Lusail Real Estate Development Company

Health, Safety, Security, Environment, Logistics & Quality Department

Lusail Construction Safety Management Procedure – Respiratory Protection

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Amendment Record

This document is reviewed to ensure its continuing relevance to the systems and process that it describes. A record of contextual additions or omissions is given below:

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1	(Pg. 2) Revised Amendment Table	HSE Working Group	Michael Ford Michael Ford	Uwe Krueger	1st April 2015

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1. Description

This element of the LCSMP is designed to provide guidance and information intended to assist the Contractor with safeguarding their workers from known and potential exposure to airborne chemical and biological contaminants, and other atmospheric hazards, resulting from various construction work activities.

This element applies to all Consultant, Contractor, subcontractor, vendor and visitor personnel working on or visiting the Lusail Real Estate Development Project who have known or potential exposure to airborne contaminants or other atmospheric hazards.

This element does not apply to worker exposures to elevated noise and temperature extremes. For further information on these topics, refer to **LUS-HSE-WG3-446-007**, Hearing Conservation Program, and **LUS-HSE-WG3-446-036**, Heat Stress Management Plan.

2. Definitions

Term	Description
Action Level	Indicates the level of a harmful or toxic substance/activity that requires medical surveillance, increased industrial hygiene monitoring, or biological monitoring. Generally considered a quantity or volume half that of the PEL/WEL.
Job Hazard Analysis (JHA)	A process used to identify the hazards or potential hazards associated with each step of a particular job or work plan in order to uncover hazards and then eliminate, control, or remove them before the work is started.
Air (Personnel) Monitoring Equipment	Devices designed to be worn or carried by an individual for the purpose of measuring the dose received (e.g., film badges, pocket chambers, pocket dosimeters, film rings, etc.
Air Purifying Respirator (APR)	Respiratory protective equipment which requires the user to draw outside air through a series of filtering media (canisters or filters) intended to scrub/ remove contaminants present in the outside air prior to the air being inhaled by the worker.
Air Supplied Respirator (ASR)	Respiratory protective equipment which is provided with an external source of breathing air.
American Conference of Governmental Industrial Hygienists (ACGIH)	A professional organization that sets recommended employee exposure guidelines called Threshold Limit Values (TLV) and Biological Exposure Indices (BEI).
American National Standards Institute (ANSI)	An agency whose purpose is to test and analyze materials, equipment and systems with the intent of setting clear criteria for design, manufacture, construction, use and loading.
Competent Person	One who is capable of identifying existing asbestos or lead hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, and who has the authority to take prompt corrective measures to eliminate them.
End of Service Life Indicator (ESLI)	A built in feature of contaminant filters and cartridges designed to visually indicate to the user when the device has expired.
Fume	Tiny solid (metal) particles condensed from a vapor, normally in the presence of intense heat such as welding, cutting, soldering, or brazing.

