مركز أبوظبي للسلامة والصحة المهنية
ABU DHABI OCCUPATIONAL SAFETY AND HEALTH CENTER

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Abu Dhabi Occupational Safety and Health System Framework

(OSHAD-SF)

Code of Practice

CoP 52.0 – Local Exhaust Ventilation

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ABU DHABI PUBLIC HEALTH CENTRE | مركز أبوظبي للصحة العامة

Important Note:

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(إعادة نشر الوثيقة لاستمرار التطبيق بإشراف مركز أبوظبي للصحة العامة)

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1. Introduction

(a) This Code of Practice (CoP) applies to all employers within the Emirate of Abu Dhabi. This CoP is designed to incorporate requirements set by UAE and Abu Dhabi regulatory authorities. If requirements of this document conflict with requirements set by another regulatory authority, employers are required to follow the more stringent requirement.

(b) This CoP sets requirements on how to control gas, vapour, dust, fume and mist in workplace air using local exhaust ventilation (LEV) to extract contaminants before they enter employee's breathing zones.

(c) Definitions applicable to this CoP:

(i) Airborne contaminants: Particles, gases or vapours and combinations of these. 'Particles' include dusts, fumes, mists and fibres.

(ii) Air cleaner or arrestor: A device to remove contaminants from air (eg. filters, cyclone, sock, wet scrubber, electrostatic precipitator (EP)).

(iii) Air mover: Devices that move air- Fan, Turbo exhauster. The 'engine' that powers the extraction system, usually a fan.

(iv) Breathing Zone: The region around operators from which they draw air for breathing. Commonly defined as being within 300 mm of nose/mouth.

(v) Boundary layer: The stationary or turbulent layers of air near a surface which can hold a contaminant cloud.

(vi) Inspirable dust: Any dust which can be inhaled.

(vii) Particulate-filter respirator: An air purifying respirator commonly referred to as a dust or a fume respirator, which removes most of the dust or fume from the air passing through the device.

(viii) Protective Coating: The application of a protective coating to protect metal surfaces from corrosion, or to improve the appearance of a product.

(ix) Respirable dust: Is only that dust which is small enough to be inhaled into the lungs. Airborne dust in sizes capable of passing through the upper respiratory system to reach the lower lung passages.

(x) Receiving Hood: The entry point into the LEV that helps direct contaminants away from the breathing zone of an employee.

(xi) Sash: A movable glass panel that covers the face area of a fume hood. Sashes can be vertical, horizontal, or a combination of the two.

(xii) Working Zone: The location in the workplace where an activity is generating contamination that could enter an employee's breathing zone.

2. Training and Competency

(a) Employers shall ensure that OSH training complies with the requirements of:

(i) *OSHAD-SF – Element 5 – Training, Awareness and Competency;*

(ii) *OSHAD-SF – Mechanism 7.0 – OSH Professional Entity Registration; and*

(iii) *OSHAD-SF – Mechanism 8.0 – OSH Practitioner Registration.*

(b) Employers shall ensure all relevant employees and contractors that perform tasks that require LEV are trained on:

(i) hazards associated with the operations being completed that requires LEV;

(ii) design specification, capabilities and limitations of LEV used at their work site;

(iii) methods and procedures that will prevent contamination of clothing and contamination of the employee's breathing zone;

(iv) the importance of LEV as a control measures;

(v) safe work practices; and

(vi) operator maintenance requirements to ensure LEV is working appropriately.

(c) Employers shall ensure managers and supervisors of operations requiring LEV shall be trained on:

(i) requirements listed in Section 2(b);

(ii) maintenance requirements to ensure LEV is working appropriately and within specifications;

(iii) relevant design and installation principles for LEV systems to ensure that provisions are fit for purpose;

(iv) how to recognize when LEV is not being used appropriately; and

(v) how to identify when the LEV is not working appropriately.

3. Requirements

3.1 Roles and Responsibilities

3.1.1 Employers

(a) Employers shall undertake their roles and responsibilities in accordance with the general requirements of *OSHAD-SF – Element 1 – Roles, Responsibilities and Self-Regulation* Section 3.2.5.

