

# SAFETY AND HEALTH STANDARDS

## OCCUPATIONAL EXPOSURE LIMITS

Effective Date: 06/10/10	Standard: 10.7	Document Number: KUCSH0007	Rev: 03
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### 10.7.1 **INTRODUCTION**

10.7.1.1 In order to protect personnel at KUC from occupational illness, workplace hazardous exposures shall be controlled to below Occupational Exposure Limits (OELs) and / or biological test limit values.

### 10.7.2 **DEFINITIONS**

10.7.2.1 **OELs** - *Occupational Exposure Limits* are levels of agents in workplace air, which it is believed are low enough to protect nearly all workers from discomfort and adverse health effects over a series of eight-hour shifts for a working lifetime.

**Biological test limit values** - provide a method of determining total exposure to a chemical by measurement of a chemical, a metabolite or a biochemical change in the body. OEL and biological test limit values should be used as guidelines only.

**TWA** - *Time Weighted Average* is defined as the average concentration for a conventional 8-hour workday and a 40-hour workweek, to which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse effect (adjustments made for 12 hour shifts).

**STEL** - *Short Term Exposure Limit* is defined as a 15-minute TWA exposure, which should not be exceeded at any time during a workday. Exposures above the OEL-TWA up to the STEL should not be longer than 15 minutes and should not occur more than four (4) times per day. There should be at least 60 minutes between successive exposures in this range.

### 10.7.3 **REQUIREMENTS**

10.7.3.1 KUC has adopted an OEL for each substance for which significant worker exposure is possible. The list of substances (Exhibit 10.7.1) was derived from KUC Material Safety Data Sheets (MSDS), chemical inventories, and process intermediates. The associated OELs were taken from Rio Tinto / OSHA / MSHA / ACGIH Permissible Exposure Limits (PELs) and Threshold Limit Values (TLVs). The KUC OEL and biological test limit values will take precedence and must be reviewed annually for relevance and efficacy.

10.7.3.2 Where workers have a working day longer than eight hours or unusual shift rotations are in effect, the TWA-OEL may need to be reduced by a suitable factor to ensure adequate worker protection.

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10.7.3.3 For some substances, the existence of an adverse carcinogenic health effect is known or suspected, but there is no internationally accepted assessment of the appropriate OEL or no agreed practical method to quantify workplace levels. In these cases, exposures to agents meeting these criteria must be as low as reasonably achievable or practical.

### 10.7.4 **RESPONSIBILITIES**

10.7.4.1 HSE personnel are responsible for reviewing the KUC Occupational Exposure Limits annually and making recommendations to the KUC Standards Committee to adjust or amend according to regulatory, Rio Tinto, or new scientific information.

### **REFERENCE**

Rio Tinto Occupational Health Standard B10 Occupational Exposure Limits  
 Rio Tinto Work Cycle WC2080 Environmental and Health Exposure Monitoring  
 ACGIH Threshold Limit Values for Chemical Substances and Physical Agents &  
 Biological Exposure Indices  
 OSHA 29 CFR Part 1910.1000

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Exhibit 10.7.1

### KUC OCCUPATION EXPOSURE LIMITS

In addition to the exposure limits listed below, Rio Tinto has established additional inhalable fraction limits for Arsenic, Cadmium, Chromium, Copper, Lead, and Silver. These limits are listed in Rio Tinto Work Cycle WC2080

