RioTinto

Iron Ore (WA)

Fibrous Minerals Management Plan

RTIO-PDE-0062061

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1 Context

1.1 Purpose

This management plan outlines the minimum operational requirements to protect, so far as reasonably practical, persons from potential hazards associated with exposure to naturally occurring fibrous minerals and complies with Western Australian legislative and Rio Tinto requirements.

Level 2 risk assessments have been carried out to ensure that all hazards related to naturally occurring fibrous minerals have been identified, risk assessed, and adequate management controls have been implemented. Refer to Section 13 for links to these documents.

1.2 Scope

This management plan applies to all Rio Tinto Iron Ore employees and contractors where there is the potential for encountering naturally occurring fibrous minerals during exploration, construction, operations and closure activities. This document does not refer to the management of building materials containing asbestos.

2 Definitions

Definitions for all terms are provided in the Iron Ore - HSEC Management System Glossary [RTIO-HSE-0063840] and the Rio Tinto HSE Definitions Database, available on the Group HSEC Website.

Fibrous Minerals – Any of the fibrous varieties of different naturally occurring minerals which include amosite, chrysotile, anthophyllite, actinolite, tremolite and crocidolite. Fibrous minerals are also known as asbestos.

Ground disturbing activity – An activity that disturbs the natural ground enough to generate dust. Examples include land clearing, drilling, blasting, loading and hauling and construction activities using machines.

Normal Area – an area for which it is unlikely that fibres will be encountered during ground disturbing activities.

Potentially Fibrous Area – an area for which there is a possibility of encountering fibrous minerals during ground disturbing activities and is reclassified through the geological assessment.

Fibrous Area – an area where naturally occurring fibrous minerals are present. Whilst naturally occurring fibrous minerals have been identified in these areas, a review of historic personal monitoring results has shown that these areas do not meet the definition of a ‘designated’ area.

Designated Area – This area classification is defined in the DMIRS guideline (2015) - Management of Fibrous Minerals in WA Mining Operations as follows: “an area suspected or confirmed to contain naturally occurring fibrous minerals that could, if worked, consistently produce respirable fibres in concentrations in excess of the exposure standard”. Historically, there have been no instances in Iron Ore whereby an area has met the definition of a ‘designated’ area (refer to data analysis report).

Occupational Exposure Limit (OEL) – OELs are levels of agents in workplace air, which it is believed are low enough to protect nearly all workers from adverse health effects over a series of eight-hour (8h) shifts for a working lifetime.

3 Legislative Requirements

The Fibrous Minerals Management Plan (FMMP) complies with Western Australia Legislation and guidance including:

- Mines Safety and Inspection Regulations 1995
- Occupational Safety and Health Act 1984
- Occupational Safety and Health Regulations 1996
- Health Act 1911
- Health (Asbestos) Regulations (1992)
- Environmental Protection Act 1986
- Environmental Protection (Controlled Waste) Regulations 2004
- Management of Fibrous Minerals in West Australian Mining Operations-Guideline second edition (2015)
- Guidance Note on Public Health Risk Management of Asbestiform Minerals Associated with Mining (2013)
- Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australian (2009)

Note: always check for the most current legislative requirements.

4 Geology of the Pilbara

While fibrous minerals can be found in many parts of Western Australia, they are particularly prominent in the banded iron formations (BIF) of the Pilbara. Within the Hamersley Basin, naturally occurring fibrous minerals are known to occur in the Marra Mamba Iron Formation, the Dales Gorge Member and the Joffre Member of the Brockman Iron Formation, and in the Weeli Wolli Formation. The Fortescue group, comprising dolerites and basalts, is also known to contain fibrous minerals.

Fibrous minerals can also occur as clasts (“floaters”) within the colluvium, alluvial gravels and detritals overlying bedded material. This type of occurrence can be less common than those within the bedded material but has a variable occurrence profile. Six types of naturally occurring silicate minerals are shown in Table 1.

