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EG&G - ROCKY FLATS PLANT  
ENVIRONMENTAL MANAGEMENT

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**ROCKY FLATS PLANT  
EMD OPERATING  
PROCEDURES MANUAL**

**Manual No.: 5-21000-OPS-FO  
Procedure No.: Table of Contents, Rev 13  
Page: 1 of 2  
Effective Date: 05/12/92  
Organization: Environmental Management**

**THIS IS ONE VOLUME OF A SIX VOLUME SET WHICH INCLUDES:**

- VOLUME I: FIELD OPERATIONS (FO)**
- VOLUME II: GROUNDWATER (GW)**
- VOLUME III: GEOTECHNICAL (GT)**
- VOLUME IV: SURFACE WATER (SW)**
- VOLUME V: ECOLOGY (EE)**
- VOLUME VI: AIR (AP)**

**TABLE OF CONTENTS  
FOR VOLUME I: FIELD OPERATIONS**

<b><u>Procedure No.</u></b>	<b><u>Title</u></b>	<b><u>Rev. No.</u></b>	<b><u>Effective Date</u></b>
FO.01	Air Monitoring and Dust Control	1	08/30/91
FO.02	Transmittal of Field QA Records	2	09/23/91
FO.03	General Equipment Decontamination	2	05/12/92
FO.04	Heavy Equipment Decontamination	2	05/12/92
DCN 92.01	Clarification of Work Area	1	01/31/92
DCN 92.02	Clarification of Center Bit Decontamination	1	03/12/92
FO.05	Handling of Purge and Development Water	2	05/12/92
FO.06	Handling of Personal Protective Equipment	2	05/12/92
FO.07	Handling of Decontamination Water and Wash Water	2	05/12/92
FO.08	Handling of Drilling Fluids and Cuttings	2	05/12/92
FO.09	Handling of Residual Samples	1	08/30/91
FO.10	Receiving, Labeling, and Handling Environmental Materials Containers	2	05/12/92

REVIEWED FOR CLASSIFICATION/UCM

By [Signature]

Date 10/18/1992

**ADMIN RECORD**

A-SW-001029

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EG&G - ROCKY FLATS PLANT  
ENVIRONMENTAL MANAGEMENT

This is a REVISION OF PHOTOIONIZATION DETECTORS (PIDS) AND FLAME IONIZATION DETECTORS (FIDS)

EG&G ROCKY FLATS PLANT  
EMD MANUAL OPERATION SOP

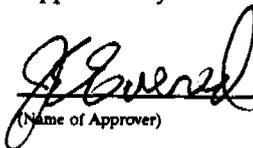
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1 of 7  
March 1, 1992  
Environmental Management

Category 2

TITLE:  
PHOTOIONIZATION DETECTORS  
(PIDS) AND FLAME IONIZATION  
DETECTORS (FIDS)

Approved By:

  
(Name of Approver)

MAY 12 1992

(Date)

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REVIEWED FOR CLASSIFICATION/UCNI

By   
Date March 4, 1992

## PHOTOIONIZATION DETECTORS (PIDS) AND FLAME IONIZATION DETECTORS (FIDS)

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EG&G ROCKY FLATS PLANT	Manual:	5-21000-OPS
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### 2.0 PURPOSE AND SCOPE

This standard operating procedure (SOP) describes procedures that will be used at Rocky Flats to define the standard operating procedure for the use of flame ionization detectors (FID) and photoionization detectors (PID) in the field. FIDs and PIDs are used to detect and measure volatile organic compounds. An FID or PID is typically calibrated to measure the concentration of a known calibration gas. The instrument can detect other volatile organic compounds, but the concentration indicated will not be accurate. Therefore, these instruments are typically used in the field to screen samples or to monitor the environment for health and safety purposes. They will not be used at Rocky Flats Plant (RFP) for the purpose of obtaining analytical chemistry data.

### 3.0 QUALIFICATIONS

Only qualified personnel will be allowed to perform measurements with FIDs and/or PIDs. The subcontractor's Site Safety Officer will determine who is qualified based on experience and demonstrated competence. Those qualified will use FIDs and PIDs in accordance with this SOP and the manufacturer's written instructions.

