



Broken Hill Mineral Separation Plant



Annual Environmental Management Report

2021

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Table 1 - Annual Review title block

Name of operation	Broken Hill Mineral Separation Plant
Name of operator	Tronox Mining Australia Ltd
Development consent / project approval	Development Consent DA 345-11-01
Name of holder of development consent / project approval	Tronox Mining Australia Ltd
Annual Review start date	1 st January 2021
Annual Review end date	31 st December 2021
I, Terry Menadue, certify that this audit report is a true and accurate record of the compliance status of the Broken Hill Mineral Separation Plant for the period 1st January 2021 to 31st December 2021 and that I am authorised to make this statement on behalf of Tronox Mining Australia Limited. Note. a) The Annual Review is an 'environmental audit' for the purposes of section 122B(2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, \$1 million and for an individual, \$250,000. b) The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (Intention to defraud by false or misleading statement—maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents—maximum penalty 2 years imprisonment or \$22,000, or both).	
Name of authorised reporting officer	Terry Menadue
Title of authorised reporting officer	Environmental Lead
Signature of authorised reporting officer	
Date: 30 March 2022 (resubmitted 26 May 2022)	26 May 2022

1 STATEMENT OF COMPLIANCE

1.1 Statement of compliance

Table 2 - Statement of compliance

Were all conditions of the relevant approval(s) complied with?	
Development Consent (DA 251-09-01)	Yes
Environment Protection Licence (12314)	Yes

Table 3 - Non-compliance

Relevant approval	Condition #	Condition description (summary)	Compliance status	Comment	Where addressed in Annual Review
Nil					

Compliance status key for Table 3

Risk level	Colour code	Description
High	Non-compliant	Non-compliance with potential for significant environmental consequences, regardless of the likelihood of occurrence
Medium	Non-compliant	Non-compliance with: - potential for serious environmental consequences, but is unlikely to occur; or - potential for moderate environmental consequences, but is likely to occur
Low	Non-compliant	Non-compliance with: - potential for moderate environmental consequences, but is unlikely to occur; or - potential for low environmental consequences, but is likely to occur
Administrative non-compliance	Non-compliant	Only to be applied where the non-compliance does not result in any risk of environmental harm (e.g. submitting a report to government later than required under approval conditions)

2 INTRODUCTION

2.1 Scope of AEMR

This Annual Environmental Management Report (AEMR) refers to the environment and community performance of Tronox Mining Australia Limited (Tronox) Broken Hill Mineral Separation Plant (MSP).



Figure 1 shows the general location of the project and Figure 2 shows the development consent boundary and operational footprint. This report has been prepared generally in accordance with the Annual Review Guideline 2015 published by the Department of

Planning, Industry & Environment NSW (DPIE NSW). This AEMR describes environment and community performance from the 1 January to the 31 December 2021.

The report is intended to satisfy requirements of the Broken Hill Mineral Separation Plant Development Consent (DA 345-11-01) Conditions issued by the Department of Planning under Part IV of the *Environmental Planning & Assessment Act 1979*.

2.2 Key Statutory Approvals

The key statutory approvals that apply to operations of the Broken Hill Mineral Separation Plant are listed below in Table 4.

Table 4 - Main Development Approvals

Statutory Approval	Approval Authority	Granted
Development Consent DA 345-11-01	NSW Department of Planning and Environment	May 2002
- Modification		February 2006
- Modification		July 2007
- Modification		December 2008
- Modification		November 2014
- Modification		September 2017
- Modification		May 2020
Environment Protection Licence No. 12314	NSW Environment Protection Authority	May 2005
- Variation		February 2006
- Variation		October 2006
- Variation		December 2007
- Variation		August 2009
- Variation		April 2010
- Variation		September 2013
- Variation		February 2015
- Variation		December 2015
- Variation		November 2017
- Variation		September 2020



Figure 1 - Regional Location



Figure 2 - Aerial Image of the MSP Plant and the Development Consent Boundary

2.3 Ancillary Statutory Approvals

Additional approvals have also been granted to allow specific activities to be undertaken at or in relation to the mine sites. These approvals in addition to the relevant legislation and the approval authority are listed below.

Office of Environment and Heritage

Section 90 Consent (National Parks & Wildlife Act 1974)
Section 87 Permit (National Parks & Wildlife Act 1974).

2.4 Amendment to Development Consent

Development Consent for the Broken Hill Mineral Separation Plant was granted by NSW Department of Planning and Environment in May 2002. Since the issue of the consent and up to the end of this reporting period, six (6) amendments have been made to the development which are discussed in Table 5.

Table 5 – Summary of Modifications to the Original Development Consent

Modification	Approval Date	Description of Change
Mod 1	February 2006	- Adjustments in the infrastructure requirements and/or site layout; - An increase of the HMC processing rate (from 450,000 tonnes per annum [tpa] to approximately 576,000 tpa); - Addition of a specific leucoxene separation circuit; - Double road train transportation of material between the Ginkgo Mine and the MSP; - Staged transportation of product; - The addition of coal as well as LPG as a fuel type during Stages 2 and 3; - Production, storage, transport and disposal of waste material classified as hazardous¹; and - Reduction in water demand.
Mod 2	July 2007	- Processing of mineral concentrate from the proposed Snapper Mine; - Changed timing of MSP stages (i.e. rutile and zircon circuits would be added to the MSP prior to the ilmenite circuit); - An increase in the mineral concentrate processing rate; - An increase in the capacity of the rutile and zircon circuits; - An increase in the volume and back loading of process waste produced; - Transportation of mineral concentrates and MSP process waste between the proposed Snapper Mine and the MSP; - An increase in the frequency of double road train movements; - An increase in the amount of mineral product railed from the MSP; - An increase in the amount of coal to be railed to the MSP; - An increase in the capacity of coal container storages; and - An increase in water demand.
Mod 3	December 2008	Amendment of five development consent conditions required as the conditions were either identified during an Independent Environmental Audit as requiring amendment or were to reflect variations with the MSP Environment Protection Licence (EPL 12314).
Mod 4	November 2014	- Increase in the capacity at the MSP from 650,000 tpa to 1.2 Mtpa; - Increase in the life of the MSP by 7 years (i.e. from 2025 to 2032); and - Planning approval for the:

		○ receipt of 450,000tpa of concentrate from the Atlas-Campaspe project at the MSP; ○ receipt of any additional concentrate produced by the Ginkgo and Snapper mines; and ○ receipt of the additional waste material generated by the Atlas-Campaspe project at the Ginkgo and Snapper mine.
Mod 5	September 2017	• Minor administrative changes were made to the development consent conditions including changes to acronyms and air monitoring requirements.
Mod 6	May 2021	• Upgrades to the MSP processing plant to modify the ilmenite circuit so that HMC can be transported directly to Broken Hill MSP from Ginkgo, Snapper and Atlas Mines without requiring pre-treatment by the WHIMS plant at Ginkgo* • Following the completion of Mod 6, the Murray Basin Traffic Management Plan and Code of Conduct was updated as per the recommendations in the Mod 6 Assessment Report.

**Further details on Mod 6 provided in the section below.*

September 2021 Modification (MOD 7)

Tronox applied to modify the development consent to allow for internal processing changes to improve mineral recovery including:

- a bypass of the wet high intensity magnetic separator (WHIMS);
- reconfiguration of the existing ilmenite circuit;
- reconfiguration of the existing leucoxene circuit building and equipment to support the modified ilmenite circuit; and
- changes to reflect road and rail transport changes assessed and approved under the Ginkgo Mine, Snapper Mine and Atlas Campaspe Mine development consents.

The proposal was to bypass the WHIMS system as this preliminary treatment stage (separating HMC into ilmenite-rich, leucoxene-rich and non-magnetic mineral concentrates for processing) can be completed at the Ginkgo, Snapper or Atlas-Campaspe mines prior to transportation to the MSP. The bypass would allow HMC to be processed directly at the MSP without pre-treatment.