(b) Employers shall be responsible for performing a risk assessment in accordance with *OSHAD-SF – Element 2 – Risk Management* to determine the risks associated to identify areas were LEV is required to reduce employee's exposures to hazards materials/chemicals.

(c) Employers shall implement the Occupational Health and Safety hierarchy of controls as defined in OSHAD-SF – *Element 2 – Risk Management*, when developing control measures to remove or reduce employee exposure to hazards.

(d) Employers shall ensure that LEV systems are designed and installed such that identified hazards are managed and controlled to an acceptable level.

(e) Employers shall ensure that when LEV is not sufficient to achieve full compliance, protective equipment or other control measures shall be used to keep the exposure of employees to hazardous materials/chemicals within limits prescribed by *OSHAD-SF – Occupational Standards and Guideline Values*.

(f) Employers shall conduct air quality monitoring at regular intervals to provide on-going assurance that LEV systems are working to an acceptable level.

(g) Employers shall develop a preventative maintenance plan to ensure LEV works efficiently and according to manufacture specifications.

(h) Employers shall perform flow tests and inspect the LEV system on a regular basis (at a minimum annually) and document the findings along with any maintenance requirements.

(i) Employers shall ensure LEV are designed to the specification set by the American Standards Institute: *ANSI/AIHA Z9.2-2006, Fundamentals Governing the Design and Operation of Local Exhaust Ventilation System*; or equivalent international standard.

(j) Employers shall ensure LEV are tested and inspected regularly (at a minimum annually) to ensure the system work in accordance with manufactures specifications.

(k) Employers shall monitor the use of LEV to ensure employees are using LEV appropriately.

3.1.2 Employees

(a) Employees shall undertake their roles and responsibilities in accordance with the general requirements of *OSHAD-SF – Element 1 – Roles, Responsibilities and Self-Regulation* Section 3.2.7.

(b) Employees shall report any activity or defect relating to LEVs which they know is reasonably practicable to endanger their safety or that of another person.

(c) Employees shall use appropriate equipment or safety devices provided by the employer in accordance with any training or instruction received in the use of the work equipment or device concerned.

(d) Employees shall not perform any task requiring training until they have received the required training.

(e) Employees shall not operate any piece of equipment that they are not familiar with, competent to operate and/or appropriately trained on its use.

3.2 Requirements of LEV Systems

(a) LEV shall be designed to prevent dispersion into the air of dusts, fumes, mists, vapors and gases in concentrations causing harmful exposure at any point of fallout.

(b) LEV shall be designed to ensure no dusts, fumes, mists, vapor or gases are drawn through the work areas or walkways.

(c) Exhaust fans, jets, ducts, hoods, separators, and all necessary equipment, including refuse receptacles, shall be designed, constructed, maintained and operated as to ensure the required protection by maintain volume and velocity of exhaust air sufficient to gather dust, fumes, vapors or gases from equipment or processes.

(d) Air outlet from every LEV shall be discharged to the outside atmosphere. Systems designed to collect non-hazardous materials (eg. wood dust) can return air back into the work area as long as it has a filtration system that removes repairable dusts and particles and does not result in a harmful exposure to employees.

(e) Exhausts of LEV shall not be located in an area that will expose other employees or near air intakes for building ventilation and/or climate control systems.

(f) The exhaust system shall be in operation continually during all operations which it is designed to serve. If the employee remains in the contaminated zone, the system shall continue to operate after the cessation of said operation, until the contaminants are removed. Employees wearing respiratory protection shall not remove it until the atmosphere is clear of contaminants.

(g) Exhausted material shall be subject to regular emissions monitoring where appropriate, and as a minimum where exhaust material may be harmful to the environment.

(h) LEV systems need to be designed for the material which they are intended to remove from the work environment.

(i) When contaminants could create a combustible or explosive hazard, the LEV system shall be designed to take this into account and reduce the potential for a fire or explosion.

(j) LEVs shall have inspection or clean-out doors not to exceed 4 meters of running length.

(k) A clean-out door shall be provided for servicing the fan and where necessary a drain shall be provided.

(l) LEV ductwork shall be appropriately supported though its length to sustain its weight plus any normal accumulation of contaminants in the interior during normal operating conditions and any negative pressure exerted upon it.