### 4.0 REFERENCES

#### 4.1 SOURCE REFERENCES

The following is a list of references reviewed prior to the writing of this procedure:

A Compendium of Superfund Field Operations Methods. EPA/540/P-87/001. December 1987.

## PHOTOIONIZATION DETECTORS (PIDS) AND FLAME IONIZATION DETECTORS (FIDS)

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Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. Interim Final. EPA/540/G-89/004. October 1988.

RCRA Facility Investigation Guidance. Interim Final. EPA. May 1989.

RCRA Groundwater Monitoring Technical Enforcement Guidance Document. EPA OSWER.9950.1. September 1986.

Rockwell International. Rocky Flats Plant Environmental Restoration Program Quality Assurance/Quality Control Plan. January 1989.

The Environmental Survey Manual. DOE/EH-0053. Volumes 1-4. 1987.

### 5.0 FID EQUIPMENT AND PROCEDURES

#### 5.1 DESCRIPTION AND THEORY

A FID uses ionization as the detection method, in which the ionization is caused by a hydrogen flame, rather than an ultraviolet (UV) light, as in a PID. The flame has sufficient energy to ionize any organic chemical species with an ionization potential (IP) of 15.4 eV or less.

Inside the detector chamber, the sample is exposed to a hydrogen flame, which ionizes the organic vapors. When most organic vapors burn, positively charged carbon-containing ions are produced, which are collected by a negatively charged collecting electrode in the chamber. As the positive ions are collected, a current proportional to the hydrocarbon concentration is generated on the input electrode. This current is measured with a preamplifier that has an output signal proportional to the ionization current.

## PHOTOIONIZATION DETECTORS (PIDS) AND FLAME IONIZATION DETECTORS (FIDS)

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An FID consists of a probe, a pumping system, a particle filter, a hydrogen gas container, a scrubber, a burning chamber, an electrical detection and amplification system, and a read-out device (meter).

FIDs must be calibrated, used, and maintained in accordance with the manufacturer's instructions for each specific instrument. See Appendix FO.15A for an example of some instructions for a specific instrument.

### 6.0 PID EQUIPMENT AND PROCEDURES

#### 6.1 DESCRIPTION AND THEORY

A PID operates on the principle of photoionization. When a photon of UV radiation strikes a chemical compound, it ionizes a molecule of the compound if the radiation is equal to or greater than the ionization potential (IP) of the compound. Because ions are capable of conducting an electrical current, an electron flow can be generated within the instrument.

In a PID, an electrical pump or fan moves the gas being sampled past a UV source. The sample is ionized and ion pair production occurs for each molecule ionized. The free electrons produce a current directly proportional to the number of ions produced. The current is amplified, detected, and displayed on a meter. Chemical species having IPs less than or equal to the lamp rating will generate an appropriate instrument response. Chemical species that have IPs greater than the lamp rating will display a poor instrument response or no response at all.

Employing an 11.7 electron volt (eV) rated lamp would provide a relatively wide range of detectable species; however, that lamp requires frequent replacement. More commonly, a 10.2-eV lamp is

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used. A 10.2-eV lamp offers relatively high radiation levels without frequent lamp replacement and will detect many species, with the notable exception of chlorinated aliphatics.

PIDs must be used, calibrated, and maintained in accordance with the manufacturer's instructions for each specific instrument. The PID consists of a probe, readout assembly, and a battery charger. The probe contains the sensing and amplifying circuitry, the readout assembly contains the meter controls, and the power supply is a rechargeable battery. There are numerous models of PIDs available (see Appendix FO.15B for example information on one specific instrument).

### 7.0 DECONTAMINATION

PIDs and FIDs will be placed in plastic bags with the sensing probe protruding through the bag prior to use in the field to reduce the potential for gross contamination. The bag will be fastened in such a way as to allow viewing of the meter readout and access to instrument controls. Bags should be discarded during decontamination at the end of the workshift. The external surfaces of the PIDs and FIDs should be wiped with Kim-wipe or a similar material prior to its return to the equipment manager. Equipment should be decontaminated in accordance with SOP FO.3, General Equipment Decontamination.