The most common non-fibrous mineral associated with fibrous minerals encountered within the iron formations is riebeckite which is only found in fresh (unweathered) BIF and is not considered to pose a risk to health. Riebeckite is a precursor to crocidolite.

Within weathered or mineralised areas, crocidolite is replaced by goethite, which makes the mineral brittle and thus it does not pose a health risk. Hazardous fibrous minerals are not found within the iron ore, as they have been replaced by iron oxide as part of the mineralisation process.

The geology and mineralogy of the Hamersley Province ores is detailed in the Green Book Update (RTIO-PDE-0073619).

Table 1: Asbestiform and non-asbestiform varieties of select silicate minerals

Asbestiform Variety	**Chemical Composition**	**Non-Asbestiform Variety**
Serpentine Group		
Chrysotile (white)	$Mg_3(Si_2O_5)(OH)_4$	Antigorite, lizardite
Amphibole Group		
Crocidolite (blue)	$Na_2Fe_3(Fe_2Si_8O_{22})(OH,F)_2$	Riebeckite
Amosite (grunerite) (brown)	$(Mg,Fe)_7(Si_8O_{22})(OH)_2$	Cummingtonite - grunerite
Anthophyllite	$(Mg,Fe)_7(Si_8O_{22})(OH,F)_2$	Anthophyllite
Tremolite	$Ca_2Mg_5(Si_8O_{22})(OH,F)_2$	Tremolite
Actinolite	$Ca_2(Mg,Fe)_5(Si_8O_{22})(OH,F)_2$	Actinolite

Riebeckite - a common amphibole group mineral found in fresh (un-weathered) Banded Iron Formation (BIF), which is blue crystalline-massive to fibrous. This mineral is an indicator to crocidolite.

Crocidolite – the asbestiform variety of riebeckite, which is blue to blue-grey and fibrous. Also known as “blue asbestos”.

Amosite (grunerite) – the asbestiform variety of cummingtonite-grunerite, this mineral is commonly referred to as “brown asbestos”.

Actinolite/tremolite – minerals which may occur in the asbestiform variety. They may be present in some of the volcanics (e.g. basalts) within the Hamersley Basin.

5 Accountabilities

Accountabilities relating to fibrous minerals management are detailed in the table below:

Stakeholders	Key accountabilities
All Employees / Contractors	Comply with the controls outlined in the Fibrous Mineral Management Plan Area Controls (refer Appendix A). In accordance with MSIR r.9.31, smoking is prohibited in workplaces where the air may contain asbestos including 'potentially fibrous', 'fibrous' and 'designated' areas.
Site General Manager / Project Manager	Ensure compliance with this document.
Registered Manager	Approving area classification changes and ensuring site compliance with legislative requirements and FMMP requirements. See Registered Manager Legislative Reporting and Recording Procedure
Health & Safety	Execute suitable risk-based monitoring and review results in accordance with legislative and Rio Tinto requirements. Reporting and record management (see Section 6) Surface Ventilation Officer is to maintain the Ventilation Log Book as per part 9 of the Mines Safety and Inspection Regulation (1995). Ensure that records of persons who have worked in a 'designated' area are retained for a minimum of 30 years.
Exploration / Evaluation / Hydrogeology	See Resource Development, Guideline for Drilling in Potentially Fibrous and Fibrous Areas (RTIO-HSE-0179525)
Mine Geology	See Fibrous Mineral Geological Assessment Procedure (RTIO- PDE-0151492).

6 Reporting and Record Management

All incidents related to naturally occurring fibrous minerals shall be managed according to HSEQMS Element 14 and the Rio Tinto Incident Reporting – Health Impacts guidance note (GNMS1402).

The first intersection of fibres in the area should be reported to the District Inspector, however, subsequent intersections within that area are not required to be reported. In the event that fibres are intersected during normal mining operations, it is recommended that, unless sufficient evidence can be obtained demonstrating previous intersections within the area have been reported to the regulator, this encounter be treated as an initial intersection and be reported to the District Inspector as per the below.

