

## Standard Operating Procedure

<b>Title:</b>	<b>Dealing with Benzene Standard Operating Procedure</b>		
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### 1 Introduction and Purpose

This procedure shall be used to ensure personnel safety whilst working on plant and process equipment that have the potential to contain benzene or release benzene into the atmosphere that may exceed benzene threshold limits. This procedure identifies testing requirements, methods, and PPE requirements.

### 2 Definitions and Abbreviations

Abbreviation	Definition
BA	Breathing Apparatus
BRPSM	Benzene Respiratory Protection Selection Matrix
PPE	Personnel Protective Equipment
PTW	Permit to Work
RPE	Respiratory Protective Equipment
STEL	Short-Term Exposure Limit
TWA	Time Weighted Average
VOCs	Volatile Organic Compounds

### 3 Exposure Limits

WorkSafe Guidelines, New Zealand Workplace Exposure Standards and Biological Exposure Indices: Benzene.

- 0.05 ppm for 8-hour Time Weighted Average (TWA)
- Short-Term Exposure Limit (STEL) - there is NO STEL for Benzene.
- To obtain a 10 & 12hr shift pattern Workplace Exposure Standards (WES) an adjustment using the Brief and Scala model is used:

$$\text{WES-TWA} = \frac{8 \times (24-h) \times \text{WES-TWA}}{16 \times h}$$

In this case = 0.025 ppm for 12-hour Time Weighted Average (TWA)

For a 10hr shift pattern the TWA is: 0.035ppm

For a 12hr shift pattern the TWA is: 0.025ppm

## Dealing with Benzene Standard Operating Procedure

The Workplace Exposure Standards (WES) and Biological Exposure Indices (BEI) are intended to be used as guidelines for health risk management by people qualified in occupational health practice.

### 4 Procedure

- a) Prior to commencing a work activity that involves breaking into systems a review of the work scope should be completed to identify where the break-in points are, and which points are to be tested for Benzene.
- b) Area or boundary testing can be conducted to determine levels of Benzene released from process systems.
- c) Ensure all personnel are aware of PTW checklists, [Checklist 59 - Making and Breaking Flanges](#) and [Checklist 54 - Bleeding Down Vessels Containing Hazardous Fluids to Drains or Atmosphere](#).
- d) Prepare a permit and the appropriate paperwork allowing at least 14 days for planned work to be reviewed.

#### 4.1 Testing and Personnel Protective Equipment (PPE) Requirements

PPE requirements for breaking into the system and performing atmospheric testing are outlined below:














- a) The testing is for the protection of people and should be undertaken in the “expected breathing zones” 30cm around the face and away from any potential contaminated areas such as directly in an opening or on contaminated surfaces.
- b) Pretesting of a work area can commence from a distance, this will determine what level of PPE is required, in this instance a half face respirator with a P3 organic vapour cartridge and gloves shall be worn.
- c) The ION Tiger Select, and the Ultra Rea 3000 Benzene monitoring devices are to be used in accordance with their operating instructions and by a competent person, overviews in Appendix [A](#) & [B](#)
- d) **All sample readings** are to be recorded on the results form in [Checklist 21 – Dealing with Benzene](#) and kept with the PTW for the activity. These will be required to be recorded in the site’s Health Hazards Register.  
[Health Hazard Management](#)
- e) Confined space entries are tested for a range of atmospheric contaminants in accordance with the Common Permit to Work system and Gas Free Certificate requirements.

#### 4.2 Respiratory Protective Equipment (RPE)

The level of RPE required depends on the atmospheric concentration of Benzene and the duration of exposure. The levels of RPE are set out in the Todd Energy Benzene Respiratory Protection Matrix guideline is provided in Appendix [C](#).

Personnel that are required to wear respiratory protection, must have been fit tested and been assessed competent to wear a face mask.

### 4.3 PPE Requirements Matrix (Appendix C will define the PPE level requirements)

<b>First Breaks of Equipment</b>	For first breaking of equipment, area, breathing zone testing with the Todd standard PPE requirements.	 Gloves	 Half face respirator with P3 organic vapour cartridge	
<b>Half Face Mask</b>	When required to wear a half face mask you should consider the task, whether you are dealing with liquids / sludges and what PPE should be utilised.  And refer to the BRPSM for respiratory protection.	 Black /blue Armour Nitrile Glove or equivalent	 Half face respirator with P3 organic vapour cartridge	 Microguard 2000 Ts Plus or equivalent if in contact with Hydrocarbons or required by the task. e.g., confined space, liquids, sludges.
<b>Full Face Mask</b>	When required to wear a full - face mask you should consider the task, whether you are dealing with liquids / sludges and what PPE is should be utilised.  And refer to the BRPSM for respiratory protection.	 Black /blue Armour Nitrile Glove or equivalent	 Gumboots or equivalent rubber hydrocarbon resistant Gumboots or boot covers if in contact with hydrocarbons or required by the task	 Microguard 2000 Ts Plus or equivalent if in contact with Hydrocarbons or required by the task. e.g., confined space, liquids, sludges.   Full face respirator with P3 organic vapour cartridge  Excludes short duration tasks where half face has been assessed as acceptable, refer to BRPSM for respiratory protection.
<b>Breathing Apparatus</b>	When required to wear Breathing Apparatus you are required to wear the full PPE, to the right in this table.	 Ansell Alpha Tec Viton/Butyl Style No. 38-612 or equivalent	 Gumboots or equivalent rubber hydrocarbon resistant  Bata PU	 Microguard Microchem 3000 or chemical resistant suit   Breathing Apparatus