(m) Joints and seams shall be sealed to prevent loss of contaminants during use and prevent contamination of other work areas.

(n) Where ductwork passes through a combustible roof or wall, the roof or wall shall be protected at the point of penetration by open space or fire-resistive material between the duct and the roof or wall.

(o) Duct work shall not pass through firewalls unless no other practicable alternative is available. An assessment shall be undertaken to identify the risks of the duct work passing through the firewall to determine any compromise to the integrity of the firewall.

(p) LEV systems shall be designed to produce as little noise as reasonably practicable.

(q) Makeup air in the work area shall be sufficient to prevent the creation of negative pressure in the room that will reduce the effectiveness of the LEV.

(r) Where LEV systems require continuous positive pressure to be effective, appropriate means of access and egress shall be provided, including where necessary air-lock doors and / or operational access control.

3.3 Paint Booths / Spray Finishing Booths

(a) Booths shall provide a continuous, uniform and evenly distributed supply of air flow throughout the spray painting area to the exhaust outlets. There shall be no pockets of still air in the booth.

(b) The source of air supply shall be pulled from an area that is not contaminated with hazardous substances or chemicals as to prevent excess accumulation of airborne contaminants or unnecessary exposures to employees.

(c) Employees (eg. spray painters) shall not be positioned between the spray gun and the ventilation exhaust duct.

(d) Booths shall maintain an internal negative pressure during operation to prevent leakage of contaminants into surrounding work areas.

(e) Booths shall be equipped with a negative pressure gauge and a gauge or alarm to indicate if airflow drops below the minimum set air flow rate to capture contaminants.

(f) Booth ventilation system shall remain on for five (5) minutes after completing spraying operations to purge the chamber.

(g) Booths shall provide a level of air velocity at any point within the booth that complies with the following requirements:

(i) Minimum air velocity for downdraft booths and cross-draft booths where drafts from outside the booth is equal to or less than 0.2 meters per second: 0.5 meters per second;

(ii) Minimum air velocity for downdraft booths and cross-draft booths where drafts from outside the booth is more than 0.2 meters per second: 0.8 meters per second; and

(iii) Minimum air velocity for electrostatic spray painting and spray finishing without operator: 0.4 meters per second.

(h) Refer to *OSHAD-SF – 48.0 – Spray Finishing* for further requirements.

3.4 Chemical Fume Hoods / Laboratory Hoods

(a) Work Area (room) Design:

(i) work areas with chemical fume hoods or laboratory hoods shall be designed to have no recirculation of air to the lab or any other spaces;

(ii) fume hoods and laboratory hoods shall be located so that person entering or exiting the work area will not have to pass in front of the hood;

(iii) in rooms where there are fume hoods or laboratory hoods installed, there shall be a minimum of two exits from the room. If this is not reasonably practicable, the hood shall be located on the side of the room farthest from the door;

(iv) fume hoods and laboratory hoods shall not be directly opposite occupied work stations;

(v) windows in laboratories containing fume hoods or laboratory hoods shall be fixed closed; and

(vi) HVAC systems in laboratory areas shall be designed such that they automatically close (or as a minimum, that dampers can be locally controlled) to avoid ingress of toxic materials into heating, ventilation, and air conditioning systems.

(b) Supply Air:

(i) before a new fume hood or laboratory hood is put into operation, a survey shall be conducted to ensure there is appropriate make-up air;

(ii) supply and exhaust volumes shall be such that the laboratory is under slightly negative pressure, even when hoods are not operational, to prevent the escape of contaminants;

(iii) ceiling and wall diffusers for the building ventilation system shall be directed so that the incoming supply of air flow does not affect the air flow at the fume hood or laboratory hood; and

(iv) supply air intake shall be a minimum of 15 meters from any fume hood or laboratory hood exhaust.

(c) Variable Air Volume (VAV) Systems:

(i) VAV systems shall be designed by a competent engineer with experience in designing VAV systems;

(ii) VAV systems shall maintain a minimum air velocity of 18 meters/min during periods of non-use; and

(iii) Existing LEVs shall not be converted to VAV systems unless designed by a competent engineer and tested to ensure it meets the minimum requirements for capturing contaminants.