Term	Description
High-Efficiency Particulate Air (HEPA)	A filter capable of trapping and retaining at least 99.97% of all mono-dispersed particles of 0.3 μ in diameter or larger.
HSE	Health Safety & Environment
Immediately Dangerous to Life or Health (IDLH)	Any atmosphere that poses an immediate hazard to life or poses immediate irreversible debilitating effects on health.
Industrial Hygienist (IH)	A professional qualified by education, training, and experience to anticipate, recognize, evaluate, and develop controls for occupational health hazards.
Lower Explosive Limit (LEL)	The concentration at which a material, in vapor, gas, mist, or particulate phase, is capable of supporting combustion in air.
National Institute for Occupational Safety and Health (NIOSH)	A federal agency under the Department of Health and Human Services Centers for Disease Control. NIOSH sets recommended employee exposure limits called Recommended Exposure Levels (REL).
NIOSH Manual of Analytical Methods (NMAM)	A reference which provides users with the guidelines for various methods of collecting and analyzing airborne contaminants.
Overexposure	Employee exposure to a chemical, physical, or biological hazard by means of inhalation, injection, absorption or ingestion at a level greater than PEL/WEL/TLV.
Oxygen-Deficient Atmosphere	Atmosphere that contains less than 19.5% oxygen by volume (conversely, an oxygen-enriched atmosphere contains 23.5% or greater oxygen by volume)
Workplace Exposure Limits (WEL)/Permissible Exposure Limit (PEL)	Regulatory limits on the amount or concentration of a substance in the air. They may also contain a skin designation. WELs are enforceable by Qatari Labor Law and PELs are recognized by Lusail as policy. If a conflict arises between WELs or PELs, the most stringent exposure limit will apply
Positive Pressure	Valve configuration on air supplied respirators whereby the user is provided with an uninterrupted flow of breathing air.
Pressure Demand	Valve configuration whereby user must physically draw a breath to trigger breathing air release. User exhalation causes valve to close and airflow to stop.
Protection Factors	A factor of protection provided by specific types of respiratory protective equipment (respirators). A respirators protection factor multiplied by the PEL/WEL/TLV of a contaminant provide the user with maximum concentration use values for specific respirators with specific contaminants.
Respiratory Protective Equipment (RPE)	Equipment intended to minimize or eliminate airborne contaminants from the workers breathing zone prior to being inhaled by the worker; the purpose being to minimize or eliminate worker exposure to harmful substances. Equipment is either air purifying or air supplying.
Respiratory Protection Program (RPP)	Program designed to evaluate a workers ability to use respiratory protective equipment, and to ensure proper selection and use of the equipment necessary to effectively minimize or eliminate worker exposure to harmful airborne contaminants at levels exceeding applicable PEL/WEL/TLV.
Self Contained Breathing Apparatus (SCBA)	An air supplying respiratory protective equipment system whereby the user carries the source of breathing air on his person.

Term	Description
Time-Weighted Average (TWA) Limit	Average value of exposure over the course of an 8-hour work shift. Thus, a worker may be exposed to a level higher than the PEL/WEL for part of the day as long as he is exposed to levels below the PEL/WEL for the rest of the day.
Threshold Limit Value (TLV)	Employee chemical and/or biological exposure limits prescribed by the ACGIH TLV. May refer to TWA, ceiling, short-term, or action level concentrations, as applicable.
Vapor	The gaseous phase of matter that normally exists in a liquid (or solid) state at room temperature.

3. Responsibilities

The Contractor is fully responsible for the pre-planning, development of Method Statements, Job Hazard Analyses, overall safe work planning and implementation. Contractor Project Management is responsible for the assurance that all work is planned and conducted according to Contractor and Lusail Health Safety & Environment (HSE) procedures and the Qatar Construction Specifications 2010. Should a conflict occur between procedures, standards or requirements the more stringent shall apply.

4. Project Respiratory Protection Program

The Contractor HSE Representative is responsible for utilizing information gained through the exposure control plan to develop and implement a project-specific Respiratory Protection Plan (RPP). The RPP should be designed to address all known and potential airborne contaminants and atmospheric deficiencies which project site workers may be exposed to as a result of their participation in or proximity to specific identified construction activities.

The Contractor Project Manager facilitates implementation and compliance with the plan, designating competent person(s) to conduct exposure monitoring; and manage selection, use, care and maintenance of respiratory protective equipment.

At a minimum, the project-specific Respiratory Protection Plan (RPP) includes the following components:

- Identification of the Competent Persons responsible for implementation of specific activities within the Plan, and for updating of the RPP.
- Methods by which the Contractor will identify and measure airborne contaminants and the extent of worker exposure to those contaminants.
- Mechanisms in place to determine worker ability to use respiratory protective equipment (RPE).
- Identification of specific work activities containing known exposure to contaminants above applicable PEL/WEL/TLV.
- Identification of specific contaminants anticipated as a result of planned work activities and their associated safe exposure levels.
- Methods for selecting appropriate RPE based upon contaminant identification and known or suspected airborne concentrations.
- Provisions for worker training on the hazards associated with use of RPE. Training must include chemical/ biological hazards that workers will/ may be exposed to, signs and symptoms of exposure, and actions to take should RPE failure or suspected overexposure occur.
- Description of the limitations of the selected RPE, associated Protection factors (PF) and the specific limitations of RPE in use.
- Care, maintenance, cleaning and storage requirements for specific types of respirators and associated equipment.
- Breathing air systems which are planned for use and the Contractors management plan for breathing air systems functionality and purity
- Methods by which the Contractor will communicate air monitoring results to workers.