### 8.0 QUALITY ASSURANCE/QUALITY CONTROL

Daily calibration and operational checks are required to ensure that the instrument is functioning properly. Manufacturer's calibration instructions must be accomplished prior to daily use, and calibration must be confirmed at the end of each day.

## PHOTOIONIZATION DETECTORS (PIDS) AND FLAME IONIZATION DETECTORS (FIDS)

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PIDs and FIDs will be checked periodically during use to ensure that they are responding to contaminants. A Magic Marker® used as a source of volatile gas works well to demonstrate that the instrument is responding.

The manufacturer's operating manual will be used for the operation, calibration, maintenance, and care of FIDs and PIDs. The manual will be present on site at all times.

### 9.0 DOCUMENTATION

Use of PIDs and FIDs will be in accordance with the Health and Safety Plan or SOPs requiring its use. Observations or calculations will be documented by personnel in a bound, water-proof field notebook. Observations that need to be documented will be entered into the site manager's daily logbook. Entries will be signed and dated by field personnel making the entries. Form FO.15A, Calibration Record, will be used to document daily calibrations. The Calibration Record asks for the following information:

- **Date/Time.**
- **Initial Response - Initial Response is the first meter reading obtained with calibration gas to either adjust instrument or note how far off the instrument is drifting depending on whether an HNu or Thermal Environmental is used.**
- **Alarm Setting.**
- **Calibration Sequence Initiated - Cal sequence is a feature specific to the Thermal Environmental System Model 580B. Calibration must be done twice on**

**PHOTOIONIZATION DETECTORS (PIDS) AND FLAME IONIZATION DETECTORS (FIDS)**

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Model 580B in order to store in memory. If only done once, the calibration is not stored in memory.

- Results.
- Calibrator's Name.



**APPENDIX FO.15A**

**Foxboro OVA-128**

## APPENDIX A

The following appendix provides information pertaining to the Foxboro OVA-128.

### A.1 LIMITATIONS

- The OVA will not detect inorganics.
- The OVA will detect methane, which is explosive but relatively nontoxic.
- Current DOT shipping regulations (Title 49CFR), must be researched before shipping an OVA containing pressurized hydrogen to determine proper shipping name, DOT index number, proper shipping container, packaging, labeling, restrictions, and placarding requirements.
- A relative humidity greater than 95 percent will cause inaccurate and unstable responses.
- A temperature less than 40°F will cause slow and poor response.
- Actual contaminant concentrations are measured relative to the calibration gas used. Therefore, specific contaminants and their quantities cannot easily be identified.
- The OVA responds differently to different compounds. Table A-1 is a list, provided by the manufacturer, of the relative sensitivities of the OVA to some common organic compounds. Since the instrument is factory calibrated to methane, all relative responses are given in percent, with methane at 100.

TABLE A-1  
RELATIVE RESPONSE SENSITIVITY FOR OVA

Chemical Compound	Instrument Indication in Percent of Actual Level
Methane	100
Ethane	90
Propane	64
N-butane	61
N-pentane	100
Ethylene	85
Acetylene	200
Benzene	150
Toluene	120
Acetone	100
Methyl ethyl ketone	80
Methyl isobutyl ketone	100
Methanol	15
Ethanol	25
Isopropyl alcohol	65
Carbon tetrachloride	10
Chloroform	70
Trichloroethylene	72
Vinyl chloride	35

**A.2****MAINTENANCE AND CALIBRATION RESPONSIBILITIES**

It is preferable to minimize the number of people responsible for maintenance and calibration of the OVA. These people shall also be responsible for logging the equipment in and out. Documentation of instrument user, dates of use, instrument identification number, maintenance and calibration procedures, and project identification shall be maintained.

