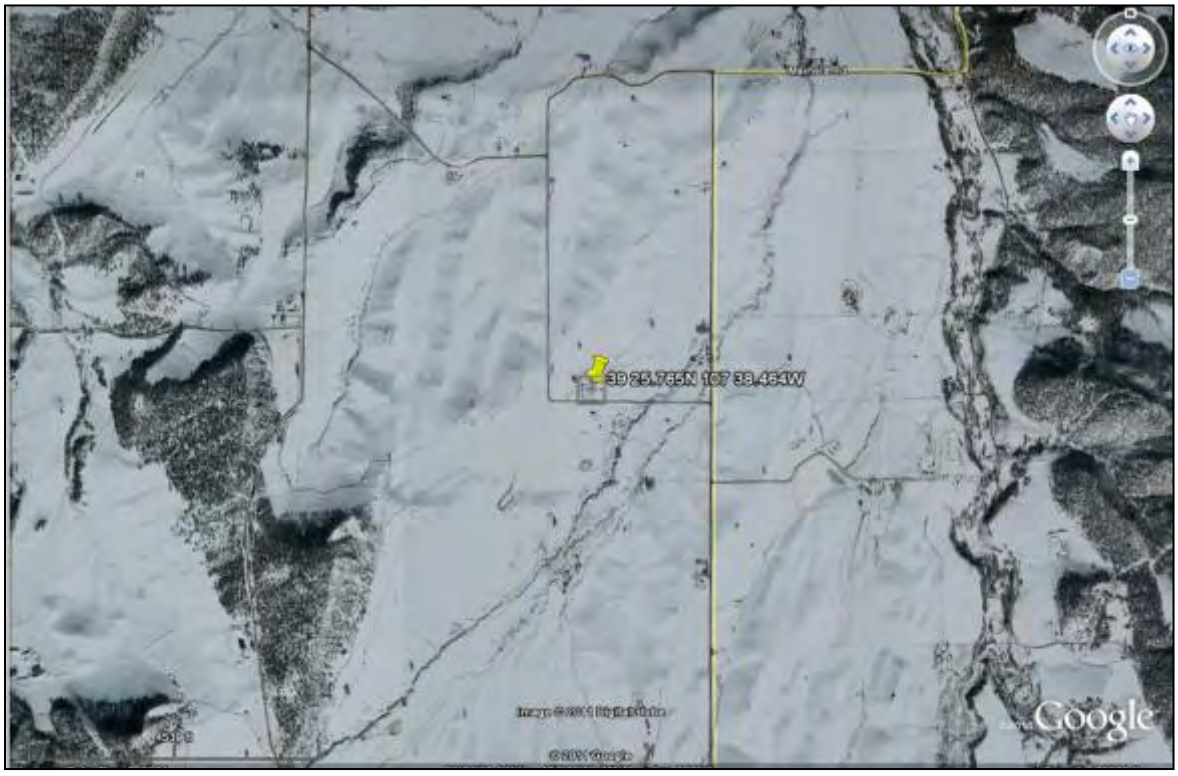
Silt – Bell Ranch

VOC, PM, and Meteorology looking west **6/2005-5/2007**

VOC, PM, and Meteorology looking east **5/2007-current**

Figure B1-6. Site Photographs – Silt – Daley Ranch. 6/2005-5/2007

Silt – Daley Ranch



VOC looking west-southwest

Figure B1-7. Site Photographs – Brock. 6/2005-1/2009

Brock

Brock

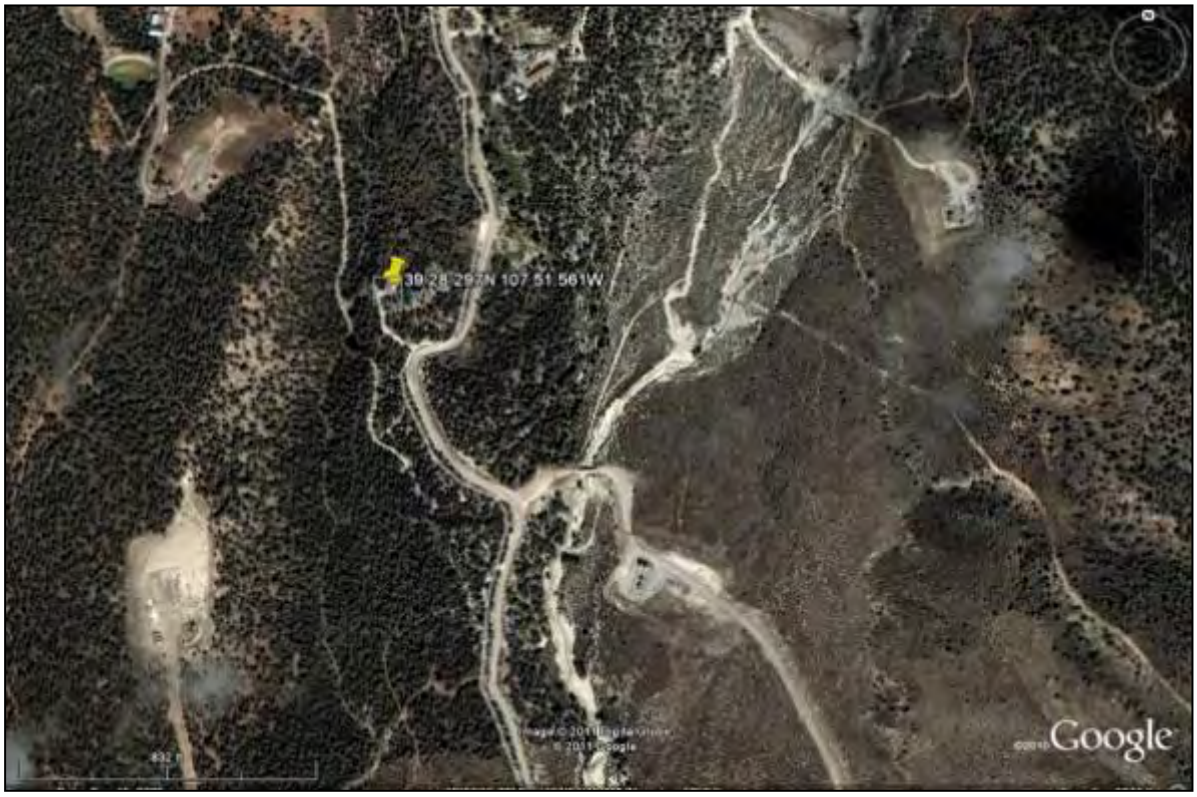
Figure B1-8. Site Photographs – Isley. 12/2005-5/2007

Isley

Isley

Figure B1-9. Site Photographs – Thompson. 6/2005-12/2005.

Thompson



Thompson

***** no photo – short sampling period *****

Figure B1-10. Site Photographs – West Landfill. 6/2005-5/2007

West Landfill

West Landfill

Figure B1-11. Site Photographs – Sebold. 6/2005-5/2007

Sebold

Sebold

Figure B1-12. Site Photographs – Haire. 6/2005-5/2007

Haire

Haire

Figure B1-13. Site Photographs – Rifle – Henry Building. 6/2005-present

Rifle – Henry Building

VOC, looking south-southwest

VOC, looking east (later configuration)

Figure B1-14. Site Photographs – Parachute. 6/2005-present

Parachute

Parachute, looking south-southwest

Parachute, looking south-southwest (later configuration)

Figure B1-15. Site Photographs – Battlement Mesa. 9/2010-current

Battlement Mesa

Battlement Mesa, looking west

Table B6-1. VOC/NMOC Monitoring Systems Routine Operations and Maintenance Requirements.

Air Toxics Systems Routine Field Procedures	
Procedure	Frequency
REGULAR MAINTENANCE (Site Operator) • General site/system inspection • Document the visit and pertinent events on the chain-of-custody log sheet • Exchange Siltek® canister, record vacuum on chain-of-custody form • Ship spent canister and chain-of-custody form to analytical laboratory	Monthly or quarterly (2005-2007) Every 6 days (2008-current)
SCHEDULED MAINTENANCE (ARS Field Specialist) • General site/system inspection • Recalibrate/maintain passive flow controllers (sent to ERG)	Every 12 months or as needed

Table B6-2. Carbonyl Monitoring Systems Routine Operations and Maintenance Requirements.

Carbonyl Systems Routine Field Procedures	
Procedure	Frequency
REGULAR MAINTENANCE (Site Operator) • General site/system inspection • Document the visit and pertinent events on the chain-of-custody log sheet • Exchange sorbent cartridge and document on chain-of-custody form • Ship spent cartridge and chain-of-custody form to analytical laboratory	Every 12 days
SCHEDULED MAINTENANCE (ARS Field Specialist) • General site/system inspection • Recalibrate/maintain sampling pumps (sent to SKC)	Every 12 months or as needed

Table B6-3. PSD-Grade Meteorological Monitoring Systems Routine Operations and Maintenance Requirements.

PSD-Grade Meteorological System Routine Field Procedures	
Procedure	Frequency
REGULAR MAINTENANCE (Site Operator) • Inspect overall system • Observe freedom of wind vane and anemometer cups/prop • Document observed weather conditions • Verify that temperature and wind measurements appear reasonable • Complete operator log sheet	Every 6 days
SCHEDULED MAINTENANCE (ARS Field Specialist) • Pre-maintenance calibration check of wind and temperature sensors • Perform system maintenance - Clean systems - Replace wind speed bearings - Replace wind vane potentiometer if required - Exchange temperature sensor with laboratory calibrated unit • Post-maintenance calibration of all sensors	Every 6 months

Table B7-1. Calibration Acceptance Criteria for the Garfield County VOC Monitoring Program.

Parameter	Calibration Method	Frequency	Criteria	Applicable Regulation	Calibration Acceptance Criteria
VOC / NMOC	None	N/A	N/A		N/A
Carbonyls	None	N/A	N/A		N/A
Temperature (PSD-grade)	Collocated transfer standard (non-immersible sensors)	Twice-annually	Max error	EPA QA Handbook for Air Pollution Measurement Systems: Vol IV	≤ ±0.5°C
Relative Humidity (PSD-grade)	Collocated reference standard	Twice-annually	Max error	EPA QA Handbook for Air Pollution Measurement Systems: Vol IV	≤ ±7%
Wind Speed (PSD-grade)	Compare to calibrated motor at 4 speeds	Twice-annually	Max error	EPA QA Handbook for Air Pollution Measurement Systems: Vol IV	≤ ±0.2 m/s at <5 m/s
Wind Direction (PSD-grade)	Solar azimuth, Precision compass, USGS map	Twice-annually	Max error	EPA QA Handbook for Air Pollution Measurement Systems: Vol IV	≤ ±5° from true degrees at any designated point
Precipitation (tipping bucket) (PSD-grade)	Addition of known water volume	Twice-annually	Max error	EPA QA Handbook for Air Pollution Measurement Systems: Vol IV	≤ ±10% of input volume