- Methods by which the Contractor will determine when modified or alternate forms of RPE are required/ necessary, or when downgrade of equipment is feasible.

5. Exposure Monitoring

Engineering controls are the first line of defence in minimizing or eliminating the potential for employee exposure to harmful contaminants or conditions in the work area. Engineering controls generally modify the work process or procedures, materials or equipment in use, ventilation, and / or proximity of workers to respirable contaminants. Administrative controls seek to inform workers, through communication, of the airborne hazards that may be present. They also modify work schedules and employee rotations to further minimize exposures. When engineering and administrative controls fail to fully eliminate or control employee exposures to acceptable levels, respiratory protection must be implemented.

Environmental monitoring will be conducted during the assessment process and throughout the course of a project to identify changing airborne conditions and the need to modify control measures specified in the HSE Plan. When airborne concentrations exceed, or have potential to exceed the workplace exposure limit (PEL/WEL) or time-weighted average (TLV) specified for site contaminants, control measures, including the use of RPE, must be implemented to ensure exposures remain below safe levels.

6. Use of Respiratory Protective Equipment (RPE)

Respiratory and atmospheric hazards will be controlled by implementing engineering control measures to the extent feasible. Examples of such measures include improved ventilation, modified procedures, and substitution of less hazardous materials. When such measures are not feasible or ineffective, or where workers need emergency protection against occasional or relatively brief exposures, employees shall use appropriate respiratory protective equipment.

6.1 Immediately Dangerous To Life or Health

The designation "Immediately Dangerous to Life or Health" (IDLH) refers to condition inside the work area or a concentration of a substance that poses an immediate threat of loss of life, immediate or delayed irreversible adverse effects on health, or acute eye exposure that would prevent escape from the work area. The National Institute of Occupational Safety and Health (NIOSH) publishes IDLH vapor concentrations in parts per million for various hazardous materials. It is understood that oxygen concentrations below 19.5% are considered IDLH conditions. It is Lusail policy that all employees shall immediately evacuate the work area when IDLH concentrations or conditions have been identified. Workers will not re-enter the area until IDLH conditions have been controlled and eliminated through the use of ventilation or other engineering controls.

6.2 Communication

Respiratory and/ or other environmental or atmospheric hazards present are communicated to all site workers and subcontractors through initial training on the site specific HSE Plan. All site workers are required to complete site safety orientation training. During the orientation, employees will be informed of respiratory or atmospheric hazards on site, the concentrations of known contaminants in their respective work areas, respiratory equipment that is required and for what tasks, and the administrative and other engineering controls in place on site.

6.3 Compressed Breathing Air Cylinder Watch Inst

Whenever air-supplying respirators (airline type) are being used, a “cylinder watch” shall be assigned for the duration of the work. Compressed air “cylinder watch” instructions are contained in (Attachment **LUS-HSE-FM4-446-023**).

6.4 Facial Hair

In order for RPE to provide the proper protection to the user, it must have a tight facial seal. Certain types of facial hair hinder or prevent a proper seal, and thus limit the effectiveness of the respirator. Contractor employees who will be working on the Lusail project where respirators will be used are prohibited from having facial hair that would prevent a proper facial seal or interfere with the operation of inhalation or exhalation valves. Beards, excessive sideburns, goatees, and certain styles of moustaches are prohibited. Additionally, personnel showing more than a day’s growth at the time they report for work will be required to shave prior to starting respiratory work that day. (Project Managers are responsible for ensuring compliance with this policy.)

6.5 Eyewear

If the employee wears spectacles, goggles, face shield, or welding helmet it must not adversely affect the seal of the respirator face piece.

Soft and gas permeable contact lenses can be worn with respiratory protection; however, it is against Lusail policy to allow impermeable / hard contact lenses to be worn in conjunction with respiratory protection.