#### 4.3.1 Contact with Liquids

Where there may be contact with liquids and/or vapours above allowable limits, the above PPE is required in addition to the Todd Energy standard PPE requirements (Fire-retardant overalls, lace up steel toe safety boots, hard hat, and eye protection).

#### 4.4 Disposing of Contaminated PPE

Disposable overalls may need to be tested to determine if they have been contaminated, if so, they will be disposed of as Benzene Contaminated in the site Hazardous Waste bin. Gumboots and work boots that have in direct contact with hydrocarbon liquids are to be cleaned, liquids from this are to be captured and disposed of in the site process drain system.



#### Additional Notes:

- a) When wearing the above PPE, the normal Flame-retardant overalls are to be worn closest to the body and to be tucked into the boots, and the Microguard or equivalent chemical suit are to be worn over top of the boots. The coveralls are also to fully cover the wrist cuffs of the fire-retardant overalls and where possible should sit on top of the cuff of the gloves.
- b) Once initial sample readings have been established and correct PPE selected, work may proceed. As liquid or sludge is found, or more flanges opened, new tests should be taken after the area is re-checked as hydrocarbon gas free. A boundary and internal selection of break points may be undertaken to determine whether a system is free of contaminants.
- c) **When undertaking other atmospheric readings for Mercury and NORMS personnel are to revert to the highest level of controls across all the SOP's.**

**Note for Sampling:** The below is an overview of sampling devices, personnel must be trained and competent in the use of these devices before they are authorised to operate them.

## APPENDIX A – Operating Overview for ION Tiger Select Benzene Sampling Device

**The ION Tiger Select Benzene sampling device is intrinsically safe.**

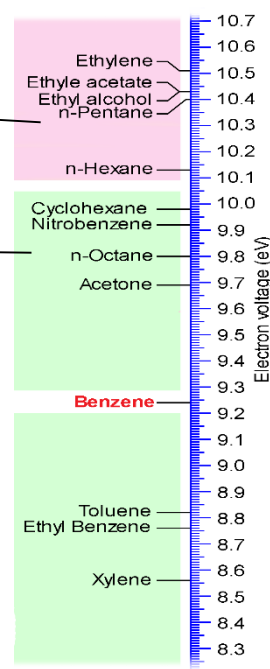
**PTW should be used when breaking into process equipment utilising checklist's 21 & 59.**


**PTW may not be required for random sampling.**

The Tiger Select uses a 10.0 eV light source so many of the gases associated with benzene are ignored.

The remaining gases associated with benzene are removed within a benzene pre-filter tube.

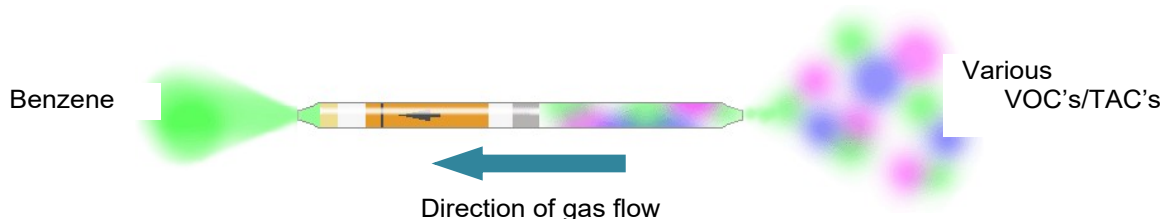
**Note:** n-butane, n-pentane, ethylene, propylene, ethanol and ethyl acetate are not shown on this illustration, however, they are also beyond the detection range of the 10.0 eV lamp so are not detected.



- To turn the device on press the  Enter / On-Off key once which will turn the device on
- To turn the device off press and hold the Enter / On-Off key for three second count down which will turn the device off.
- The ION Tiger Select Benzene device comes pre-set to detect total volatile organic compounds VOC's and or total aromatic compounds TAC's, if present will read these when turned on.
- If the there are no VOC's/TAC's in and around the sampling areas, there will be no Benzene to sample and 0.00 will show on the LCD screen.
- The device will show level readings on its LCD screen if there is a presence of VOC's/TAC's in the atmosphere will alarm a pre-set level to alert the user that they are approaching a contaminated area, if the user is not wearing respiratory protection, they should leave the area and obtain the appropriate PPE so they can continue with their sampling.