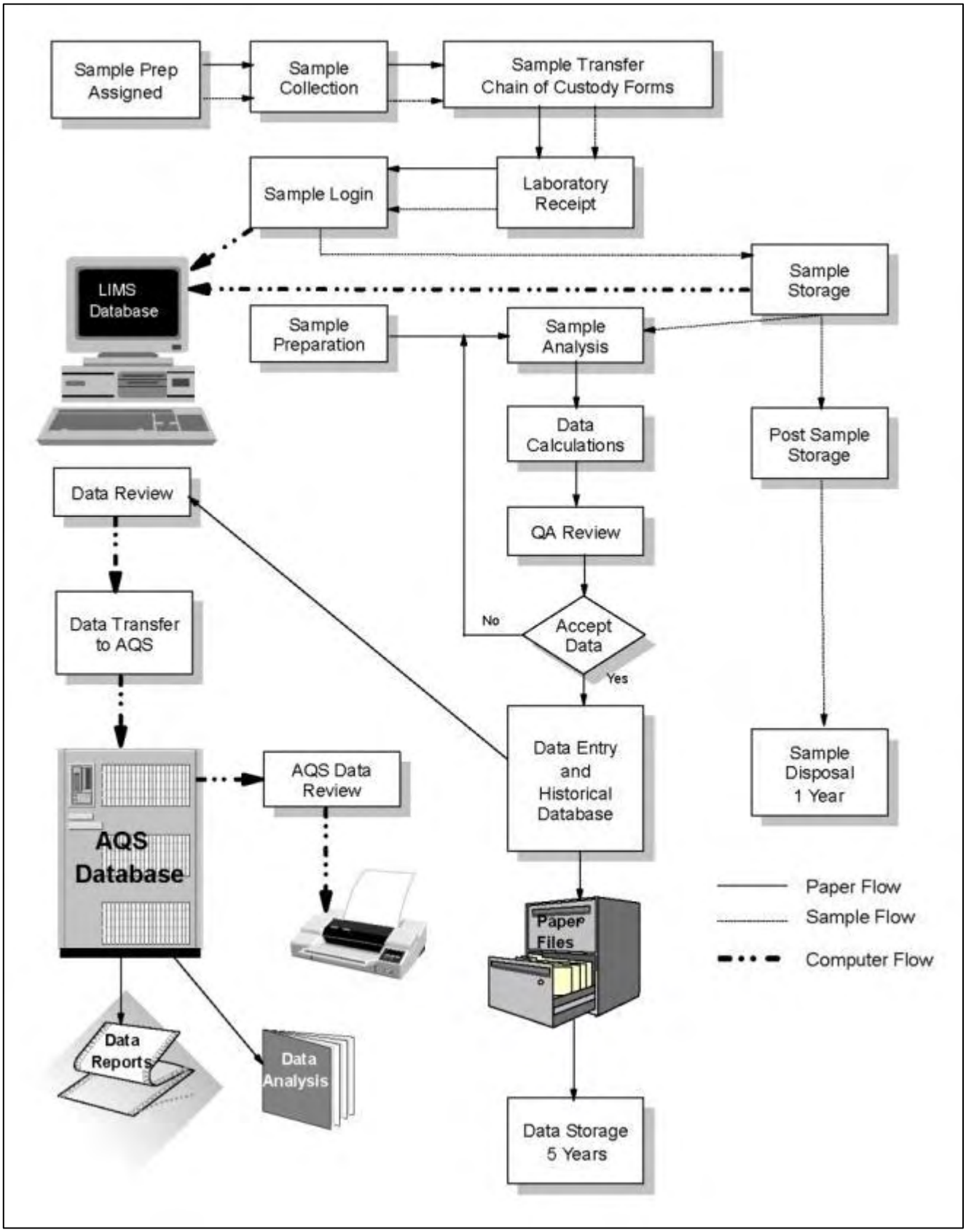


Figure B10-1. Laboratory Data Management and Sample Flow Diagram.

C ASSESSMENT/OVERSIGHT

This section describes the activities for assessing implementation of the Garfield County Volatile Organic Compounds Monitoring Program and associated quality assurance/quality control (QA/QC) activities. This section includes the following subsections:

C1 Assessments and Response Actions
C2 Reports to Management

C1 ASSESSMENTS AND RESPONSE ACTIONS

2005-2007

VOC analytical operations were assessed by CAS personnel in the laboratory. VOC and meteorological system operation were assessed during each site operator station visit.

The site operator visited the stations according to the program schedule and assessed the physical condition of all systems including wiring and tubing. The operator also replaced sample media and consumable supplies as needed and shipped the spent canisters to the analytical laboratory. Appropriate documentation was completed for each instrument. This regular physical inspection of instrumentation helped to ensure collection of quality assured data.

2008-Present

Assessments of the Garfield County VOC Monitoring Program include daily data checks, weekly operation checks, semiannual internal calibrations of the instrumentation, and twice-annual independent audits, as discussed below.

Daily Data Review

ARS data analysts download and review PSD-grade meteorological data daily. The review assesses operation of the systems, data completeness, and data quality. If any inconsistencies are noted, the program manager is notified and initiates corrective action.

Site Visits

Regular physical inspection of instrumentation is critical to collection of quality assured data. The site operator visits the stations every 6 or 12 days (canister sites and cartridge sites, respectively), and assesses the physical condition of all systems including wiring and tubing. The operator also reviews automated control checks and replaces sample media and consumable supplies as needed. The operator ships the spent canisters and cartridges to the analytical laboratory and completes documentation for each instrument.

Laboratory Receipt and Analysis

Canisters and cartridges are inspected upon receipt at the laboratory, along with their chain-of-custody forms, according to SOP ERG-MOR-045.

Semiannual Calibrations

Non-PSD-grade meteorological instrumentation do not receive any maintenance or calibration. ARS field specialists perform pre-maintenance checks of PSD-grade meteorological sensors prior to any service or adjustment. These checks are used to assess the "as found" response of the sensors. Sensors will be serviced upon acceptance testing of a new instrument, upon installation or removal from a monitoring location, whenever control limits are exceeded, prior to and following any corrective action or maintenance that affects its operation, or at a maximum interval of six months. Audit challenge ranges and acceptable criteria for meteorological sensors are identical to the calibration acceptance criteria listed in Table B7-1.

C2 REPORTS TO MANAGEMENT

2005-2007

Project updates were provided regularly to GCPH by CMC. A final report was prepared by GCPH and CDPHE and presented to the Garfield County Board of County Commissioners and the general public in early 2008.

2008-Present

Reports to GCPH include monthly program status reports, quarterly data submittals, and annual data reports, as described below.

Monthly Program Status Reports

Monthly status reports are delivered via e-mail to GCPH within 45 days of the month of record. They contain program status and schedule, including site visit maintenance, event summaries, pending contract information, preliminary validation of data, and stackplots depicting data values. Several ARS program staff are also sent this report.

Quarterly Data Submittal

Quarterly data submittals are delivered within 90 days of the end of each calendar quarter and include all types of data. The reports summarize the air quality, program status, and significant events that occurred during the previous calendar quarter.

Annual Data Reports

Annual data reports are prepared and delivered within 180 days after the end of the previous year of monitoring. These reports include collection statistics, data summaries, and integrated graphic and tabular presentations. Integrated analysis summaries include bar charts, stacked data plots, wind roses, pollutant roses, residence time maps, and other graphic presentations. Presentations that emphasize interrelationships among data types are also included.

D DATA VALIDATION AND USABILITY

This section describes the activities that occur after the data collection phase of the Garfield County VOC Monitoring Program is completed. This section includes the following subsections:

D1 Data Review, Validation, and Verification Requirements
D2 Validation and Verification Methods
D3 Reconciliation with User Requirements

D1 DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

Data validation requirements for the Garfield County VOC Monitoring Program follow protocols that have been adopted by EPA and are implemented throughout the United States. Sections A6 and A7 briefly discuss validation procedures. Validation requirements for each parameter are summarized below.

2005-2007

VOC canisters underwent specific analytical procedures as defined by EPA TO-14A and TO-15 protocols. Meteorology collected during this period were collected with professional-grade, non-regulatory instrumentation and were not validated.

2008-Present

NMOC canisters and carbonyl cartridges undergo specific analytical procedures as defined by EPA methods TO-12 and TO-11A, respectively. After a reporting batch is completed at the laboratory, a thorough review of data is conducted for completeness and data entry accuracy. Once the data are transferred to the LIMS database, they are reviewed for routine outliers and data outside acceptance criteria. Each sample is logged into LIMS. Accompanying field forms are reviewed to verify that all data entry is complete and correct. During data validation, data are filtered and accepted or rejected based on QA criteria in ERG's SOPs (see Appendix C).

The two non-PSD-grade meteorology stations continue to collect data identical to the 2005-2007 period. PSD-grade station data undergo complete validation as defined by EPA protocols, as detailed in SOP 3450, *Ambient Air Quality and Meteorological Monitoring Data Validation*. Data are processed through three levels of validation by ARS personnel. Data are reviewed daily and validation is completed quarterly.

D2 VALIDATION AND VERIFICATION METHODS

Data validation methods for the Garfield County VOC Monitoring Program follow protocols that have been adopted by EPA and are implemented throughout the United States. Validation methods for each parameter are summarized below.

2005-2007

VOC data validation followed EPA compendium methods TO-14A and TO-15. Meteorology data were collected with professional-grade, non-regulatory instruments and were not validated.

2008-Present

NMOC and carbonyl data validation follow EPA compendium protocols TO-12 and TO-11A, respectively. Meteorology data at two stations are collected with professional-grade non-regulatory instruments and are not validated. Meteorology data at the other two stations are collected with PSD-grade instruments following SOP 3450, *Ambient Air Quality and Meteorological Monitoring Data Validation*. A flowchart detailing these procedures is presented as Figure D2-1.

D3 RECONCILIATION WITH USER REQUIREMENTS

Garfield County oversees an air quality study designed to characterize the current exposure of the general population of Garfield County to VOCs, NMOCs, and carbonyl compounds. Meteorological monitoring systems also operated alongside air toxics systems to assist in determining the direction and extent of travel of compounds. Beginning in 2008, two of the four operating meteorology systems were converted to EPA PSD-grade monitoring protocols to provide scientifically defensible data. Data are expected to provide a true representation of these atmospheric constituents in the area, and fulfill GCPH goals and objectives, which are defined in Section A5.

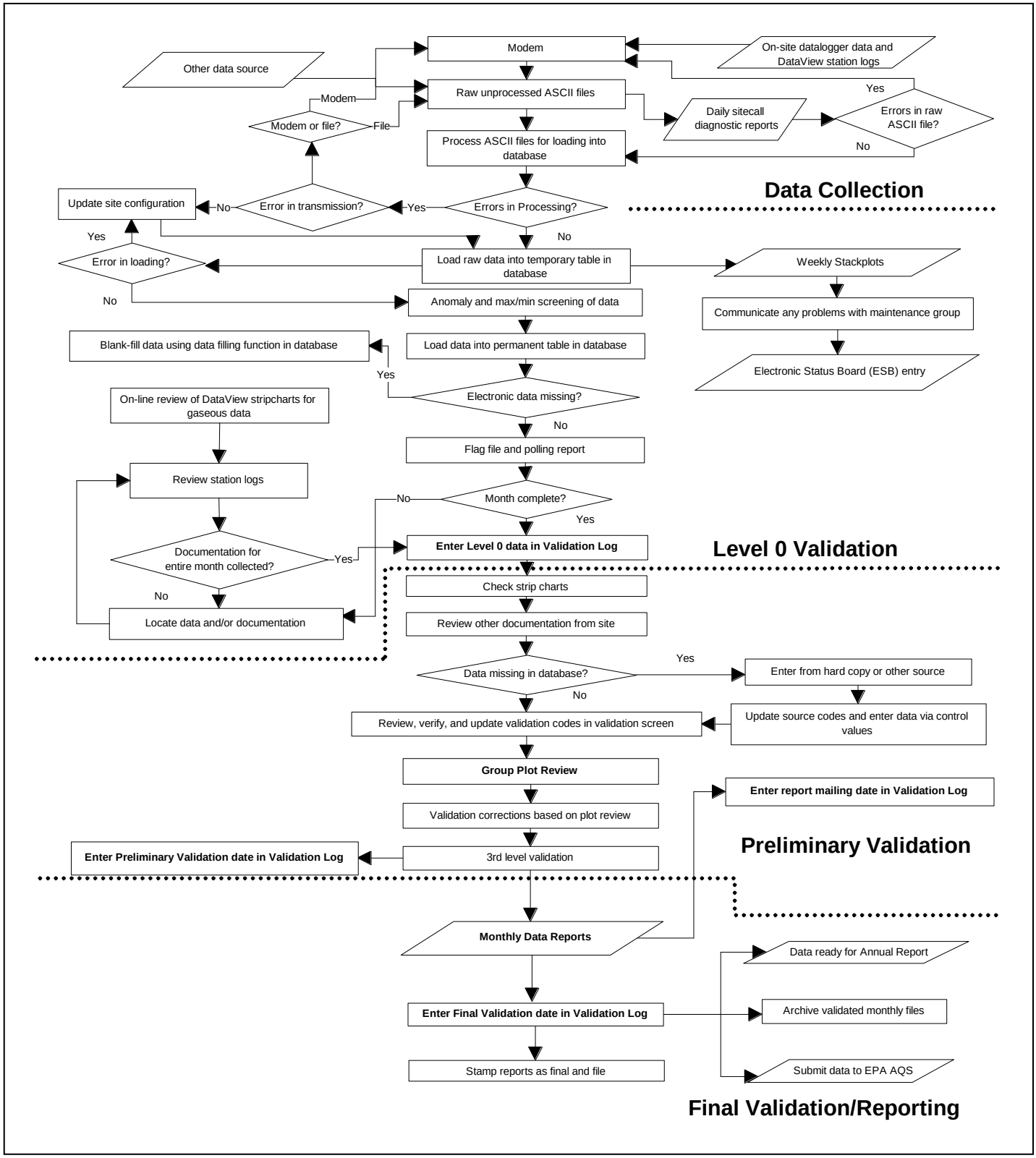


Figure D2-1. Meteorological Data Validation Flowchart.