Tronox also proposed to modify the ilmenite circuit to allow for processing of HMC without pre-conditioning which would include:

- adding two ilmenite mineral reheaters (with associated stacks), magnetic separators and trash screens;
- duplicating the circuit feed conveyor;
- a minor extension of the ilmenite circuit building; and
- additional minor reconfigurations to processing infrastructure.

The stacks would be designed and constructed in accordance with the approved stack design parameters in the development consent and designed to comply with the criteria specified in the Protection of the Environment Operations (Clean Air) Regulation 2010.

The proposed modification would be located entirely within the approved disturbance area. Construction is anticipated to take approximately 3 months, during which operations at the MSP would cease. To reduce downtime, Tronox propose to be able to construct 24 hours a day, 7 days a week.

Additionally, as a result of the March 2015 modifications of the Snapper Mine and Ginkgo Mine development consents, and the December 2019 modification of the Atlas Campaspe development consent (Modification 1), transportation of mineral concentrate to the MSP has increased to 975,000 tpa by road and 650,000 tpa by rail, respectively.

The modification application therefore sought approval to align the project description for the MSP to reflect the approved mineral concentrate/HMC road transport and rail transport limits specified in the approved Snapper Mine, Ginkgo Mine and Atlas Campaspe development consents. This included an increase in the rate of MSP process waste transported to the Ivanhoe Rail Facility from 50,000 tpa to 65,000 tpa. However, as there are no mineral concentrate/HMC transport limits specified in the development consent for the MSP, no condition changes have been proposed in this regard for the modification.

The Department for Planning, Industry and Environment (DPIE) assessed the proposed modification and concluded that the proposed modification is in the public interest and should be approved, subject to revised conditions.

These conditions included Tronox to review and revise strategies, plans and programs within three months of any modification to the consent, in consultation with the relevant government authorities and to the satisfaction of the Planning Secretary. This included the Air Quality Management Plan, Energy Management Plan and Noise Management Plan to reflect potential impacts associated with the additional stacks and construction activities, and inclusion of the revised transport limits in the Transport Code of Conduct.

The following environmental management plans were review following the Modification 7 approval:

- Air Quality Management Plan (Approved September 2021)
- Energy Management Plan (Approved October 2021)
- Noise Management Plan (Approved July 2021)

The plans for the upgrades to Broken MSP are shown in Figure 2.

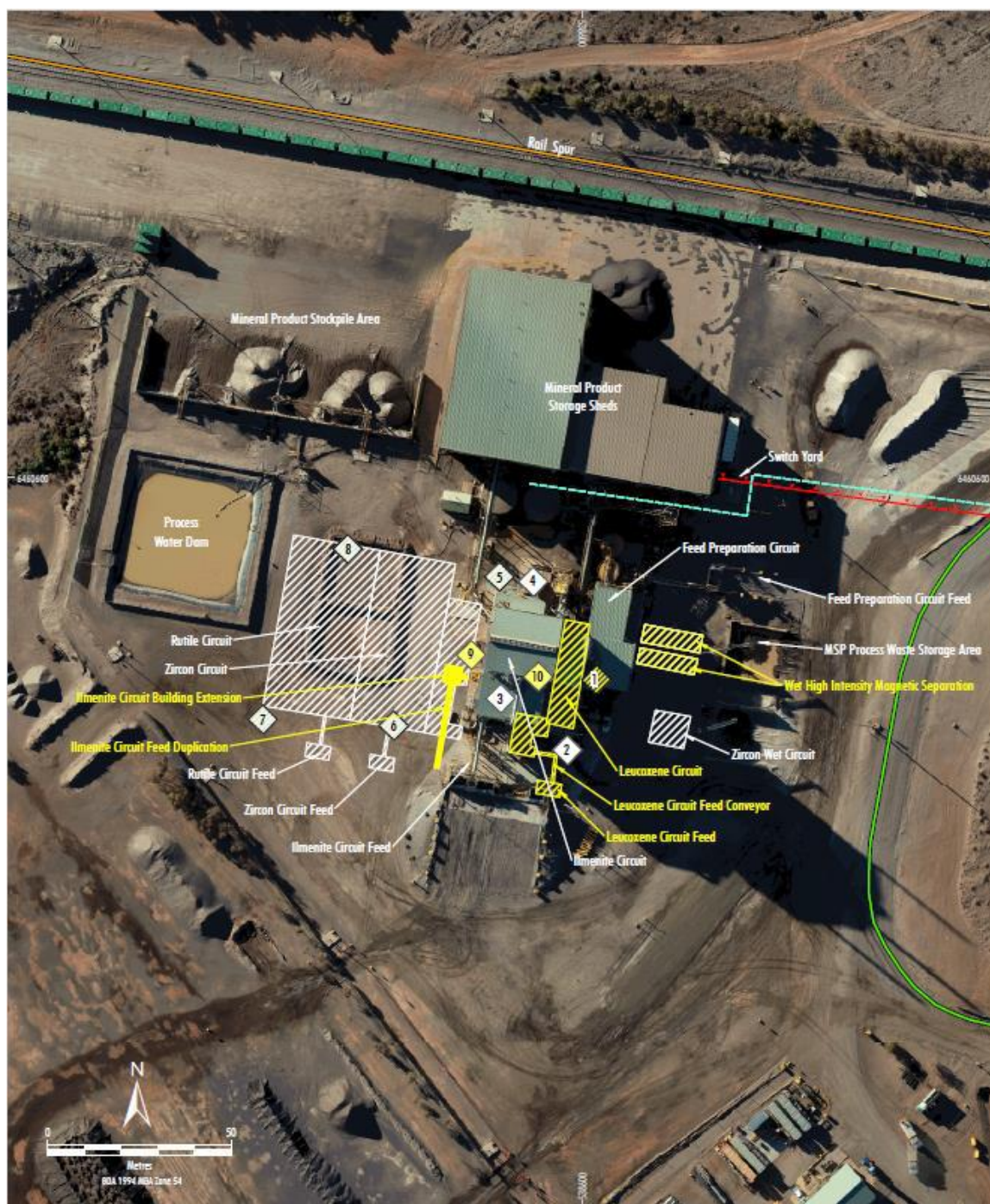


Figure 3 - Existing Project and Proposed Modification at Broken Hill MSP

2.5 Amendments to Environment Protection Licence

A description of amendments to EPA Licence 12314 prior to 2020 is provided in previous Broken Hill MSP AEMRs.

A variation to Environment Protection Licence 12314 was approved by the NSW EPA on 22 September 2020 to temporarily reduce and suspend the frequency of air quality monitoring given the border restrictions related to COVID-19 public health orders. Once

the COVID 19 restrictions are eased or by 31 January 2021, Tronox will advise the EPA and DPIE and reinstate the previous environmental monitoring frequencies.

A variation to Environment Protection Licence 12314 was approved by the NSW EPA on 12 August 2021. The variation included the proposed changes to the MSP plant as applied for in Modification 6 of the Development Consent (see Section 2.4).

2.6 Statutory Compliance

In 2019 a review of compliance against statutory approval conditions for the site was conducted. This review demonstrated that, notwithstanding the identified non-compliance and areas for improvement, operations were being conducted in a manner that minimised their impact on the environment.

As required under the Broken Hill Mineral Separation Plant DA 345-11-01 Condition 4.1 (a), Tronox undertook an Independent Environmental Audit using Telford Environmental Consulting Services who were approved by the Secretary of the Department of Planning, Industry and Environment.

A summary of the audit findings and responses are shown in Table .

Table 6 – Summary of audit findings

Identifier	Condition	Finding	Recommendation	Tronox Response
NC-2019-1	EPL A1.2	A portion of the processed sand generated at the MSP was being transported off-site and reused without provision for such reuse in the EPL.	Continue to seek the required approval to enable licensed reuse of processed sand generated at the MSP (if desired by Tronox).	Tronox may pursue a pathway to lawfully sell processed waste sand in the future.
NC-2019-2	EPL R1.5	The Annual Return for the reporting period 1 January 2018 to 31 December 2018 was not received by EPA within 60 days of the end of the reporting period.	Aim to avoid late submission of future annual returns. It is recognised that this occurred under extenuating circumstances and EPA was advised of the anticipated delay in submission of the annual return.	This was a result of sand sales issue where Tronox were required to provide additional information in the annual return which meant the due date was exceeded. The EPA were notified by telephone and were supportive of the late submission.

