

BROOKHAVEN NATIONAL LABORATORY Safety & Health Services Division	NUMBER IH75550
	REVISION FINAL Rev0
INDUSTRIAL HYGIENE GROUP Standard Operating Procedure	DATE 07/19/06
Instrument Operation: Crowcon <i>Triple Plus+ IR</i>	PAGE 1 OF 10

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1.0 Purpose & Scope

The *CROWON Triple Plus+ IR* is a microprocessor controlled portable gas detector which is capable of monitoring up to four gas types simultaneously and providing warning of hazardous levels. It uses electrochemical and IR absorption sensors to detect toxic gases.

This procedure provides a standardized method of operation for the *CROWON Triple Plus+ IR*. It provides a method for easy and accurate analysis of four atmospheric hazards found in building fires: Carbon Monoxide, Carbon Dioxide, Hydrogen Cyanide, and Hydrogen Chloride. The meter is set up for measuring the main toxic airborne contaminants to be expected in a building after electrical and building content fires. It is intended for “grab and go” simplicity so that a rapid detection can be made in “emergency” situations. The intended use sequence is: rapid bump check, then entry with SCBA into the post-fire scene for a scan of the area in preparation for re-occupancy.

The *CROWON Triple Plus+* should be used in conjunction with the IH procedure IH75180: *Atmospheric Testing Using Direct Reading Instruments*.

2.0 Responsibilities

Personnel that perform area exposure monitoring with this instrument are responsible to:

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- Have demonstrated the competency to satisfactorily use the meter as evidenced by experience and training to the qualification criteria set in Section 7.
- Follow all steps in this procedure.
- Have an appropriate evaluation of the hazard and risk on the data collected using this meter by a knowledgeable professional.

3.0 Definitions none

4.0 Prerequisites

4.1 Area Access (non-emergency situations):

- Contact the appropriate Facility Support Representative or Technician to obtain approval to enter radiological areas, if applicable. Verify if a Work Permit or Radiological Permit is needed or is in effect. If so, review and sign the permit.
- Use appropriate PPE for the area and check with the ESH Coordinator or FS representative for other appropriate training.

4.2 **Area Access (emergency situations):** Act under the direction of the Incident Commander. Use appropriate PPE for the area and incident.

4.3 **Qualification:** The use of the *Crowcon Triple Plus+* is limited to persons who meet one of the two qualifications stated in Section 7 of this procedure.

4.4 If respiratory protection is required for personal protection, the operator must be in full compliance with the BNL *Respiratory Protection Program*.

5.0 Precautions

5.1 Hazard Determination:

- The operation of this meter does not cause exposure to any chemical, physical, or radiological hazards. The meter design does not cause significant ergonomic concerns in routine use. The meter does not generate Hazardous Waste. Disposal of the sensors from this meter is to be through the EWMSD waste management disposal stream.

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- By its very nature as a toxic gas monitor, this meter may be used in areas where atmospheric hazards are known or suspected to be present. Inhalation of toxic gases or oxygen deficient atmospheres can have significant health consequences. There may be significant chemical hazards in areas where this meter is used, especially following a fire. These hazards must receive a hazard evaluation by a cognizant S&H professional at the scene. PPE appropriate to hazards must be used. See section 5.2.
- The meter readings must be observed continuously when entering areas of potential hazards. The user is to leave the area (unless wearing SCBA) if an OSHA PEL or ACGIH TLV levels are exceeded or the meter alarms.
- Physical hazards may be present in the areas this meter is used in due to the damage caused by fires. Observe a high degree of safety awareness and precautions.
- Follow instructions of the on-scene Incident Commander. Be careful not to disturb the physical condition of the scene in a manner that will jeopardize incident /event investigations.

