

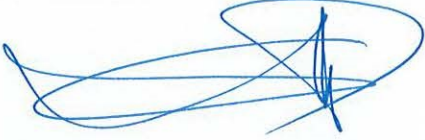





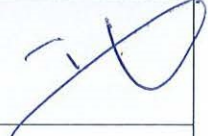
## COMPANY STANDARD INSTRUCTION

### BENZENE CONTROL PROGRAM

Instruction Number: IN-253-ENV-09

Document Classification: Internal

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**Revision / Modification History:**

Rev #	Date	Section No.	Reason for revision / modification
0	08/11/2020	All	New Instructions for Benzene Control Program

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Review Team: (Optional. May be used when a team is used for reviewing the document)

Rev #	Job Title	Department	Remarks
00	Ethylene Plant Manager	Ethylene	
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	Safety Engineer	Safety (Olefins/Polyolefins)	
	Sr. HSEQ Officer	Manufacturing Group (SC/PE)	
	Day Supervisor-Ethylene	Ethylene	
	Turnaround Engineer	TAR	
	Sr. Firefighting Officer	Fire Fighting	
	Sr. Business Analyst-Quality	Quality/HSEQ Department	

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## 1. OBJECTIVE

The objective of this instruction is to provide a working plan to ensure compliance with the Occupational Safety and Health Administrations' (OSHA) Benzene Standard: OSHA 29 CFR 1910.1028. It explains and outlines QAPCO's methods of compliance that include engineering controls, work practices, and personal protective equipment requirements. This guideline also provides hazard communication and health hazard information for QAPCO employees, regarding their exposure to Benzene

## 2. SCOPE

This instruction will apply across QAPCO premises & any future expansions within QAPCO. It is applicable to QAPCO staff and contractors entering the QAPCO Plant premises and applies to all work activities at QAPCO that may involve potential exposure to benzene and stipulates general exposure control procedures to be utilized during work activities that may expose an employee to benzene.

## 3. INSTRUCTION SUMMARY

This instruction provides information to relevant internal stakeholders (HSEQ, Line Manager, Employees) and external stakeholders (contractors) on Benzene Control Program for both QAPCO employees and contractors.

Benzene Control Program can be briefly summarized as below:

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Responsible Role	Clause #	Activity	Remarks
Defined in Section 6.0	Table 6.2	Identifying the Hazard & Route of Entry: Benzene	Identify the Activities and Exposure Groups, where Benzene Exposure May possible
Defined in Section 7.0	7.1	Identification of Critical Control Points	Identify each equipment /vessel containing benzene more than 1% by volume.
Defined in Section 7.0	7.2	Work-place Monitoring	Benzene Specific Direct reading monitors should be used for quantitative assessment
Defined in Section 7.0	7.3	Establishing Controls: Engineering,	Engineering controls and work practices shall be utilized to control employee exposures below the PEL and STEL
Defined in Section 7.0	7.4, 7.5	Hazard Signages & Respiratory Protection	HAZCOM signs, labeling, barricading and Respiratory Protection shall be used
Defined in Section 7.0	7.6, 7.7	Personal Exposure Monitoring & Health Surveillance	Personal Exposure Monitoring & Medical Surveillance Requirements shall be followed.

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#### 4. ABBREVIATIONS / DEFINITIONS