Identifier	Condition	Finding	Recommendation	Tronox Response
OfI-2019-1	DC sched. 2, cond. 3.2(a)	The stack discharge velocity of EPA discharge point 11 (Ilmenite Dryer) during the 2019 stack emissions test was 14 m/s, which is below the 15 m/s design parameter specified in condition 3.2(a) of the development consent.	Check that the stack discharge velocity of EPA discharge point 11 (Ilmenite Dryer) is at least 15 m/s during the 2020 stack emissions test. Investigate the reason for the reduced discharge rate if it is below 15 m/s and follow-up with the Department of Planning & Environment if necessary.	Stack testing was undertaken at discharge point 11 in February 2021 and measured discharge velocity at 15 - 18m/s (refer Attachment 1).
OfI-2019-2	DC sched. 2, cond. 3.6D	Managers of future construction work may not be aware of the limitations on the hours that construction work is permitted in the development consent.	Establish a trigger in project planning to include awareness of the time limits placed on works by schedule 2 condition 3.6D of the development consent.	Prior to the proposed upgrade works to the plant, MSP management will be notified of the construction times permitted specified in Schedule 2 Condition 3.6D.
OfI-2019-3	DC sched. 2, cond. 6.4(c)	The copy of the Air Quality Management Plan, June 2017 on the Tronox website has been superseded by the March 2018 revision.	Replace the copy of the Air Quality Management Plan (June 2017) on the Tronox website with the March 2018 revision.	Tronox have updated the website with the current version (2021) of the AQMP.
OfI-2019-4	EPL G1.3	The EPL published on the Tronox website is the 24 February 2015 version. The current version of the EPL is 16 November 2017.	Replace the EPL published on the Tronox website with the 16 November 2017 version.	Tronox have updated the website with the current EPL.
OfI-2019-5	EPL E3.2	The Effluent Management Plan is due for review and should include revision of the nutrient balances using water quality data and water application rate trends observed over the past three years, and the three-yearly soil monitoring results.	When reviewing the Effluent Management Plan, include revision of the nutrient balances using water quality data and water application rate trends observed over the past three years, and the three-yearly soil monitoring results.	A revision of the effluent water management plan will include updating nutrient balances. The EWMP will be revised in 2022.

Outstanding actions from the audit are as follows:

- NC-2019-1 Tronox are still considering whether to pursue authorisation to sell processed waste sand from MSP. Target completion date is 31 December 2022.
- OfI-2019-5 Tronox to revise the Effluent Management Plan in 2022.

The next independent audit for the MSP will be conducted in November 2022.

2.7 MSP Contacts

Table 6- MSP Contacts

Personnel	Position	Contact No.
Peter Collins	Site Director	(03) – 5074 8900
Linton Smith	MSP Manager	(08) – 8080 0800
Jarda Virgo	SHE Advisor	(08) – 8080 0832
Terry Menadue	Environmental Lead	(03) – 5074 8904

2.8 Action Required at Previous AEMR Review

Table 7 lists the actions arising from the review of the 2020 AEMR. Also listed are the relevant sections of this report that describe the measures taken in response to these actions.

Table 7 - Actions from the previous Annual Review

Actions required from the Previous Annual review	Requested by	Action taken by	Where discussed in Annual Review
No actions required			

3 OPERATIONS DURING THE REPORTING PERIOD

3.1 Land Preparation

No construction works took place during 2021 that required disturbance of un-cleared land. Planning for construction in the next reporting period following the Modification 6 approval is underway.

3.2 Operations

The Mineral Separation Plant involves the following processes.

- the transport of Heavy Mineral concentrates from the Ginkgo and Snapper Mines;
- a non-magnetic concentrate separation circuit (wet plant);
- two magnetic concentrate separation circuits (Leucoxene and BHT plants);
- the rail transport of the finished products Leucoxene, Secondary Ilmenite and non-magnetic concentrate; and
- back loading of waste material to the Ginkgo Mine.

The general site arrangement and the layout of the MSP are shown in Figure 3. The relevant process flows are shown in Figure 4.

Magnetic Separation (WHIMS)

Salt washing and magnetic separation within the WHIMS circuit is undertaken at the Ginkgo Mine (these process activities were originally proposed at the MSP and are now being undertaken at the Ginkgo Mine). The concentrates resulting from the WHIMS circuit include ilmenite, leucoxene and non-magnetic concentrates. Ilmenite (i.e. Mag 1), leucoxene (i.e. Mag 2) and non-magnetic (i.e. non-mags containing zircon and rutile) concentrates are transported to the MSP by double and triple road trains. The concentrates are stockpiled in the designated areas as Mag 1 and 2 and Non-mag products upon delivery to the MSP.

Mineral Processing

The feed preparation circuit (wet plant) processes the WHIMS non-magnetic concentrate to remove a waste component and produce a non-magnetic concentrate product. The non-magnetic concentrate product is stored in a dewatering stockpile prior to rail transport to Port Adelaide then ocean delivery to Western Australia for further mineral separation to saleable products. In Western Australia, rutile, zircon and leucoxene products are produced. The waste component from the Broken Hill MSP is back loaded to the Ginkgo Mine. Further detail on waste management is provided in Section 3.4.

The dry plant (BHT) processes the WHIMS magnetic concentrate to remove a waste component and separates the concentrate into two products; BHI and BHT. The products are stored in separate covered sheds prior to rail transport to South Australia for export as saleable products. The waste component is back loaded to the Ginkgo Mine.

The Leucoxene plant has not been operational since 2014 as the BHT plant is currently producing the required saleable products.

3.3 *Production*

For the production in this reporting period, production statistics (in tonnes) and estimates for the next AEMR period are provided in Table 8.

Table 7 - Production Statistics – AEMR Period

Material	AEMR Period				
	2018	2019	2020	2021	2022 (est.)
Non-Magnetics	195,420	124,578	151,339	143793	403031
BH Zircon Concentrate	20,198	14,195	-	11142	0
BHI (ilmenite)	115,960	50,860	58,747	80452	33765
BHT (ilmenite)	191,728	117,535	80,669	21765	0