**A.3****SPECIFIC PROCEDURES****A.3.1****Startup Procedures**

- Connect the probe/readout connectors to the side-pack assembly.
- Check the battery condition and hydrogen supply.
- For measurements taken as methane-equivalent, check that the GAS SELECT dial is set at 300.
- Turn the electronics on by moving the INST switch to the ON position, and allow 5 minutes for warm-up.
- Set the CALIBRATE switch to X10; use the CALIBRATE knob to set the indicator at 0.
- Open the H<sub>2</sub> tank valve and the H<sub>2</sub> supply valve completely. Check that the hydrogen supply gauge reads between 8.0 and 12.0 psig.
- Turn the PUMP switch to ON.
- Check that the BACKFLUSH and INJECT valves are in the UP position.

- To light the flame, depress the igniter switch until a meter deflection is observed. The igniter switch may be depressed for up to 5 seconds. Do not depress the switch for longer than 5 seconds, as it may burn out the igniter coil. If the instrument does not light, allow the instrument to run several minutes and then repeat the ignition attempt.
- Confirm an OVA operational state by using an organic source, such as a Magic Marker<sup>®</sup>. Any meter deflection will indicate that the OVA is operating.
- Establish a background level in a clean area or by using the charcoal scrubber attachment to the probe (depress the sample inject valve), recording background measurements for reference.
- Set the alarm level, if desired.

#### A.3.2 Shutdown Procedure

- Close the H<sub>2</sub> supply valve and H<sub>2</sub> tank valve (do not overtighten the valves).
- Turn the INST switch to OFF.
- Wait until the H<sub>2</sub> supply gauge indicates that the system is purged of H<sub>2</sub> (approximately 10 seconds); then switch off the pump.
- Put the instrument on an electrical charger at completion of day's activities.

### A.3.3

#### Maintenance and Calibration Schedule

<u>Function</u>	<u>Frequency</u>
Check particle filters	Weekly or as needed
Check quad rings	Monthly or as needed
Clean burner chamber	Monthly or as needed
Check secondary calibration	Prior to project startup
Check primary calibration	Monthly, or if secondary calibration is off by more than $\pm 10$ percent
Check pumping system	Before project startup
Replace charcoal in scrubber attachment	120 hours of use, or when background readings in a clean environment are higher with the inject valve down than with the inject valve up
Factory service	At least annually

Note: Instruments that are not in service for extended periods of time need not meet the above schedule. However, they must be given a complete checkout before their use, addressing the maintenance items listed above.

### A.3.4

#### Calibration Procedures

##### A.3.4.1

#### Primary Calibration.

- Remove the instrument components from the instrument shell.
- Turn on ELECTRONICS and ZERO INSTRUMENT on the X10 scale. Set the gas-select dial to 300.

- Turn on PUMP and HYDROGEN. Ignite the flame. Go to SURVEY MODE.
- Introduce a methane standard near 100 parts per million (ppm).
- Adjust R-32 Trimpot on the circuit board to make the meter read to standard.
- Turn off the hydrogen flame, and adjust the meter needle to read 40 ppm (calibrate @ X10) using the calibration adjust knob.
- Switch to X100 scale. The meter should indicate 0.4 on the 1 to 10 meter markings ( $0.4 \times 100 = 40$  ppm). If the reading is off, adjust with R33 Trimpot.
- Return to X100 scale and adjust the needle to 40 ppm with calibration; adjust the knob, if necessary.
- At the X10 scale, adjust the meter to read 0.4 on the 1-to-10 meter markings using the calibration adjust. Switch to the X1 scale. The meter should read 4 ppm. If the reading is off, adjust using the R31 Trimpot.

#### A.3.4.2 Secondary Calibration.

- Fill an air sampling bag with 100 ppm (certified) methane calibration gas.
- Connect the outlet of the air-sampling bag to the air-sampling line of the OVA.
- Record the reading obtained from the meter on the calibration record.

#### A.3.4.3 Documentation

All field calibrations will be documented on the calibration record form, Attachment 1.15A (see Section II).