The requirement to report shall follow confirmation that the fibres encountered are asbestiform, see Table 1, p. 5. Confirmation can be obtained from either a trained Geologist, or lab analysis at a NATA accredited laboratory, following which the below shall occur.

1. The Registered Manager shall prepare a report to be submitted to the District Inspector including, at a minimum, the information detailed below:
    - Location of occurrence
    - Depth
    - Type of fibrous mineral
    - Controls in place and actions taken e.g. reference Fibrous Minerals Management Plan (FMMP)
2. The Surface Ventilation Officer (SVO) shall update the Ventilation Logbook to reflect positive identification of asbestiform material within the mining area. This shall include a copy of the report submitted to the district inspector.

Ventilation logbook requirements outlined in part 9 of the Mines Safety and Inspection Regulations (1995) shall be met.

Record and report monitoring results to employees and management and enter the data into Cority (GXII). Ensure that the data is stored for a minimum of 30 years.

7 Classification of Fibrous Areas

The Iron Ore Fibrous Minerals Management Plan relies upon the geologists in the exploration and evaluation stages to identify naturally occurring fibrous minerals, the stratigraphies and the structures likely to host these fibrous minerals. The geologist will capture this in the geological model via the fibre occurrence variable (see Figure 1), where it will be used to populate the mining model used by mine planning to determine quantities and potential locations of fibrous mineral intersections and storage locations.

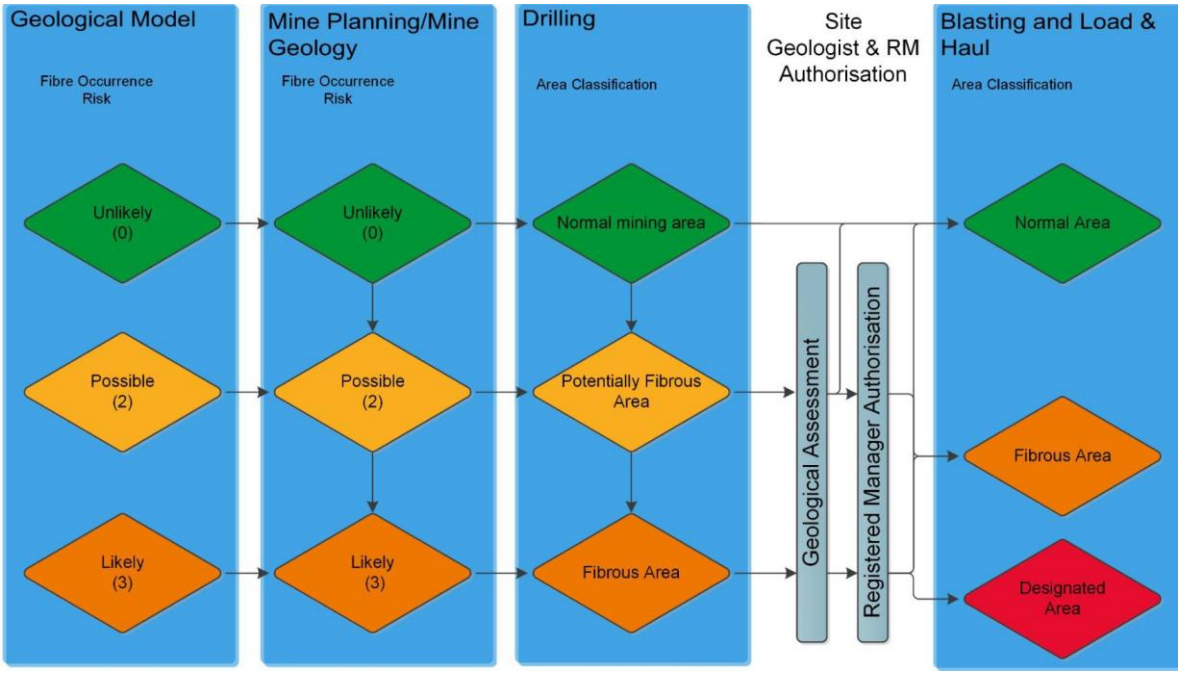


Figure 1: FMMP Classification Process Flow (fibre occurrence model variable)