REFERENCES

40 CFR 58 — Appendix A. *Quality Assurance Requirements for SLAMS, SPMs and PSD Air Monitoring*

40 CFR 58 — Appendix C. *Ambient Air Quality Monitoring Methodology*.

40 CFR 136 — Appendix B. *Definition and Procedure for the Determination of the Method Detection Limit*

EPA/625/R-96-010b — EPA Compendium Method TO-11A: *Determination of Formaldehyde in Ambient Air Using Absorbent Cartridge Followed by High Performance Liquid Chromatography (HPLC)*

EPA/625/R-96-010b — EPA Compendium Method TO-12: *Determination of Non-Methane Organic Compounds (NMOC) in Ambient Air Using Cryogenic Preconcentration and Direct Flame Ionization Detection (PDFID)*

EPA/625/R-96/010b — EPA Compendium Method TO-14A: *Determination of Volatile Organic Compounds (VOCs) In Ambient Air Using Specially Prepared Canisters With Subsequent Analysis By Gas Chromatography*

EPA/625/R-96/010b — EPA Compendium Method TO-15: *Determination of Volatile Organic Compounds (VOCs) in Air Collected in Specially-Prepared Canisters and Analyzed by Gas Chromatography/Mass Spectrometry (GC/MS)*

EPA/600/R-94/038a — EPA Quality Assurance Handbook for Air Pollution Measurement Systems: Volume I, A Field Guide to Environmental Quality Assurance (*http://www.epa.gov/ttn/amtic/files/ambient/qaqc/r94-038a.pdf*)

EPA-454/R-98-004 — Volume II, Ambient Air Quality Monitoring Program Quality System Development (*http://www.epa.gov/ttn/amtic/files/ambient/qaqc/redbook.pdf*)

EPA/600/R-94/038d — Volume IV, Meteorological Measurements (*http://www.epa.gov/scram001/guidance/met/vol4metmeas1.pdf*)

EPA-454/R-99-005 — Meteorological Monitoring Guidance for Regulatory Modeling Applications (*http://www.epa.gov/scram001/guidance/met/mmgma.pdf*)

EPA-450/4-87-007 — Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD) (*http://www.epa.gov/ttn/amtic/files/ambient/criteria/reldocs/4-87-007.pdf*)

EPA/240/R-02/009 — EPA Guidance for Quality Assurance Project Plans (EPA QA/G-5) (*http://www.epa.gov/quality1/qs-docs/g5-final.pdf*)

EPA/240/B-001/003 — EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5) (*http://www.epa.gov/quality1/qs-docs/r5-final.pdf*)

Garfield County Public Health and Colorado Department of Public Health and Environment, December 2007, Garfield County Ambient Air Quality Monitoring Study June 2005 – May 2007. *http://www.garfieldcountyaq.net/default_new.aspx*

APPENDIX A – Lists of Compounds Analyzed

June 2005 – December 2007

CAS #	Compound
74-87-3	Chloromethane
75-01-4	Vinyl Chloride
74-83-9	Bromomethane
75-00-3	Chloroethane
67-64-1	Acetone
75-69-4	Trichlorofluoromethane
75-35-4	1,1-Dichloroethene
75-09-2	Methylene chloride
76-13-1	Trichlorotrifluoroethane
75-15-0	Carbon Disulfide
156-60-5	trans-1,2-Dichloroethene
75-34-3	1,1-Dichloroethane
1634-04-4	Methyl tert-Butyl Ether
108-05-4	Vinyl Acetate
78-93-3	2-Butanone (MEK)
156-59-2	cis-1,2-Dichloroethene
67-66-3	Chloroform
107-06-2	1,2-Dichloroethane
71-55-6	1,1,1-Trichloroethane
71-43-2	Benzene
56-23-5	Carbon Tetrachloride
78-87-5	1,2-Dichloropropane
75-27-4	Bromodichloromethane
79-01-6	Trichloroethene
10061-01-5	cis-1,3-Dichloropropene
108-10-1	4-Methyl-2-pentanone
10061-02-6	trans-1,3-Dichloropropene
79-00-5	1,1,2-Trichloroethane
108-88-3	Toluene
591-78-6	2-Hexanone
124-48-1	Dibromochloromethane
106-93-4	1,2-Dibromoethane
127-18-4	Tetrachloroethene
108-90-7	Chlorobenzene
100-41-4	Ethylbenzene
136777-61-2	*m,p*-Xylenes
75-25-2	Bromoform
100-42-5	Styrene
95-47-6	o-Xylene
79-34-5	1,1,2,2-Tetrachloroethane
541-73-1	1,3-Dichlorobenzene
106-46-7	1,4-Dichlorobenzene
95-50-1	1,2-Dichlorobenzene

2008 - Current

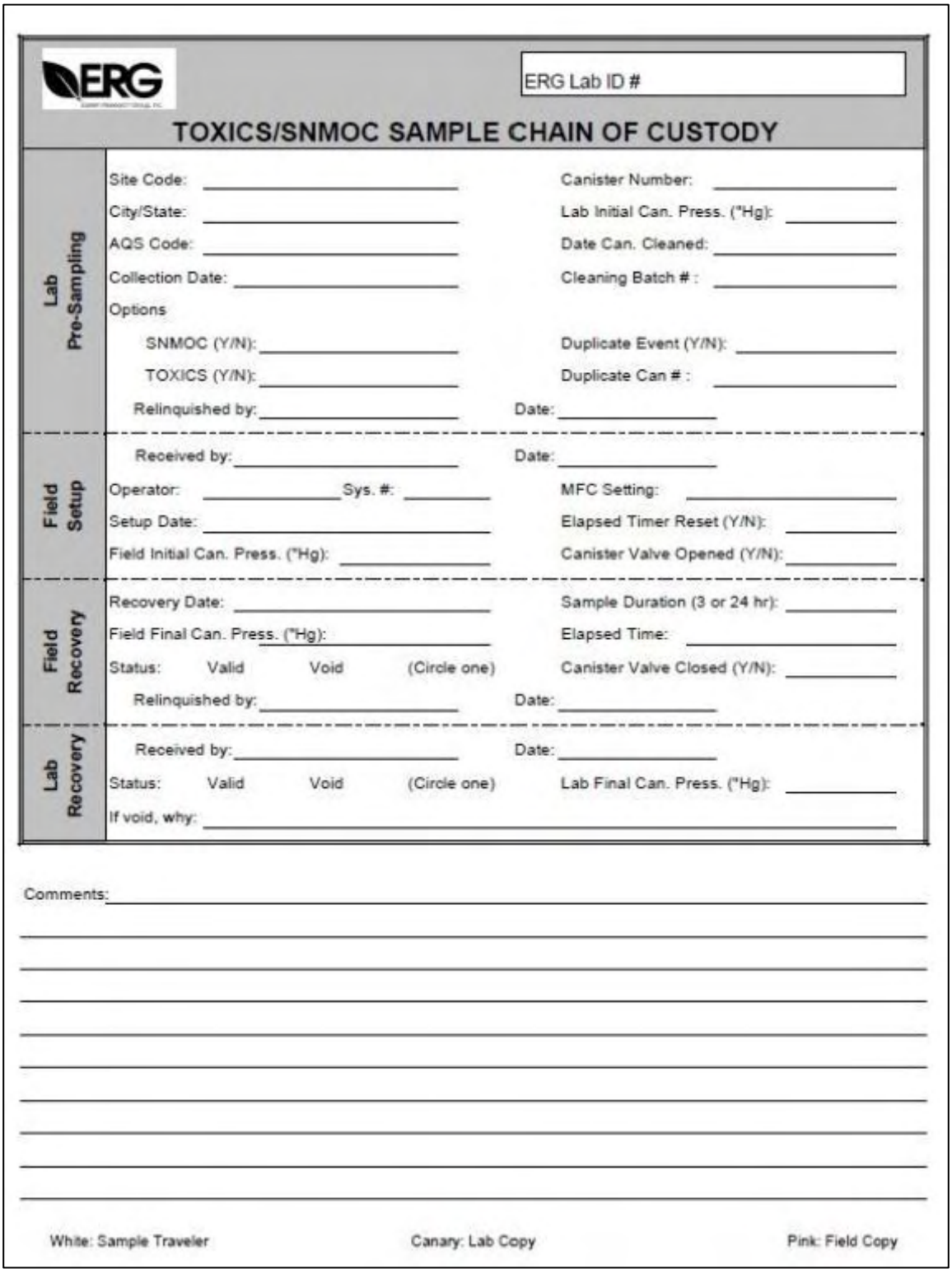
SNMOC[5] Target Compounds

Compound	
Ethylene	2,3-Dimethylpentane
Acetylene	3-Methylhexane
Ethane	1-Heptene
Propylene	2,2,4-Trimethylpentane
Propane	*n*-Heptane
Propyne	Methylcyclohexane
Isobutane	2,2,3-Trimethylpentane
Isobutene	2,3,4-Trimethylpentane
1-Butene	Toluene
1,3-Butadiene	2-Methylheptane
n-Butane	3-Methylheptane
trans-2-Butene	1-Octene
cis-2-Butene	*n*-Octane
3-Methyl-1-Butene	Ethylbenzene
Isopentane	*m,p*-Xylene
1-Pentene	Styrene
2-Methyl-1-Butene	*o*-Xylene
n-Pentane	1-Nonene
Isoprene	*n*-Nonane
trans-2-Pentene	Isopropylbenzene
cis-2-Pentene	*n*-Propylbenzene
2-Methyl-2-Butene	α-Pinene
2,2-Dimethylbutane (Neohexane)	*m*-Ethyltoluene
Cyclopentene	*p*-Ethyltoluene
4-Methyl-1-Pentene	1,3,5-Trimethylbenzene
2,3-Dimethylbutane	*o*-Ethyltoluene
Cyclopentane	β-Pinene
2-Methylpentane (Isohexane)	1,2,4-Trimethylbenzene
3-Methylpentane	1-Decene
2-Methyl-1-Pentene	*n*-Decane
1-Hexene	1,2,3-Trimethylbenzene
2-Ethyl-1-Butene	*m*-Diethylbenzene
n-Hexane	*p*-Diethylbenzene
trans-2-Hexene	1-Undecene
cis-2-Hexene	*n*-Undecane
Methylcyclopentane	Dodecene
2,4-Dimethylpentane	*n*-Dodecane
Benzene	Tridecene
Cyclohexane	*n*-Tridecane
2-Methylhexane (Isoheptane)	Total NMOC

Carbonyl[6] Target Compounds

Compounds	
Formaldehyde	Isovaleraldehyde
Acetaldehyde	Valeraldehydes
Propionaldehyde	Tolualdehydes
Crotonaldehyde	Hexaldehyde
Butyraldehyde	2,5-Dimethylbenzaldehyde
Isobutyraldehyde	Acetone
Benzaldehyde	

APPENDIX B – Chain-of-Custody Forms and Field Log Sheets



ERG Lab ID #

TOXICS/SNMOC SAMPLE CHAIN OF CUSTODY

Lab Pre-Sampling

Site Code: _____ Canister Number: _____

City/State: _____ Lab Initial Can. Press. ("Hg): _____

AQS Code: _____ Date Can. Cleaned: _____

Collection Date: _____ Cleaning Batch # : _____

Options

SNMOC (Y/N): _____ Duplicate Event (Y/N): _____

TOXICS (Y/N): _____ Duplicate Can # : _____

Relinquished by: _____ Date: _____

Field Setup

Received by: _____ Date: _____

Operator: _____ Sys. #: _____ MFC Setting: _____

Setup Date: _____ Elapsed Timer Reset (Y/N): _____

Field Initial Can. Press. ("Hg): _____ Canister Valve Opened (Y/N): _____

Field Recovery

Recovery Date: _____ Sample Duration (3 or 24 hr): _____

Field Final Can. Press. ("Hg): _____ Elapsed Time: _____

Status: Valid Void (Circle one) Canister Valve Closed (Y/N): _____

Relinquished by: _____ Date: _____

Lab Recovery

Received by: _____ Date: _____

Status: Valid Void (Circle one) Lab Final Can. Press. ("Hg): _____

If void, why: _____

Comments: _____

White: Sample Traveler Canary: Lab Copy Pink: Field Copy

Example NMOC Canister Chain-of-Custody Form (2008-current).