#	Abbreviation / Key word	Definition summary
1.	<b>Action level</b>	Means an airborne concentration of benzene of 0.5 ppm calculated as an 8- hour time-weighted average.
2.	<b>Authorized person</b>	Means any person specifically authorized by the employer whose duties require the person to enter a regulated area, or any person entering such an area as a designated representative of employees for the purpose of exercising the right to observe monitoring and measuring procedures.
3.	<b>Area Monitoring (Workplace Monitoring)</b>	Exposure monitoring conducted with a device (Chemical Specific direct reading instruments) in a location where potential exposure of benzene in the workplace.
4.	<b>Benzene</b>	(C <sub>6</sub> H <sub>6</sub> ) (CAS Registry No. 71-43-2) means liquefied or gaseous benzene. It includes benzene contained in liquid mixtures and the benzene vapors released by these liquids. It does not include trace amounts of un-reacted benzene contained in solid materials.
5.	<b>Chemical</b>	Is any substance, compound, or mixture, which potentially has physical or health hazards.
6.	<b>Chronic</b>	Occurring over a relatively long time period, including weeks to years.
7.	<b>Container</b>	Means any barrel, bottle, can, cylinder, drum, reaction vessel, storage tank, or the like, but does not include piping systems.
8.	<b>Emergency</b>	Means any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment which may or does result in an unexpected significant release of benzene.
9.	<b>Employee exposure</b>	means exposure to airborne benzene which would occur if the employee is not using respiratory protective equipment.
10.	<b>Hazard Communication (HazCom)</b>	Is a program that details the process of providing information to employees about hazardous substances known to be in the workplace to which they may be exposed. The OSHA HazCom Program includes elements such as product labeling, and other forms of warning, safety data sheets, including training.
11.	<b>Hazardous Substance</b>	Is any material that, because of its quantity, concentration, or physical or chemical characteristics, poses a significant present or potential hazard to human health and safety or to the environment if released into the workplace or the environment.
12.	<b>Immediately Dangerous to Life or Health (IDLH)</b>	Means an atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual's ability to escape from a dangerous atmosphere. IDLH for Benzene is 500 ppm.
13.	<b>Licensed Healthcare Professional</b>	Is a person with the necessary qualification in an area of medicine or nursing that maintains a license to practice with professional body.
14.	<b>Safety Data Sheet (SDS)</b>	Is a printed document concerning a hazardous substance, which is prepared in accordance with OSHA 29 CFR 1910.1200.

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15.	<b>Permissible Limit (PEL)</b>	<b>Exposure</b>	Limit published and enforced by OSHA as a legal standard. A PEL carries the same definition as TLV and is typically an 8-hour TWA unless otherwise noted. OSHA PEL for Benzene is 1 ppm.
16.	<b>Regulated Area</b>		Means any area where airborne concentrations of benzene exceed or can reasonably be expected to exceed the PEL, of 1 ppm or the short-term exposure limit of 5 ppm for 15 minutes.
17.	<b>Similar Exposure Groups (SEGs)</b>		A group of employees who likely experience similar exposure to chemical or physical agents. The exposure must be similar enough so that monitoring a randomly selected group of workers in the SEG provides data which can be used to predict the exposure of the general population of workers in the SEG.
18.	<b>Short-Term Limit (STEL)</b>	<b>Exposure</b>	Limit that is usually a 15-minute TWA exposure that shall not be exceeded at any time during a workday, even if the 8-hour TWA is within the TLV-TWA. OSHA STEL is 5 ppm.
19.	<b>Threshold Limit Value (TLV)</b>		Published by the American Conference of Governmental Industrial Hygienists (ACGIH). TLVs are defined as 8-hour TWA airborne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse health effects. Benzene TLV is 0.5 ppm.
20.	<b>Time-Weighted Average (TWA)</b>		Exposure concentration for a conventional 8-hour workday and a 40-hour workweek.
21.	<b>Medical Protection (MRP)</b>	<b>Removal</b>	Mitigation to temporarily or permanently remove affected worker from a work unit aimed at preventing the worker from further exposure to Benzene presence in that particular work unit.
22.	<b>PPM</b>		
			Parts per Million (for Air Borne Concentration)
23.	<b>HOM</b>		
			Head of Medical
24.	<b>SHO</b>		
			Senior Hygiene Officer
25.	<b>SEM</b>		
			Sustainability & Environment Department Manager
26.	<b>HSEQGM</b>		
			Health, Safety, Environment & Quality Dept. Group Manager
27.	<b>CHSEQO</b>		
			Chief HSEQ Officer