5.2 Personal Protective Equipment (PPE): The use of this meter alone does not require PPE.

The following considerations may be necessary based on hazards of an area entered:

- **Hand:** Use of this meter in areas of known or suspected surface contamination requires the use of disposable gloves. Exam-style, splash gloves are acceptable in: Nitrile, Neoprene, PVC, Butyl, Natural Rubber, Viton, and PEVAL (SilverShield®).
- **Body:** If contact of the body with contaminated surfaces is anticipated, a disposable suit should be used. Acceptable CPC materials include: Tyvek®, KleenGuard®, and cotton. Disposable garments may need to be discarded as waste if contact with contamination has occurred. Consult with EWMSD on the scene. If personal clothing items become contaminated with a hazardous material, they must be surrendered for BNL cleaning or disposal.
- **Foot:** If contact of the feet with contaminated surfaces is anticipated, disposable shoe coverings, boots or booties should be used. Acceptable CPC material include: Tyvek®, KleenGuard®, and vinyl, and rubber. If personal shoes become contaminated, they must be surrendered for BNL cleaning or disposal.

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- **Respiratory:** If airborne levels of hazards exceed the OSHA PEL or ACGIH TLV, respirators are required. A respirator complying with BNL's Respiratory Protection Selection and Issuance SOPs must be used. In post-fire entries, SCBA is required during the entry with this meter to conduct the air monitoring to determine safe conditions for re-entry.
- **Eye:** Safety Glasses with side shields are required in laboratories, general industry areas, and construction areas. The face piece of a SCBA satisfies this requirement.

5.3 Instrument protection:

- The *Crowcon Triple Plus+* is intended for vapor use only. Do NOT allow the probe or the meter to come in contact with liquids, dust or other foreign material. In a post-fire scenario, install the paper filter inline with the sample to avoid smoke damage to the IR sensor.
- The electrochemical sensors require a small amount of electrical current to keep them in their best state of readiness to detect gas when the instrument is turned on. Crowcon recommends:
 - The battery should not be removed for more than 30 minutes.
 - Do NOT store the instrument with the battery disconnected.

6.0 Procedure

6.1 Equipment:

- Meter Body
- Sensor cover for attaching tubing and calibration gases
- 6 foot sample tube
- Particulate filter



6.2 Switch On – Press the button marked “ON”.

- Serial number is displayed.
- Instrument displays the message “Testing System” and indicates battery voltage.
- If calibration date is past preset CAL-DUE date, the message CALIBRATION DUE will display.
- Red alarm LED flashes and the sounder operates.
- After 5 seconds, the display changes to indicate gas levels.

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- 6.3 **Response check** (bump) the sensors once per day of issuance.
- Install the sensor cover under the ledge above the sensor panel and secure with the half-turn fasteners.
 - Connect the cylinder of TEST GAS to the inlet of the sensor cover.
 - Direction of flow is marked on the sensor cover.
 - Observe if the sensor reacts to the gas.
 - Shut off the valve and disconnect the supply of TEST GAS.
 - Repeat for each of the four gases in the sensor.



- 6.4 **Calibration:** The manufacturer recommends a recalibration interval of 6 months. Do not use the meter if the date exceeds 6 months. For calibration at BNL:
- Install the sensor cover under the ledge above the sensor panel and secure with the half-turn fasteners.
 - Connect the cylinder of TEST GAS to the inlet of the sensor cover via a flow meter.
 - Direction of flow is marked on the sensor cover.
 - Adjust the control valve on the flow meter to achieve a flowrate of 0.5 liters/min.
 - Wait until the reading has stabilized on the TRIPLE PLUS display before programming in the new level.
 - Shut off the valve and disconnect the supply of TEST GAS.
 - Repeat for each of the four gases in the sensor.

6.5 **Battery Charging**

- The CROWCON battery pack has sufficient capacity to power the instrument for 12 hours. Full recharge is accomplished in 4-6 hours. A well charged battery will display > 5.8V. Levels below 5.3V causes a low battery warning.
- Turn the meter off. Place the instrument in the charger housing and observe that the charging indicator LED glows. As the battery approaches full charge, the current drops to the trickle rate and the LED switches to **green**.
- An instrument may be left at the trickle charge rate indefinitely, or removed for use.



6.6 **Display**

- For Post-fire testing, run the meter with the pump on, the sensor cover in place, and the particulate filter upstream of the sensor cover.
- For each sensor, the display indicates the gas concentration, the units of

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measurement (e.g., ppm) and the channel name (e.g. HCN).