ERG Lab ID #

CARBONYL COMPOUNDS CHAIN OF CUSTODY

Lab Pre-Samp.

Site Code: _____ Collection Date: _____

City/State: _____ Cartridge Lot #: _____

AQS Code: _____ Duplicate Event (Y/N): _____

Relinquished by: _____ Date: _____

Field Setup

Received by: _____ Date: _____

Set-Up Date: _____ Operator: _____ Sys. #: _____

Pre-Sampling Rotameter Reading (cc/min): _____ Elapsed Timer Reset (Y/N): _____

Field Recovery

Recovery Date: _____ Sample Duration (3 or 24 hr): _____

Post Sampling Rotameter Reading (cc/min): _____ Elapsed Time: _____

Cartridges Capped (Y/N): _____ Status: Valid Void (Circle one)

Relinquished by: _____ Date: _____

Lab Recovery

Received by: _____ Date: _____

Status: Valid Void (Circle one) Temperature: _____

If void, why: _____

Sample Volume (total Liters): _____

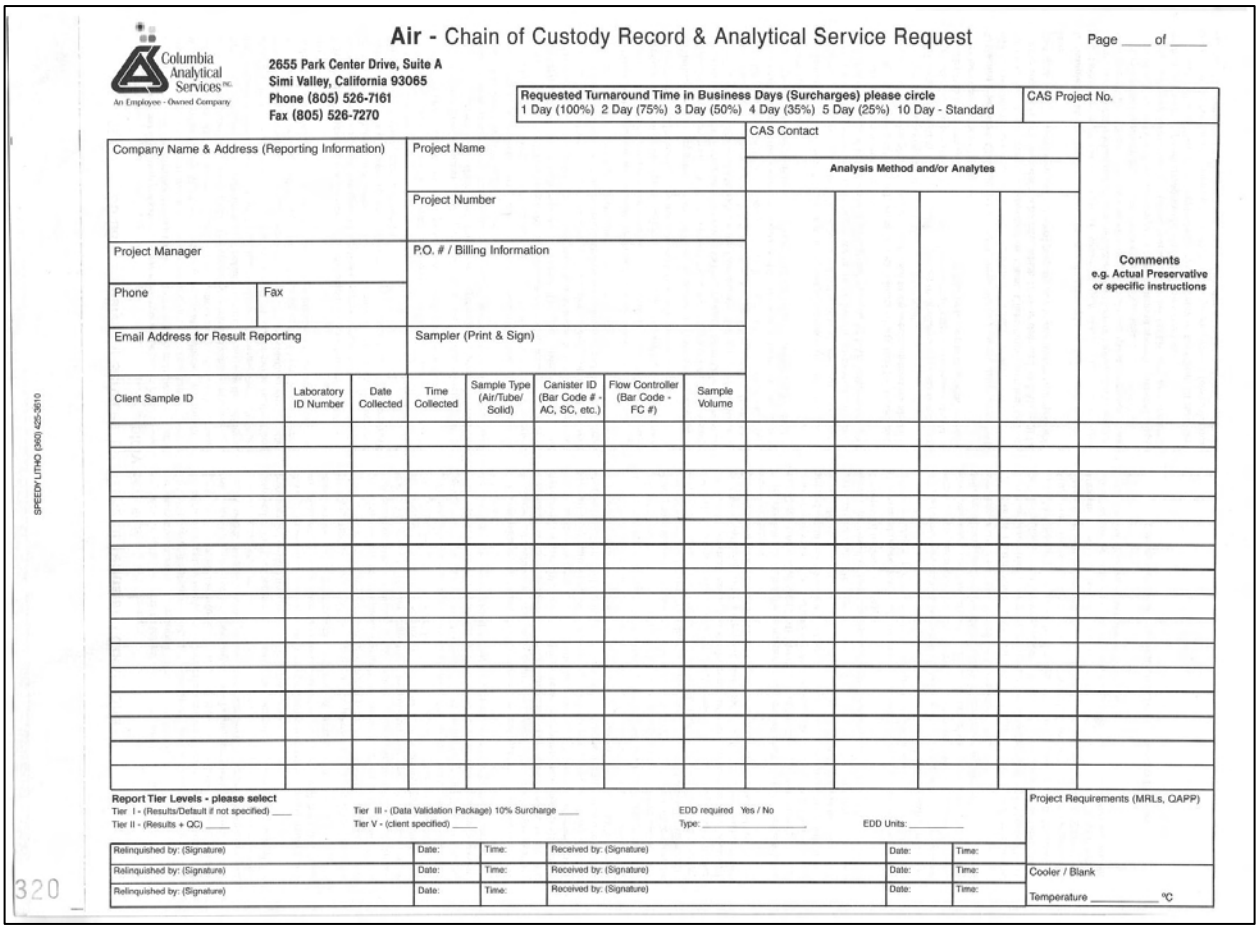
PAMS

Sample Date	Sample Time	Sample Duration	Sample Volume	Cartridge Lot #	Sample ID	Lab ID

Comments: _____

White: Sample Traveler Canary: Lab Copy Pink: Field Copy

Example Carbonyl Cartridge Chain-of-Custody Form (2008-current).



Air - Chain of Custody Record & Analytical Service Request

Page ____ of ____

Columbia Analytical Services INC.
An Employee - Owned Company

2655 Park Center Drive, Suite A
Simi Valley, California 93065
Phone (805) 526-7161
Fax (805) 526-7270

Requested Turnaround Time in Business Days (Surcharges) please circle
1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (25%) 10 Day - Standard

CAS Project No.

Company Name & Address (Reporting Information)

Project Name

Project Number

CAS Contact

Analysis Method and/or Analytes

Project Manager

P.O. # / Billing Information

Phone | Fax

Email Address for Result Reporting

Sampler (Print & Sign)

Comments
e.g. Actual Preservative or specific instructions

Client Sample ID	Laboratory ID Number	Date Collected	Time Collected	Sample Type (Air/Tube/ Solid)	Canister ID (Bar Code # - AC, SC, etc.)	Flow Controller (Bar Code - FC #)	Sample Volume					

Report Tier Levels - please select
Tier I - (Results/Default if not specified) ____
Tier II - (Results + QC) ____
Tier III - (Data Validation Package) 10% Surcharge ____
Tier V - (client specified) ____

EDD required Yes / No
Type: _____ EDD Units: _____

Project Requirements (MRLs, QAPP)

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Date:	Time:

Cooler / Blank
Temperature _____ °C

SPEEDY LITHO (949) 425-3610

320

Example NMOC Canister Chain-of-Custody Form (2005-2007).

Columbia Analytical Services INC.
An Employee - Owned Company

SUMMA CANISTERS

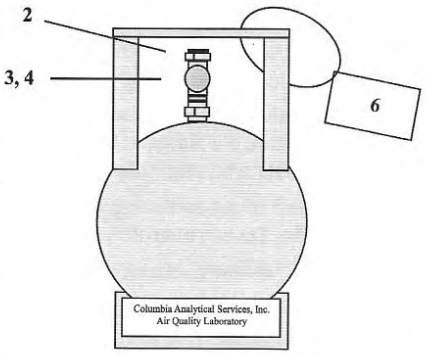
SAMPLING WITH A SUMMA CANISTER - HOW TO TAKE A GRAB SAMPLE

EQUIPMENT:

Summa or Silco canister – cleaned, evacuated, valve checked for leakage, and certified by CAS Air Quality Laboratory prior to shipment.

PROCEDURE:

1. Ensure that the valve is fully closed (the green knob should be turned completely clockwise).
2. Using a 9/16" wrench, remove the brass cap above the valve on the top of the Summa canister.
3. To fully open the canister valve, turn the green knob counterclockwise until there is no resistance. This is approximately 1¼ turns. You will hear a hissing noise as the vacuum dissipates and air flows in.
4. Once the hissing noise stops, the vacuum has fully dissipated, and your sample has been collected. This takes approximately 5-10 seconds. Close the valve by turning the green knob clockwise.
5. Replace the brass cap. Tighten it with a 9/16" wrench.



6. Label the sample with the tag provided, then attach the tag to the canister with the plastic tie. Complete a chain of custody form.
7. Place the chain of custody form, along with the canister, back into the original box in which it was shipped to you.

IMPORTANT NOTES:

- *Care must be used with the canister valves. DO NOT OVER-TIGHTEN THE VALVES.*
- *Do NOT connect to a source with positive pressure greater than 40 psi.*
- *The valve fitting is a ¼" male Swagelok fitting.*
- *Do not remove the bar code or serial number labels from the canisters.*
- *Do not make any markings directly on the canister or affix any labels.*
- *Please call the laboratory with any questions regarding proper shipping of canisters.*

2655 Park Center Drive, Suite A
Simi Valley, California 93065
TEL 805.526.7161
FAX 805.526.7270

WWW.CASAIRLAB.COM
805.526.7161

O:\PROMO\SUMMA_CANISTER_SAMP_FLYER (8/11/07)

Example Canister Field Handling Instructions (2005-2007).

Garfield County Air Quality Station
Meteorological Monitoring Monthly Check

Site_____ Date_____ Operator_____

1. Inspect and record overall system including wiring and tripod. _____

_____

2. Does the wind vane and propeller move freely? Y N

3. Check the time and date on the data logger in the upper left hand corner of the screen.

Data logger time _____MST Actual Time_____MST

The data logger time is always set to Mountain Standard Time. If time is off by more then 2 minutes contact ARS 970-484-7941.

4. Record the following values from the data logger and the TEOM. To observe the TEOM values press the "TEOM DATA" button and record the "1 Hr. MC" values.

LOGGER VALUES	**TEOM VALUES MC (Top Line)**
PM10 _____	PM 10 _____
PMFINE _____	PM 2.5 _____
PMCORS _____	PM Coarse _____

Do the values agree within 5 micrograms per cubic meter? Y N

4. Record the current conditions from the data logger.

TMP _____ degrees C	RS_____ m/s
RH_____%	RD_____ degrees
WS_____ m/s	ITEMP_____ degrees C
WD_____degrees	SIGMA_____ degrees

5. Record the current weather conditions. _____

_____

6. Do the data logger values agree with the current conditions? Y N

Keep a copy in site notebook after faxing to:
Data Coordinator, Air Resource Specialists, Inc.; 1901 Sharp Point Drive, Suite E; Fort Collins, CO 80525
Telephone: 970-484-7941 Fax: 970/484-3423

Example Meteorological Field Log sheet (2008-current).