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## 5. DOCUMENT REFERENCES

#	Document ID	Document Name	Summary of dependency or use
2	OSHA 29 CFR 1910.1028	Title 29 of the Code of Federal Regulations, Section 1910.1028, Benzene Standard (OSHA). Title 29 of the Code of Federal Regulations, Section 1910.1200, Hazard Communication (OSHA).	Reference
3	ISBN 978 1 607260 59 2	Threshold Limit Values for Chemical Substances & Physical Agents & Biological Exposure Indices, American Conference of Governmental Industrial Hygienists (ACGIH)- Latest Edition, 2020	Technical Reference to prepare Appendix-2
4	Publication No 77-173, NIOSH, 5th Edition	Occupational Exposure Sampling Strategy Manual, NIOSH.	Reference
5	J R Mulhausen, J Damiano (eds.),	A Strategy for Assessing and Managing Occupational Exposures, 4th edition, American Industrial Hygiene Association.	Reference
6	ISBN 9780717661886, HSG-173	Monitoring Strategies for Toxic Substances, HSG173, 2nd edition, Health & Safety Executive, 2006.	Reference
7	ATSDR- Tox. Profile: Benzene	Public Health Statement - BENZENE	Appendix-3
8	PR-250-HSE-02	PPE Management Procedure	Reference
9	PR-253-ENV-03	Industrial Hygiene Exposure Monitoring Program	Ref.- Sec. 7.6
10	PR-310-MED-02	Fitness to Work Procedure	Ref.- Sec. 7.7



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## 6. RESPONSIBILITIES (RASCISUMMARY)

#	Procedure chapter	Area Owner (Department)	CHSEQO	SEM /Sr. Hygiene Officer	HSEQ Officer	Contractors	Medical Section
1	Implementing Benzene Control Program	R	A	R	S/C	R	I
2	Identification of Critical Control Points & Profiling 'High Risk' Activities	A/R	I	S/C	S/C	R	I
3	Work-place monitoring and Personal Exposure Monitoring	A	A	R	S/C	S/C	I
4	Providing Improvement Action Plan or Benzene Control Recommendations	S/C	A	R	S/C	S/C	I
5	Implementing Necessary Controls, I.e. Engineering, Administrative & PPE	A/R	I	S/C	S/C	R	I
6	Implementing Medical Surveillance Program	S/C	A	S	S	--	R

### **Legend:**

- R = Responsible (the class of people who are ultimately responsible for getting the work done)
- A = Accountable (the position that is accountable to oversee that the work gets done)
- S = Support (the person who supports by providing information and suggest any deviations from the Procedure)
- C = Consulted (the person who can advise when needed)
- I = Informed (concerned persons who are required to be informed or communicate to)

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## 7. INSTRUCTION METHOD

Benzene Exposure Control is one of the important elements of Occupational Health/Industrial Hygiene Risk Management Program (IHRMP). Detailed methodology of QAPCO's Benzene Control Program is as follows:

- **Establishing Benzene Control Program:**

While establishing 'Benzene Control Program' for QAPCO Operations, these are the major elements or components, which needs to align and implemented to control human exposure to benzene.

- Route of entry for exposure to Benzene & Health effects
- Identification of Critical Control Points & Profiling 'High Risk' Activities
- Work-place Monitoring with Direct reading monitors
- Engineering Solution- (Feasibility Study, Initiate MOC & Implement Design Modifications)
- Establishing Procedural Controls & Administrative Controls
- Hazard Signages
- Respiratory Protection Program
- Personal Exposure Monitoring
- Health Surveillance
- Employee Training & Awareness

### 7.1 Identification of Critical Control Points & Profiling 'High Risk' Activities:

This Process includes identification of Process Areas, Plant/Unit, Equipment, Storage Vessel, Loading Unloading Operations, and Operation-Maintenance work activities that may involve potential exposure to benzene at or above PEL. (1 ppm). Work operations with benzene mixtures less than 1% by volume are excluded in terms of identifying critical control points and Hazard signages requirements, However Employee's Health Protection measures (i.e. Personal exposure Monitoring & Health Surveillance) shall be ensured for any human exposure at or above PEL (1 ppm).

In order to define critical control points, operation has to identify each equipment /vessel containing benzene more than 1% by volume.