- The green LED flashes intermittently accompanied by short beep to give confidence to the user that the meter is functioning well.
- **OVERRANGE:** If a sensor signal is out of range, this causes the relevant numbers on the display to flash, and indicates a high gas level or faulty sensor module. Calibration should be checked after such a warning.
- **BACKLIGHT** can be activated to illuminate the display by pressing the button marked with a light symbol. Press the button again to switch off the backlight.
- **ALARMS:** In an alarm condition, the red light flashes and the sounder emits a loud fast bleep.
- **CLOCK:** The instrument has a built-in clock which can be displayed by pressing the **UNMARKED** button. The display will show the current time on the top line of the display, with the elapsed time (since the instrument was switched on) on the bottom line. Press the button again, or wait 4 seconds, and the display will return to its previous mode.

6.7 **Data Logging:** (See Attachment 9.1 for more details). Data logging takes place continuously within a **TRIPLE PLUS** when switched on. Readings are stored of all four gas channels at a rate set by **log-PERIOD**. For each channel, the maximum level seen since the last reading was taken is recorded. Logged data is retained in battery-backed memory when the instrument is turned off. When the memory is full, new data overwrites the oldest data.

- Press **LOG-CLEAR** to clear the memory.
- Reviewing the data is via the commands **LOG_STATS**, **LOG-DUMP**, and **LOG_LATEST**.

6.8 **Analyzing the response:** The reading should be as low as possible but always below the **IDLH**, **TLV** & **PEL**:

- Carbon Dioxide: 5000 ppm
- Carbon Monoxide: 25 ppm
- Hydrogen Cyanide: 4.7 ppm
- Hydrogen Chloride: 2 ppm

Re-occupancy after a fire [for personnel without respiratory PPE and normal occupants] should be below these values:

- Carbon Dioxide: 1000 ppm
- Carbon Monoxide: 5 ppm
- Hydrogen Cyanide: 1 ppm

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- Hydrogen Chloride: 0.2 ppm

6.9 **Powering Off:** Press the “ON” button and the UNMARKED button simultaneously.

7.0 Implementation and Training

Prior to using this meter, the operator:

- 7.1 Training prior to using this meter includes a demonstration of proper operation of the instrument based on training, education, and experience. All persons must have met the qualification criteria for IH75 Chemical Hazard Assessor set in *IH50300 BNL IH Program and IH Group Training & Qualification Matrix*.
- 7.2 Personnel are to document their training using Attachment 9.2, the Job Performance Measure Completion Certificate. Qualification on this JPM is required on a 3 year basis, providing the professional is monitoring chemical sources frequently.
- 7.3 Other appropriate training for the area to be entered (check with ESH coordinator or FS Representative for the facility).

NOTE: It is intended that in emergency situations, this meter will be set up by SHSD personnel with JPM Qualification, but may be carried onto the restricted area at the fire scene by someone (typically an Emergency Services Fire Rescue fire fighter) who has only had a briefing on the meter response at the scene by the SHSD personnel. The SHSD member is to explain the audible alarm, backlight, confidence beep, and the acceptable meter reading for the four toxic gases to the meter user.

8.0 References

- 8.1 Crowcon Triple Plus+ Instruction Manual

9.0 Attachments

- 9.1 Troubleshooting Guide & Data logging information
- 9.2 Job Performance Measure Qualification Criteria Record

The only official copy is on-line at the SHSD IH Group website.
 Before using a printed copy, verify that it is current by checking the document issue date on the website.

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10.0 Documentation

Document Development and Revision Control Tracking		
PREPARED BY: <i>(Signature and date on file)</i> Nicole Bernholc Date: 07/07/06	REVIEWED BY: <i>(Signature and date on file)</i> J. Peters Date: 07/18/06	APPROVED BY: <i>(Signature and date on file)</i> R. Selvey IH Manager Date: 07/19/06
ESH Coordinator/ Date: <i>none</i>	Work Coordinator/ Date: <i>none</i>	SHSD Manager / Date <i>none</i>
QA Representative / Date: <i>none</i>	Training Coordinator / Date: <i>none</i>	Filing Code: IH52
Facility Support Rep. / Date: <i>none</i>	Environ. Compliance Rep. / Date: <i>none</i>	Effective Date: 07/19/06
ISM Review - Hazard Categorization <input type="checkbox"/> High <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Low/Skill of the craft	Validation: <input type="checkbox"/> Formal Walkthrough <input checked="" type="checkbox"/> Desk Top Review <input type="checkbox"/> SME Review Name / Date:	Implementation: Training Completed: Tracked in BTMS Procedure posted on Web: 07/19/06 Hard Copy files updated: 07/19/06