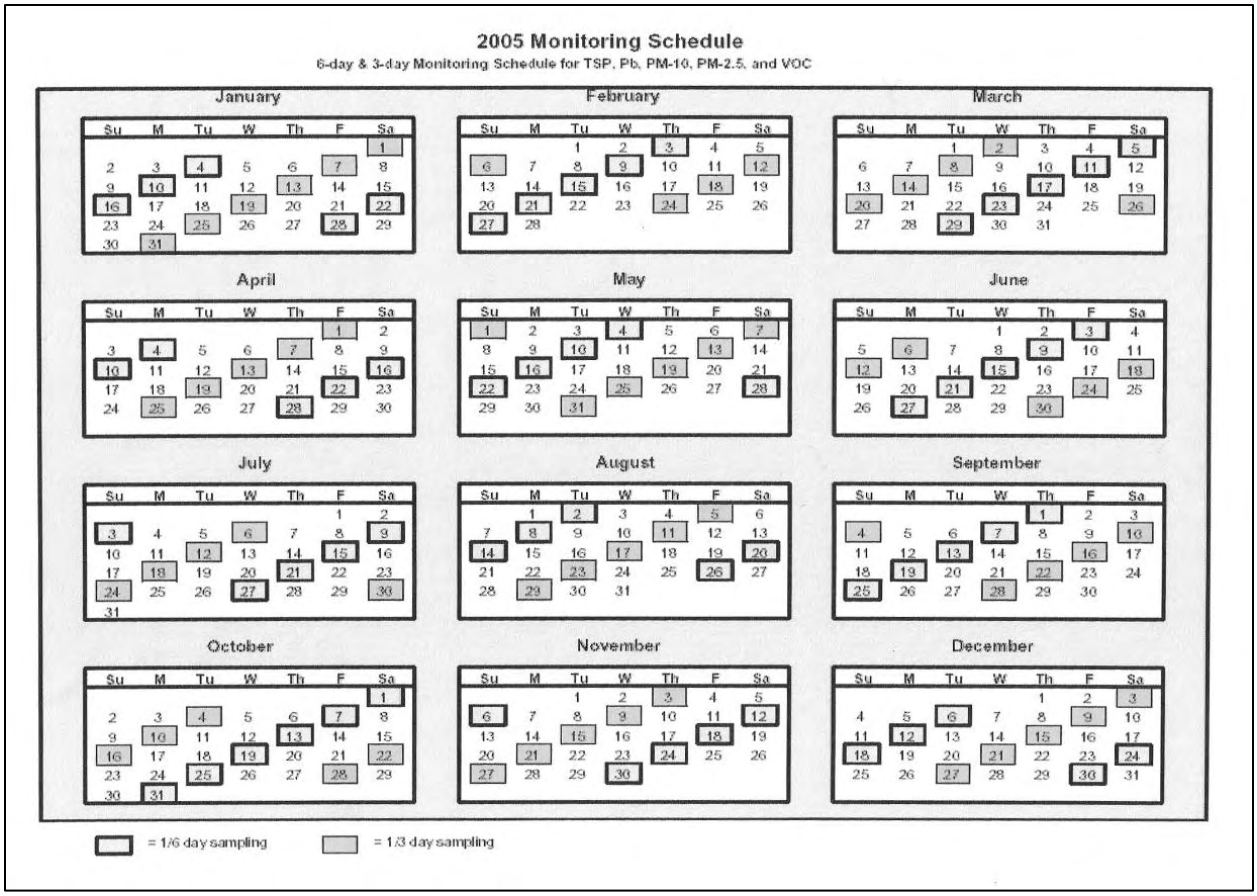
APPENDIX C - Eastern Research Group Quality Assurance Documents

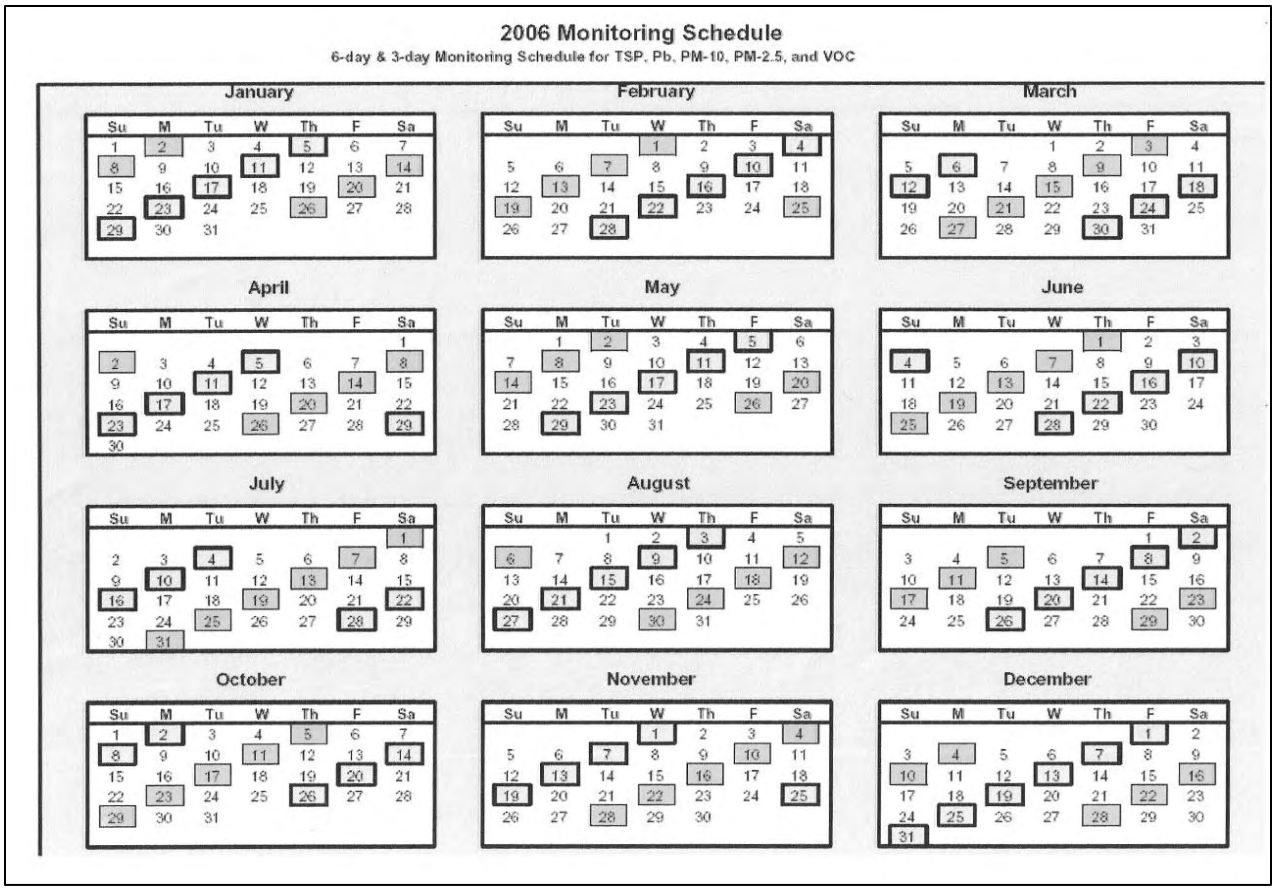
The following quality assurance manuals are used in executing this program, beginning in 2008. These documents were written by the analytical laboratory, Eastern Research Group and their general policies and instructions are applied to the Garfield County VOC Monitoring Program.

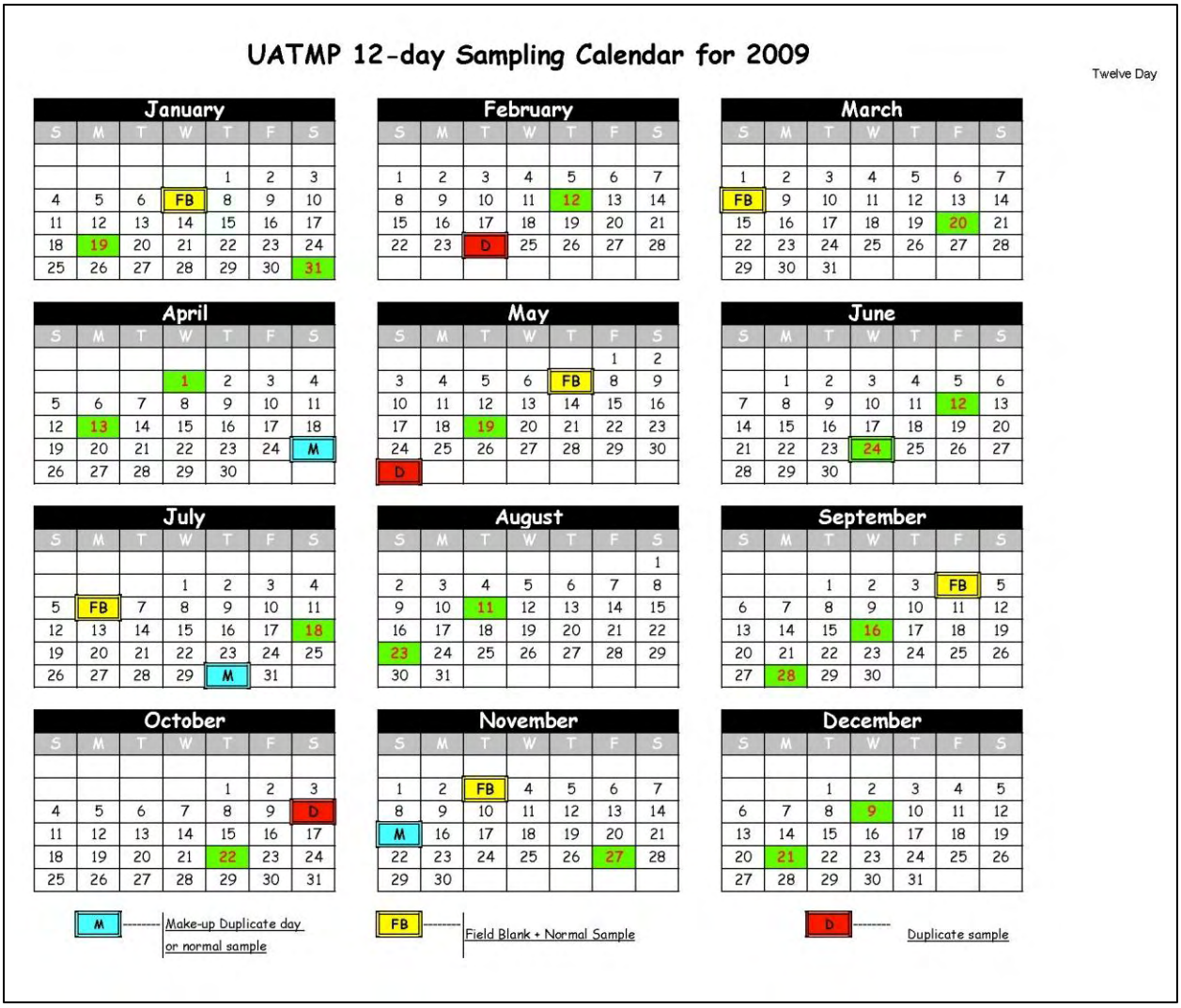
Number	Title	QAPP Section(s)
ERG-MOR-024	Standard Operating Procedure for Preparing, Extracting, and Analyzing DNPH Carbonyl Cartridges by Method TO-11A	
ERG-MOR-045	Standard Operating Procedure for Sample Receipt at the ERG Chemistry Laboratory	**B3, B5, C1**
ERG-MOR-046	Field Procedure for Collecting Speciated and/or Total Nonmethane Organic Compounds Ambient Air Samples Using the ERG SNMOC Sampling System	**B4**
ERG-MOR-047	Field Procedure for Collecting Ambient Carbonyl Compounds Samples Using the ERG C Sampling System	**B4**
ERG-MOR-060	Standard Operating Procedure for PDFID Sample Analysis by Method TO-12	
ERG-MOR-061	Standard Operating Procedure for Standard Preparation Using Dynamic Flow Dilution System	**B5**
ERG-MOR-062	Standard Operating Procedure for Sample Canister Cleaning	**B3**
ERG-MOR-079	Standard Operating Procedure for Sample Login to the Laboratory Information Management System	**B3, B5**
	Support for the EPA National Monitoring Programs (UATMP, NATTS, CSATAM, PAMS, and NMOC Support)	

