SAFETY AND HEALTH STANDARD
PARTICULATE and GAS / VAPOR EXPOSURES

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10.6.1 **INTRODUCTION**

10.6.1.1 This Standard applies to dust, fibers, mist and fume (i.e. particulates), gas and vapor exposures in the workplace, with emphasis on inhalation as the prime route of exposure. It covers particulate and gas / vapor hazard evaluation, control program design and evaluation (medical surveillance), to ensure that employees and contractors will not suffer adverse health effects from particulates or gas / vapors, either used or generated by KUC.

10.6.2 **REQUIREMENTS**

10.6.2.1 Where a risk assessment indicates the need, a workplace air-monitoring program must be in place. The workplace air-monitoring program must:

- Comply with all relevant requirements in the Rio Tinto Standards.
- Adequately describe air quality of the workplace with regard to dust, fiber, mist, fume, gas and vapor emissions.
- Identify and adequately characterized workplace particulate and gas / vapor sources that contribute to the exceedences of Occupation Exposure Limits (OELs).
- Ensure control measures are periodically checked that they minimize emissions and protect employees and contractors from adverse exposure.

10.6.2.2 Designated areas will be created where:

- It is likely that the 95 percent upper confidence limit of a Similar Exposure Group (SEG) mean concentration for agents resulting in chronic effects, such as total inhalable dust, respirable dust, respirable crystalline silica, asbestos or non-asbestos fibrous materials exceeds the relevant OEL; or
- Agents with an acute effect (e.g. CO, SO2, NH3, HF, etc) exceed 50 per cent of the relevant OEL.

10.6.2.3 Designated areas must:

- Be identified and mapped, posted or otherwise clearly communicated to employees working in the area. Signs, where necessary, shall use appropriate wording or symbols to identify the hazard.
- Have a documented respiratory protection program based on risk assessments and standards, which is applied to employees, contractors, and visitors.
- Have regular monitoring of SEGs working in the area, and

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- Have a formal review of the practicality of engineering controls at least every two years, or less where they are a critical control for a significant risk.

10.6.2.4 Particulate and gas / vapor monitoring shall be based on the use of equipment approved by regulatory authorities.

- There shall be special consideration given to the sampling of hot / volatile / pressurized toxic process streams where they occur.

10.6.2.5 Exposure data for known human carcinogens, mutagenic and reproductive toxicants, must be statistically validated on an annual basis. Time-weighted average (TWA) measurements over several shifts, and consistent with the work-day period, must be used. If three or more years of statistically significant data are less than 25 percent of the OEL, or below the detection limit, then monitoring frequency can be extended to once every three years, provided that process and work organization remains unchanged.

10.6.2.6 Exposure data for progressive chronic conditions with a known cause (requiring long-term exposure for an effect to manifest) or suspect carcinogens, mutagenic and reproductive toxicants, must be statistically valid on an annual basis. TWA measurements over several shifts, and consistent with the work-day period must be used. If three or more years statistically significant data are less than 50 percent of the OEL, then monitoring frequency can be extended to once every three years, provided the process or work organization (including maintenance)remains unchanged.

10.6.2.7 Where a risk assessment indicates the possible presence of levels of gas or vapor sufficient to cause health effects in less than one shift (e.g. confined space entry), continuous monitoring is required as long as the potential for harm exists.

10.6.2.8 Employees and Category 1 contractors shall be covered by a medical surveillance program when:

- Their SEG TWA mean exposure to respirable crystalline silica, total inhalable dust, respirable dust, lead, arsenic, cadmium, or asbestos dust is greater than 50% of the relevant OEL.
- The medical adviser considers that it is advisable, or
- There is a legal requirement for medical monitoring.

10.6.2.9 Where a risk assessment indicates a risk of a respiratory condition, assessment programs shall include a medical history of the

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pulmonary organ system, chest x-rays, and pulmonary function tests meeting the following standards:

- High quality chest x-rays will be taken every 5 years, unless local legislation requires these to be more frequent.
- All chest x-rays will be read by a board certified radiologist.
- A physician will review any reading suggesting active lung disease.
- All spirometry testing will be by trained staff following the American Thoracic Society guidelines or equivalent and be offered at a frequency determined by the likely rate of detectable change in lung function.
- Abnormalities that are not defined by above shall undergo further testing to include but not limited to: CT/MRI scanning, open lung biopsy, referral to Pulmonologist.

10.6.2.10 All lead biological monitoring programs shall meet the following standards:

- All testing will be of venous blood.
- Only laboratories using an active quality assurance or quality control scheme will be used for testing.
- Females of reproductive capacity with a whole-blood lead above 20µg/dL will be removed from exposure until the physician declares the worker fit for duty, and exposure to lead should cease when pregnancy is notified to the Company.
- All other workers with a whole-blood lead above 40µg/dL will be removed from exposure until the level has fallen below 30µg/dL, and the physician declares the worker fit for duty.

10.6.2.11 All biological monitoring programs for other substances (i.e. arsenic and cadmium) shall be documented.

10.6.2.12 When a risk assessment determines that controls or treatment is needed, the following hierarchy of controls shall be considered:

1. Removal or substitution of the hazard.
2. Isolation.
3. Administrative controls.
4. Personal protective equipment (PPE).