## Dealing with Benzene Standard Operating Procedure

- f) Once VOC's/TAC's have been detected and the sampler wants to know the levels of Benzene the sampler can use the Pre-Filter Benzene tubes that absorb the VOC/TAC gases and let the benzene pass through for analysis by the device.



- g) To achieve this, unscrew the small tip at the top of the device.



- h) Ensure that the rubber seal is in place in the device after unscrewing the tip



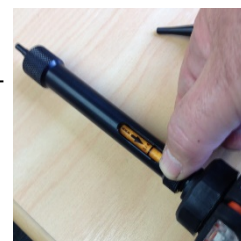
- i) Prepare the pre-tube filter by using the tube opener/cutting tool.

- j) Insert the tube into the tube holder ensuring the black arrow on the tube is pointing towards the open end (towards the instrument).

(Watch out for sharp edges on both ends of the tube after you have cut them off)



- k) Screw the tube holder and the tube on to the instrument



- l) Understanding the keypad

The keypad comprises two soft keys: **A** and **B**, **Up** and **Down** arrow keys, an **Escape (Esc)** key, and an **Enter / On/Off** button. In general, setup and application settings are selected and adjusted via the soft keys, options are selected by the arrow keys and confirmed by the **Enter** key. A single press is used as a switching operation.



## Keypad Function Descriptions



Soft keys **A** and **B** rely on graphical prompts on the display to indicate their functionality.



**Note:** Pressing both soft keys together switches the flashlight / torch on and off.



**Up** and **Down** keys are used to adjust settings and navigate through the menu structure.



**Enter / On/Off** key is used to accept adjustments and select functions; also, to turn the TIGER on and off.



**Escape (Esc)** key is used to abort an adjustment or exit from a menu.



**Note:** Personnel that wish to operate the Tiger Select Benzene detection device must be trained in its use before they can operate the device.

**Detailed operating instructions for the Tiger Select device will accompany the meter.**

## APPENDIX B – Operating overview for: The Ultra Rea 3000 Benzene Sampling Device

**The Ultra Rea 3000 Benzene sampling device is intrinsically safe.**

**PTW should be used when breaking into process equipment utilising checklists 21 & 59.**

**PTW may not be required for random sampling.**

The Ultra Rea 3000 is similar to the ION Tiger Select when turned on runs through its calibration and is then ready to read volatile organic compounds VOCs in the atmosphere.

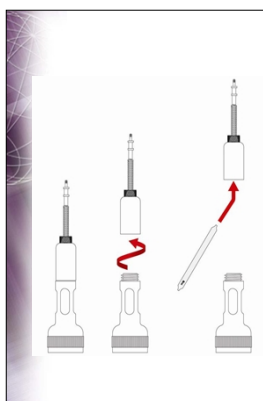
- a) To start the device, push the button in-between the Y/+ and N/+ buttons and the Start-up self-test sequence will begin.
- b) Once the start-up procedure is complete, the instrument shows a numerical reading screen with icons. This indicates that the instrument is fully functional and ready to use.
- c) It is then ready to measure for VOCs in the atmosphere.
- d) If there are no VOC's in and around the sampling areas, there will be no Benzene to sample and 0.00 will show on the LCD screen.
- e) The device will show level readings on its LCD screen if there is a presence of VOCs in the atmosphere will alarm a pre-set level to alert the user that they are approaching a contaminated area if the user is not wearing respiratory protection they should leave the area and obtain the appropriate PPE so they can continue with their sampling.
- f) Once VOC's have been detected and the sampler wants to know the levels of Benzene, the sampler can use the Pre-Filter Benzene tubes that absorb the VOC's gases and let the benzene pass through for analysis by the device as does the ION Tiger Select device.

When you want to sample specifically for Benzene it is much like the ION Tiger Select device and you follow the screen prompts for the insertion of the Pre-Filter tube and then the use of the device.

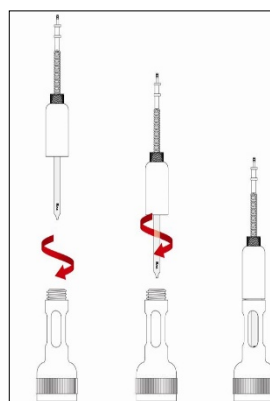




## Dealing with Benzene Standard Operating Procedure



Unscrew the probe from the base of the device and slip the tube into the rubber holder in the front portion of the probe.



Insert the other end of the tube into the middle of the base while turning the front portion to tighten it into the base's thread, don't overtighten.