***** lab qapp here *****

APPENDIX D – Garfield County VOC Filter Change Schedules




2006 Monitoring Schedule
6-day & 3-day Monitoring Schedule for TSP, Pb, PM-10, PM-2.5, and VOC
January
February
March
April
May
June
July
August
September
October
November
December



UATMP 12-day Sampling Calendar for 2009

Twelve Day

January

S	M	T	W	T	F	S
				1	2	3
4	5	6	FB	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

February

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	D	25	26	27	28

March

S	M	T	W	T	F	S
1	2	3	4	5	6	7
FB	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

April

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	M
26	27	28	29	30		

May

S	M	T	W	T	F	S
					1	2
3	4	5	6	FB	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
D						

June

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

July

S	M	T	W	T	F	S
			1	2	3	4
5	FB	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	M	31	

August

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

September

S	M	T	W	T	F	S
		1	2	3	FB	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

October

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	D
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

November

S	M	T	W	T	F	S
1	2	FB	4	5	6	7
8	9	10	11	12	13	14
M	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

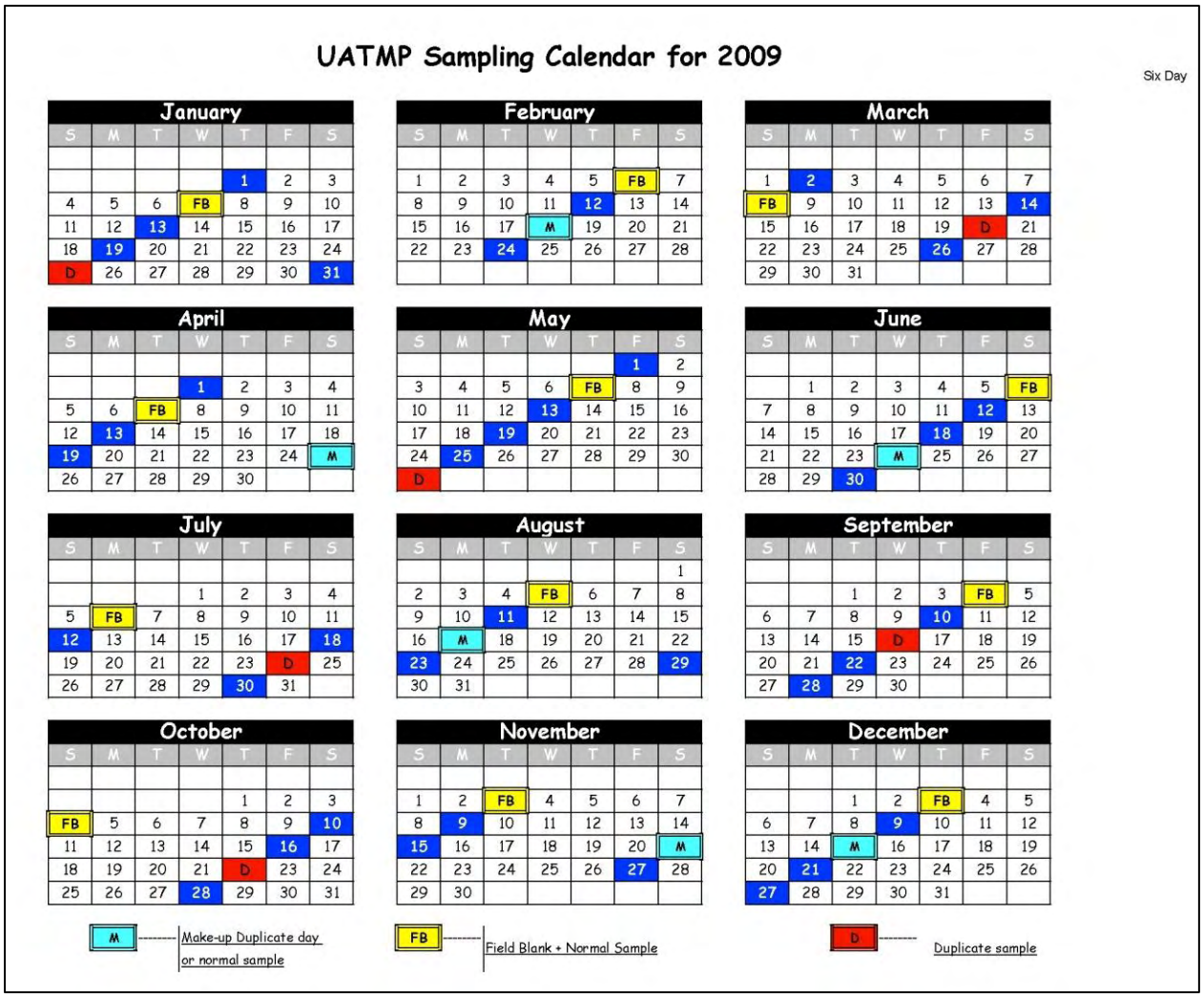
December

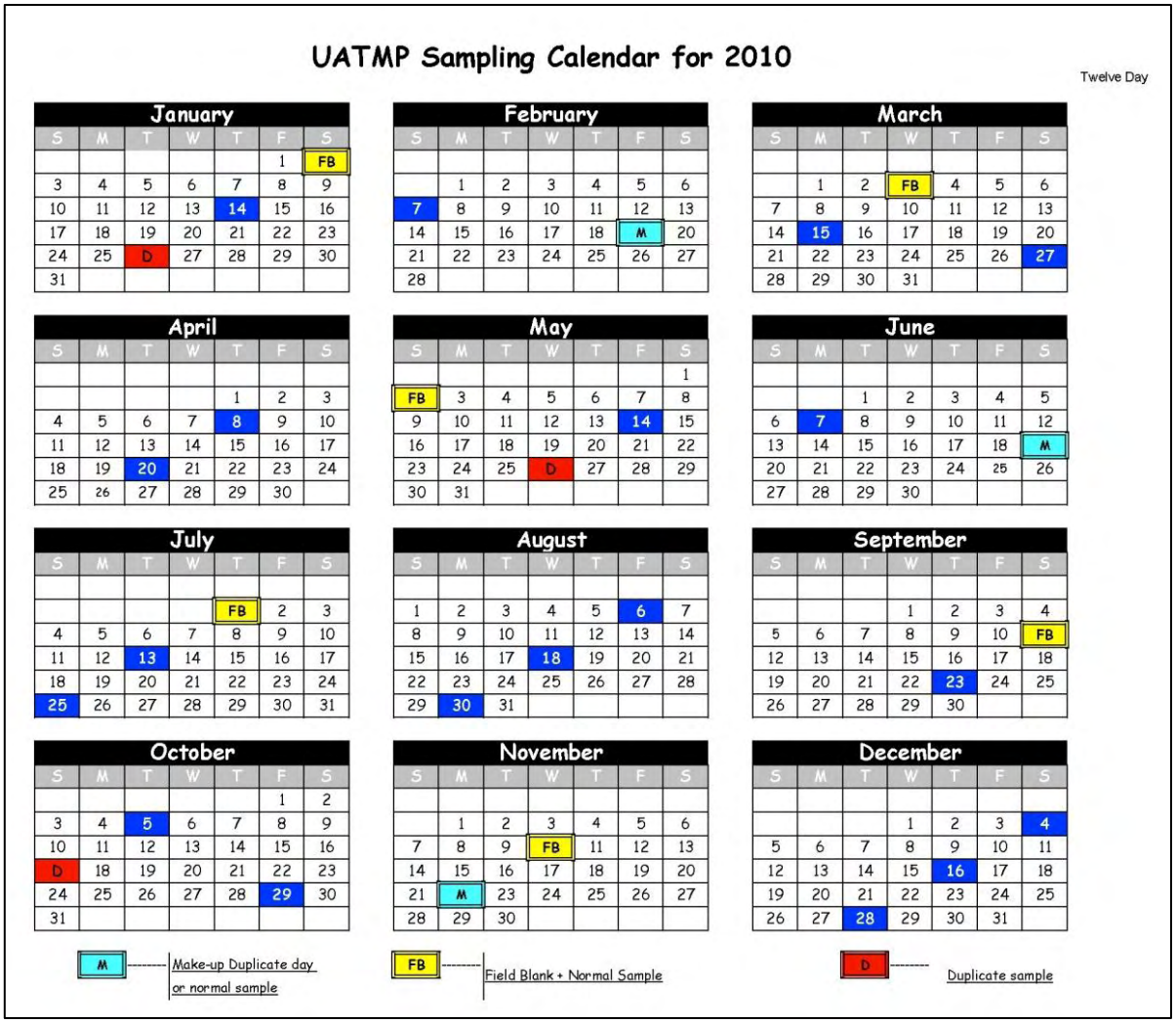
S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

M ------- Make-up Duplicate day or normal sample

FB ------- Field Blank + Normal Sample

D ------- Duplicate sample


UATMP Sampling Calendar for 2009
Six Day
January
February
March
April
May
June
July
August
September
October
November
December
M ------- Make-up Duplicate day or normal sample
FB ------- Field Blank + Normal Sample
D ------- Duplicate sample



UATMP Sampling Calendar for 2010

Twelve Day

January

S	M	T	W	T	F	S
					1	FB
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	D	27	28	29	30
31						

February

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	M	20
21	22	23	24	25	26	27
28						

March

S	M	T	W	T	F	S
	1	2	FB	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

April

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

May

S	M	T	W	T	F	S
						1
FB	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	D	27	28	29
30	31					

June

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	M
20	21	22	23	24	25	26
27	28	29	30			

July

S	M	T	W	T	F	S
				FB	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

August

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

September

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	FB
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

October

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
D	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

November

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	FB	11	12	13
14	15	16	17	18	19	20
21	M	23	24	25	26	27
28	29	30				

