PRELIMINARY HAZARD ANALYSIS, PROPOSED FLOUR MILL B, SHOALHAVEN STARCHES, BOMADERRY, NSW

Prepared by: Dean Shewring

7 October 2016

Pinnacle Risk Management Pty Limited
ABN 83 098 666 703

PO Box 5024 Elanora Heights
NSW Australia 2101
Telephone: (02) 9913 7284
Facsimile: (02) 9913 7930

Preliminary Hazard Analysis, Shoalhaven Starches, Proposed Flour Mill B

Disclaimer

Rev	Date	Description	Reviewed By
A	3/5/15	Draft for Comment	Shoalhaven Starches
B	31/5/15	Final Issue	Shoalhaven Starches
C	30/9/16	Project Revision	Shoalhaven Starches
D	7/10/16	Manildra Comments Included	Shoalhaven Starches

CONTENTS

EXECUTIVE SUMMARY I
GLOSSARY II
1 INTRODUCTION 1
1.1 Background 1
1.2 Objectives 2
1.3 Scope 2
1.4 Methodology 2
2 SITE DESCRIPTION 3
3 PROCESS DESCRIPTION 7
4 HAZARD IDENTIFICATION 10
4.1 Hazardous Materials 10
4.2 Potential Hazardous Incidents Review 11
5 RISK ANALYSIS 21
5.1 Dust Explosions 23
5.2 Building Explosions 26
5.3 Dust Explosion Safeguarding 27
5.3.1 Dust Free Process 27
5.3.2 Dust Control 27
5.3.3 Control of Ignition Sources 27
5.3.4 Inerting 28
5.3.5 Explosion Containment 28
5.3.6 Explosion Isolation 28
5.3.7 Explosion Suppression 28
5.3.8 Explosion Venting 28
5.3.9 Equipment Separation 29
5.4 Fires 29
5.5 Aircraft Impact and Other External Events 30
5.6 Cumulative Risk 31
5.7 Societal Risk 31
5.8 Risk to the Biophysical Environment 32
5.9 Transport Risk 32
6 CONCLUSION AND RECOMMENDATIONS 33

7 REFERENCES 34

LIST OF FIGURES

Figure 1 - Site Locality Plan 4
Figure 2 – Site Layout 1 5
Figure 3 – Site Layout 2 6
Figure 4 – Example Silo Fire 30

LIST OF TABLES

Table 1 – Hazard Identification Word Diagram 12
Table 2 - Risk Criteria, New Plants 22
Table 3 - Dust Explosion Modelling Results 25
Table 4 – Effects of Explosion Overpressures 26

LIST OF APPENDICES

Appendix 1 – Process Flow Diagrams.

EXECUTIVE SUMMARY

The Shoalhaven Starches factory located on Bolong Road, Bomaderry, produces a range of products for the food, beverage, confectionary, paper and motor transport industries including starch, gluten, glucose and ethanol.

Shoalhaven Starches propose to install a new flour mill at the site. This will include four new wheat tempering silos. The new flour mill will be in principle the same design as the existing flour mill although with a higher throughput.

As part of the project requirements, a Preliminary Hazard Analysis (PHA) is required. This report details the results from the analysis.

The risks associated with the proposed new flour mill at the Shoalhaven Starches Bomaderry site have been assessed and compared against the DoP risk criteria.

In summary:

- The potential hazardous events associated with the new flour mill are dust explosions and smouldering fires. Given the nearest public land is approximately 110 m away and the river is 25 m away then no adverse off-site impacts are expected;
- All risk criteria in HIPAP 4 is expected to be satisfied for this development;
- The risk of propagation to neighbouring equipment is low given that the potential dust explosions are either to be vented to atmosphere or of limited consequential impact and the potential fires are of a smouldering nature; and
- Societal risk, environmental risk and transport risk are all considered to be broadly acceptable.

The recommendations included in the Hazardous Event Word Diagram (Table 1 in this report) will require addressing as part of the design for the new flour mill. There are no other recommendations from the assessment performed in this PHA.

GLOSSARY

AS	Australian Standard
IECEX	International Electrotechnical Commission (Explosive Atmospheres)
DDG	Dried Distillers Grain
DoP	NSW Department of Planning
HIPAP	Hazardous Industry Planning Advisory Paper
LAAB	(Equipment Trade Name)
LEL	Lower Explosive Limit
LFL	Lower Flammability Limit
PHA	Preliminary Hazard Analysis
QRA	Quantitative Risk Assessment

REPORT

1 INTRODUCTION

1.1 BACKGROUND

From Ref 1, Shoalhaven Starches is a member of the Manildra Group of companies. The Manildra Group is a wholly Australian owned business and the largest processor of wheat in Australia. It manufactures a wide range of wheat based products for food and industrial markets both locally and internationally.

The Shoalhaven Starches factory located on Bolong Road, Bomaderry, produces a range of products for the food, beverage, confectionary, paper and motor transport industries including starch, gluten, glucose and ethanol.

At present, industrial grade flour is supplied to the Starches Plant at Shoalhaven Starches from two sources:

1. Flour is delivered to the site by rail. This flour is produced at the Company's other flour mills (owned by the Manildra Group of Companies); and

2. Flour from the existing flour mill located on the Shoalhaven Starches site. This flour is made from the processing of wheat grain delivered to the site by rail.

The flour mill at Manildra has the capacity to produce premium grade flour in addition to the industrial grade flour used by the Shoalhaven Starches site. The Manildra Group propose to free-up the production capacity of the Manildra Mill for the production of the premium grade flour by constructing a new flour mill (Mill B) at the Shoalhaven Starches site that will produce industrial grade flour.

At present, 12,300 tonnes per week of flour is delivered to the site by rail while 7,700 tonnes of flour is processed by the existing flour mill located on the site.

As a result of the proposed new flour mill, it is anticipated that Shoalhaven Starches will still obtain 3,800 tonnes per week of flour from the Manildra mill by rail, however, a total of 16,200 tonnes per week of flour will be produced by the existing and proposed flour mills located on the Shoalhaven Starches site at Bomaderry. That is, the total flour output from the site remains unchanged at 20,000 tonnes per week.

In principle, the new flour mill will be the same design as the existing flour mill. The existing flour mill is rated for 7,700 tonnes per week of flour whilst the new flour mill will be larger in size, i.e. 8,500 tonnes per week of flour.