The geological model is based on information collected during exploration and evaluation activities. Operations and mine geology use this to assign area classifications for application during development and drill and blast stages. The mine geology team undertake a geological assessment reviewing all available information to confirm the visible presence or absence of naturally occurring fibrous minerals and recommend areas / material as either 'normal', 'fibrous' or 'designated'. The Registered Manager reviews and approves the recommendation for 'fibrous' and 'designated' areas provided by the mine geology team prior to blasting, loading and hauling. Areas that may meet the definition of a 'designated' area shall be determined by the geology and health and safety teams with authorisation from the Registered Manager.

Where there is insufficient information to classify an area or material that will be disturbed, a geological assessment shall be completed ahead of project execution or construction activities.

8 Exploration, Evaluation and Water Bore Drilling

The early phases of drilling programmes have limited geological information regarding the presence of fibrous minerals. As such controls shall be implemented to protect employees and contractor's health. During planning, the geology team shall review all available information to determine the likelihood of encountering fibrous minerals in planned drill holes. If it is found that there is a potential to encounter fibrous minerals, then all workers on the project shall be notified. Other control considerations include:

- Wet drilling shall be undertaken. Water or dust-suppression systems should be used to reduce dust emissions where wet drilling is not practicable.

- Dust and water emissions from the T-piece and cyclone shall be directed away from workers and captured in sumps.

- Drill collars shall be sealed.

- Logging of samples shall be undertaken by a competent geologist.

- If fibrous minerals are intersected during drilling, equipment shall be washed down before being moved from site, signage and demarcation erected and the site captured in the relevant register.

- Personnel shall check clothing and boots for presence of visible fibrous material. Remove material, remove all dirt from boots or change clothing if material cannot be removed.

Further information is outlined in the Resource Development Guideline for Drilling in Potentially Fibrous and Fibrous Areas (RTIO-HSE-0179525).

9 Working in Fibrous Areas

9.1 Minimum Requirements

This section provides further clarification regarding minimum requirements for working in 'potentially fibrous' or 'fibrous' areas outlined in the FMMP Area Controls (refer Appendix A). A leader flowchart has been provided to ensure the minimum requirements are in place (refer Appendix B).

9.1.1 Training

There is a Fibrous Minerals Awareness training (125044) package that provides an overview of the minimum requirements for those working in 'potentially fibrous', 'fibrous' or 'designated' areas.

Geologists must complete the Identification of Asbestiform Minerals for Geologists (RTIO-HSE-0179529) training package.

Respiratory Awareness Training (124169) and Respiratory Protection Device (RPD) fit testing (1 Yearly 00124168, or 2 Yearly 31000849) or positive pressure Powered Air Purifying Respirator (PAPR) (30375271) training shall be completed by all personnel who may be required to work in 'potentially fibrous' or 'fibrous' areas in accordance with the Iron Ore – Medical Surveillance and RPD/HPD fit testing guidance note RTIO-HSE-0141134.

9.1.2 Personal Protective Equipment (PPE)

Those entering 'potentially fibrous' or 'fibrous' areas shall carry the appropriate respiratory protection (P2 disposable mask or PAPR) and be clean shaven in alignment with the Facial Hair Policy RTIO-HSE-0133557 if using a negative pressure respirator (i.e. disposable or re-usable respirators). The area specific PPE requirements are detailed in Section 10.

9.1.3 Signage and Demarcation Requirements

Entrances to 'potentially fibrous' and 'fibrous' areas shall be sign posted and demarcated in accordance with the Iron Ore Pit Barricading and Signage Work Practice RTIO-HSE-0065301 using three sided 900*880 orange pyramid cones with the below stickers attached to each of the three sides. These areas shall also be captured on relevant site maps.