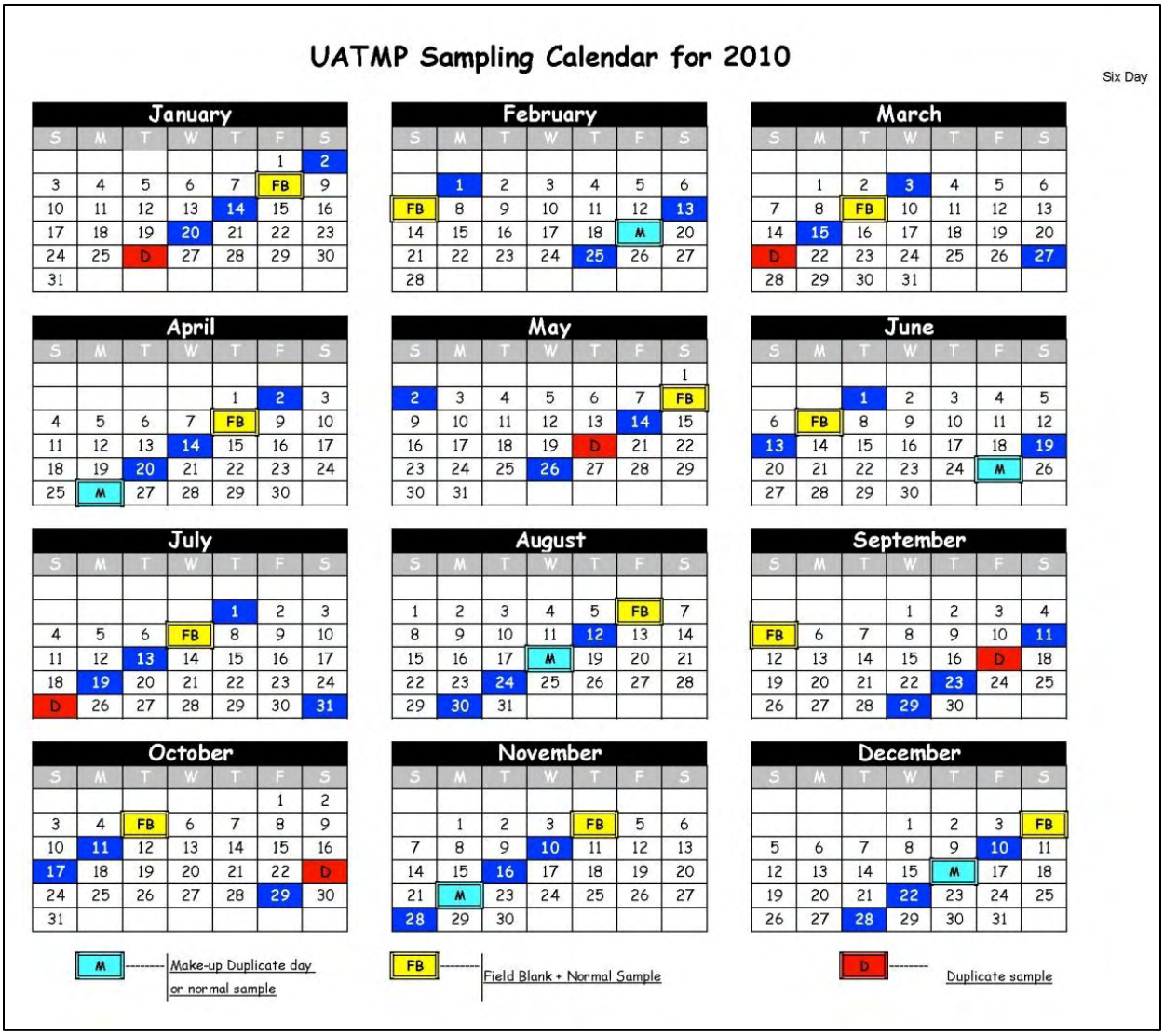
December

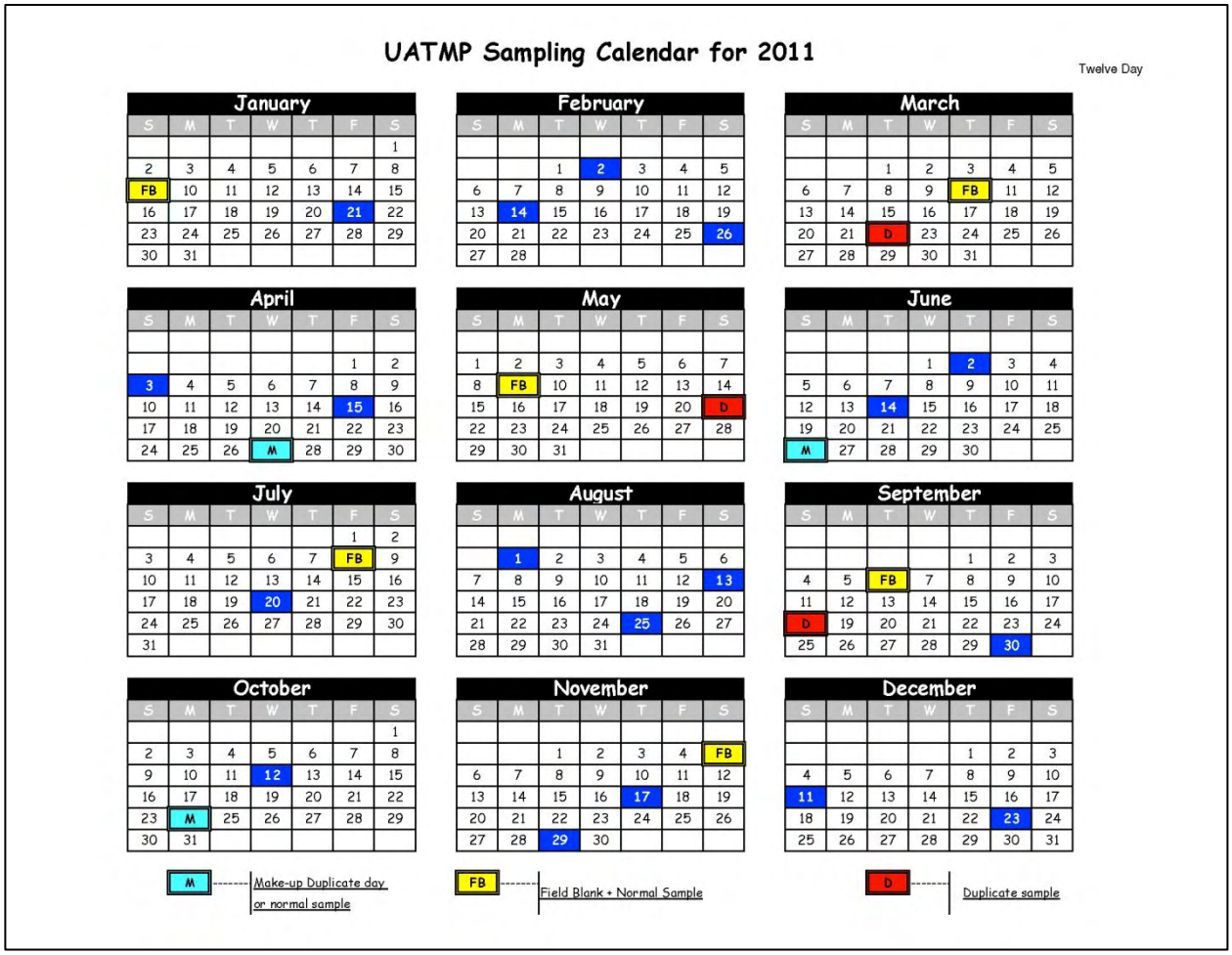
S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

M ------ Make-up Duplicate day or normal sample

FB ------ Field Blank + Normal Sample

D ------ Duplicate sample


UATMP Sampling Calendar for 2010
Six Day
January
February
March
April
May
June
July
August
September
October
November
December
M ------- Make-up Duplicate day or normal sample
FB ------- Field Blank + Normal Sample
D ------- Duplicate sample



UATMP Sampling Calendar for 2011

Twelve Day

January

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
FB	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

February

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28					

March

S	M	T	W	T	F	S
		1	2	3	4	5
6	7	8	9	FB	11	12
13	14	15	16	17	18	19
20	21	D	23	24	25	26
27	28	29	30	31		

April

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	M	28	29	30

May

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	FB	10	11	12	13	14
15	16	17	18	19	20	D
22	23	24	25	26	27	28
29	30	31				

June

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
M	27	28	29	30		

July

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	FB	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

August

S	M	T	W	T	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

September

S	M	T	W	T	F	S
				1	2	3
4	5	FB	7	8	9	10
11	12	13	14	15	16	17
D	19	20	21	22	23	24
25	26	27	28	29	30	

October

S	M	T	W	T	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	M	25	26	27	28	29
30	31					

November

S	M	T	W	T	F	S
		1	2	3	4	FB
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

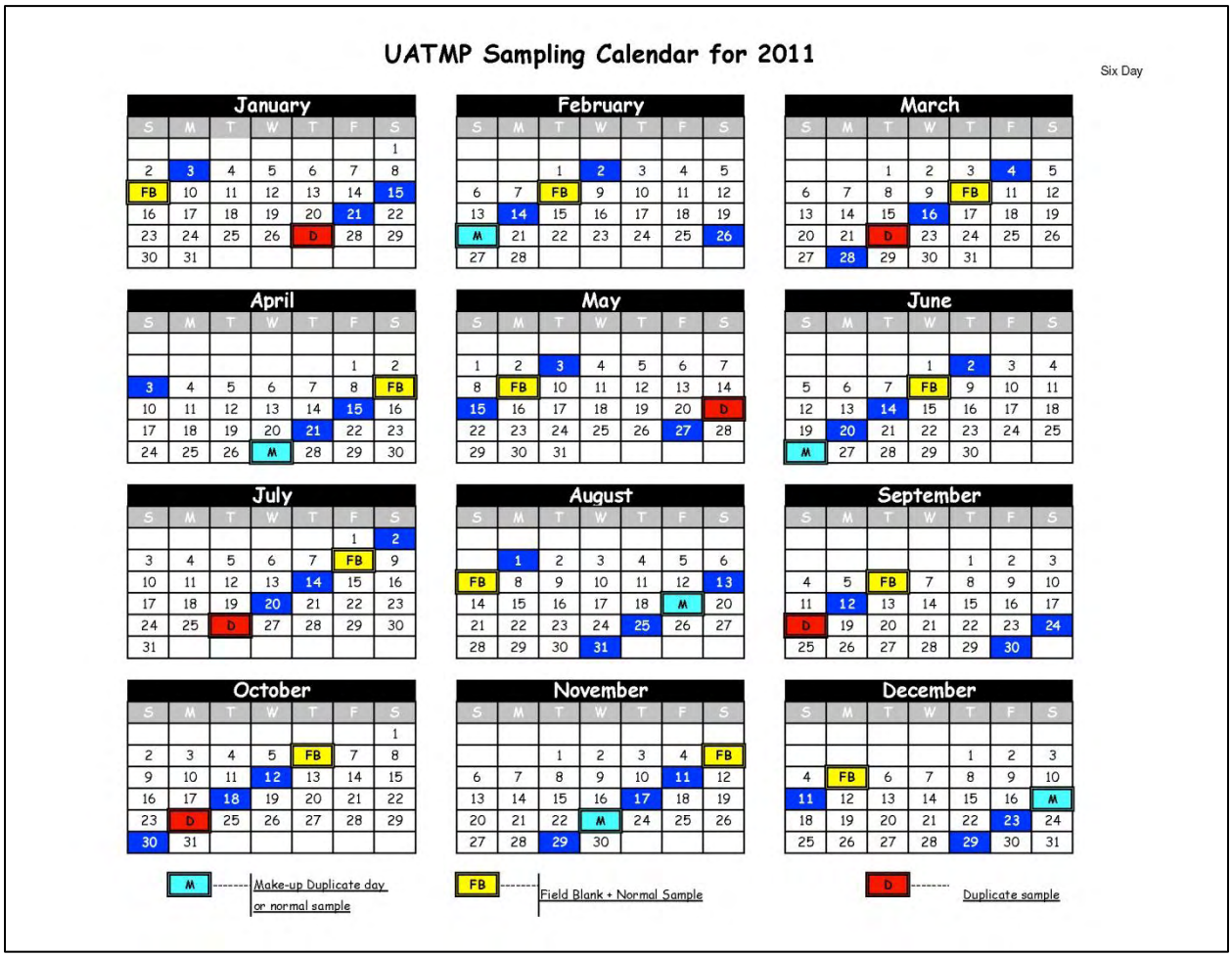
December

S	M	T	W	T	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

M ------ Make-up Duplicate day or normal sample

FB ------ Field Blank + Normal Sample

D ------ Duplicate sample


UATMP Sampling Calendar for 2011
Six Day
January
February
March
April
May
June
July
August
September
October
November
December
M
Make-up Duplicate day or normal sample
FB
Field Blank + Normal Sample
D
Duplicate sample

APPENDIX E – 2008 Ambient Air Monitoring Field Protocols

GARCO 2008 Ambient Air Monitoring

Field Protocol

III. Standard Operation Procedures for Monitoring SNMOC in Ambient Air Using the EPA **Compendium Method TO-12**

Required Equipment:

1. 4 to 5 evacuated TO-Can Canisters
2. 4 to 5 Veriflo SC423XL flow controllers

Vacuum Range: 29.9 to 7 in Hg

Sample Time: 1440 min (24-hr)

Air Volume: 4 to 6 L

Sampling Procedure:

Sample Start-up Procedures

1. Begin recording the "Lab Pre-Sample" section of the Toxics/SNMOC Sample Data Sheet
    - Site Codes: Rifle = RICO, Parachute = PACO, Bell = BRCO, Moving Site = MOCO
    - City/State: RICO = Rifle CO, PACO = Parachute CO, BRCO = Silt CO, MOCO Varies
    - AQS Code: RICO = 08-045-0007, PACO = 08-045-0005, BRCO = 08-045-0009, MOCO = N/A
    - Collection Date: The date sample is started
    - Options: SNMOC is 'Yes'. Toxics is 'No'
    - Canister Number: Record the number from outside the canister
    - Lab Initial Can Pressure: Will be filled out by lab
    - Date Can Cleaned: Will be filled out by lab
    - Cleaning Batch Number: Will be filled out by lab
    - Duplicate Event: 'Yes' or 'No' based on the red 'D' from the Sampling Calendar
    - Duplicate Can Number: Record canister number from the corresponding duplicate canister
2. Remove gold cap from canister using a wrench. Save and store.
3. Remove silver caps from both ends of the flow controller. Save and store.
4. Connect the flow controller to the canister and tighten screw using a wrench
5. Begin recording the "Field Setup" section of the Toxics/SNMOC Sample Data Sheet