7. Voluntary Respirator Use

The HSE Representative meets with employees who use respirators voluntarily (i.e., when not required by the project respiratory protection plan) to ensure that voluntary respirator use does not:

- Interfere with an employee's ability to work safely, such as restricting necessary vision or radio communication, *or*
- Create health hazards. Examples of health hazards include:
  - Skin irritation, dermatitis, or other health effects caused by using a dirty respirator
  - Illness created by sharing contaminated respirators
  - Health effects caused by use of an unsafe air supply, such as carbon monoxide poisoning

All voluntary respirator users must be provided the advisory information in (Attachment **LUS-HSE-FM4-446-019**).

8. Selecting Respirators

Respirators come in two general categories: air purifying and air supplied. Examples of respirators in each category, and conditions in which to use them, are discussed below. Project Managers will ensure that employees are provided with and use the proper respirator for the hazard(s) associated with the job. (Attachment **LUS-HSE-FM4-446-022**) is a guide to the proper selection of respirators.

8.1 Protection Factors

Different respirators offer different levels of protection. NIOSH has established Protection Factors (PF) for every type of respirator to indicate how much user protection a specific respirator provides. The respirator protection factor is the ratio of contaminant concentration level outside the respirator to the expected possible concentration inside the respirator. The higher the PF value for a given respirator, the less contaminant leakage into the face piece is anticipated. PF values are approximate and apply only when the wearer has been properly fit tested and trained, and when the respirator is correctly worn and kept in proper operating condition.

As a general rule, when a contaminant has a specific worker exposure limit (PEL/WEL) listed in the regulatory standard, the maximum contaminant level at which a respirator may be used is the lower value of either the PEL multiplied by the PF for the respirator (shown below), or the maximum use concentration specified on the NIOSH/MSHA approval label/ stamp on the respirator.

PEL x PF = Max. Contaminant Level Allowable with Respirator

An exposure assessment including comprehensive air monitoring must be conducted prior to selecting respirators for each work area. Personnel conducting the assessment must empirically identify the "worst case" contaminant concentrations possible in each work area, which when formulated with the PF, will ensure that the respirators chosen will adequately protect the user under all foreseeable work conditions and atmospheres.

8.2 Types of Respirators

Air-Purifying Respirators

Air-purifying respirators (APR) are used when there is an adequate supply of oxygen (>19.5%) and the airborne contaminants can successfully be filtered out of the air that workers are breathing. It is important to remember that no respirator will filter out 100% of the contaminant(s), but merely reduce the concentration to an acceptable, safe level. There are two general types of air purifying respirators:

Cartridge/ Canister Respirators - These respirators can be full or half face type. They use replaceable cartridges to filter the air. Each cartridge is color coded to show what kind of contaminants it is designed to protect against. See LCSMP 08-08 for a list of color schemes and contaminants. These respirators protect against low concentrations of a variety of gases and vapors. An adequate supply of oxygen must be available. Selection and use of the proper cartridge is critical, as well as determination of an appropriate cartridge change-out schedule.

Particle (dust) Mask - This is a disposable mask used to protect against larger scale visible dusts and particles, such as nuisance dust, sand, sawdust, etc. They are made from a variety of materials, with paper the being most common. Various models are NIOSH approved, however, achievement of a sound seal with the face is impossible, and therefore, these masks should not be used with airborne chemical contaminants, or particulates less than 10 microns in size.

Air-Supplying Respirators

There are four conditions in which you would use an air-supplying respirator (ASR):

1. Oxygen deficiencies- < 19.5% (Lusail prohibits project employees from working in known oxygen-deficient atmospheres.)

2. No appropriate air purifying cartridge is available for the contaminant,
3. The concentration of a contaminant(s) is too high to use an APR
4. The contaminants and/or their concentrations in the work area are unknown.

   These respirators receive breathing air from a source other than the atmosphere, such as a compressed air cylinder, air compressor, or an oxygen-producing chemical reaction.

   There are two general types of air-supplied respirators:

   - Supplied Air-line Respirators (SAR) - This respirator system includes a full-face mask attached to a regulator, which accepts breathing air via air lines. Breathing air lines are attached to one or more compressed breathing air cylinders. The worker also carries a 5-minute “escape” bottle, which should the air line become pinched or severed, will allow the worker enough air to facilitate exiting the work area. Air line length must never exceed 300 feet. A responsible person, or “cylinder watch”, is required to ensure that air supply and pressure in the cylinders is adequate at all times.