Pure streams of benzene are not produced by QAPCO facility; however, the Ethylene units produce a liquid fuel stream that contains benzene. Benzene can be found at / within the following Process Areas /Equipment:

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Gasoline Flash Drum (B14127)	Gasoline Heater
CG 1 <sup>st</sup> / 2 <sup>nd</sup> /3 <sup>rd</sup> /4 <sup>th</sup> stage Suction Drums	DM2 Reboiler
CG 5 <sup>th</sup> Stage Discharge Drum (B14126)	CG 1st Stage Suction Drum Drips Pump
Drier Feed Knock Out Drum (B14340)	Deethaniser
Demethaniser Column (C1402)	Depropaniser
Propane Absorber (C14103)	HP Deethanizer
Slops Tank	LP C2 Stripper
Slops Pump	Deethaniser Reboiler
GHU 1st Stage Recycle Cooler	Depropaniser Reboiler
GHU 2nd Stage Effluent Cooler	HP Deethanizer Reboiler
GHU 1st Stage Feed Drum	LP C2 Stripper Reboiler
GHU 1st Stage Hot & Cold Separator	Debutanizer
GHU 2nd Stage Separator	Debutanizer Reboiler
GHU Recycle Compressor KO Drum	Raw Pygas Cooler
GHU Stabilizer Reflux Drum	Py Gasoline Transfer Pump
Sulfiding Agent Drum	Off Spec Gasoline Tank
<p>Note: Full List of equipment having benzene more than 1% at Ethylene plant is given in Appendix- 1.</p>	

Once equipment, vessel and processes are identified; next step is to evaluate the ‘High Risk Activities’, where direct involvement of field operators, maintenance crew or contract workers may require as a part of their job. High Risk activities are classified as: Any work activities, where potential human exposure to benzene vapor is expected to be, at or above PEL (1 ppm for 8 hours) and STEL (5 ppm for 15 min) values.

Some of the examples of High-Risk Activities (Benzene Exposure Point of view) at Ethylene Plant are:

- TAR Filters/ Strainer Removal activities,
- Slop Tank venting,
- Open channel Draining of Quench tower bottoms, oil-water separators, CGC suction drums,
- Line equipment opening and clearing
- Purging & Steaming Activities (Pre-shutdown & Post Shutdown)
- Vessel Entry (Confined Space) on high benzene stream, etc.

Qualitative and quantitative risk assessments are required to be performed for these types of high-risk activities and appropriate controls measures including usage of Respiratory Protection shall be considered accordingly.

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## 7.2 Work-place Monitoring with Direct Reading Monitors (DRM):

Benzene Specific Direct reading monitors working on PID (Photoionizing Detectors) principle should be used for quantitative assessment of airborne concentration of benzene at work-place.

As described in Section 7.1, all identified critical control points and profiled high-risk activities should be quantitatively evaluated by using PID Monitor (as shown in picture). Results on airborne concentration of benzene represent the existing work-place conditions and further exposure control strategies relies on these results.



Work-place concentrations of benzene below 1 ppm may indicate safe work area as far as benzene health effects concerns. On or above 1 ppm of work-place concentrations of benzene at worker's breathing zone, must be controlled by means of Engineering controls, Administrative controls or Respiratory Protection.

It is also important to conduct Work-place monitoring of benzene during commissioning and de-commissioning activities, Purging & Steaming Activities (Pre-shutdown & Post Shutdown), prior to vessel entry on high benzene stream (above 1% by volume).

Direct reading instruments may also be used to assess the potential exposure of various SEGs (Similar Exposure Groups) including emergency handling team. DRM are also useful whenever spills, leaks, ruptures or other breakdowns occur and after the clean up to ensure that exposures have returned to the level that existed prior to the incident.

Benzene Exposure Control strategies should be based on work-place concentration of benzene compared to the limits as PEL, STEL and IDLH as stipulated by OSHA.

<b>Permissible Exposure Limit (PEL):</b>	<b>1 ppm for 8 Hours of exposure</b>
<b>Short-Term Exposure Limit (STEL):</b>	<b>5 ppm as 15-minute TWA.</b>
<b>Immediately Dangerous to Life or Health (IDLH):</b>	<b>500 ppm</b>

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### 7.3 **Engineering Controls:**

Engineering controls and work practices shall be utilized to control employee exposures below the PEL and STEL, whenever feasible. Examples include, but not limited to:

- The use of double seal pumps and seal-less pumps,
- Vapor recovery lines,
- Closed channel draining
- Connecting the vents & release points to Flare, incinerators, impingers, activated carbon bed etc. to avoid atmospheric venting
- Preventative maintenance program for local exhaust and control room ventilation systems, where applicable.