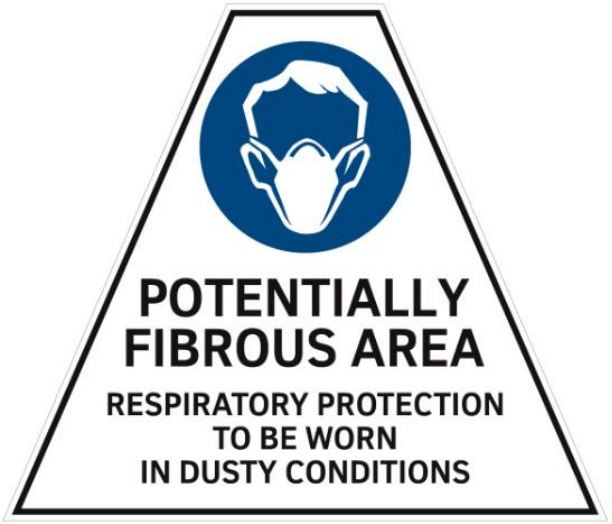


Figure 2: 'Potentially Fibrous' Area sign

Figure 3: 'Fibrous' Area / Waste Dump sign

Further details to assist with ordering signage can be found below

Sign Type	Material Number	Vendor	Vendor Item Code
Potentially Fibrous Area	20768607	Hartac	HS8281-62-A
Fibrous Area	20768608	Hartac	HS8281-63-A

9.1.4 Vehicle Requirements

Vehicle entry in fibrous areas shall be kept to a minimum and all vehicles and equipment shall maintain positive pressure in-cab to prevent dust ingress. This shall be tested using either a manometer or via the integrated cab pressurisation system and should achieve, at a minimum, between 10 and 20 pa.

9.1.5 Dust Management

Dust suppression shall be used to minimise dust generation as required based on risk assessment and considering the activity and conditions. Wet drilling shall be undertaken.

9.1.6 Area Permission Requirements

Verbal permission to enter ‘potentially fibrous’ and ‘fibrous’ areas shall be obtained from the area supervisor.

10 Fibrous Area Controls

This section provides further clarification regarding the specific controls required, in addition to the minimum requirements outlined in Section 9, when working in ‘potentially fibrous’ or ‘fibrous’ areas.

10.1 Potentially Fibrous Area

When working in a ‘potentially fibrous’ area, the following controls are required in addition to the minimum requirements (Section 9):

- Respiratory protection shall be worn if working in dusty conditions and not in a pressurised cab (i.e. on foot).
- Upon exit, inspect equipment and personnel and clean if required:
    - Personnel: shall check person, clothing and boots for the presence of visible fibrous material. If present remove material (e.g. manually brush off clothing and/or boots) or change clothing.
    - Equipment: shall check equipment (e.g. haul truck, drill, axillary equipment) for the presence of visible fibrous material. If present wash equipment before exiting the ‘potentially fibrous area’, particularly focusing on build-up or hang up of material.

Note: If fibrous material is suspected, notify the area supervisor and geology team.

10.2 Fibrous Area

When working in a ‘fibrous’ area the following controls are required in addition to the minimum requirements (Section 9):

- Respiratory protection shall be worn when not in a pressurised cab (i.e. on foot). If deemed necessary based on risk assessment, disposable overalls can be worn within a ‘fibrous’ area.

- Upon exit, inspect equipment and personnel and clean if required:
    - Personnel: shall check person, clothing for the presence of visible fibrous material. If present remove material (e.g. manually brush off clothing and/or boots) or change clothing. Remove all dirt from boots upon exit.
    - Equipment: shall check equipment (e.g. haul truck, drill, axillary equipment) for the presence of visible fibrous material. If present wash equipment before exiting the 'fibrous area', particularly focusing on build-up or hang up of material.
- Haul trucks shall be loaded to minimise spillage during transportation.