10.6.2.13 There shall be documented procedures for inspection, assessment and maintenance of the engineering controls to ensure that the equipment continues to operate to design specifications.

10.6.2.14 Controls shall be of an adequate standard such that surfaces are

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adequately cleaned to avoid:

- Dust generation due to material dislodgment (e.g. wind blown), where practicable; and
- Fume generation from accumulated dust during welding / heating or cutting operations.

10.6.2.15 Where a risk assessment indicates the need to reduce exposures to toxic substance, good personal hygiene must be enforced. The program must include:

- Not smoking, eating or drinking in designated hazard area. Cigarette smoking must also be prohibited in all indoor areas and wherever people are likely to be exposed to second-hand smoke.
- Washing of hands and face prior to drinking, eating or smoking.
- Showering at work post shift or after exposure.
- Laundering of contaminated clothing by the operation.

10.6.2.16 Abrasive blast cleaning shall be conducted so as to protect worker health and minimize dust emissions. Substitutes shall be used whenever practicable for abrasives containing crystalline silica. However, if such abrasives are used, workers shall be aware of the hazards and exposure monitoring conducted. The hazardous properties of alternative materials shall be considered before use.

10.6.2.17 Fixed station monitors and alarms shall be installed where appropriate to warn against accidental or periodic releases of toxic gases / vapors (e.g. HCN, CO, SO_2). All affected personnel shall be trained on the capabilities and limitations of the monitors.

- All fixed station monitors / alarms shall be identified, listed and included in a periodic schedule of preventive maintenance and testing, including written documentation of calibration of detectors.
- Periodic drills with regard to response to sounding of the alarm shall be conducted. Frequency of drills should be based on level of risk.

10.6.2.18 Where required, training in the recognition of signs and symptoms of hazardous particulate and gas / vapor exposure, emergency procedures and preventative measures must be provided.

10.6.2.19 **RESPIRATORY PROTECTION DEVICES (RPD)** – Where required, there shall be a documented respiratory protection program. The program must include:

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- Periodic inspection of RPDs, including before each use;
- Periodic evaluation of cleaning, sanitizing, maintenance and storage practices by competent persons;
- Performance of positive and negative fit checks before each use by RPD wearers to ensure that respirator is functioning properly; and
- Training at first issue of a RPD and regular refresher training thereafter provided according to regulatory requirements or at least once every two years.

10.6.2.20 RPDs shall be selected with regard to:

- The potential particulate particles size, gas / vapor types, substance toxicity, and likely concentrations.
- Compatibility with the work tasks and other PPE.
- Comfort (as it affects wear-time) and allowance for adequate communication.

10.6.2.21 Half-face and full-face air-purifying respirators shall not be used where:

- The atmosphere is oxygen deficient (< 19.5%).
- The atmosphere is immediately dangerous to life or health (e.g. in areas where CO concentrations are > 1,500 ppm or NH_4 > 300 ppm).
- Gases and vapors are more than 10 times their OEL or greater than 1000 ppm for half-face respirators, or more than 100 times their OEL for full-face respirators.
- Particulates are more than 5 times their OEL for half-face respirators, or more than 50 times their OEL for full-face respirators.

10.6.2.22 An air-supplied type respirator must be worn for atmospheres that are oxygen deficient, contain unknown hazards, have concentrations of gases and vapors that are unknown, or could potentially exceed Immediately Dangerous to Life or Health (IDLH) values.

- For air-supplied RPDs, breathing air must be effectively filtered and / or isolated from plant and instrument air, and isolated from sources of potential contaminants. The quality of the breathing air must be checked for conformance with national standards.

10.6.2.23 For effective use of negative pressure RPDs (including disposable RPDs), fit testing must be qualitative and documented as a minimum, although quantitative fit testing is preferred. Fit testing

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must be performed by a competent person when respirators are first issued and must be repeated annually. There shall be a policy requiring a clean-shaven face when using a negative or neutral pressure RPD for routine tasks or the use of a positive pressure RPD will be required. A pulmonary function test is required to determine whether or not an individual is medically fit to wear a respirator.

10.6.3 **RESPONSIBILITIES**

10.6.3.1 Area Manager is responsible to ensure:

- A Risk Management Team develops a "Risk Register" and that the hazards in their respective work areas are defined and a hazard inventory is compiled and maintained and risks are controlled.
- Control measures are periodically checked and that they minimize emissions and protect employees and contractors from adverse exposure.
- Signs are posted in areas where particulate hazards exceed the relevant OEL and clearly communicated to employees.
- Procedures are document for inspection, assessment and maintenance of the engineering controls to ensure that the equipment continues to operate to design specifications
- All fixed station monitors / alarms are identified, listed and included in a periodic schedule of preventive maintenance and testing, including calibration of detectors. In addition, periodic drills with regard to response to sounding of the alarm shall be conducted.

10.6.3.2 HSE is responsible to:

- Identify and characterize workplace particulate and gas / vapor sources that contribute to the exceedences of OELs.
- Perform work plan exposure monitoring for job classifications and support the risk management team.

REFERENCES:
Rio Tinto Health Standard B1. Particulate and Gas / Vapor exposures

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13221	Scheduled review and update – last update 3/04. Recommended updates and changes provided by the IH department. Also, updated format and Document number added.	KUC Safety and Health Standards Committee	08/10

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