Whenever implemented engineering controls and work practices are not sufficient to reduce employee's exposure below the PEL or STEL, they shall be utilized to reduce employee exposure to the lowest levels achievable and shall be supplemented with the use of respiratory protection.

Employee rotation shall not be used as a means of compliance with the PEL.

A Leak Detection & Repair program (LDAR) should be implemented to identify fugitive emission sources and fix the leakers and flameout repair points.

### 7.4 **Establishing Procedural Controls, Administrative Controls & Hazard Signages:**

Good housekeeping and safe work practices will prevent potential exposure to benzene. In routine, Turn-arounds and emergency operations- proper work procedures (i.e. TBI- Task Based Instructions) and response techniques shall be strictly followed. Safe work procedures, including the precautions for the safe use, storage and handling of benzene should be maintained and continuously reviewed. Where the equipment is needed, onsite training should be given on its proper use.

#### **Barricading the Regulated Areas:**

- Regulated area shall be established for work areas where area monitoring results indicate the workers exposure may exceed or can reasonably be expected to exceed, either the 8-hour TWA of 1 ppm (PEL) or the short term exposure limit of 5 ppm for 15 minutes.
- Area readings (at breathing zone of worker) greater than 1 ppm on a chemical specific direct reading instrument will result in the establishment of a Regulated Area.
- These areas shall be demarcated with red and white "Danger - Benzene" barricade tape.
- Only Authorized personnel with current training and proper protective equipment shall be allowed to enter the barricaded area.

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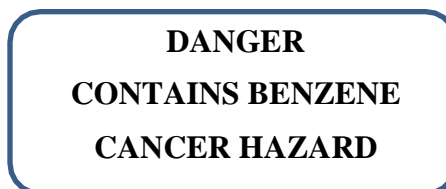
- Danger sign shall be posted at entrance to regulated areas in order to warn employees.
- The signs at Regulated Areas shall bear the following legend (as per OSHA 29 CFR 1910.1028):



HAZCOM Sign & Label:

Signages and labelling requirements also applies to the equipment containing Benzene in concentrations greater than or equal to 1% (10,000 ppm). Appropriate Benzene labels must be affixed on Benzene containers. (as per OSHA 29 CFR 1910. 1028)

All vessels, tanks, drums, or other containers (portable totes, roll off waste boxes), which contain benzene shall bear the following legend. There is no requirement to label pipes.