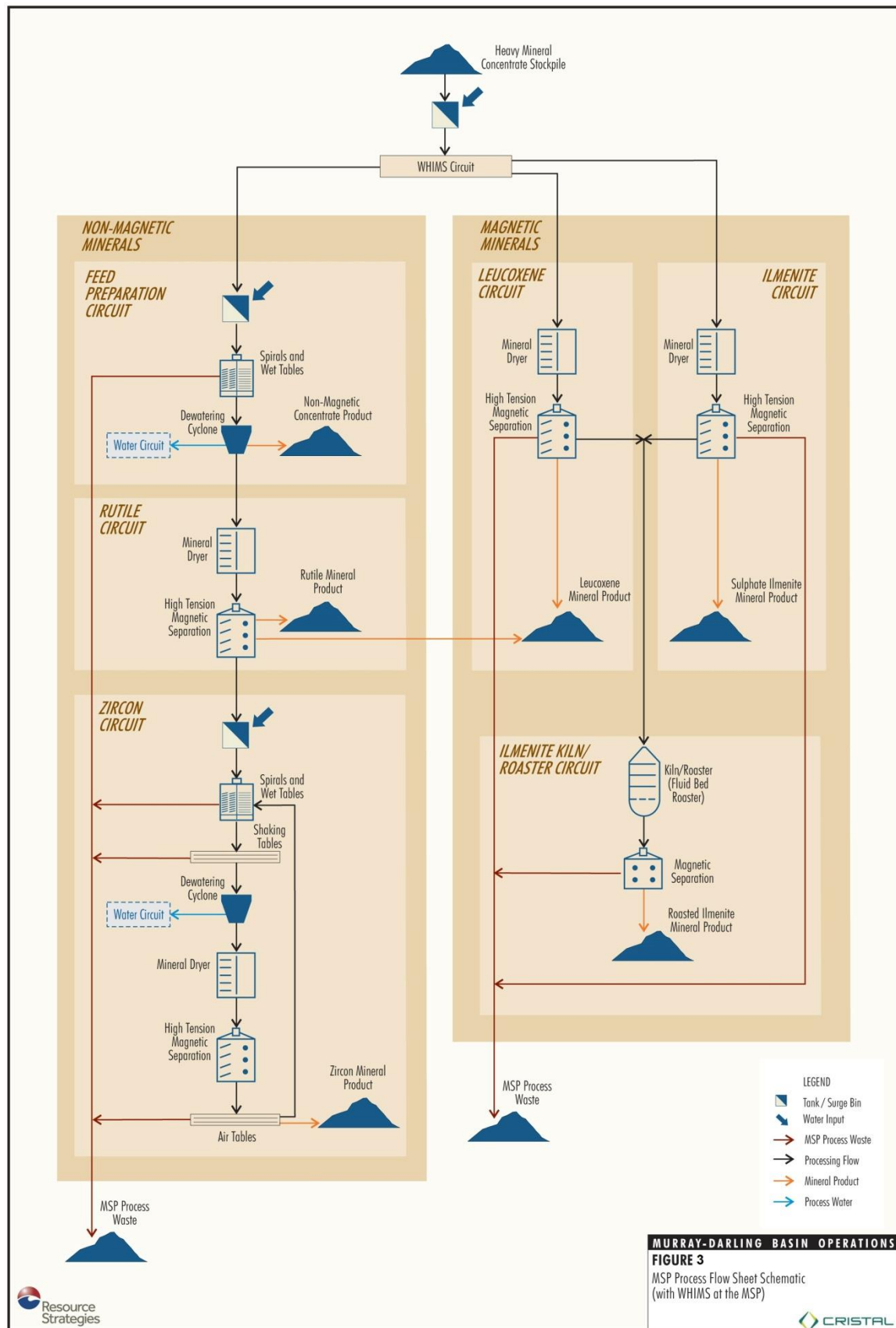


Figure 5 - MSP Process Flow Sheet

3.4 Waste Management

The Broken Hill Mineral Separation Plant commenced operations in March 2006. Transporting of production waste material from the Broken Hill MSP to the Ginkgo Mine commenced in the second quarter of 2006.

All heavy mineral sands ore bodies contain traces of the natural radioactive elements uranium and thorium together with their decay products. Waste materials generated at the MSP include silica, quartz and monazite. The only mineral sands component that is significantly radioactive is monazite. The monazite fraction of the MSP waste determines the activity levels of the MSP waste. Monazite from the Ginkgo and Snapper deposits are separated from the other heavy minerals at the Broken Hill MSP, and returned to the mine site for disposal. 50,780 tonnes of waste was returned to Ginkgo mine in 2021 to be deposited as backfill into the pit.

Since 2009, the total activity of the combined waste materials generated at the MSP occasionally exceeded 100 Becquerel's per gram (Bq/g). Therefore under the Waste classification guidelines Part 3: Waste containing radioactive material (EPA, 2014), the combined waste materials produced are classified as *hazardous* wastes (i.e. total activity would be more than 100 Bq/g). These materials are classified as hazardous on the basis they contain radioactive material from the separation circuit and except for this radioactive component would be classified as inert waste as specified in Schedule 1 of the Radiation Control Regulation 2013.

In accordance the Waste classification guidelines Part 3: Waste containing radioactive material (EPA, 2014), the combined waste materials produced were classified as *hazardous* waste. This is based on calculation of the total activity ratio. All waste transported from the MSP to Ginkgo was transported as hazardous waste under appropriate documentation in accordance with the NSW Radiation Control Act 1990 and the ARPANSA Code: Safe Transport of Radioactive Material (2019) rps No.C-2 (Rev 1).

The waste classification outlined above is based on the combined waste materials generated at the MSP. That is, blending of the waste generated by the non-magnetic concentrate separation circuit (wet plant) and the waste generated by the magnetic concentrate separation circuit (dry plant).

The two circuits produce separate waste streams that have different radiation activity levels due to the handling of the monazite fraction. The dry plant removes monazite and other wastes (mostly quartz) which are classified as hazardous material. The wet plant however, does not remove the monazite from the mineral concentrate and therefore the resulting waste stream is classified as inert waste in accordance with Section 4.5 and the Waste classification guidelines Part 3: Waste containing radioactive material (EPA, 2014)

Tronox has ceased the reuse of it inert waste sand for making concrete that is used in shot creating tunnels in nearby underground mine workings. Should Tronox elect to restart the sale of inert sand, consultation with the NSW EPA and Department of Planning, Industry and Environment will be undertaken to ensure this activity can re-commence lawfully in accordance with Environment Protection Licence 12314 and Development Consent (DA 251-09-01) .

3.5 Water Management

The water management system has been designed to contain and control stormwater runoff generated from project development and operational areas, while diverting other runoff water around such areas.

The water management system is based on the containment of site waters and on the control of sediment that may be potentially carried with runoff from disturbed areas. The key components of the strategy are:

- Separation of undisturbed area runoff from disturbed area runoff.
- Evaporation/sediment sumps to contain runoff.
- Capture and on-site containment of potentially contaminated MSP site waters.

No changes to the system were made during the reporting period.

3.6 Hazardous Material Management

Hazardous materials on-site are managed in accordance with Material Safety Data Sheets, Work Cover and OEH requirements. Due to the lack of reagents required in the separation plant, the only potentially hazardous material required in significant volume is Liquefied Natural Gas (LNG).

LNG is classified as flammable gas (Class 2) dangerous goods for the purposes of storage and handling. The project LNG storage tank has been constructed and operated in accordance with the requirements of the AS 3961-2005 – *The Storage and Handling of Liquefied Natural Gas*.

4 ENVIRONMENTAL MANAGEMENT

4.1 Air Quality

4.1.1 Management

Prior to the commencement of construction at MSP, Tronox prepared an [Air Quality Management Plan](#) in accordance with Development Consent requirements for the construction and operation of the MSP and associated infrastructure. The Air Quality Management Plan prescribes the dust prevention, monitoring, assessment, control, incident response and reporting procedure for the site. Details of the air quality criteria for concentrations of various emissions are provided in Table 9.

Table 8 - Air Quality Criteria

Pollutant	Location	Averaging Period	Concentration	Set by
Dust Deposition	Ground Level	Annual (total)	4 g/m ² /month	NSW EPA
	Ground Level	Annual (increase)	2 g/m ² /month	NSW EPA
*PM ₁₀	Ground Level	24hr	50 µg/m ³	NSW EPA
*PM ₁₀	Ground Level	Annual	30 µg/m ³	NSW EPA
Total Solid Particles	In-Stack	-	100 mg/m ³	EPA Licence 12314
Nitrogen Oxides	In-Stack	-	350 mg/m ³	EPA Licence 12314

**Monitoring of PM₁₀ has been suspended effective November 2017, See section 4.1.2 for further information.*

The MSP dust monitoring network consists of three (3) dust deposit gauges. The monitoring is undertaken nearby residential locations on the MSP site. The location of the dust deposit gauge sites is listed in Table 10 below and identified in Figure 5.