10.3 Designated Area

Historically, there have been no instances in Iron Ore whereby an area has met the definition of a 'designated' area as defined in the DMIRS guideline (refer to data analysis report). If there is any uncertainty:

- Stop work and report to Area Supervisor;
- Notify the site Registered Manager (or delegate), Health & Safety and Geology teams.

If it is determined that the area does meet the definition of a 'designated' area, a risk assessment must be completed and the requirements outlined in the DMIRS (2015) - Management of Fibrous Minerals in WA Mining Operations must be met.

11 Fibrous Material Waste Disposal

Waste rock containing fibrous material shall be dumped in a fibrous waste dump and encapsulated to prevent fibrous material from becoming airborne.

It shall be encapsulated with at least one metre of clean waste material as soon as reasonably practicable. Once encapsulated, there shall be no further disturbance of this material as far as reasonably practicable.

Fibrous waste dumps shall be sign posted (refer to Section 9, figure 3) and located as far as reasonably practical from buildings and areas personnel may work. The locations and quantities of fibrous waste dumps shall be recorded on-site for reporting purposes.

12 Equipment Maintenance Activities

12.1 Minimum Requirements

This section provides further clarification regarding minimum requirements for maintenance activities in fibrous areas or other areas (e.g. workshop, shut pad or normal pit areas).

Maintenance personnel required to wear respiratory protection are required to complete respiratory awareness training (124169), respirator fit testing or PAPR training in accordance with the Iron Ore – Medical Surveillance and RPD/HPD fit testing guidance note RTIO-HSE-0141134.

12.2 Maintenance in Fibrous Areas

Maintenance personnel performing work in 'potentially fibrous' or 'fibrous' areas shall meet the control requirements defined in Section 9 and 10.

12.3 Maintenance in Normal Areas

All equipment (e.g. haul truck, drill, axillary equipment) and light vehicles should be washed down as per standard wash down practices prior to being maintained in the maintenance area.

Respiratory protection is required for all Heavy Mobile Equipment (HME) filter change-outs and PAPR is required for the blowing out of electrical cabinets on all vehicles to prevent dust exposure. These activities should be completed in an open area to prevent dust generation in maintenance workshops.

13 References

Iron Ore, RTIO-HSE-0309744 - FMMP Project (Stage 1) Level 2 Risk Assessment

Iron Ore, RTIO-HSE-0324163 - FMMP Project (Stage 2) Level 2 Risk Assessment

Iron Ore, RTIO-PDE-0151492 - Fibrous Mineral Geological Assessment Procedure

Iron Ore, RTIO-HSE-0179529 - RTIO ID of Asbestiform Minerals for Geos

Iron Ore, RTIO-HSE-0065301 - Pit Barricading, Demarcation and Signage Work Practice

Iron Ore, RTIO-HSE-0141134 - Medical Surveillance and RPD/HPD Fit Testing Guidance Note

Iron Ore, RTIO-HSE-0179525 - Resource Development Guideline for Drilling in Potentially Fibrous and Fibrous Areas.

Iron Ore, RTIO-PDE-0073619 - 2010 Green Book Update

Iron Ore, RTIO-HSE-0065158 - Registered Manager Legislative Reporting and Recording Procedure