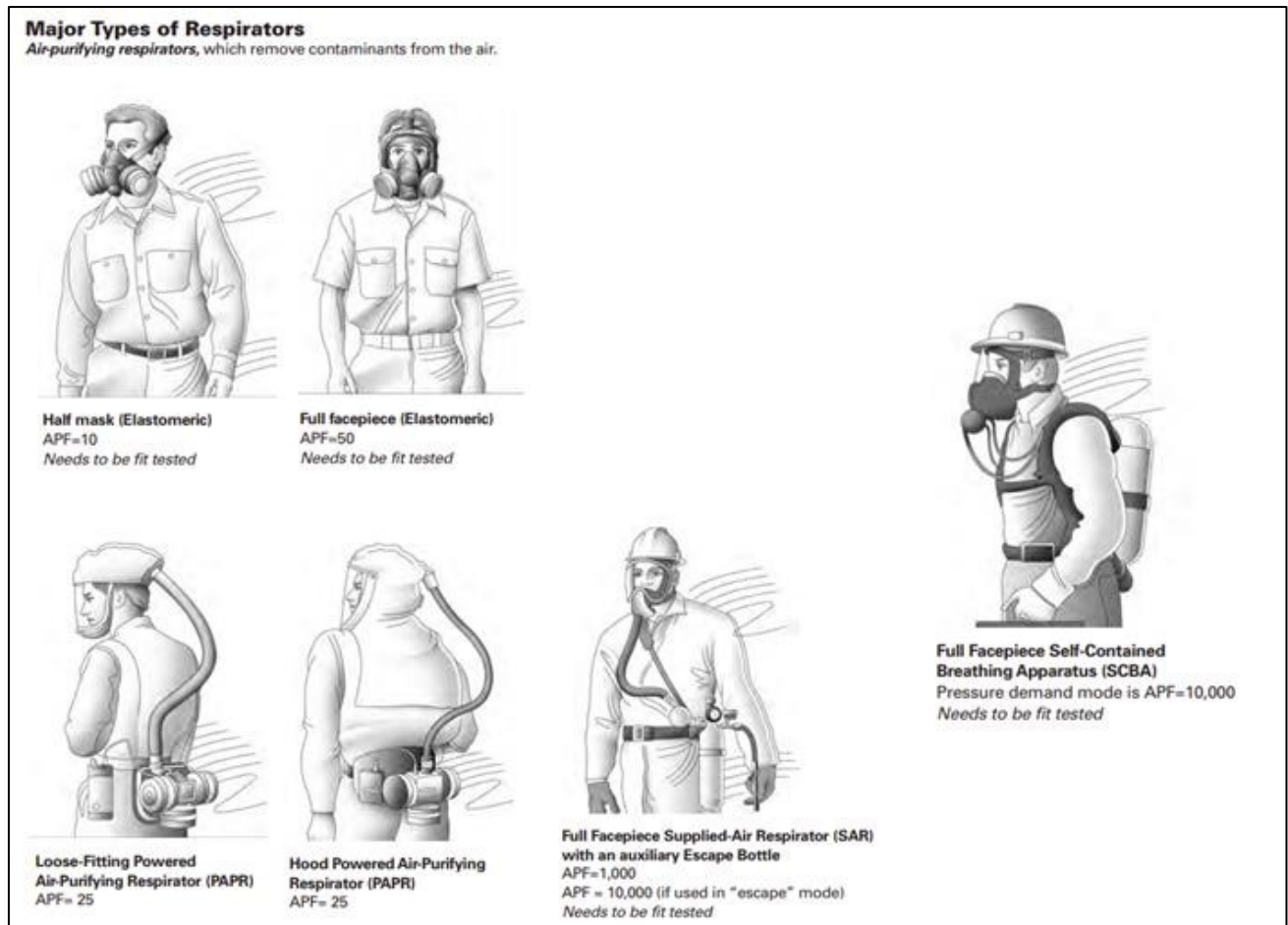


**7.5 Respiratory Protection for Benzene Exposure Control:**

Wherever the feasible engineering controls and work practices which can be instituted are not sufficient to reduce employee exposure to or below the PELs, the QAPCO shall use respiratory protection to reduce employee exposure to the lowest levels achievable. Various types of respiratory protection available at QAPCO and can be used for benzene exposure control are:

- 1) Powered Air Purifying Respirators- PAPR
- 2) Full face Chemical Cartridge Mask (twin cartridge)
- 3) Supplied Air Full Face Mask
- 4) Self Contained Breathing Apparatus (SCBA).

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Each type of respirator is having their own protection factor called APF: Assigned Protection Factors.

Benzene Exposure Control & Respiratory Protection Guide is described in Appendix-2,

Cartridge Change Schedule for Air Purifying Respirators is described in Appendix-1 on this Instruction.

## 7.6 **Personal Exposure Monitoring:**

Employees shall not be exposed above the Permissible Exposure Limits (PEL's) of 1 ppm for 8 Hours TWA. Therefore, to measure Employee's full shift personal exposure to benzene, Personal exposure Monitoring shall be conducted:

### **Employee Exposure Monitoring:**

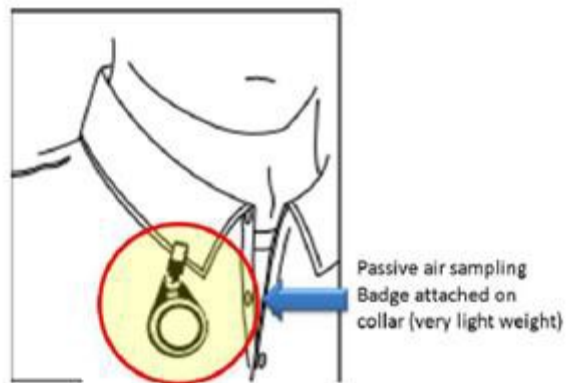
- i. Representative 8-hour TWA employee exposures shall be determined on the basis of one sample or samples representing the full shift exposure for each job classification in each work area.