As part of the project requirements, a Preliminary Hazard Analysis (PHA) is required. Shoalhaven Starches requested that Pinnacle Risk Management prepare the PHA for the new flour mill. This PHA has been prepared in accordance with the guidelines published by the Department of Planning (DoP) Hazardous Industry Planning Advisory Paper (HIPAP) No 6 (Ref 2).

1.2 OBJECTIVES

The main aims of this PHA study are to:

- Identify the credible, potential hazardous events associated with the new flour mill;
- Evaluate the level of risk associated with the identified potential hazardous events to surrounding land users and compare the calculated risk levels with the risk criteria published by the DoP in HIPAP No 4 (Ref 3);
- Review the adequacy of the proposed safeguards to prevent and mitigate the potential hazardous events; and
- Where necessary, submit recommendations to Shoalhaven Starches to ensure that the new flour mill is operated and maintained at acceptable levels of safety and effective safety management systems are used.

1.3 SCOPE

This PHA assesses the credible, potential hazardous events and corresponding risks associated with the Shoalhaven Starches proposed new flour mill with the potential for off-site impacts only.

As the net volume of flour product from the site does not change as part of this project then off-site transport risk is not included.

1.4 METHODOLOGY

In accordance with the approach recommended by the DoP in HIPAP 6 (Ref 2) the underlying methodology of the PHA is <u>risk-based</u>, that is, the risk of a particular potentially hazardous event is assessed as the outcome of its consequences and likelihood.

The PHA has been conducted as follows:

- Initially, the new flour mill and its location was reviewed to identify credible, potential hazardous events, their causes and consequences. Proposed safeguards were also included in this review;
- As the potential hazardous events are located at a significant distance from other sensitive land users, the consequences of each potential hazardous event were estimated to determine if there are any possible unacceptable off-site impacts;
- Included in the analysis is the risk of propagation between the proposed equipment and the adjacent processes; and
- If adverse off-site impacts could occur, assess the risk levels to check if they are within the criteria in HIPAP 4 (Ref 3).

2 SITE DESCRIPTION

From Ref 1, the Shoalhaven Starches factory site is situated on various allotments of land on Bolong Road, Bomaderry, within the City of Shoalhaven (see Figure 1). The factory site, which is located on the south side of Bolong Road on the northern bank of the Shoalhaven River, has an area of approximately 12.5 hectares.

The town of Bomaderry is located approximately 0.5 km to the west of the factory site and the Nowra urban area is situated 2.0 km to the south west of the site. The “Riverview Road” area of the Nowra Township is situated approximately 600 metres immediately opposite the factory site across the Shoalhaven River.

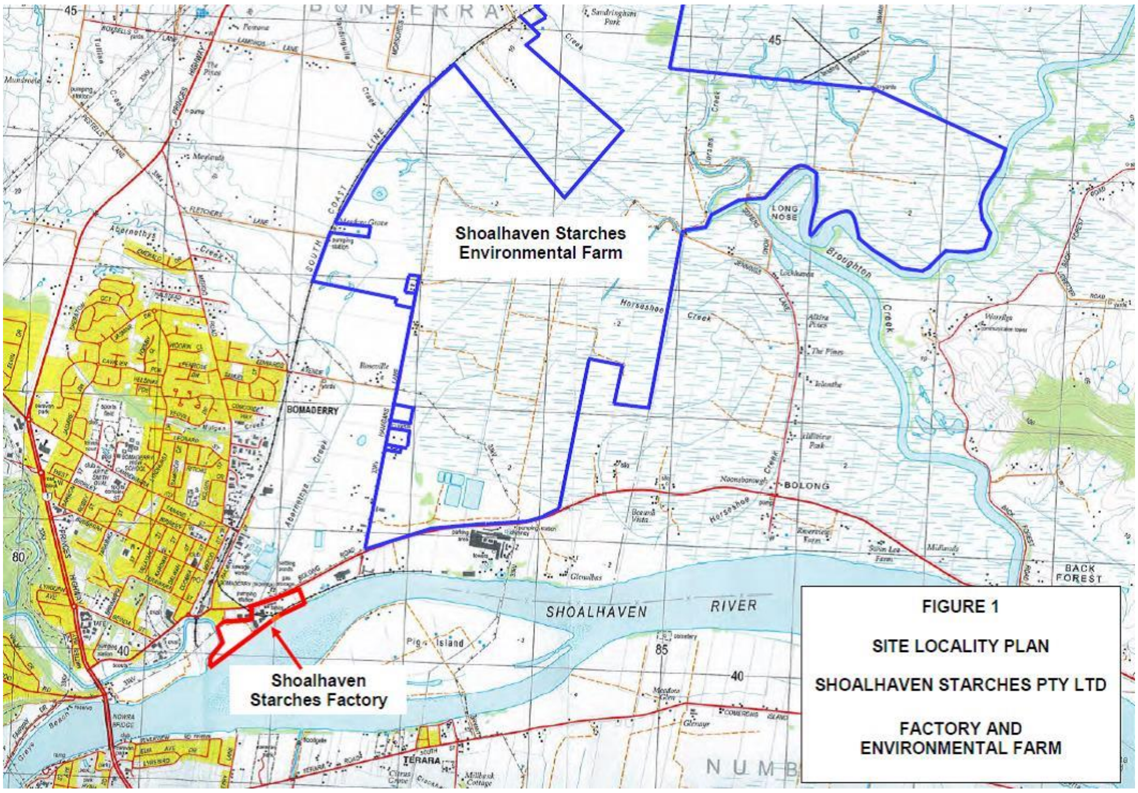
The village of Terara is situated approximately 1.5 kilometres to the south east of the site, across the Shoalhaven River. Pig Island is situated between the factory site and the village of Terara and is currently used for dairy cattle grazing.

There are a number of industrial land uses, which have developed on the strip of land between Bolong Road and the Shoalhaven River. Industrial activities include a metal fabrication factory, the Shoalhaven Starches site, Shoalhaven Dairy Co-op (formerly Australian Co-operative Foods Ltd – now owned by the Manildra Group) and the Shoalhaven Paper Mill (also now owned by the Manildra Group). The industrial area is serviced by a privately owned railway spur line that runs from just north of the Nowra-Bomaderry station via the starch plant and the former Dairy Co-op site to the Paper Mill.