(d) Construction and Installation:

(i) chemical fume hoods and laboratory hoods shall maintain an average minimum air velocity of 19 meters/min when in use. For VAV systems, the system shall maintain this velocity when the sash is fully open;

(ii) a minimum of 9 measurements shall be taken in various locations of the working area of the chemical fume hood or laboratory hood to ensure minimum average air velocity is met. No result shall be less than 13.5 meters/min;

(iii) a competent person in the design of chemical fume hoods and laboratory hoods shall determine the minimum number of air changes per hour required depending on the use of the system. At a minimum, six air changes per hour will be required for hazardous materials laboratories, but this can be increased depending on the materials used in the laboratory;

(iv) chemical fume hoods and laboratory hoods and associated ductwork and fans shall be constructed of a material compatible with the materials/contaminants captured by the hood. All areas of potential leaks shall be sealed;

(v) portable, non-ducted fume hoods (eg. use a filter to clean the air) are not acceptable for use with hazardous chemicals;

(vi) all hoods shall have a working airflow indicator installed. Airflow indicators shall be checked during regular maintenance of the hood to ensure it is working appropriately and calibrated annually;

(vii) hood exhaust stacks shall extend at least two meters above the roof and one meter above any parapet walls, whichever is greater;

(viii) hood exhausts shall be a minimum of 15 meters and preferable downwind from any air intakes. This distance can be increased as needed to prevent re-entrainment of exhaust fumes;

(ix) rain caps and other such devices are not allowed if they divert the exhaust towards the roof;

(x) all plumbing utilities shall have shut-off valve or cock adjacent to the hood;

(xi) electrical outlets shall be outside the hood;

(xii) lighting fixtures shall be compatible with the contaminants captured by the system. It is suggested to use fluorescent fixtures when feasible;

(xiii) lighting fixtures shall be sealed and vapour tight, UL-listed, and protected by a transparent impact resistant shield; and

(xiv) sashes shall be made of safety glass. Polycarbonate sashes shall not be used for chemical contaminants.

(e) Safe Work Practices:

(i) Employers shall ensure the following safe work practices are followed:

1. all work involving hazardous or odorous chemicals shall be performed in a chemical fume hoods or laboratory hood;
2. all equipment and materials shall be placed at least 15 centimetres back from the face of the hood and they shall not obstruct the movement of air into the hood;
3. when sashes are used, they hall be kept as low as reasonably practicable when the hood is in use;
4. employee's heads shall not be placed into the hood when contaminants are present;
5. hoods shall not be used as a storage area or overloaded with unnecessary equipment and materials;
6. hoods shall not be used to for storage of hazardous chemical wastes;
7. foot traffic shall be minimized when the hood is in use;
8. the interior of the ventilation system shall be kept clean and tidy; and
9. no work shall be conducted in a malfunctioning hood.

(f) Test and Inspection:

(i) hoods shall have their performance tested and certified on an annual basis (Emirates Authority for Standardization and Metrology approved third party entity);

(ii) hood testing shall be based on manufacture recommendations, applicable international standards, and international best practices;

(iii) a competent person shall be responsible for performing the annual testing and certification of hoods;

(iv) all identified deficiencies shall be reported and corrected. Hoods found unable to provide appropriate airflow or leaking contaminants shall be taken out of service until repairs are made;

(v) LEV systems shall undergo a daily visual pre-operation check and inspection; and

(vi) LEV systems shall undergo monthly inspection of air cleaning and filtration components and maintenance as required.

3.5 Requirements Hoods and Enclosure Type Local Exhaust Ventilation Systems

(a) In addition to the requirements set in this CoP, the following operational specific requirements for ventilation systems apply.

3.5.1 Hood and Enclosure Design

(a) All grinding and abrasive cutting-off wheel shall have manufacture supplied hoods in place to protect the operator from the hazards of bursting wheels, as well as to provide a means for the removal of dust and dirt generated. Equipment shall not be used unless a hood is in place.

(b) Hoods shall be located as close as reasonably practicable to the operation.

(c) Exhaust hoods for floor stands, pedestals, and bench grinders shall be designed in accordance with applicable standard requirements. The adjustable tongue shall be kept in working order and shall be adjusted within one-quarter inch of the wheel periphery at all times.