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- ii. Determinations of employee exposure shall be made from breathing zone air samples that are representative of each employee's average exposure to airborne benzene.
- iii. Determinations of compliance with the STEL shall be made from 15-minute employee breathing zone samples measured at operations where there is reason to believe exposures are high or task is for the short term.
- iv. Details of the quantitative occupational exposure assessment shall be carried out as per the section 8.2 of Industrial Hygiene Exposure Monitoring Program (PR-253-ENV-03).
- v. Sampling shall be conducted using methods of monitoring and analysis that can measure Benzene to within an accuracy of plus or minus 25 percent ( $\pm 25\%$ ) and can produce accurate measurements to within a statistical confidence level of 95 percent for airborne concentrations at or above the action level.
- vi. Testing for personal exposures to airborne benzene vapors should be conducted using the following instrumentation:
  - a) Organic Vapor Monitoring (OVM) badges: Passive Samples
  - b) Activated charcoal tubes coupled to air sampling pumps.



Passive Air Sample – Applicable for BTEX, TVOC, EDC, VCM



- vii. It is important, when wearing a monitor, to go about your job in a normal manner as you would on any workday. This will enable the monitor to obtain a sample representative of the air to which you are commonly exposed.
- viii. If the test results are above the 1 ppm (PEL), the following actions are required:
  - a) An investigation into the causes of the high result.
  - b) Testing repeated until acceptable results are achieved.
  - c) Enrolment into Medical Surveillance Program



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- ix. If exposure levels continue to exceed the PEL, a "COMPLIANCE PLAN" shall be initiated to reduce the exposures below the PEL
  - a) This program will consist of engineering methods, administrative controls, Respiratory protection and work practices to minimize employee exposure below the TLV.
- ix. All industrial hygiene monitoring should be coordinated with the maintenance and operations groups as needed.
- x. Samples shall be collected utilizing internationally recognized sampling methods (i.e. OSHA, NIOSH).
- xi. A report should be generated for all sample results and shall be communicated to the affected groups via authorized channel.

### **Periodic Monitoring & Exposure Reassessment**

- i. Job classifications or work tasks for which initial exposure assessments have indicated exposures below the Action Level; the exposure assessment shall be repeated at least every two years.
- ii. Job classifications or work tasks for which initial exposure assessments have indicated exposures above the Action Level but at or below the PEL, the exposure assessment shall be repeated at least every 12 months.
- iii. Job classifications or work tasks for which initial exposure assessments have indicated exposures above the PEL; the exposure assessment shall be repeated at least every 3 months.
- iv. The exposure assessment may alter the monitoring schedule from every 3 months to 12 months for any employee or tasks for whom two consecutive measurements taken at least 7 days apart indicate that the exposure has decreased to the TWA or below but is at or above the Action Level.
- v. Monitoring for the STEL shall be repeated as necessary to evaluate exposure s of employee's subject to short term exposures.

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### Periodic Sampling Frequency Exposure Reassessments

Geometric Mean of Baseline Data (GM)	Approximate Sampling Frequency in Months
<50% the PEL	24
>50% the PEL and <100% the PEL	12
>100% the PEL	3

- vi. Workplace exposure shall be reassessed whenever there is a significant change in the production, process, control equipment, material, jobs, tasks, or work practices. Furthermore, reassessments are necessary whenever new and significant information becomes available on the toxicity of a material, or a change occurs in the PEL.
- vii. Significant changes in the workforce shall be identified and considered in reassessing exposures. Exposure assessments may be affected by a re-organization of the workforce affecting the designation of SEGs.
- viii. Additional Monitoring
  - Whenever spills, leaks, rupture or other significant breakdowns occur including turn-arounds that may result exposure to Benzene,
  - Exposure shall monitor using leak source such as direct reading instruments, area or personal monitoring.

#### 7.7 **Health Surveillance Program:**

Health surveillance for Benzene is a process where a worker's exposure to Benzene in a workplace is monitored and the data gathered will be analyzed to detect health related problems arising Benzene exposure. Health surveillance is required from any of the following:

- Recommendation from occupational health risk assessment (OHRA) report and/or
- Exposure monitoring and/or
- Advice from Head of Medical

Typically, the program should consist:

- a) Medical surveillance
  - Biological monitoring
  - Medical examination
  - Biological effect monitoring
- b) Medical Removal Protection (MRP)
- c) Return to Work (RTW)

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Medical surveillance is required for those employees who are potentially exposed to Benzene:

- a) At or above the Action Level 30 or more days per year.
- b) At or above the TLV or STEL10 or more days per year.
- c) During an emergency response to Benzene spill or release.