The Company also has an Environmental Farm located over 1,000 hectares on the northern side of Bolong Road. This area is cleared grazing land and contains spray irrigation lines and wet weather storage ponds (total capacity 925 Mega litres). There are at present six wet weather storage ponds on the farm that form part of the waste water management system for the factory. A seventh pond approved in 2002 was converted into the biological section of the new wastewater treatment plant has now been commissioned.

The Environmental Farm covers a broad area of the northern floodplain of the Shoalhaven River, stretching from Bolong Road in the south towards Jaspers Brush in the north. Apart from its use as the Environmental Farm, this broad floodplain area is mainly used for grazing (cattle). The area comprises mainly large rural properties with isolated dwellings although there is a clustering of rural residential development along Jennings Lane (approximately 1 kilometre from the site), Back Forest Road (approximately 500 metres to 1.2 kilometres to the west) and Jaspers Brush Road (approximately 1.2 kilometres to the north).

Figure 1 - Site Locality Plan



Source: Ref 1.

Security of the site is achieved by a number of means. This includes site personnel and security patrols by an external security company (this includes weekends and night patrols). The site operates 7 days per week (24 hours per day). Also, the site is fully fenced and non-operating gates are locked. Security cameras are installed for staff to view visitors and site activities.

There are approximately 170 people on site during Monday to Fridays 8 am to 5 pm and 44 people on site at other times.

The main natural hazard for the site is flooding. No other significant external events are considered high risk for this site.

Layout drawings showing the proposed location of the new flour mill are shown in Figure 2 and Figure 3.

Figure 2 – Site Layout 1

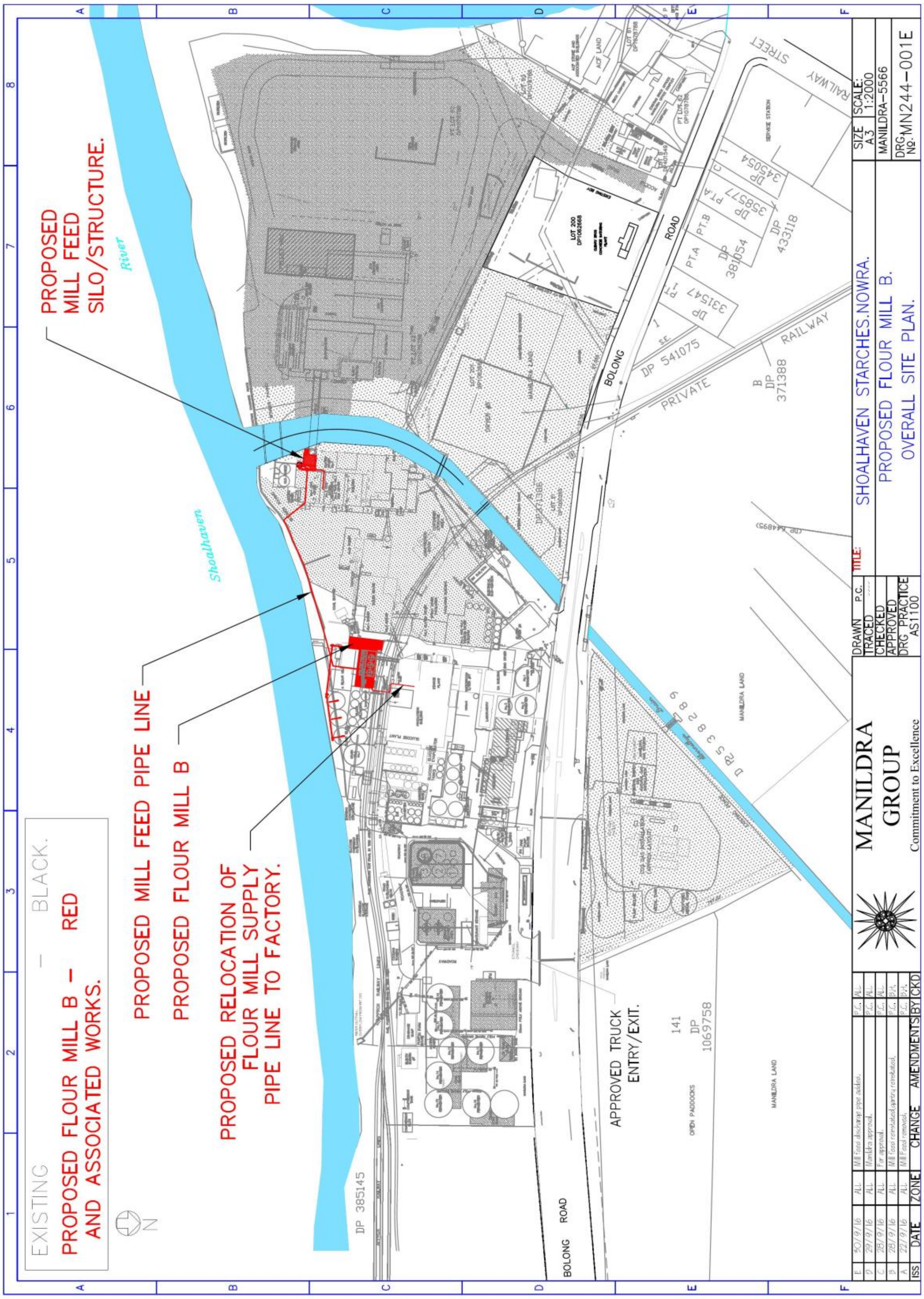
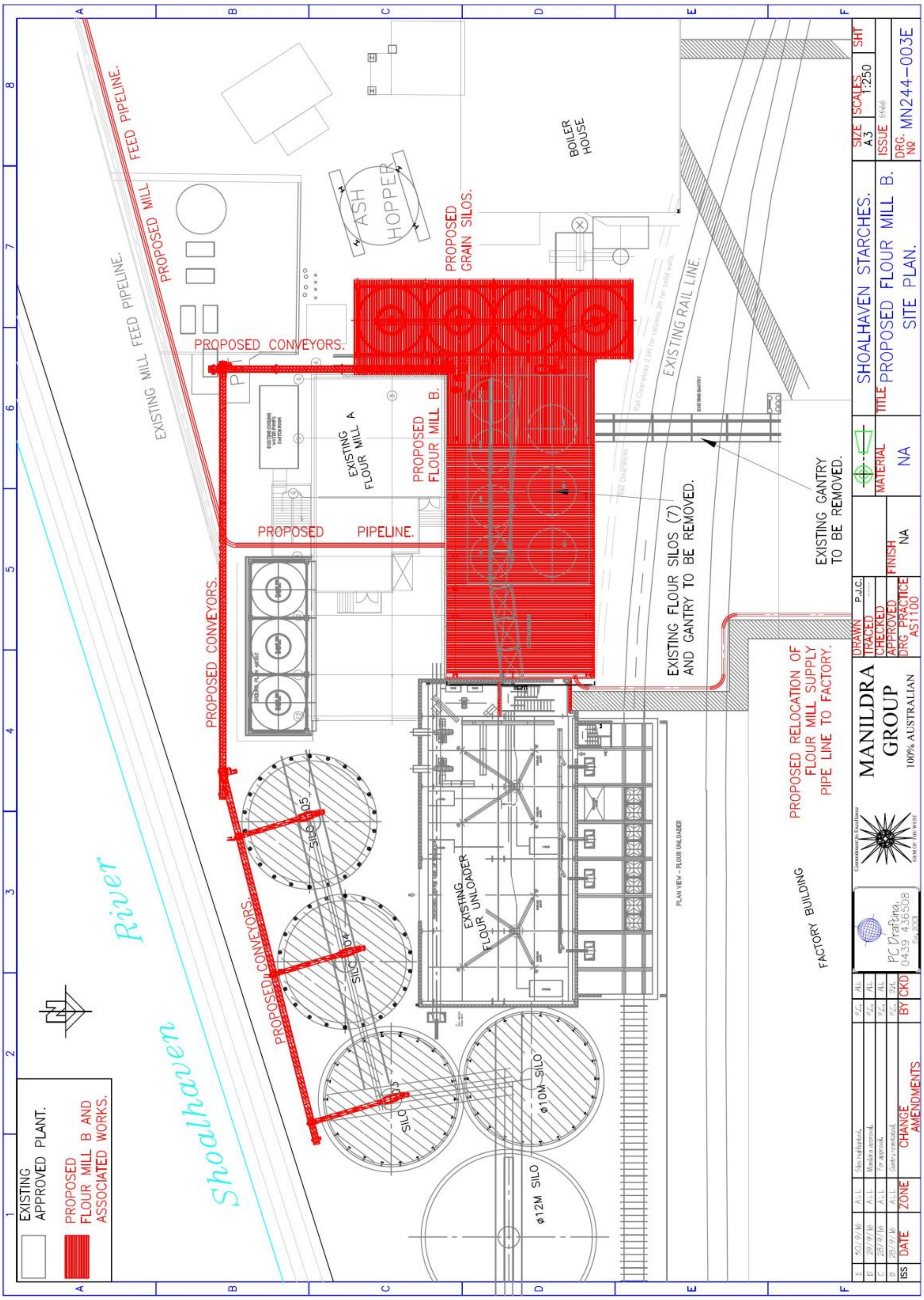