(d) Portable grinding operations, whenever the nature of the work permits, shall be conducted within a partial enclosure. The opening in the enclosure shall be no larger than is actually required in the operation and an average face air velocity of not less than 200 cubic feet per minute shall be maintained.

(e) Hoods for polishing and buffing and scratch-brush wheels shall be constructed to conform as closely to standard requirements as the nature of the work will permit.

(f) Cradle grinding and polishing operations shall be performed within a partial enclosure meeting standard requirements. The operator shall be positioned outside the working face of the opening of the enclosure. The face opening of the enclosure shall not be any greater in area than that actually required for the performance of the operation and the average air velocity into the working face of the enclosure shall not be less than 150 feet per minute.

(g) Hoods for horizontal single-spindle disc grinders shall be constructed to conform as closely as reasonably practicable to the hood. It is essential that there be a space between the back of the wheel and the hood, and a space around the periphery of the wheel of at least 25.4mm in order to permit the suction to act around the wheel periphery. The opening on the side of the disc shall be no larger than is required for the grinding operation, but shall never be less than twice the area of the branch outlet.

(h) Horizontal double-spindle disc grinders shall have a hood encircling the wheels and grinding chamber. The openings for passing the work into the grinding chamber shall be kept as small as reasonably practicable, but shall never be less than twice the area of the branch outlets.

(i) Vertical-spindle disc grinders shall be encircled with a hood so constructed that the heavy dust is drawn off a surface of the disc and the lighter dust exhausted through a continuous slot at the top of the hood.

(j) Grinding and polishing belt hoods shall be constructed as close to the operation as reasonably practicable. The hood shall extend almost to the belt, and 1-inch wide openings shall be provided on either side.

3.5.2 Enclosures

(a) Temporary enclosures shall be used when the object or structure is unable to be transported. Any object measuring greater than 2.5m x 2.5m x 3.0m shall be considered large in consideration with applicable local / national regulations or the international standard. Temporary enclosures are also used for fixed structures, eg. bridges or water tanks.

(b) Where monitoring indicates that persons in surrounding areas may be exposed to dust levels in excess of the national exposure standards, they shall be excluded from the area, where reasonably practicable, by warning signs and barricading, or provided with personal protective equipment (PPE).

(c) Grinding Wheels: Ventilation systems for grinding wheels on floor stands, pedestals, benches, and special-purpose grinding machines and abrasive cutting-off wheels shall have not less than the minimum exhaust volumes shown in Table 1, with a recommended minimum duct velocity of 4,500 feet per minute in the branch and 3,500 feet per minute in the main. The entry losses from all hoods except the vertical-spindle disc grinder hood shall equal 0.65 velocity pressure for a straight take-off and 0.45 velocity pressure for a tapered take-off.

Wheel diameter(inches)	Wheel width (inches)	Minimum exhaust volume (feet^3/min)
To 9	1 1/2	220
Over 9 to 16	2	390
Over 16 to 19	3	500
Over 19 to 24	4	610
Over 24 to 30	5	880
Over 30 to 36	6	1,200

Table 1 - Grinding and Abrasive Cutting-Off Wheels

Note: For any wheel wider than wheel diameters shown in the above table, increase the exhaust volume by the ratio of the new width to the width shown.

Example:

If wheel width = 4 1/2 inches, then 4.5 divided by 4 X 610 = 686 (rounded to 690).

(d) Scratch-brush, buffing, and polishing wheels: Scratch-brush wheels and all buffing and polishing wheels mounted on floor stands, pedestals, benches, or special-purpose machines shall have not less than the minimum exhaust volume shown in below Table 2.

Wheel diameter(inches)	Wheel width (inches)	Minimum exhaust volume (feet^3/min)
To 9	2	300
Over 9 to 16	3	500
Over 16 to 19	4	610
Over 19 to 24	5	740
Over 24 to 30	6	1040
Over 30 to 36	6	1,200

Table 2 - Buffing and Polishing Wheels

(e) Grinding wheels/discs for horizontal single-spindle disc grinders: Grinding wheels or discs for horizontal single-spindle disc grinders shall be hooded to collect the dust or dirt generated by the grinding operation and the hoods shall be connected to branch pipes having exhaust volumes as shown in Table 3.