Iron Ore, RTIO-HSE-0063840 - HSEC Management System Glossary

Rio Tinto, GNMS1402 - Incident Reporting – Health Impacts Guidance Note

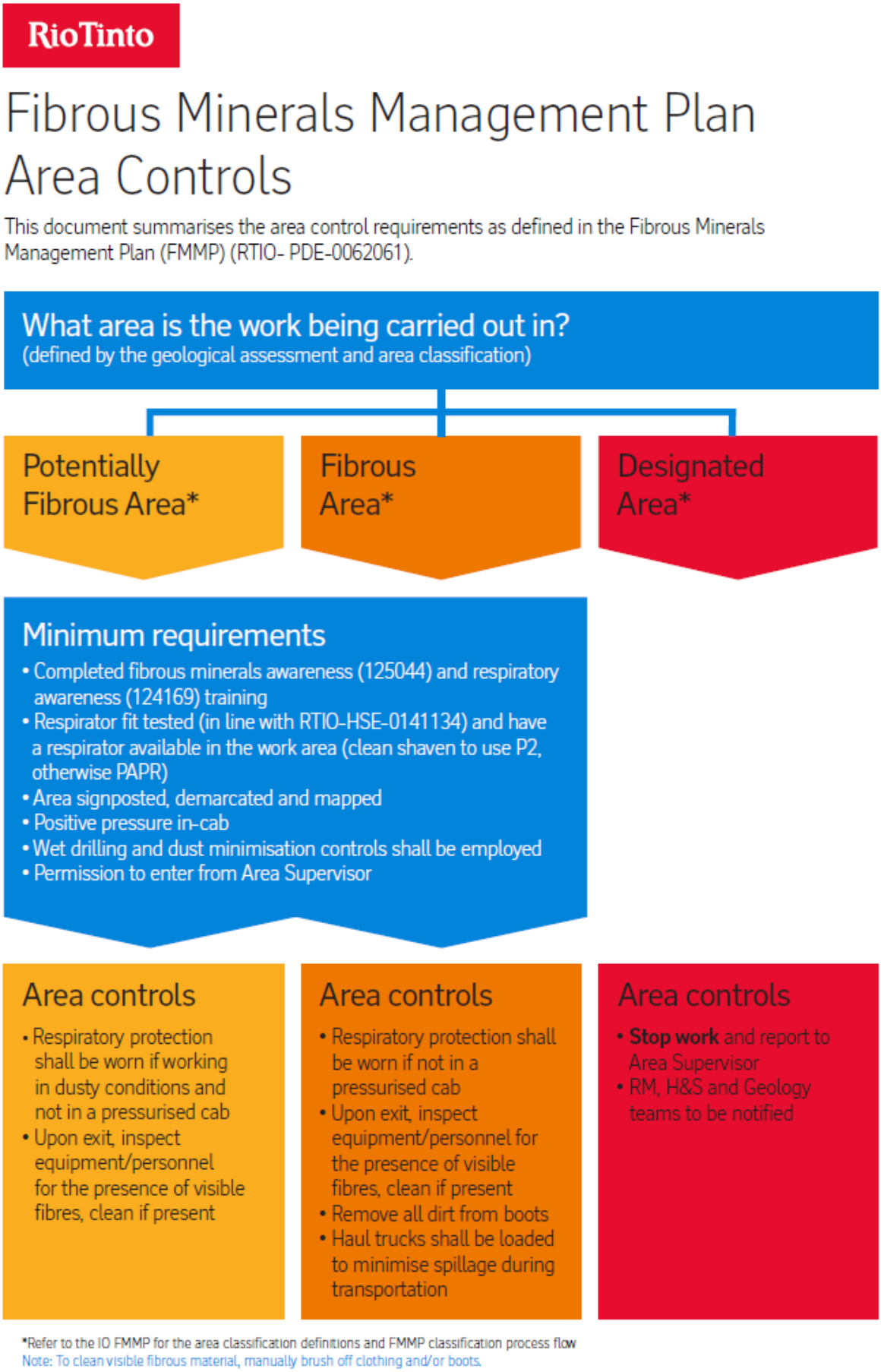
Rio Tinto, H1 – Chemicals and Hazardous Substances Exposure Control

Iron Ore, RTIO-HSE-0325314 - Personal fibre sampling data analysis report 2011 – 2018

Department of Mines, Industry Regulation & Safety, 2015, Management of Fibrous Minerals in WA Mining Operations Guideline

Appendices

Appendix A – FMMP Area Controls



Appendix B – Leader Flowchart