Figure 3 – Site Layout 2



3 PROCESS DESCRIPTION

The project scope is as follows:

- Redirect, relocate or make redundant process and services piping, cables and equipment currently located within the footprint of the new mill;
- Deconstruct and dismantle the pipe bridge between the existing flour mill and starch plant to make way for the new flour mill and remove seven silos in this area. This will be assessed via a Construction Safety Study and has no impact on off-site risk as assessed in this report;
- Relocate one existing flour silo to a new location for mill feed storage. This location is adjacent to Abernethys Creek as shown on Figure 2. The silo is proposed to be approximately 50 te capacity and will provide feed to the DDG (Dried Distillers Grain) plant. This feed system is separate to the new flour mill project and hence is not included in this report;
- Install a transfer pipeline (blowline) to transfer mill feed from the new flour mill building to the new mill feed silo location at Abernethys Creek. This will be approximately 120 m long;
- Install drag chains conveyors between the existing grain silos and the intake system for the new flour mill; and
- Install the new flour mill and tempering bins building.

The proposed new flour mill will process 11,300 tonnes per week of grain and will produce 8,500 tonnes per week of flour.

The flour mill will involve the construction of a building with a plan area of about 400 m^2. This building will be constructed using tilt-up concrete panel construction or its equivalent and will have a height above ground level of 39.5 metres. This will approximately match the height of the existing adjacent structures. The flour mill is proposed to be sited immediately adjoining and to the north-west of the existing flour mill.

Wheat will be delivered to the site five times per week in rail hopper cars nominally of 60 tonne capacity. Each train will deliver approximately 2,100 tonnes of wheat. The additional wagons used to receive wheat will be offset by a reduction in rail wagons used to receive flour. The proposal will not alter the current number or frequency of train movements to the site.

Wheat delivered to the site by train will discharge through an existing grid below the hopper outlet using the existing grain intake system and will be transported via drag chain conveyors and a bucket elevator system into two existing silos each of 1,600 tonne capacity.

Wheat will be transferred from the raw wheat silos via drag chain conveyors, weighed and then passed through various cleaning operations as follows:

- Sieves for the removal of impurities larger or smaller than wheat;
- Gravity separators for the removal of heavy impurities such as stones;
- Magnetic separators for the removal of ferromagnetic impurities; and

- Aspirators, using air currents, for the removal of lighter impurities.

The moisture content of wheat received at the site will typically be in the range of 8% to 10% which is too dry for milling. Water will therefore be added to the wheat in a carefully controlled manner to increase the moisture content of the grain to around 15%. The damped wheat will then be stored in a conditioning or tempering bin where it will be allowed to remain for a period of time (normally up to 24 hours) to allow the added moisture to be fully absorbed into the grain.

The new conditioning silos (tempering bins) will have a capacity of 600 m^3 each. There will be four of these silos and are shown in Figure 3 immediately to the east of the new flour mill.

Conditioning of grain is necessary to:

- Assist in the separation of the component parts of the grain by toughening the bran to ensure a clean separation of the endosperm from the bran and germ; and
- Allow the reduction rollers to grind the endosperm into flour with the minimum power consumption and ensure accurate and easy sifting on the following sieving machines.