   - Self-Contained Breathing Apparatus (SCBA) - This system is similar to the supplied air-line respirator, except that the user carries the breathing air supply on their back. The SCBE bottle is generally a 30- minute supply of breathing air. The worker also carries a 5-minute “escape” bottle, as described above. The SCBA regulator is equipped with a supply gauge and audible alarm to inform the worker when air supply is running low.

8.3 Oxygen Concentration

Air monitoring of each area within the work area must be conducted to identify the concentration of oxygen available to the workers. Suspect areas include: those where oxygen displacing materials are used or stored, such as nitrogen, areas where internal combustion engines are running, and areas toxic gas or organic vapors concentrations are extremely high. It must be understood that air purifying respirators are not effective where there is an oxygen deficient atmosphere. Work areas where oxygen is, or has the potential to be less than 20.9% require the use of air supplying respirators.

8.4 Compressed Breathing Air

The following guidelines apply to the operation and maintenance of compressed breathing air:

A. Breathing air shall be of high purity and meet at least the requirements of the specification for Grade D breathing air as described in the Compressed Gas Association Commodity Specification G-7.1 (ANSI Z86.1-1973).

B. Breathing air cylinders shall be legibly identified with the words "AIR" or "BREATHING AIR", in letters at least 1/25 the diameter of the cylinder, but in no case less than 1/8", by means of stenciling, stamping, or labeling as near the valve end as practical.

C. A high-temperature or carbon monoxide alarm, or both, shall be used to monitor carbon monoxide levels for oil-lubricated compressors. If only high-temperature alarms are used, the air supply shall be monitored, via instrumentation, at intervals sufficient to prevent carbon monoxide in the breathing air from exceeding 10 ppm.

D. Airline couplings shall be incompatible with outlets for other irrespirable gases or oxygen.

E. The air pressure at the hose connection to positive pressure respiratory equipment shall be within the range specified in the approval of the equipment.

   Guidelines for operating bottled air equipment are contained in (Attachment **LUS-HSE-FM4-446-023**).

9. Respiratory Protection Equipment Maintenance

Cleaning, repair, storage, and inspection of respiratory equipment are critical functions in an effective respiratory protection program. Poorly maintained equipment will result in equipment defects causing greater potential for exposure to workers, an increase in injuries, and elevated medical and equipment costs. Contractor employees are responsible for the proper maintenance of the RPE they are issued. RPE which is damaged or defective must be discarded and replaced, or returned to the manufacturer for proper repair. Employees shall not attempt to make repairs to RPE for which they do not have the proper training. The procedures for proper inspection, maintenance, hygiene, storage, and repair of respirators are part of the RPE Care Guidelines, located in (Attachment **LUS-HSE-FM4-446-020**)

10. Medical Surveillance

An employee's health status must be considered before allowing respirator use. Prior to any employee using a respirator (not including dust masks) the employee must be medically cleared to wear a respirator by a licensed health care provider.

Employees are first required to complete a *"Respirator Medical Evaluation Questionnaire."* The questionnaire is then forwarded to the physician for review. Based upon the physicians' determination, the employee is either immediately granted clearance, or is requested to report to the physician for a physical examination. These factors are considered during the respirator medical evaluation of an employee:

- Medical history pertaining to a condition that could affect the employee's ability to wear a respirator.
- Physical examination with emphasis on respiratory and cardiovascular condition.
- Spirometry test for forced vital capacity and forced expiratory volume in one second.

Upon request, the Contractor shall provide the following information to assist the examining physician with employee assessment:

- type of respirator required for the work
- duration and frequency of respirator use
- type of work to be performed while wearing respirator
- environmental conditions in workplace
- other personal protective equipment to be worn

Upon clearance, the examining physician will grant respirator clearance for at least a one year, and possibly a two year period, based upon factors such as the number of days the employee spends on site wearing a respirator each year.