## BIOLOGICAL MONITORING

### a. Routine Exposure

For routine operations, workers placed under Health Surveillance should undergo yearly end-of-shift urine testing for S-Phenyl Mercapturic Acid (s-PMA) or trans, trans-Muconic Acid (t,t,-MA). The Health Surveillance for Benzene may be ceased once the exposure (based on OHRA and/or Exposure Monitoring) is no more significant and upon consultation with Head of Medical.

The Biological Index (BEI) for both are: <b>Bio-markers</b>	<b>Analysis Method</b>	<b>BEI</b>
s-PMA	GCMS	25 µg/gm of creatinine
tt-MA	HPLC/GCMS	500 µg/gm of creatinine

### b. Non-routine Exposure

For non-routine operations (turnaround, spill clean-up, etc.), workers working in work areas with significant Benzene exposure based on exposure monitoring level such as tank cleaning, should undergo post-shift urine testing (within 24 hours) after completion of the work.

## MEDICAL EXAMINATION

Medical examination is required to be conducted for employees identified for Health Surveillance Program to detect early signs and symptoms of health effects due to exposure to the health hazards. The requirements of medical examination are as below, but not limited to:

- a. History taking (medical, family and occupational history)
- b. Symptom survey
- c. Physical examination

The example of medical examination to be observed for chronic benzene exposure is signs and symptoms of anemia.

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### **BIOLOGICAL EFFECT MONITORING (BEM)**

Biological Effect Monitoring refers to laboratory evaluation of the effects of Benzene to the exposed workers. It may be required for the following circumstances:

- a. Workers found to have exceeded at or above BEI level
- b. As advised by the Head of Medical

The screening should include the following laboratory tests to look for indication of leukemia:

- a. Complete Blood Count
- b. Peripheral Blood Film

Abnormalities found require consultation with a clinical specialist such as a hematologist, to determine the pathology behind the changes. Investigation of the workplace should be carried out to rule out Benzene as the cause for the changes.

### **MEDICAL REMOVAL PROTECTION (MRP)**

MRP for Benzene exposure is the procedure to temporarily or permanently remove affected worker from a work unit aimed at preventing the worker from further exposure to Benzene presence in that particular work unit. The affected worker may be relocated to another work unit free from Benzene.

- If the urine s-PMA levels are at or above the Biological Exposure Index (BEI) of 25 µg/g creatinine, the worker shall be placed under the Medical Removal Protection (MRP) program to ensure that they are not further exposed to Benzene. The workers may be temporarily assigned to other tasks that have no Benzene risk.
- Once the repeated Biological/Biological Effect monitoring level for Benzene is normal, physiological/functional/anatomical changes have improved and appropriate corrective actions have been put in place at the pre-MRP work, the employees placed under temporary MRP may return to their pre-MRP work and/or workplace.
- Details on MRP will be available in the Health Surveillance Instruction.

**RETURN TO WORK (RTW):** Details of RTW program available in the Fitness to Work Procedure PR-310-MED-02

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## 8. RECORDS

The following records shall be maintained in support of this Instruction:

Document / Record ID	Document / Record name	Responsible department or section
<b>Technical reports, Survey findings, Exposure Monitoring results.</b>	OHRA Reports, Hazardous Chemical's Exposure Monitoring Reports, Benzene Control Program	SED & User Dept.
<b>Health/ Medical Surveillance Records</b>	Employee Health Risk Profiling	Medical Section, HSEQ

## 9. APPENDIX

**9.1 CARTRIDGE CHANGE SCHEDULE FOR AIR PURIFYING RESPIRATORS - IN-253-ENV-09-APP-01**

**9.2 BENZENE EXPOSURE CONTROL & RESPIRATORY PROTECTION GUIDE - IN-253-ENV-09-APP-02**

**9.3 PUBLIC HEALTH STATEMENT: BENZENE - IN-253-ENV-09-APP-03**