When the grain is at the optimum milling condition it will be taken from the conditioning bins and passed through final scouring, weighing and separation stages before being passed to the mill.

Milling will be carried out on roller mills which will mill the grain into progressively finer fractions. Each milling process will be followed by coarse sieving to separate large flakes of bran and chunks of endosperm which will then be passed to the next milling cycle. The finer starchy material will be passed over a series of progressively finer sieves to remove any flour and to grade the remaining particles into various sizes for further grinding.

Flours from the various grinding operations will be collected and blended together before passing through final treatment and weighing operations to bulk storage bins. Flour will be taken from these bins for use in the existing site production processes.

The coarse particles left at the end of the reduction system, known as pollard, and the bran from the end of the break system will be combined into a single by-product (DDG – Dried Distillers Grain) for sale as animal feed.

All air extracted from the mill will be passed through bag houses prior to being discharged to the atmosphere.

Pneumatic conveying will be used extensively to transport product throughout the mill. The air blower will be mounted in an acoustic enclosure.

The new mill will be powered by electrical energy, will not require any additional natural gas supply and will use compressed air only for instrument use.

As the new flour mill will receive wheat from the existing rail services (in lieu of receiving flour) there will be no changes to rail or road traffic volumes and frequencies.

The final design for the fire protection system is yet to be completed for the flour mill but will include sprinkler systems, hydrants, smoke detectors and/or control and alarm systems similar to that installed in the existing flour mill.

The process is a dry process. There is no requirement for bunding and no process water is used other than the initial conditioning water which is 100% absorbed into the wheat and which will come from the existing water break tank in the existing flour mill.

A hazardous area zoning drawing will be developed along similar lines to that developed for the existing flour mill. All equipment in any designated zoned areas is to be IECEX certified.

Given the above process description, no Dangerous Goods are involved with the new flour mill. Process flow diagrams are included in Appendix 1.

4 HAZARD IDENTIFICATION

4.1 HAZARDOUS MATERIALS

Wheat:

Wheat, like barley, oats and rye, is a cereal grain. Wheat grains are generally oval shaped although different wheats have grains that range from almost spherical to long, narrow and flattened shapes. The grain is usually between 5 and 9 mm in length and weighs between 35 and 50 mg.

There are three main components to the grain:

Bran:

The outer coating or "shell" of the wheat kernel is made up of several layers. These layers protect the main part of the kernel.

Endosperm:

This is the main part of the wheat kernel and represents about 80% of the kernel weight. It is from this part that white flour is milled. The endosperm is rich in energy-yielding carbohydrate and important protein.

Germ or Embryo:

This part grows into a new plant if sown. The germ lies at one end of the grain and represents only 2% of the kernel. It is a rich source of B vitamins, oil, vitamin E and natural plant fat. It needs to be removed during milling because the fat is liable to become rancid during flour storage.

Dust from wheat can be formed by activities such as loading / unloading, filling a silo, milling and pneumatic conveying. It is a potentially explosive dust when critical parameters exist, e.g. particle size less than 500 micron and moisture content less than 30% (Ref 4).

Ignition sources include (Ref 5):

- Smouldering, self-heating or burning dust;
- Open flames, e.g. welding, hot work, cutting and matches;
- Hot surfaces, e.g. hot bearings, dryers, incandescent materials and heaters;
- Lightning;
- Heat from mechanical impact or friction; and
- Electrical discharges and arcs.

K_{st} is a measure of a dust's explosibility classification and is a measure of the maximum rate of pressure rise, i.e. the higher the K_{st} value, the greater the explosive energy. For grain dust, the K_{st} value is typically between 0 and 200 bar.m/s. These are deemed potentially weak explosions although it is noted that previous incidents involving grain dust explosions have led to fatalities (Refs 4 and 5).

Whilst grains are combustible when exposed to strong ignition sources, e.g. open flames, they typically burn as a smouldering type of fire and therefore do not pose significant radiant heat hazards. Smouldering grains, however, can be a precursor to dust explosions as the hot grains can provide the ignition energy to cause a dust cloud to deflagrate.

Grain dust is a respiratory sensitiser. This means it can trigger an allergic reaction in the respiratory system. Once this reaction has taken place, further exposure to the substance, even to very small amounts, may produce symptoms (Ref 6). The possible ill-health outcomes are:

- Rhinitis (runny or stuffy nose);
- Coughing and breathing difficulties;
- Asthma (attacks of coughing, wheezing and chest tightness);
- Chronic bronchitis (cough and phlegm production usually in winter months);
- Chronic obstructive pulmonary disease (a longer-term illness that makes breathing progressively difficult and includes chronic bronchitis and chronic asthma);
- Extrinsic allergic alveolitis, for example farmer's lung (fever, cough, increasing shortness of breath, muscle / joint pains and weight loss); and
- Organic dust toxic syndrome, for example grain fever (a sudden onset, short-lived, 'flu-like' illness with fever and often associated with cough and chest discomfort).

The above health effects are more likely for people with significant exposure to grain dust on-site but not off-site due to the controls to prevent fugitive emissions.

4.2 POTENTIAL HAZARDOUS INCIDENTS REVIEW

In accordance with the requirements of **Guidelines for Hazard Analysis**, (Ref 2), it is necessary to identify hazardous events associated with the facility's operations. As recommended in HIPAP 6, the PHA focuses on "atypical and abnormal events and conditions. It is not intended to apply to continuous or normal operating emissions to air or water".

In keeping with the principles of risk assessments, credible, hazardous events with the potential for off-site effects have been identified. That is, "slips, trips and falls" type events are not included nor are non-credible situations such as an aircraft crash occurring at the same time as an earthquake.

The identified credible, significant incidents (in particular, with the potential for off-site impacts) for the proposed new flour mill are summarised in the Hazard Identification Word Diagram following (Table 1). These potential events were determined during a hazardous event identification workshop involving project, design, technical, operations and maintenance personnel.

This diagram presents the causes and consequences of the events, together with major preventative and protective features that are to be included as part of the design.