Table 9 - Dust Deposit Gauge Locations

Dust Gauge Id	Location
DBH01	Talbot Residence
DBH02	Removed due to solar farm development
DBH03	Abattoir Boundary
DBH04	Western Boundary

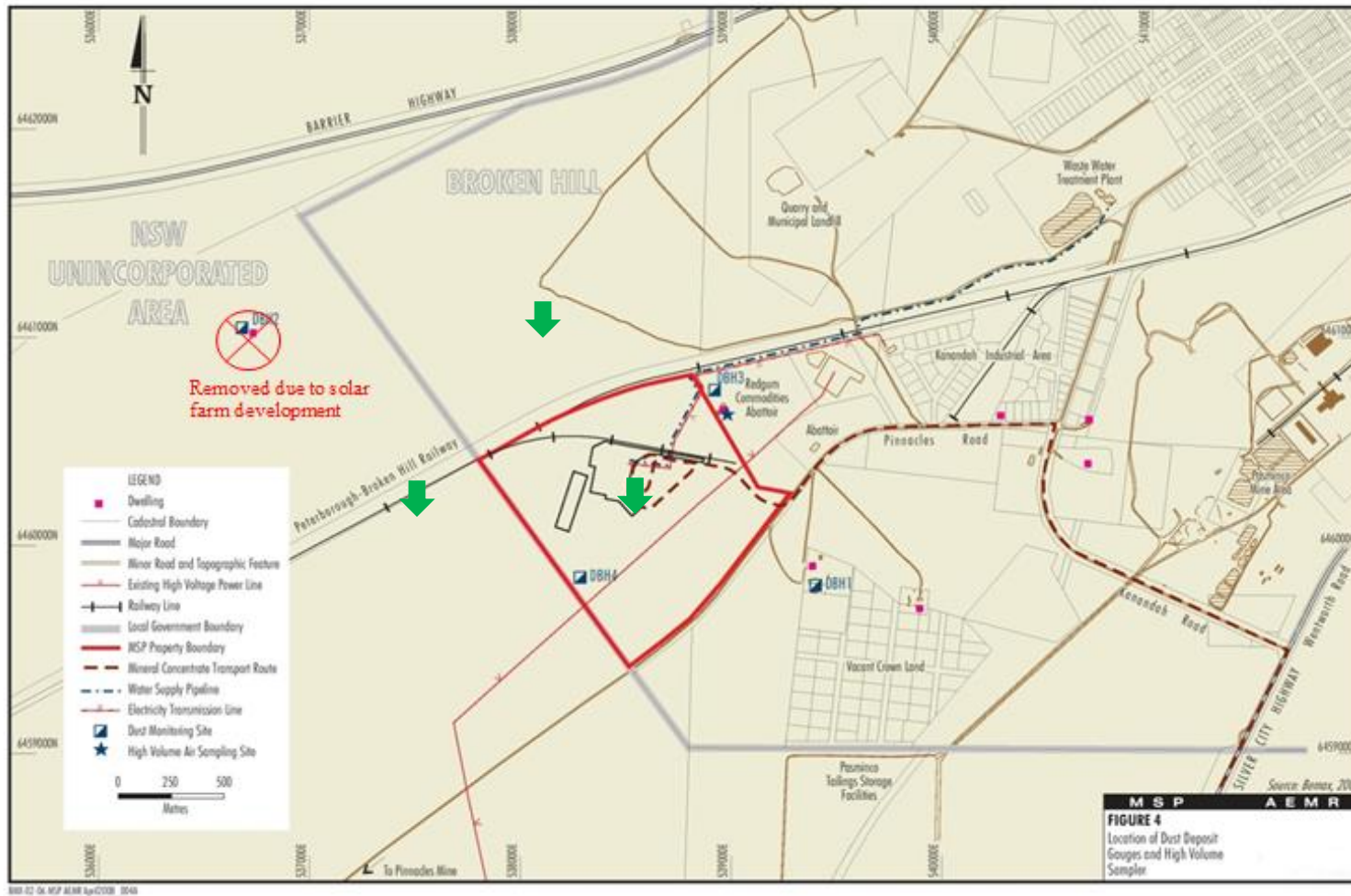


Figure 6 - Location of Dust Deposit Gauge (See Green Arrows)

4.1.2 Performance

Dust Deposition

The NSW EPA amenity criteria for dust deposition seek to limit the maximum increase in the average annual rate of dust deposition from a new development to 2 g/m²/month and total dust deposition to 4 g/m²/month. The nominal background dust deposition levels (as per Broken Hill MSP EIS 2001) were estimated to be approximately 2.4 g/m²/month.

During 2021 (36) dust samples were collected. **Error! Reference source not found.6** provides a graphical representation of the dust deposition for 2020. No exceedances of the annual average compliance criteria occurred during the reporting period, and the highest monthly measurement for 2021 was at DBH03 in February.

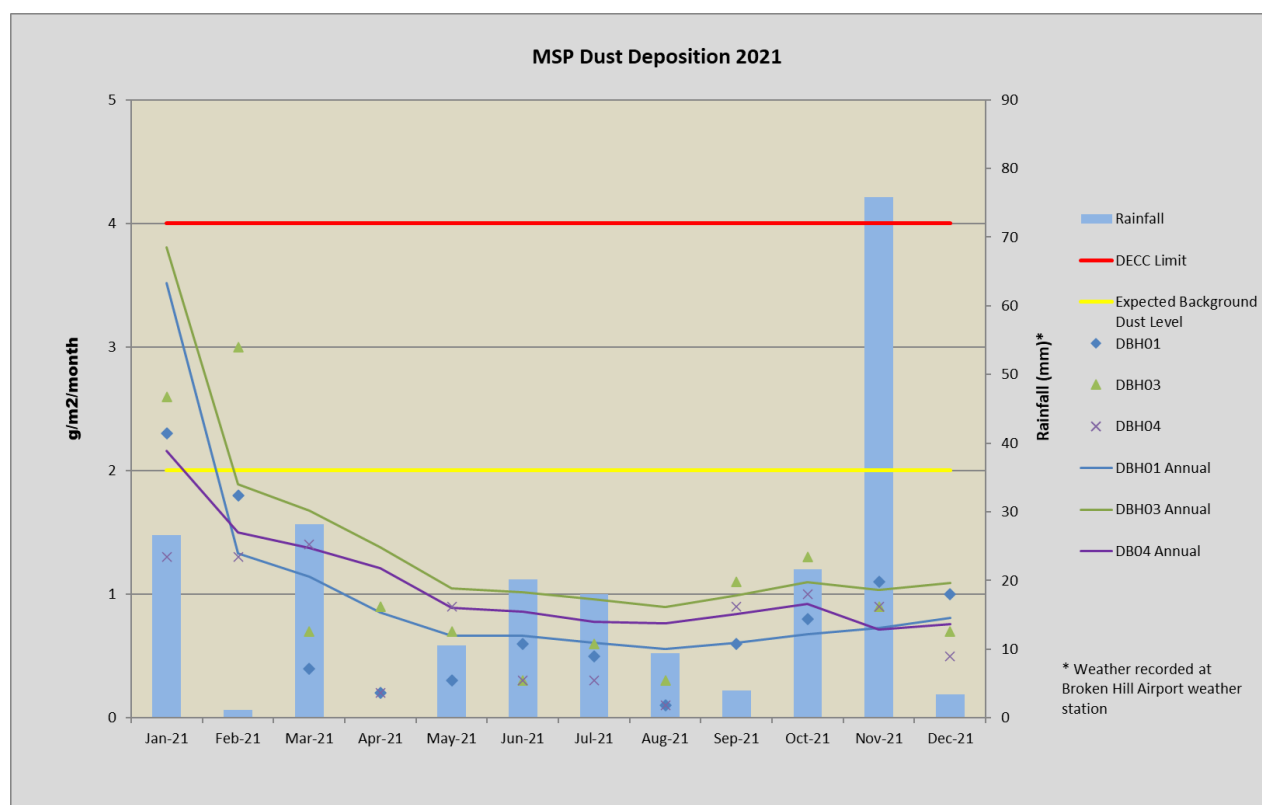


Figure 7 - Dust deposition results measured by the MSP network in 2021

High Volume Air Sampler

PM₁₀ monitoring was suspended in November 2017 after a review of the historical monitoring results indicated that PM₁₀ levels have been acceptable over the past 10 years. A modification to the development consent conditions to remove PM₁₀ monitoring was approved by the Department of Planning and Environment in September 2017. The MSP Air Quality Management plan was amended to reflect the changes to PM₁₀ monitoring requirements and approved by the Department of Planning and Environment. An amendment to the EPA license to remove PM₁₀ monitoring was approved in November 2017.