Agents (in air)	KUC OEL
Ammonia	25 ppm (TWA) 35 ppm (STEL)
Arsenic	0.01 mg/m <sup>3</sup> (TWA) 0.005 mg/m <sup>3</sup> (Action Level)
Arsine	0.05 ppm
Asbestos	0.1 f/mL (for all types) 1.0 f/mL (30 min.)
Beryllium	0.0002 mg/m <sup>3</sup>
Cadmium	0.005 mg/m <sup>3</sup> (TWA) 0.0025 mg/m <sup>3</sup> (Action Level)
Carbon monoxide (CO)	30 ppm
CHROMIUM	0.005 mg/m <sup>3</sup> (Cr VI) 0.5 mg/m <sup>3</sup> (Cr other)
Coal Dust	2.4 mg/m <sup>3</sup> (<5% SiO <sub>2</sub> ) 0.1 mg/m <sup>3</sup> (>5% SiO <sub>2</sub> )
Coal tar pitch (CTP) volatiles	0.2 mg/m <sup>3</sup> (BSM) <b>sk*</b>
COPPER	1 mg/m <sup>3</sup> (dust/mist) 0.1 mg/m <sup>3</sup> (fume)
Fluorides	0.5 mg/m <sup>3</sup>
Hydrogen cyanide (HCN)	5 ppm (TWA) <b>sk*</b> 10 ppm (STEL)
Hydrogen sulfide (H <sub>2</sub> S)	5 ppm (TWA) 10 ppm (STEL)
Inhalable dust (total)	10 mg/m <sup>3</sup>
Ionizing radiation (gamma / x-rays) includes radon contributions	20 mSv/year
Lead	0.05 mg/m <sup>3</sup> (TWA) 0.30 mg/m <sup>3</sup> (Action Level)
Manganese	0.5 mg/m <sup>3</sup> Inhalable
Mercury	0.025 mg/m <sup>3</sup> Inhalable <b>sk*</b>
Molybdenum	0.5 mg/m <sup>3</sup>
Nitrogen dioxide	1 ppm (STEL) 5 ppm (ceiling)
Oil mist	5 mg/m <sup>3</sup> (TWA) 10 mg/m <sup>3</sup> (STEL)
Respirable crystalline silica (quartz)	0.1 mg/m <sup>3</sup> 0.05 mg/m <sup>3</sup> (Action Level)
Respirable coal dust	3 mg/m <sup>3</sup>

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Respirable dust – other	5 mg/m <sup>3</sup>
SELENIUM	0.1 Inhalable mg/m <sup>3</sup>
SILVER	0.01 mg/m <sup>3</sup>
Sodium hydroxide mist (NaOH)	2.0 mg/m <sup>3</sup> (ceiling)
Sulfuric acid mist	0.2 mg/m <sup>3</sup> Thoracic
Sulfur dioxide (SO <sub>2</sub> )	2 ppm (TWA) 5 ppm (STEL)
Vanadium Pentoxide	0.05 mg/m <sup>3</sup> Inhalable
Wood dust -	1 mg/m <sup>3</sup> (hardwood) 5 mg/m <sup>3</sup> (softwood)
Zinc	5 mg/m <sup>3</sup> (dust/mist) 1 mg/m <sup>3</sup> (fume)
Non-asbestos fibrous silicates (NAFS) – Respirable	1.0 f/mL
NAFS – Non-Respirable	5 mg/m <sup>3</sup>
Noise	85 dB (A) (Leq) 140 dB (C)

\* “**sk**” - Skin absorption - may be a significant additional source of exposure for some agents.

Exhibit 10.7.2

## KUC BIOLOGICAL TEST LIMITS

Agents	KUC Biological Test Limits
Arsenic in urine (creatinine corrected)	50 µg/g CR (end work week)
Cadmium in blood	5 µg/L (any time)
Cadmium in urine (creatinine corrected)	5 µg/g CR (any time)
Carbon monoxide in end-exhaled air	30 ppm (post-shift)
Carboxyhaemoglobin in blood	5% (post-shift)
Chromium (VI) in urine (creatinine corrected)	30 µg/g CR (end work week)
Fluoride in urine (creatinine corrected)	3 mg/g CR (pre-shift) 10 mg/g CR (post-shift)
Lead in blood – male	40 µg/dL (any time)
Lead in blood – female of reproductive capacity	20 µg/dL (any time)

### REVISION HISTORY:

MOC #	Description of Change	Prepared By	Date
7961	General review and revision of standard. Update KUC Occupational Exposure Limits. Updated format and Document number added.	KUC Safety and Health Standards Committee	02/2008
10743	Updated KUC OELs to reflect OEL changes made by Rio Tinto.	KUC Industrial Hygiene Department	10/2009

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12305	Updated to comply with new Rio Tinto requirements. KUC IH personnel completed a review and provided recommended updates including removing the Rio Tinto OEL's list from the standard; the current Rio Tinto "Work Cycle" will now be referenced as the Rio Tinto requirement.	KUC Industrial Hygiene Department KUC Safety and Health Standards Committee	06 / 2010
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