Table 1 – Hazard Identification Word Diagram

Event Number	Facility Area / Activity	Hazardous Event	Causes	Consequences	Existing Safeguards - Prevention Detection Mitigation	Additional Safeguards
1	Bucket elevators and drag chain conveyors	Ignition of confined wheat dust	Foreign object, belt slip, poor belt tracking, baghouse fire / explosion propagating back to the elevators. Failure of the drive end clutch resulting in high temperatures. Flame will propagate to screw - chain conveyor and spread throughout the mill	Product and equipment fire, potential for internal dust explosion	Bearings are external. Belt drift / mis-alignment sensors. Aspiration system (with interlocks). Equipment designed to IECEX including hazardous area assessment. Foreign objects removed via screen and separators	Review the need for installing temperature sensors in the elevators for fire detection and/or the installation of deluge or fire suppression system (Inergen). Operator detection of issue required plus response, e.g. opening a valve to initiate the deluge. Check with Buhler / explosion experts the explosion prevention / protection measures for bucket elevators and drag chain conveyors, e.g. explosion vents every 6 m as per NFPA for bucket elevators
2	Hazardous Zoning	Explosion	Static electrical explosions	Explosion - fire, loss of life, equipment damage, production downtime	Earthing of equipment, static bonding, preventative maintenance in hazardous areas	Check with Buhler that the belts and flights are anti-static

Event Number	Facility Area / Activity	Hazardous Event	Causes	Consequences	Existing Safeguards - Prevention Detection Mitigation	Additional Safeguards
3	Whole Mill	Dust explosion	Loss of containment of dust within the building, e.g. failure of product lift pipe	Dust explosion within the building, loss of life, equipment damage, production downtime	Sealed process systems lowering the likelihood of leaks, aspirated system, instrument and electrics to hazardous zones, housekeeping. Permit to work system requiring adequate cleaning and control of ignition sources	Review the need to install explosion vents on each level of the building. Review the need for installing dust monitors
4	Magnetic separators	Fire	Failure of magnets	Metal particles through the process - ignition source due to impact or friction	Daily checks, cleaned every morning. Fire sprinkler system, fire hose reels, hydrants and fire extinguishers installed	None
5	Aspiration system	Propagating explosion	Charged particles on the conveyor	Fire / explosion could propagate to other equipment, e.g. dust collectors	Design of process includes explosion vents on the dust collectors. Removal of ferromagnetic materials via magnets	None
6	LAAB Cleaning Separator	Static explosion	Static electricity from product flowing over the flour trays (vibrators and motors)	Static fire, causing explosion	All equipment is bonded and earthed	Check if the metal screens in the LAAB cleaning separator are rated for static / bonded / earthed

Event Number	Facility Area / Activity	Hazardous Event	Causes	Consequences	Existing Safeguards - Prevention Detection Mitigation	Additional Safeguards
8	Mill A	Explosion	Hammermill fire (Mill A), foreign object entering the Mill A hammermill	Explosion – fire, loss of life, equipment damage, production downtime. Can also propagate backwards to Mill B if directly connected	Explosion vents in dust collector. Interlocks on loss of air flow through the dust collector and blowline (if used)	Confirmed if the new mill lines are connected directly to the hammermill in Mill A (and hence explosion protection is required) or indirectly, e.g. via a screenings bin
9	Rollers	Dust explosion	Broken roller, failed roller mechanism, failure of equipment	Dumping of product in front of inspection flap, i.e. flour pushed up the inlet chute and a loss of containment from choking of the system. Dust in the area that can settle on motors causing heat build-up. This can result in ignition of product from hot motor. Build-up of product on the roller that continues to roll. Overfill the inlet chute as above, heating of the flour due to the rollers and hence a possible smouldering fire	Covers over motor, high level switch, programmed maintenance every three months, housekeeping, testing of sensors to ensure sensitivity is suitable	Ensure appropriate alarms for the monitoring of rollers are in place

Event Number	Facility Area / Activity	Hazardous Event	Causes	Consequences	Existing Safeguards - Prevention Detection Mitigation	Additional Safeguards
10	Rollers / Impact Detacher (machines)	Hot surfaces	Normal running conditions (rollers running hot), back up failure, unable to segregate wheat products, relifts choke (unable to handle) and nothing going through (no product flowing) friction causing heat – internal ignition back up into rollers	Fire / explosion within the building. Potential for burn injury to worker	High level alarm, during staffed times – inspections every hour, housekeeping within the building, hazardous area zones. Fire sprinkler system, fire hose reels, hydrants and fire extinguishers installed	None
11	Rollers	Dust explosion	Foreign object within the rollers, e.g. failure of the magnets, or static	Dust explosion that can propagate to other equipment, downtime	Maintenance, inspections and housekeeping on the magnets. Procedures for checking particular items (ball bearings) source when they appear on the magnets. Regular walkthroughs during staffed hours would pick up noises in the rollers. Designed to IECEX standards	None

Event Number	Facility Area / Activity	Hazardous Event	Causes	Consequences	Existing Safeguards - Prevention Detection Mitigation	Additional Safeguards
12	Detachers	Dust explosion	Foreign object (e.g. detacher pin release), plate contact within the detacher, static	Fire within the detacher which has the potential to propagate to the dust collector via the cyclone	Explosion vent on the dust collector, detacher earthed, magnet prior to the rollers	None
13	Detachers	Fire	Hand hold leak – gravity feed product (vacuum) product will settle on motor and hence will heat up (source of ignition)	Heat from motor causing fire hazard	Operators trained to replace inspection hatch covers, walkthroughs to detect abnormal conditions, housekeeping, hazardous area zones. Fire sprinkler system, fire hose reels, hydrants and fire extinguishers installed	Check the proposed design of the hand holds to ensure there is minimal risk of losses of containment
14	Distributors – Cyclones	Dust explosion	High velocity impact / object	Propagate to dust collectors. Dust collector fills up with dust and product	High level switch stops the mill (dust collectors and filtered flour hopper). Magnets before the rollers, explosion vents on dust collectors, earthing and bonding	None