- Instrument calibrated (I.D. or serial number)
- Date of calibration
- Results of the calibration
- Identification of person who calibrated the instrument

- Identification of person who calibrated the instrument
- Identification of the calibration gas (source, type, concentration, lot number)

#### A.3.4.4 Pump System Checkout.

- With the pump on, hold the unit upright and observe the flow gauge.
- See if the ball level is significantly below a reading of 2; if so, flow is inadequate.
- Check connections at the sample hose.
- Clean or replace particle filters if the flow is impaired or if it is time for scheduled service.
- Reassemble and retest flow.
- If the flow is still inadequate, replace the pump diaphragm and valves.
- If flow is normal, plug the air intake. The pump should slow and stop.
- If there is no noticeable change in the pump, tighten the fittings and retest.
- If there is still no change, replace the pump diaphragm and valves.
- Document this function in the maintenance records.

#### A.3.4.5 Burner Chamber Cleaning.

- Remove the plastic exhaust port cover.
- Unscrew the exhaust port.
- Use a wire brush to clean the burner tip and electrode. Use a wooden stick to clean the Teflon surfaces.
- Brush the inside of the exhaust port.
- Blow out the chamber with a gentle air flow.
- Reassemble and test the unit.
- Document this function in the maintenance records.

#### A.3.4.6 Quad Ring Service.

- Remove OVA instruments from their protective shell.
- Remove the clip ring from the bottom of the valve.
- Unscrew the nut from the top of the valve.

- Gently pull the valve shaft upward and free it of its housing.
- Examine the rings for signs of damage; replace them as necessary.
- Lightly grease the rings with silicone grease.
- Reassemble the valve; do not pinch the rings during shaft insertion.
- Document this function in the maintenance records.

#### A.3.4.7 Troubleshooting.

<u>Indication</u>	<u>Possible Cause</u>
High background reading (More than 10 ppm)	Contaminated hydrogen Contaminated sample line
Continual flameout	Hydrogen leak Dirty burner chamber Dirty air filter
Low air flow	Dirty air filter Pump malfunction Line obstruction
Flame will not light	Low battery Igniter broken Hydrogen leak Dirty burner chamber Air flow restricted
No power to pump	Low battery Short circuit
Hydrogen leak	Leak in regulator (instrument not in use) Leak in valves

#### A.3.4.8 Hydrogen Recharging.

- High-grade hydrogen (99.999 percent) is required. Maximum pressure the instrument can handle is 2,300 psig.
- Connect the fill hose to the REFILL FITTING on the side pack assembly with the FILL/BLEED valve in the OFF position.
- Open the H<sub>2</sub> SUPPLY BOTTLE valve.
- Place the FILL/BLEED valve on the fill hose in the BLEED position MOMENTARILY to purge any air out of the system.

- Open the instrument TANK valve.
- Open the REFILL valve on the instrument.
- Place the FILL/BLEED valve in the FILL position until the instrument pressure gauge equalizes with the H<sub>2</sub> SUPPLY BOTTLE pressure gauge.
- Shut the REFILL valve, FILL/BLEED valve, and H<sub>2</sub> SUPPLY BOTTLE valve, in quick succession.
- Turn the FILL/BLEED valve to BLEED until the hose pressure equalizes to atmospheric pressure.
- Turn the FILL/BLEED valve to the FILL position; then turn the valve to the BLEED position; then turn to the OFF position.
- Close the TANK on the instrument.
- Disconnect the FILL HOSE and replace the protective nut on the REFILL FITTING.

#### A.3.4.9

#### Particle Filter Servicing.

Filters have been placed at two points in the air sampling line of the OVA to keep particulates from entering the instrument. The first filter is located in the probe assembly, and the second filter (primary filter) is located on the side pack assembly. Cleaning procedures are as follows:

- Detach the probe assembly from the readout.
- Disassemble the probe (unscrew the components).
- Clean the particle filter located within the probe by blowing air through the filter.
- Reassemble the probe.
- Gain access to the primary filter, located behind the sample inlet connector on the side pack assembly, by removing the sample inlet connector with a thin-walled, 7/16-inch socket wrench. Remove the filter, and clean it as above.

- Reassemble the sample inlet fitting and filter to the side pack assembly.
- Check the sample flowrate.

**Note:** The manufacturer's operating instruction and calibration manual for the specific model of Flame Ionization Detector must be used.