No further PM₁₀ monitoring using the High-Volume Air Sampler will be conducted unless any of the following triggers are occur:

- A complaint(s) related to dust and air quality concerns from nearby residences. If investigations indicate that the MSP is a potential source of air monitoring concerns, PM₁₀ monitoring may be undertaken to assess compliance of MSP operations against relevant guidance.
- Air monitoring at other monitoring points and subsequent review of this data that indicates exceedance of assigned limits or a trend towards decreasing air quality.
- Expansion of the MSP involving additional operations and activities that have been assessed as likely to impact on air quality (i.e., as per an environmental assessment undertaken for a modification to the Development Consent).

Tronox will consult with an Environmental Consultant, qualified in air quality monitoring and assessment, to assess the requirement for the reinstatement of PM₁₀.

Stack Emissions

Stack emission testing at the MSP took place in February 2021, the results for each operation plant are shown in Table 10 and Table 11.

The stack testing confirmed that stack emissions are compliant with the EPA Licence conditions.

The next stack emission testing is scheduled for the first half of 2022.

Table 10 – MSP Stack Testing Result (Ilmenite Hygiene Bag-house Stack Emissions)

EPA Discharge point ID	7		
Exhaust stack identification	Ilmenite Hygiene Bag House 102		
Purpose of Test	EPA Licence 12314 Compliance		
Date of Test	9 February 2021		
Plant Conditions	Ventilation of the dry BHT plant. Production rate: 51 - 53 TPH. Baghouse pressure drop 1.6 kPa.		
Stack location	538600 m E, 6460576 m N		
Sampling Plane:	Ideal, laminar flow, >8 stack diameters from flow disturbances. Two 150mm flange ports 90° apart.		
Internal Stack Diameter	0.72	m	
Base of stack elevation	300	m above sea level	
Height of stack	40	m above ground	
Average barometric pressure	97.8	kPa	
Stack gas static pressure	- 0.1	kPa	
Moisture	0.6	%	
Stack-gas molecular weight	29	g/g-mole	
Dry gas density	1.3	kg/m ³	
Average Temperature	48	°C	
Average Velocity	18	m/s in stack	
Volumetric Flow Rate	5.9	m ³ /s Dry STP	
Oxygen	20.9	%	
Carbon Dioxide	< 0.1	%	
Nitrogen Oxides (as NO ₂)	< 0.002	g/m ³ Dry STP	
Sampling time	1209 - 1320	1324 - 1443	hours
Total Particulate Matter	17	12	mg/m ³ Dry STP
	100	71	mg/s
Isokineticity	0.93 - 0.97	0.92 - 1.02	
Comment	Complies with EPA licence conditions		

Table 11 – MSP Stack Testing Result (Ilmenite Dryer Bag-house Stack Emissions)

EPA discharge point ID	11		
Exhaust stack identification	Ilmenite Dryer Bag House 101		
Purpose of Test	EPA Licence 12314 Compliance		
Date of Test	9 February 2021		
Plant Conditions	Production rate: 48 - 51 TPH Fuel rate: 300 - 320 kg/hr methane Baghouse pressure drop 1.1 kPa.		
Stack location	538591 m E, 6460562 m N		
Sampling Plane:	Ideal, laminar flow, >8 stack diameters from flow disturbances. Two 100mm flange ports 90° apart.		
Internal Stack Diameter	0.90	m	
Base of stack elevation	300	m above sea level	
Height of stack	40	m above ground	
Average barometric pressure	97.9	kPa	
Stack gas static pressure	- 0.1	kPa	
Moisture	14	%	
Stack-gas molecular weight	28	g/g-mole	
Dry gas density	1.2	kg/m ³	
Average Temperature	69	°C	
Average Velocity	15	m/s in stack	
Volumetric Flow Rate	6.2	m ³ /s Dry STP	
Oxygen	17	%	
Carbon Dioxide	1.9	%	
Nitrogen Oxides (as NO ₂)	0.029	g/m ³ Dry STP	
	0.18	g/s	
Nitrogen Oxides (as NO ₂) ref. 3% O ₂	0.14	g/m ³ Dry STP	
Sampling time	0928 - 1034	1041 - 1155	hours
Total Particulate Matter	2	4	mg/m ³ Dry STP
	12	25	mg/s
Total Particulate Matter ref. 3% O ₂	10	19	mg/m ³ Dry STP
Isokineticity	0.92 - 1.01	0.93 - 1.05	
Comment	Complies with EPA licence conditions		

4.1.3 Incidents

No incidents were recorded during the reporting period.

4.1.4 Improvements

Management and monitoring of air quality continued in accordance with the Air Quality Management Plan, which was updated during the reporting period.

The following controls continued throughout the reporting period:

Mitigation of dust emissions

- Mineral concentrate and product storage sheds;
- Covered conveyors used to transfer concentrate into dry and wet plants for processing;
- Containers are filled up on the ground, lids placed on and loaded onto the train with reach stackers.
- Use of water trucks to reduce wind borne dust.
- Onsite water storage tanks fitted with high flow pumps to reduce water truck fill times.
- Height of the stockpiles are limited to reduce the surface area exposed to the wind.
- Stockpiles turned into the predominate wind direction to minimise frontal area to reduce dust lift off.
- Early warning dust lift off system in place.
- Wind breaks.
- Sealing of internal roads and hardstands.
- Vacuum truck to clean hardstands
- Ducted vacuum system in BHT plant to remove mineral fines
- Polymer dust suppression trial has commenced.

Wind breaks

The MSP site is very exposed with little natural protection from strong winds. As a long-term strategy, trees have been planted along operational boundaries to act as wind breaks to reduce wind speeds moving across the site and limit fugitive dust emissions. Over 1300 trees planted around the MSP (See photo below). All trees are irrigated by utilising on site treated effluent water.

Wind break fabric has been installed along the southwestern perimeter fence adjacent to mineral stockpiles to help reduce the amount of windblown material entering the work area of the MSP.

In 2020 a further 80m stretch of fabric fencing was installed around the waste stockpiles to prevent contamination in surrounding undisturbed areas.



Fabric wind break installed around the site boundary



Native tree wind break

Early warning system for dust events

An early warning dust lift-off system that warns staff prior to a dust lift off event. Staff receive emails alerting them up to 4 days in advance the likelihood of a dust event. This allows staff to implement measures to reduce the severity of the event.

Road and rail hardstand

The internal roadways and rail hardstand are sealed with bitumen. The sealing of these areas has reduced the amount of dust created from vehicle movements and train loading activities within the MSP. A vacuum truck is used for sweeping and vacuuming hardstands regularly to further reduce dust emissions from these areas. A portable vacuum can be attached to the rear of the sweeper to clean other areas where accessibility is limited.



Sweeper truck



Portable vacuum on sweeper truck

Ducted vacuum system

In 2020 the first phase of the BHT dry plant vacuum system was commissioned for use.



Ducted vacuum system 2020

Polymer dust suppression trials

In 2020 a trial of polymer dust suppression is being used around the site in low traffic areas. With the lack of rainfall in the broken hill district hopefully this will be a positive result in dust suppression.

4.2 Noise

4.2.1 Management

Prior to the commencement of construction Tronox prepared a [Noise Management Plan \(NMP\)](#) in accordance with Development Consent requirements for the construction and operation of the mine. The NMP prescribes the frameworks to monitor, assess, investigate, mitigate, and report noise generated by the MSP operations.

During 2015 Tronox undertook unattended noise monitoring at the Smiths residence which is located near the MSP site.

Tronox formed an agreement with Smiths residence in 2015 that no further noise monitoring is required as noise from MSP is neither a factor nor a concern. Tronox has assured the Smiths residence that should they have any concerns regarding noise from the MSP to contact Tronox and the matter will be investigated and any mitigation measures necessary will be adopted.

The Department of Planning, Industry and Environment acknowledges the agreement Tronox has with the Smith residence and has approved the noise monitoring suspension. The Noise Management Plan has been amended to reflect the changes to noise monitoring and includes details of the agreement and triggers for noise monitoring to be undertaken.