Event Number	Facility Area / Activity	Hazardous Event	Causes	Consequences	Existing Safeguards - Prevention Detection Mitigation	Additional Safeguards
15	Sifters	Fire / Explosion	Mechanical / electrical problems, counter weight within sifter coming loose (1 te each), choke underneath one of the sifters leading to too much flour on one side of a sifter	Sifters out of alignment, structural damage to building, worn electrical cables due to excessive vibration which could lead to ignition	When the sifter motors stop, it will be alarmed and the Mill will trip, safety cables (16mm stainless cable) on the sifters, canes (nylon or timber) on each corner of sifter, rotation sensor on top of each of the sifters. Fire sprinkler system, fire hose reels, hydrants and fire extinguishers installed	None
16	Sifters	Explosion	Failure of connecting socks	Loss of containment of flour dust with potential of ignition – explosion in the building	Sensors on each of the bottom socks – if they disconnect – break the beam and stop the mill (bottom socks only – not the top socks). Walkthrough observations	Review the need for CCTV or similar surveillance as required
17	Rotary Valves	Explosion	Surface ignition, e.g. from a foreign object	Potential for a fire / explosion	Magnets and screens	None
18	Hopper	Air pollution, water pollution	Loss of containment from equipment items outside the mill	Pollution – product could be blown off site	System is designed for product containment with high level trips	None

Event Number	Facility Area / Activity	Hazardous Event	Causes	Consequences	Existing Safeguards - Prevention Detection Mitigation	Additional Safeguards
19	Transfer to Flour Bins	Loss of containment of product – enclosed area	High level switch failure on a bin	Overfill bins and the flour is blown into the aspiration lines to the dust collector which fills up and then escapes to the atmosphere via the air inlet line	High pressure trip on the blowers. Level sensor calibration	None
20	Dust Collectors	Explosion	Static, carryover spark. Propagation of fire event from elsewhere in the process, e.g. burning embers	Explosion	Earthing / bonding of all equipment. Hazardous area zones. The switches on the explosion vents stop the mill including the rotary seals to stop the explosion propagating. Induced draft which keeps the concentration kept below the LFL. All filters are pulsed with air for cleaning, pressure is measured and checked every day. If issues arise the socks are changed. The socks are also changed every 6 months. Anti-static socks	Review the need for check valves to stop flame propagation from the dust collectors to elsewhere in the plant

Event Number	Facility Area / Activity	Hazardous Event	Causes	Consequences	Existing Safeguards - Prevention Detection Mitigation	Additional Safeguards
21	Dust Collector	Release of product	Failed sock	Product release	Visual detection, reporting from outside sources, replacement every 6 months – as above. LEL levels not reached, i.e. not considered to be an ignition risk	None
22	Silos and bins	Dust explosions and fires	Static, foreign object, hot work	Confined dust explosion with damage to the silos and bins, potential for injury to people	All equipment containing dust are to be designed to IECEX standards. The mill is to be rated for hazardous zones including electrics and instruments are to be suitably rated and all equipment is to be bonded and earthed. Fire sprinkler system, fire hose reels, hydrants and fire extinguishers installed. Permits to work	None

Event Number	Facility Area / Activity	Hazardous Event	Causes	Consequences	Existing Safeguards - Prevention Detection Mitigation	Additional Safeguards
23	Mill and silos	Flooding	Natural event involving significant rain fall	Potential for off-site environmental impact from material being swept away in the flood	The structural characteristics of the mill and silos will be certified by an engineer as capable of withstanding flooding and will not become unsafe during floods or as a result of moving debris that would potentially threaten the safety of people or the integrity of the structures	None
24	Mill feed blowline	Internal dust explosion within the blowline	Low likelihood event, e.g. static	As the blowline is to be designed for containment then the flame front will travel to the downstream bin	Bonding and earthing of the entire blowline, no other sources of ignition present during normal operation, control of ignition sources during maintenance, high pressure trip on the blower	None

5 RISK ANALYSIS

The assessment of risks to both the public as well as to operating personnel around the new mill requires the application of the basic steps outlined in Section 1. As per HIPAP 6 (Ref 2), the chosen analysis technique should be commensurate with the nature of the risks involved. Risk analysis could be qualitative, semi-quantitative or quantitative.

The typical risk analysis methodology attempts to take account of all credible hazardous situations that may arise from the operation of processing plants etc.

Having identified all credible, significant incidents, risk analysis requires the following general approach for individual incidents:

Risk = Likelihood x Consequence

The risks from all individual potential events are then summated to get cumulative risk.

For QRA and hazard analysis, the consequences of an incident are calculated using standard correlations and probit-type methods which assess the effect of fire radiation, explosion overpressure and toxicity to an individual, depending on the type of hazard.

In this PHA, however, the approach adopted to assess the risk of the identified hazardous events is scenario based risk assessment. The reasons for this approach are:

1. The distance from the new mill to residential and other sensitive land users is large and hence it is unlikely that any significant consequential impacts, e.g. due to radiant heat from fires, from the facility will have any significant contribution to off-site risk; and

2. The new mill is identical in principle to the existing mill.

The risk criteria applying to developments in NSW are summarised in Table 2 on the following page (from Ref 3).

Table 2 - Risk Criteria, New Plants

Description	Risk Criteria
Fatality risk to sensitive uses, including hospitals, schools, aged care	0.5×10^{-6} per year
Fatality risk to residential and hotels	1×10^{-6} per year
Fatality risk to commercial areas, including offices, retail centres, warehouses	5×10^{-6} per year
Fatality risk to sporting complexes and active open spaces	10×10^{-6} per year
Fatality risk to be contained within the boundary of an industrial site	50×10^{-6} per year
Injury risk – incident heat flux radiation at residential areas should not exceed 4.7 kW/m^2 at frequencies of more than 50 chances in a million per year or incident explosion overpressure at residential areas should not exceed 7 kPa at frequencies of more than 50 chances in a million per year	50×10^{-6} per year
Toxic exposure - Toxic concentrations in residential areas which would be seriously injurious to sensitive members of the community following a relatively short period of exposure	10×10^{-6} per year
Toxic exposure - Toxic concentrations in residential areas which should cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community	50×10^{-6} per year
Propagation due to Fire and Explosion – exceed radiant heat levels of 23 kW/m^2 or explosion overpressures of 14 kPa in adjacent industrial facilities	50×10^{-6} per year

As discussed above, the consequences of the potential hazardous events are initially analysed to determine if any events have the potential to contribute to the above-listed criteria and hence worthy of further analysis.

5.1 DUST EXPLOSIONS

An analysis of the equipment where potential dust explosions could occur is summarised below.