11. Program Evaluations

Contractors shall evaluate the continued effectiveness of their respiratory program annually. This evaluation includes the following tasks:

- Check fit-test results and health provider evaluations
- Talk with employees who wear respirators about their respirators:
  - How they fit
  - Does the employee feel that the respirator protects his adequately
  - Does the employee notice any difficulties in breathing while wearing the respirator
  - Does he notice any odors while wearing the respirator
- Periodically check employee job duties for changes in chemical exposure
- Periodically check maintenance and storage of respirators
- Periodically check how employees use their respirators

12. Employee Training and Education

All Lusail development project employees who will use, or have the potential to use, respirators on a project site shall receive comprehensive training on the requirements of this RPP, as well as the respiratory protection standard at the time of their initial assignment, and at least annually thereafter.

Employees will be instructed in the nature of the contaminants anticipated on the project site(s) they are assigned to. They will be informed of the signs and symptoms of exposure should RPE fail during the course of work, or simply be ineffective.

Material Safety Data Sheet's for each known chemical of concern will be reviewed with employees to accomplish this. Employees will learn of the engineering controls, if applicable, which are currently in use, or planned for their particular project.

Instruction will cover the respirator's capabilities and limitations, and the function and possible malfunction of each part of the respirator. The respirator user will be instructed in his/her responsibility for equipment inspection prior to use, as well as the proper care and maintenance required to ensure a properly working respirator. This portion of the training will cover proper storage, cleaning, sanitizing, maintenance, and methods to assure adequate fit and function of the respirator each time it is donned.

Each employee will participate in a field exercise; whereupon all workers will practice proper donning and doffing of the respirator. Employees will be asked to perform a moderately strenuous task while wearing their respirator to simulate the potential for elevated temperature and exertion hazards caused by working with a respirator. Lastly, employees will learn to perform the fit check exercises intended to let users know if their seal has been compromised or if they have improperly donned the respirator.

13. Qualitative Fit Tests

Employees preparing to use respirators on the Lusail Development project must first be fit tested to ensure that the respirator size and model selected for each employee provides the proper seal with the user's face. This fit test procedure involves a number of testing agents (innocuous chemicals) which will allow the employee to determine if his or her seal is adequate.

Qualitative fit tests must be re-performed at least annually, when the employee is assigned to a new project site having different contaminants, when a change in the user's facial features have changed, or when a "breakthrough" event occurs.

The qualitative fit test shall be performed using the procedures located in (Attachments **LUS-HSE-FM4-446-017** & **LUS-HSE-FM4-446-018**).

14. Quantitative Fit Tests

Quantitative fit testing (e.g., Porta-Count particle counter) may be required for work with some materials. The HSE Representative assists Project Management with identifying these specific needs and compliance with these requirements.

The employee must perform a field fit check of respirator's seal each time he dons the respirator and before he enters a hazardous atmosphere. All employees must be instructed in user seal checks from the Respirator Fit Testing Procedures (Attachment **LUS-HSE-FM4-446-017**).

15. References

Qatar Construction Specifications 2010 Section 11 Part 1.2.2.11 "Respiratory protection"

Qatar Construction Specifications 2010 Section 11 Part 2.3.2 COSHH

Qatar Construction Specifications 2010 Section 11 Part 2.3.9 "Personal Protective Equipment (PPE)"

NIOSH Publication No. 2005-100, NIOSH/CDC Respirator Selection Logic, Section III, Respirator Selection Logic Procedure

EH/40 Workplace Exposure Limits

16. Attachments

LUS-HSE-FM4-446-017	Respirator Fit Testing Procedures
LUS-HSE-FM4-446-018	Qualitative Fit Test Form
LUS-HSE-FM4-446-019	Voluntary Use of Respirators
LUS-HSE-FM4-446-020	Respirator Protective Equipment Care Guidelines
LUS-HSE-FM4-446-021	SCBA Maintenance Form
LUS-HSE-FM4-446-022	Respiratory Protective Equipment Selection Guide
LUS-HSE-FM4-446-023	Compressed Breathing Air Cylinder Watch Instructions
LUS-HSE-FM4-446-024	Respiratory Cartridge Color Code
LUS-HSE-FM4-446-025	Respiratory Program Evaluation