4.2.2 Performance

Unattended noise monitoring was undertaken during 2015 within 30m of the Smiths Residence. The results provided below in Table 12 have been adjusted to exclude data recorded at wind speeds above 3 m/s.

Table 11 - Unattended Noise Monitoring at Smith's Residence

Date	Average Noise Level, dB(A)								
	Day 0700 - 1800			Evening 1800 - 2200			Night 2200 – 0700		
	L ₉₀	L _{eq}	L ₁₀	L ₉₀	L _{eq}	L ₁₀	L ₉₀	L _{eq}	L ₁₀
30/09/15 – 07/10/15	30.1	39.4	41.6	27.0	32.7	35.0	30.0	33.6	35.8
Noise Limits*	-	35*	-	-	35*	-	-	35*	-

* EPA limit except during rain and wind speeds greater than 3m/s – NSW Industrial Noise Policy (2000)

Attended noise monitoring was completed in 2015 in accordance with the Development Consent *DA 345-11-01 section 3.6A Noise Monitoring*, to help determine the source of any potential high noise levels. During the monitoring, multiple noise sources around the residence were present in addition to the Mineral Separation Plant (MSP).

Observations made at the time of the monitoring were that noises from offsite sources masked noise from MSP. The only noise relating to Tronox operations that was audible were haul trucks entering and leaving the site.

The primary sources of noise at the Smiths residence were crows and magpies within the area, and the MSP was barely audible during lulls of extraneous noise from other sources.

Background noise is the term used to describe the noise measured in the absence of the noise under investigation. It is described as the average of the minimum noise levels measured exceeded for ninety percent of a sample period. This is represented as the L₉₀ noise level. L₁₀ is the sound pressure level that is exceeded for 10% of the time for which the given sound is measured. L_{eq} is the equivalent sound pressure level, and is defined as the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.

To put the decibel readings in perspective the relative scale of various noise sources is provided in Table 13.

Table 12 - Relative Scale of Various Noise Sources

Noise Level (dBA)	Relative Loudness	Common Indoor Noise Levels	Common Outdoor Noise Levels
110 – 130	Extremely noisy	Rock band	Jet flyover at 1,000 m
100	Very noisy	Inside subway train	Petrol engine lawn mower at 1 m
90	Very noisy	Food blender at 1 m	Diesel truck at 15 m
80	Loud	Garbage disposal at 1 m, Shouting at 1 m	Urban daytime noise
70	Loud	Vacuum cleaner at 3 m, Normal speech 1 m	Commercial area heavy traffic at 100 m
60	Moderate to quiet	Large business office	-
50	Moderate to quiet	Dishwasher next room, Wind in trees	Quiet urban daytime
40	Quiet to very quiet	Small theatre, large conference room (background), Library	Quiet urban night-time
30	Quiet to very quiet	Bedroom at night, Concert hall (background)	Quiet rural night-time
20	Almost silent	Broadcast and recording studio	-
10-0	Silent	Threshold of hearing	-

After United States Department of Interior (1994)

4.2.3 Incidents

No noise incidents were recorded during 2021.

4.2.4 Improvements

Any complaint received that is related to noise will be investigated and resolved.

4.3 Pest management

4.3.1 Weeds

Both declared noxious weeds *Mesquite* and *African boxthorn* occur on the MSP property.

4.3.2 Performance

During 2020 areas of known occurrences of both Mesquite and African Boxthorn were monitored for presences of either declared noxious weeds. Mesquite and African Boxthorn will monitored and controlled as required in the 2022 reporting period.

4.3.3 Incidents

No Incidents were recorded during 2020.

4.3.4 Improvements

Further monitoring and any necessary treatment will occur during spring in 2021.

4.4 *Indigenous Heritage*

4.4.1 Management

Prior to the commencement of construction Tronox prepared an [Aboriginal Heritage Management Plan](#) in accordance with Development Consent requirements for the construction and operation of the MSP. The Aboriginal Heritage Management Plan is now superseded by the Cultural heritage Management Plan dated October 2014. The Cultural Heritage Management Plan addresses the consultation program with the local indigenous community and identification, assessment, monitoring, conservation and management of archaeological heritage.

The Plan includes results of Aboriginal heritage surveys and assessments of the MSP site, rail corridor, and the process water pipeline. The surveys and assessments were undertaken in accordance with OEH requirements and in consultation with representatives from local Aboriginal organisations. Details of the locations of the identified heritage sites are provided in **Error! Reference source not found..**

4.4.2 Performance

The objectives of the Cultural Heritage Management Plan (CHMP) were achieved in 2021 with impacts controlled in accordance with statutory conditions.

The sites identified during Aboriginal heritage surveys were open camp sites and quartz quarries. In all, seven quarry sites (AS1-AS4, AS12-AS14) and eight camp sites (AS5-AS11, and AS15) were identified within the MSP site. Another quartz quarry site (AS16) was identified in the adjacent rail corridor (see Figure 7). In 2005, sites located within the disturbance area for construction of the MSP were removed in accordance with the CHMP and the permits and consents issued by OEH under Sections 87 and 90 respectively of the *National Parks and Wildlife Act 1974*.

Sites located outside the disturbance area are managed and protected in accordance with the Cultural Heritage Management Plan.

4.4.3 Incidents

No incidents regarding Aboriginal archaeology were recorded in 2021.

4.4.4 Improvements

In 2022, management of Aboriginal heritage will continue to be undertaken in accordance with the Aboriginal Heritage Management Plan, Section 87 permit and Section 90 consent.