Revision Log		
Purpose: <input type="checkbox"/> Temporary Change <input type="checkbox"/> Change in Scope <input type="checkbox"/> Periodic review <input type="checkbox"/> Clarify/enhance procedural controls		
Changed resulting from: <input type="checkbox"/> Environmental impacts <input type="checkbox"/> Federal, State and/or Local requirements <input type="checkbox"/> Corrective/preventive actions to non-conformances <input type="checkbox"/> none of the above		
Section/page and Description of change:		
<i>(signature/date on file)</i> SME Reviewer/Date:	SME Reviewer/Date:	SME Reviewer/Date:

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Attachment 9.1

TROUBLESHOOTING GUIDE

SYMPTOM	DIAGNOSIS	REMEDY/CHECK
Does not switch on	Battery flat	Recharge battery
Does not switch off	OFF Disabled	Alter configuration*
No audible tick	Tick disabled	Alter configuration*
Alarm signals, no gas	Alarm latched	Reset with unmarked button
Gas reading, no gas	Zero drift	Zero instrument
Unstable/inaccurate reading	Sensor failed	Recalibrate or replace sensor**
See SETTING UP or TERMINAL INTERFACE**	**See MAINTENANCE AND CALIBRATION	

Configuration of the data logger or access to logged data is via the following TERMINAL INTERFACE commands

LOG_CLEAR	Clear the data logging memory
LOG-PERIOD hour min sec	Display or change the data logging interval. This may be anywhere between 1 second 00:00:01 and 25 hours for four channels (23:59:59). If the logger is set for 1 second the memory has sufficient capacity to store information for 100 minutes before overwriting. For most applications the default log period of 1 minute provides a good compromise storing 100 hours of gas data
LOG-STATS (report)	Show the min, mean and max values of all logged data reports or a single report. This is useful as it condenses pages of information into one. If a significant deviation from ambient air is noted, it can be looked at in more detail with the LOG-DUMP command.
LOG-DUMP (report)	Output all logged data by report or dump a single numbered report. Every gas reading within the specified report is output to the terminal screen
LOG-LATEST(hr)(min)(sec)	Dump all data reports logged over the past 30 minutes or over a requested time period.

**Safety & Health Services Division
Industrial Hygiene Group**

HP-IHP-75550

**Crowcon Triple Plus+ IR
Job Performance Measure (JPM) Qualification Certificate**

Expires (3 years)

Candidate's Name	BNL#	Date of Qualification
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Topic	Criteria	Qualification Status		
		Not Qualified	Recovered	Satisfactory
Personal Protective Equipment	Understands the need to be aware of the potential surface contamination and airborne levels of contaminants and knows how to determine the need for PPE and how to obtain the correct PPE for the hazard.			
Sampling Equipment	Shows where equipment needed for the procedure is located and how to properly sign it out.			
Sampling Protocol	Understands the exposure monitoring logic necessary to appropriately select sampling locations to accurately measure worker, public and environmental exposure potential.			
Meter Operation	Demonstrates turning on and off, warming up, and zeroing			
	Demonstrates obtaining the bump check gas and setting up a bump check			
	Demonstrates observing the real time reading and maximum reading from the meter for each hazardous compound			
	Demonstrates reading and interpreting the concentration			
Record forms	Shows how to correctly and completely fill all forms associated with this SOP.			
Analysis of data	Shows how to perform (or who to request to perform) the data analysis on the sampling data to access potential exposure to the sampler, worker, public and environment.			

I accept the responsibility for performing this task as demonstrated within this JPM and the corresponding SOP.

Candidate Signature:	Date:
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I certify the candidate has satisfactorily performed each of the above listed steps and is capable of performing the task unsupervised.

Evaluator Signature:	Date:
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