Once the tube is in place, begin measuring by pressing [Y/+]. The display shows a countdown.

- a) 60 seconds is standard, but sampling time depends on the type of separation tube selected and the temperature.
- b) You can abort the sampling by pressing [N/-] at any time.

**Note:** Personnel that wish to operate the Ultra Rea 3000 Benzene detection device must be trained in its use before they can operate the device.

**Detailed operating instructions for the Ultra Rea 3000 Benzene device will accompany the meter.**

**APPENDIX C: Todd Energy Benzene Respiratory Protection Matrix for 10-Hour & 12-Hour Shift Pattern (TWA)**

Concentration / Duration	15 minutes	30 minutes	45 minutes	1 Hour	3 Hours	6 Hours	8 Hours	12 Hours
0.025 ppm	No Mask	No Mask	No Mask	No Mask	No Mask	No Mask	No Mask	No Mask
0.05 ppm	No Mask	No Mask	No Mask	No Mask	No Mask	No Mask	Half Face Mask	Half Face Mask
0.25 ppm	No Mask	No Mask	No Mask	No Mask	Half Face Mask	Half Face Mask	Half Face Mask	Half Face Mask
1 ppm	No Mask	Half Face Mask	Half Face Mask	Half Face Mask	Half Face Mask	Full Face Mask	Full Face Mask	Full Face Mask
1.5 ppm	No Mask	Half Face Mask	Half Face Mask	Half Face Mask	Full Face Mask	Full Face Mask	Full Face Mask	Full Face Mask
2 ppm	Half Face Mask	Half Face Mask	Half Face Mask	Half Face Mask	Full Face Mask	Full Face Mask	Full Face Mask	Full Face Mask
2.5 ppm	Half Face Mask	Half Face Mask	Half Face Mask	Half Face Mask	Full Face Mask	Full Face Mask	Full Face Mask	Full Face Mask
5 ppm	Half Face Mask	Half Face Mask	Half Face Mask	Full Face Mask	Full Face Mask	Full Face Mask	Full Face Mask	Breathing Apparatus
10 ppm	Half Face Mask	Full Face Mask	Full Face Mask	Full Face Mask	Full Face Mask	Breathing Apparatus	Breathing Apparatus	Breathing Apparatus
25 ppm	Full Face Mask	Full Face Mask	Full Face Mask	Full Face Mask	Breathing Apparatus	Breathing Apparatus	Breathing Apparatus	Breathing Apparatus
50 ppm	Full Face Mask	Full Face Mask	Full Face Mask	Breathing Apparatus	Breathing Apparatus	Breathing Apparatus	Breathing Apparatus	Breathing Apparatus
100 ppm	Full Face Mask	Breathing Apparatus	Breathing Apparatus	Breathing Apparatus	Breathing Apparatus	Breathing Apparatus	Breathing Apparatus	Breathing Apparatus
>100 ppm	Stop Work	Stop Work	Stop Work	Stop Work	Stop Work	Stop Work	Stop Work	Stop Work

**The Benzene Respiratory Protection Selection Matrix has been designed for workers that have been Fit Tested and assessed as competent to wear a face mask.**

The duration of exposure indicated is the sum over a 10 or 12hr working day, for example, if a worker is exposed to 1 ppm benzene for 45 minutes in the morning and 1 hour in the afternoon, the total duration of exposure is 1hour forty-five minutes. By applying the references in the matrix, the worker should be able to determine the level of respiratory protection that is required. In this instance they should be looking at the 1ppm to the 3-hr duration and determine that they should wear a Half-Face mask.

**Note:** Where the benzene vapour in or around the equipment/system is recorded over **>100 ppm**, the work is to be stopped and the activity will be reassessed, and measures put in place to reduce the atmospheric conditions.

## Dealing with Benzene Standard Operating Procedure

### Revision History

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2	30/06/2021 1:08:02 PM	Approved for Use	Chris Berry	Chris Berry		David Bradley	30/06/2021 12:11:57 PM	30/06/2021 11:18:41 AM
3	24/07/2023 2:24:49 PM	Approved for Use	Chris Berry	Mike Klenner; Dion West; Cameron Murray; Peter Martin; Brooke Gamlin	27/06/2023 12:00:00 AM	Hilary Gibson	24/07/2023 2:21:33 PM	24/04/2023 9:08:42 AM
4	26/09/2023 1:34:50 PM	Approved for Use	Brooke Gamlin	Peter Martin	20/09/2023 12:00:00 AM	Hilary Gibson	25/09/2023 1:56:57 PM	20/09/2023 9:15:42 AM
5	25/11/2024 1:39:54 PM	Approved for Use	Matthew Ussher	Rhys Harvey	30/10/2024 12:00:00 AM	Hilary Gibson	25/11/2024 1:07:46 PM	30/10/2024 9:43:29 AM

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