- Operator: Operator's Last Name
- Sys#: Leave Blank
- Setup Date: The date sample was started. Also record time sample was started.
- Field Initial Can Pressure: Record from pressure meter after flow controller is turned 'on'
- MFC Setting: Leave Blank
- Elapsed Timer Reset: N/A
- Canister Valve Opened: Write 'Yes' after flow controller is turned 'on'

6. Set canister on a flat surface approximately ½ to 1 m off the ground/rooftop

7. Turn dial counterclockwise (on) until a vacuum is established and finish recording information in the "Field Setup" section of the Toxics/SNMOC Sample Data Sheet

Sample Recovery Procedures

1. Begin recording the "Field Recovery" section of the Toxics/SNMOC Sample Data Sheet

    - Recovery date: The date sample ended. Also record time sample ended.
    - Field Final Can Pressure: Record from pressure meter before flow controller is turned 'off'
    - Sample Duration: Write "24" if a successful sample was achieved
    - Elapsed Time: Calculate total elapsed time (min) from start and end times
    - Canister Valve Opened: Write 'Yes' after flow controller is turned 'off'

2. Turn dial clockwise (off) and finish recording information in the "Field Setup" section of the Toxics/SNMOC Sample Data Sheet

GARCO 2008 Ambient Air Monitoring

Field Protocol

II. Standard Operation Procedures for Monitoring Carbonyls in Ambient Air Using the EPA **Compendium Method TO-11A**

Required Equipment:

3. 4 to 5 Air Sampling Pumps - SKC 224-PCXR8 Series Universal Samplers (refer to Operating Instructions)

4. An NIST-Traceable Flow Calibrator - Bios Defender 500 Series (Dry Cal) Primary Gas Flow Calibrator (refer to User Manual)

5. 4 to 5 Sorbent Tubes - Waters Sep-Pak XPoSure Aldehyde Samplers (WAT047205)

    - Always store samplers in their protective pouches to prevent contamination
    - Store sealed pouches in a refrigerator at 4°C for up to six months

6. 4 to 5 Ozone Scrubbers – Waters Ozone Scrubber Cartridges (WAT054420)

Flow Rate: 600 to 800 mL/min

Sample Time: 1440 min (24-hr)

Air Volume: 1000L

Sampling Procedure:

Sample Start-up Procedures

8. Begin recording the "Lab Pre-Sample" section of the Carbonyl Compounds Data Sheet

    - Site Codes: Rifle = RICO, Parachute = PACO, Bell = BRCO, Moving Site = MOCO
    - City/State: RICO = Rifle CO, PACO = Parachute CO, BRCO = Silt CO, MOCO Varies
    - AQS Code: RICO = 08-045-0007, PACO = 08-045-0005, BRCO = 08-045-0009, MOCO = N/A
    - Collection Date: The date sample is started
    - Cartridge Lot #: Record this from the outside of silver DNPH cartridge pouch
    - Duplicate Event: 'Yes' or 'No' based on the red 'D' from the Sampling Calendar

9. Remove protective cover from the metal enclosure using a Phillips head screw driver

10. Place air pump right side up in it's designated location using the pre-applied Velcro adhesive

4. Plug one end of the AC adapter into the power strip and the other end into the pump. Be sure the power strip is turned on (red indicator light).

7. To set up a sorbent tube sampling train, take a fresh DNPH-cartridge from its pouch. **Be certain to wear Poly gloves when handling carbonyl cartridges.**

8. Take a fresh ozone scrubber from its pouch.

9. Label the DNPH cartridge with the appropriate ID number using a permanent marker (e.g. CA0001). Record this number in the "ERG Lab ID#" section (upper right hand corner) of the data sheet.

10. Remove and save the plugs from the DNPH-cartridge

11. Attach the ozone scrubber ahead (in front) of the DNPH cartridge

12. Connect the cartridges to the pump using flexible tubing (1/8-inch Tygon). The cartridges are bidirectional (flow can be in either direction). However, be assured that the ozone scrubber is in front of the DNPH cartridge.

13. Start the pump using the on/off switch. Make sure the elapsed time on sampling pump is reading "0000".

14. Remove the protective caps (yellow) from the flow meter and connect to the intake of the sampling medium using flexible tubing (1/8-inch Tygon)

15. Start the flow meter using the on/off button.

16. Take 10 continuous flow measurements

17. Adjust the flow rate (600 – 800mL/min) using the "flow adjust" screw on the sampling pump.

18. Disconnect the flow meter and record average flow in the "Field Setup" section of the Carbonyl Compounds Data Sheet

    - Setup Date: The date sample was started. Also record time sample was started.
    - Operator: Operator's Last Name
    - Sys#: Leave Blank
    - Pre-Sampling Rotometer Reading (cc/min): Average startup flow. Note that cc/min = mL/min
    - Elapsed Timer Reset: 'Yes' based on "0000" reading

17. Place the end of sampling train inlet through the small hole at the rear of the metal enclosure

18. Replace protective cover from the metal enclosure and tighten screw using a Phillips head screw driver

Sample Recovery Procedures

1. Remove protective cover from the metal enclosure using a Phillips head screw driver

2. Remove the protective caps (yellow) from the flow meter and connect to the intake of the sampling medium using flexible tubing (1/8-inch Tygon)

3. Start the flow meter using the on/off button.

4. Take 10 continuous flow measurements

5. Disconnect the flow meter and record average flow in the "Field Recovery" section of the Carbonyl Compounds Data Sheet. Record elapsed time and turn pump off using on/off switch.

    - Recovery date: The date sample ended. Also record time sample ended.
    - Post-Sampling Rotometer Reading (cc/min): Average end flow. Note that cc/min = mL/min
    - Sample Duration: Write "24" if a successful sample was achieved (1380 – 1500 min)
    - Elapsed time: Reading from pump at shut down
    - Cartridges Capped: Write 'Yes' after capping the cartridge

6. Remove ozone scrubber and discard.

7. Remove and cap DNPH-cartridge and place in a User Sample Pouch. **Be certain to wear Poly gloves when handling carbonyl cartridges.**

8. Unplug and remove sampling pump from metal enclosure. Leave AC adapter in metal enclosure.

9. Replace protective cover from the metal enclosure and tighten screw using a Phillips head screw driver

10. DO NOT TURN OFF POWER STRIP!! (red light). This will disable the weather station!

Post-sampling Procedures

1. Cap DNPH-cartridge and place in a User Sample Pouch with appropriate identification (i.e. ID# on cartridge should match ID# on pouch)

2. Close the pouch by folding open edge over twice and stapling shut. KEEP SAMPLERS AWAY FROM HEAT!

3. Store samplers in a refrigerator at 4°C until shipped. Elute the samples within two weeks.

Met Station Protocols

I. Downloading Met Data from Rainwise Data Logger using Palm Pilot and Retriever WL Software.

Supplies needed: Palm Pilot with Retriever WL software loaded, multitool, serial port Palm/connector.

a) Open enclose with multi tool and connect Palm to serial port connector from data logger (use rubber band to ensure good connection).
b) Turn on Palm
c) Select Retriever (Dog) icon
d) Select "current data output" and send. This will let you know if you have a good connection.
e) Select "output logged data" and check "capture file" box. You will be prompted to name the data base. Do not select clear data command. Each data logger will hold approx 6 weeks of data and serves as a backup source.
f) Use Palm keyboard to name the data base. Activate the cursor by tapping the dotted line, then access keyboard by tapping the "abc" spot.
g) Name the data base
h) Select "ok" , select "send"
i) Data download will occur and takes approx 10 minutes.
j) When download is complete Palm will time out and "O" will appear on screen.
k) Turn the Palm back on (button on top of unit) and tap on the home icon. You will see a message "creating data base". This must be done before any further downloads are attempted. Other wise the next data set will write on top of the previous one.

Potential Problems:
1) Poor connection. This will prevent download. Play with the connection until you can get the Palm to respond with the "current data output". In some cases the Palm will need to be reset (button on back). Using the rubber band really helps.

II Downloading Met Data from Palm onto PC

Materials Needed: USB/Palm Connector, PC with Palm Pilot Sync installed, MS Office software

a) Connect USB connector from Palm to PC.
b) Push hot sync button on cable
c) The data will be written into the Retriever WL folder (**C:\Program Files\palmOne\NRMI2\RetrieverWL**). If a data base is in the folder with the same, the new file will replace the old file. Before downloading ensure that all old files in the Retriever WL folder have been resaved somewhere else.

III Bringing Data into Excel

a) Open text file in Retriever WL folder.
b) Name and save file into other location (site name/last date in data set)
c) Bring into Excel using data command
d) Select line through the wizard where you want your data to come in.
e) Select "delimited file"
f) Select "comma separated"

note each location has two spread sheets. One is the "master" which contains all daily min/max data and the other is "(2") and contains all the data except the daily/min max. To create the "(2)" version, copy and paste data without the daily min/max info into the "(2)" version, from the "master" version. The"(2)" version is used for creating Access tables.

APPENDIX F – EPA Compendium Methods

APPENDIX G - Air Resource Specialists Meteorological Standard Operating Procedures and Technical Instructions

The following standard operating procedures (SOPs) and technical instructions (TIs) will be used in executing this program. These documents were written by Air Resource Specialists, Inc. Please note that program-specific documents have not been written; this program relies in part on SOPs and Technical Instructions (TIs) that have been prepared to support other field studies. The general policies and instructions outlined in these procedures, however, are relevant to the Garfield County VOC Monitoring Program, and as such, are suitable for this particular study.

Number	Title	QAPP Section(s)
SOP 3001	**PROCEDURES FOR QUARTERLY MAINTENANCE TO AN AMBIENT AIR MONITORING STATION**	**B6.2**
SOP 3150	**CALIBRATION AND ROUTINE MAINTENANCE OF METEOROLOGICAL MONITORING SYSTEMS**	**A7.2.1, B5, B6.1, B6.2, B7**
TI 3150-2103	Calibration and Routine Maintenance of R.M. Young Model 05305 Wind Monitor-AQ Wind Speed and Direction Sensor Systems	
SOP 3350	**COLLECTION OF AMBIENT AIR QUALITY AND METEOROLOGICAL MONITORING DATA SITE DOCUMENTATION**	**B2, B10**
TI 3350-4000	Collection of Ambient Air Quality and Meteorological Monitoring Data via Telephone Modem	
SOP 3450	**AMBIENT AIR QUALITY AND METEOROLOGICAL MONITORING DATA VALIDATION**	**A6.2, A7.2.1, B10, D1, D2**
TI 3450-5000	Ambient Air Quality and Meteorological Monitoring Data – Level 0 Validation	
TI 3450-5010	Ambient Air Quality and Meteorological Monitoring Data – Preliminary Validation	
TI 3450-5020	Ambient Air Quality and Meteorological Monitoring Data – Final Validation	
SOP 3550	**AMBIENT AIR QUALITY AND METEOROLOGICAL MONITORING DATA REPORTING**	
TI 3550-5000	Ambient Air Quality and Meteorological Monitoring Data Monthly Reporting	
TI 3550-5100	Ambient Air Quality and Meteorological Monitoring Data Annual Reporting	
TI 3550-5200	Handling Requests for Ambient Air Quality and Meteorological Monitoring Data	
TI 3550-5300	Submitting Ambient Air Quality and Meteorological Monitoring Data to the EPA AQS Database	
SOP 3650	**IMC STAFF'S MAINTENANCE RESPONSIBILITIES FOR THE AMBIENT AIR QUALITY DATA BASE MANAGEMENT SYSTEM (AQDBMS)**	
SOP 3750	**METEOROLOGICAL MONITORING SENSOR AUDIT PROCEDURES**	