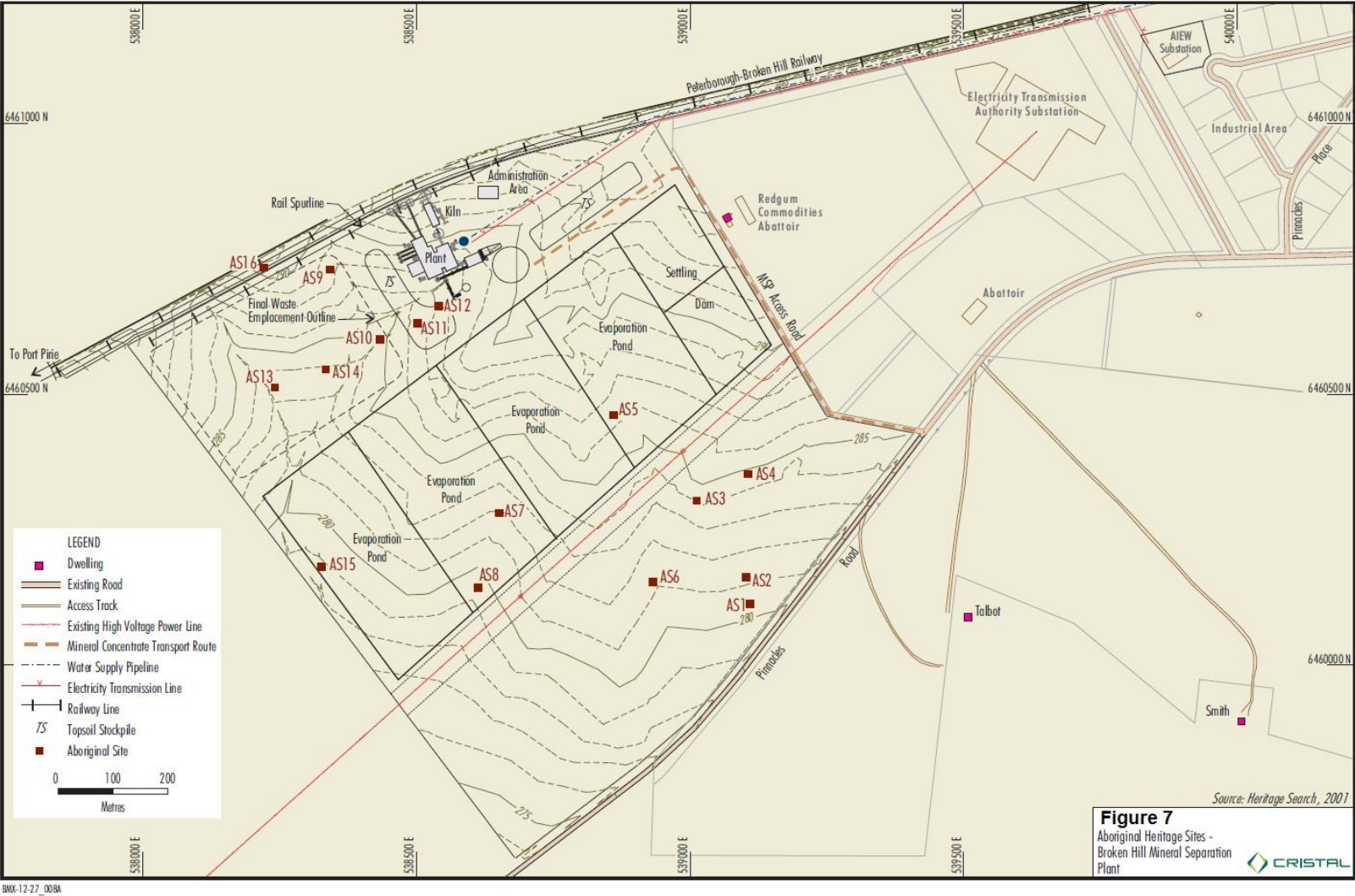


Figure 8 - Heritage Sites

4.5 Waste

4.5.1 Management

Prior to the commencement of operations Tronox prepared a [Waste Management Plan](#) and an [Effluent Management Plan](#) both of which are in accordance with Development Consent requirements for the operation of the MSP. The Plans detail the segregation, storage, transportation, disposal and tracking requirements of wastes generated at the MSP site.

4.5.2 Performance

The objectives of the management plans were achieved in 2021.

Production Waste

A description of the production waste classification is outlined in Section 3.4. The total tonnage of MSP production waste disposed of at the Ginkgo Mine for 2020 is provided in Table 14 below.

Table 13 - MSP Waste Disposed of at Ginkgo

EP Licence No. Development Approval No.	Approved Waste Limit (t) per annum	Waste Disposed (t)
EPL 12314	300,000	50,780
DA 345-11-01	300,000	50,780

Waste material is temporarily stored in a concrete storage bay prior to haulage via double road train for back loading at the Ginkgo Mine.

All waste transported from the MSP to Ginkgo was transported as hazardous waste under appropriate documentation in accordance with the NSW Radiation Control Act 1990 and the ARPANSA Code: Safe Transport of Radioactive Material (2019) rps No.C-2 (Rev.1).

Effluent Management System

The main element of the effluent management system is an aerated treatment system. The system consists of primary (anaerobic) treatment, an aeration unit, a clarifier unit and a disinfection and irrigation unit. The aerated treatment system accepts sewage from the plant amenities buildings.

Approximately one third of the effluent from the aerated treatment system is reused on site as irrigation water for over 1300 trees planted around the site during 2006 and 2007.

The volume of effluent discharge applied to the effluent discharge area is monitored via a meter. Average daily discharge during 2021 was 664 litres.

Table 15 below summarises the discharge of nutrients and other pollutants during 2021. Average E. coli was below the prescribed limits, and the average for Biological Oxygen Demand (BOD) was at the limit. In November an extremely high suspended solids reading occurred, which due to the inconsistency with the other readings, appears to be an invalid result.

BOD levels will continue to be monitored and if the readings increase further investigation will be undertaken in the next reporting period.

Suspended solid results have been monitored since the November reading of 500mg/L and the December and January readings were 2mg/L and <1mg/L respectively.

Table 14 - Effluent Discharge Monitoring 2021

Month	E. Coli Organisms/100ml	BOD (mg/L)	Suspended Solids (mg/L)	Total Nitrogen (mg/L)	Total Phosphorous (mg/L)
Jan	0	19	5	31	23
Feb	0	8	<1	0	22
Mar					
Apr	0	<2	4	25	20
May	0	4	10	39	21
Jun	0	7	8	45	20
Jul					
Aug	0	7	10	44	19
Sep	0	11	11	40	20
Oct	0	13	<1	31	23
Nov	0	10	500	35	22
Dec	0	14	2	35	19
Average	0	10	69	32	21
Limits*	<1000	<10	<10	-	-

*BHCC set limits

A groundwater monitoring bore installed down slope from the discharge area to monitor effluent discharge, the bore remains dry indicating no groundwater in the vicinity. Effluent water has since been relocated to watering roadside native trees.

Recycling

The objective of the waste management program is to minimise the production and impact of general waste (all waste other than process waste) produced at the MSP through the implementation of the waste minimisation hierarchy:

Avoid/Reduce ⇒ Reuse/Recycle ⇒ Treat ⇒ Dispose

Waste avoidance is a priority, followed by reuse and recycling/ reprocessing, with disposal as the last resort. During 2021 recycling included:

- 3x skip bins of scrap metal
- 27.5m³ of cardboard
- 340 batteries

4.5.3 Incidents

No incidents occurred during the reporting period.

A single suspended solids exceedance in the effluent discharge monitoring has not been treated as an incident as the data appears to be invalid.

4.5.4 Improvements

Monitoring of effluent waters and waste disposal will continue in 2022.

Close monitoring of BOD and suspended solids levels in effluent water will be a priority for 2022.

4.6 Water Management, Erosion and Sediment Control

4.6.1 Management

A [Water Management Plan \(WMP\)](#) has been prepared as a requirement of Development Consent Condition 6.4(c)iii for the MSP. The WMP outlines measures for controlling and managing water resources including surface water, stormwater and process water associated with the operation of the MSP. The MSP comprises the separation plant and associated ancillary infrastructure including an electricity transmission line and a water supply line.

The WMP includes:

- the requirements for environmental management of water for operations at MSP as stipulated by regulatory approvals (See Section 2.2) for the project;
- the roles and responsibilities for implementing the WMP;
- a description of the environmental mitigation measures and associated limits to meet objectives, targets and regulatory approval requirements; and
- an overview of the environmental monitoring programs and contingency plans associated with environmental mitigation measures.

4.6.2 Performance

Based on monitoring, sediment and erosion control in accordance with the objectives of the WMP was achieved in 2021. Sediment and erosion control methods are listed in Section 3.5.

Surface water run-off is generated off compacted areas such as loading and storage pads, and roads etc. This run-off is managed with the construction of drains and sediment dams.

In 2021, diversion drains and sedimentation dams were regularly inspected to ensure sufficient capacity remained to accommodate run-off from future rainfall events. This inspection program helps to identify sedimentation dams and drains that require de-silting. Inspections after rainfall events also identify where additional capacity may be required.

4.6.3 Incidents

No incidents occurred during the reporting period.

4.6.4 Improvements

Monitoring of water, erosion and sediment will continue in 2022 to ensure compliance with the WMP.

5 COMMUNITY RELATIONS

5.1 *Environmental Complaints*

Under the Tronox EMS, all sites have implemented a procedure for receiving, investigating, responding to and reporting complaints received from the community.

No complaints were received during the reporting period.

5.2 *Community Liaison*

At Tronox, corporate citizenship is an integral part of our business. We believe we can and should play a leadership role in improving the quality of life in the communities in which we operate. The Tronox Community Grant Scheme is one way we achieve this, supporting projects that are aligned with our core values and corporate social responsibility pillars.

Tronox Mining offers local non-for-profit organisations the opportunity to apply for grants to support their project/group. Our total community investment for Eastern Operations was approximately \$80,000, covering health and wellness, STEM education, diversity and equity, sustainability and the environment. Funding was also provided to support indigenous and community health during the Covid-19 pandemic response.

In 2021, groups that received funding included local sporting clubs, Aboriginal health services, primary and secondary schools, local field days, and mental health service providers. In 2022, our priority will be continuing to invest in groups and projects to empower and support our host communities.