Disc diameter(inches)	Minimum exhaust volume (feet3/min)
Up to 12	220
Over 12 to 19	390
Over 19 to 30	610
Over 30 to 36	880

Table 3 - Horizontal Single-Spindle Disc Grinder

(f) Grinding wheels/discs for horizontal double-spindle disc grinders: Grinding wheels or discs for horizontal double-spindle disc grinders shall have a hood enclosing the grinding chamber and the hood shall be connected to one or more branch pipes having exhaust volumes as shown in Table-4.

Disc diameter(inches)	Minimum exhaust volume (feet^3/min)
Up to 19	610
Over 19 to 25	880
Over 25 to 30	1200
Over 30 to 53	1770
Over 53 to 72	6280

Table 4 - Horizontal Double-Spindle Disc Grinder

(g) Grinding wheels/discs for vertical single-spindle disc grinders: Grinding wheels or discs for vertical single-spindle disc grinders shall be encircled with hoods to remove the dust generated in the operation. The hoods shall be connected to one or more branch pipes having exhaust volumes as shown in Table 5.

Disc diameter(inches)	One-half or more of disc covered		Disc not covered	
	Number (1)	Exhaust foot (3)/min	Number (1)	Exhaust foot^3/min
Up to 20	1	500	2	780
Over 20 to 30	2	780	2	1,480
Over 30 to 53	2	1,770	4	3,530
Over 53 to 72	2	3,140	5	6,010

Table 5 - Vertical Spindle Disc Grinder

(1) ***Number of exhaust outlets around periphery of hood, or equal distribution provided by other means.***

(h) Grinding and Polishing Belts: Grinding and polishing belts shall be provided with hoods to remove dust and dirt generated in the operations and the hoods shall be connected to branch pipes having exhaust volumes as shown in Table 6.

Belts width (inches)	Exhaust volume (feet ^{3}/min)
Up to 3	220
Over 3 to 5	300
Over 5 to 7	390
Over 7 to 9	500
Over 9 to 11	610
Over 11 to 13	740

Table 6- Grinding and Polishing Belts

(i) Cradles and swing-frame grinders. Where cradles are used for handling the parts to be ground, polished, or buffed, requiring large partial enclosures to house the complete operation, a minimum average air velocity of 150 feet per minute shall be maintained over the entire opening of the enclosure. Swing-frame grinders shall also be exhausted in the same manner as provided for cradles.

4. Record Keeping

(a) Employers shall ensure they keep appropriate records as required by their OSHMS including, but not limited to valid and up to date test and inspection certificates for LEV systems. These shall be maintained on site for the lifetime of the LEV system.

5. References

- *OSHAD-SF – Element 1 – Roles, Responsibilities and Self-Regulation*
- *OSHAD-SF – Element 2 – Risk Management*
- *Controlling Airborne Contaminants at Work-UK HSE Book HSG 258*
- *ESMA Standard 209 E: Industrial Safety And Health Regulations – Part 3: Occupational Health And Environmental Control*
- *American National Standards Institute: ANSI/AIHA Z9.2-2006, Fundamentals Governing the Design and Operation of Local Exhaust Ventilation System*
- *OSHA PART 1910 – Occupational Safety and Health Standards — Subpart G— Occupational Health and Environmental Control § 1910.94 Ventilation*
- *OSHA PART 1926.57: Ventilation*
- *OSHA Technical Manual Section III- Chapter 3 (Ventilation Investigation)*
- *OSHA Standard on Respiratory Protection - 29 CFR 1910.134*
- *Industrial Sector OSH Regulatory Authority, Industrial Development Bureau (IDB) Awareness Flyer on Abrasive Blasting & Spray Painting*
- *U.K HSE INDG408 Clearing the Air- A simple guide to buying and using Local Exhaust Ventilation (LEV)*

6. Document Amendment Record

Version	Revision Date	Description of Amendment	Page/s Affected
3.0	1st July 2016	Change of Logo	All
		Change from AD EHS Center to OSHAD	throughout
		Change of document title: AD EHSMS RF to OSHAD-SF	Throughout
		Acknowledgements deleted	2/3
		Preface Deleted	4
		EHS changes to OSH	throughout
		Update of incorrect references	16