- Baghouse filters with the associated bins / hoppers / silos. Dust explosions are to be either vented via the fan housings or explosion vents (the larger volume filters are fitted with explosion vents);
- Bucket elevators and drag chain conveyors. Dust explosions are vented via explosion vents (note: low conveyor speeds will be used to minimise the risk of ignition and belt tracking with limit switches will be installed as well);
- Hammer mill, rollers and impact detachers. Protection for these unit operations include magnetic separators, grounding and explosion propagation prevention deveices;
- Silos, hoppers, bins, cyclones, separators and sifters. These are to be designed to IECEX standards; and
- Aspiration and pneumatic conveying systems. These are to be designed to IECEX standards.

Modelling of the only externally vented explosion vent from the side of the building is shown in Table 3. All other explosion vents are to be flameless or at roof level. These results were derived as follows.

From Ref 7, the damage radius of a dust explosion is usually limited to the building (or equipment item) in which it occurs and to a very short range outside. This is supported by the historical incidents involving dust explosions where the majority of fatalities involve on-site personnel.

The majority of dust explosion incidents detailed in Ref 5 resulted in no fatalities. For the incidents where fatalities occurred, these were to on-site personnel. Again, the greater risk for fatality or injury for dust explosions is to on-site personnel as stated in Ref 7.

The maximum explosion overpressures at a distance D (m) from a vent or point of release is given by (Ref 8):

$$P_{blast} = (P_{max} \times C1 \times C2) / D$$

Where:

P_{blast} is the overpressure (or peak blast pressure) at a distance D from the vent, kPag

P_{max} is the pressure within the vessel when the vent opens or the rupture pressure of the vessel (if no vent installed), kPag

C1 = 10^((-0.26/A) + 0.49)

A = vent area, m^2

C2 = 1 m

D = distance away from the vent, m

The rupture pressure of weak structures such as silos is typically less than 90 kPag (Ref 5). This reference quotes one experiment where a 500 m^3 silo ruptured at 60 kPag with a hole size of 50 m^2.

To estimate the possible maximum horizontal flame length from a vented dust explosion, the following equation is used (Ref 8):

$$\text{Flame Length} = 10 \times V^{1/3} \text{ (m)}$$

Where:

V is the volume of the vessel, m^3

However, no flame length has ever been measured greater than 30 m (even for large volumes) so this should be taken as the upper limit (Ref 9). Other studies in Ref 9 also show that effects of thermal radiation from the fireball is limited to the fireball's volume given the short duration.

Importantly, the proposed explosion vents must therefore be directed to a safe location to avoid injury to personnel or propagation to other adjacent equipment.

Table 3 - Dust Explosion Modelling Results

Equipment	Rupture Pressure, kPag	Volume, m^3	Vented Inside or Outside the Building	Vent Area, m^2	Flame Length, m	Distance (m) to the Selected Overpressures:		
						21 kPa	**14 kPa**	**7 kPa**
Filter, B-2061	10	8.7	Outside	0.4	21	-	-	<10

The effects of explosion overpressures are summarised in the following table (Ref 3).

Table 4 – Effects of Explosion Overpressures

OVERPRESSURE, kPa	PHYSICAL EFFECT
3.5	90% glass breakage No fatality, very low probability of injury
7	Damage to internal partitions & Joinery 10% probability of injury, no fatality
14	Houses uninhabitable and badly cracked
21	Reinforced structures distort, storage tanks fail 20% chance of fatality to person in building
35	Houses uninhabitable, rail wagons & plant items overturned. Threshold of eardrum damage, 50% chance of fatality for a person in a building, 15% in the open
70	Complete demolition of houses Threshold of lung damage, 100% chance of fatality for a person in a building or in the open

Given the estimated impact distances in Table 3 and the distances to off-site areas from the new flour mill then no significant off-site impacts are expected from explosion overpressures or radiant heat from flames. Therefore, the risk criteria shown in Table 2 will be satisfied for potential dust explosions within equipment.

5.2 BUILDING EXPLOSIONS

It is possible that dust explosions could occur in the new mill building, e.g. deposited dust is not removed due to failure of the housekeeping program. This hazard exists at the site now for the existing flour mill.

The primary means to prevent this event is to design for containment. This is the basis for the design of the existing flour mill and will be similarly for the new flour mill.

Should losses of containment of combustible dust occur then controls such as housekeeping, hazardous zoning and permits to work are required. These are discussed in more detail in Section 5.4 but are important measures to lower the risk of dust explosions within the existing and new buildings. For the existing mill building, cleaning is performed daily to help prevent the build-up of combustible dust. This includes sweeping and vacuuming.

As the hazard of a building dust explosion exists now on-site then the existing safety management systems for prevention of confined dust explosions within the existing building needs to be implemented to the new building. No further safeguarding is recommended for this scenario.

5.3 DUST EXPLOSION SAFEGUARDING

For equipment processing a potentially explosive dust, it is generally not possible to always ensure the concentration of the dust is below the lower explosive limit. Rather, safeguarding is required to prevent and/or control the potential explosions as discussed below.

There are no mandatory standards or regulations that dictate the design criteria and features for equipment where dust explosions can occur. However, the main means for safeguarding against dust explosions are as follows.

A discussion of the proposed safeguards for the new flour mill is included at the end of this section.

5.3.1 Dust Free Process

Inherently safer options include operating with the materials being wet rather than dry, i.e. preventing dust formation. Not all processes are suited to this option though, e.g. wheat grains, as self-heating and degradation of the grain can occur. For a mill, this is not an option.

5.3.2 Dust Control

Measures to control dust and avoiding the explosive range include:

- Avoid large volumes as much as possible, e.g. to avoid equipment items running empty;
- Avoid dust formation by limiting the free-fall;
- Remove the dust at the point of production rather than convey it along ducts where it can accumulate;
- Buildings which contain plant handling combustible dusts should be designed to minimise the accumulation of dust deposits and to facilitate cleaning; and
- Regular housekeeping to avoid dust build-up.

5.3.3 Control of Ignition Sources

Measures used to control ignition sources which could give rise to dust explosions include:

- Avoid direct fired equipment;
- Bonding and earthing for static dissipation;
- Permits to work, training and auditing;
- Regular housekeeping to avoid dusts overheating, e.g. on hot surfaces;
- Hazardous area determination with compliant electrics and instruments;
- Preventative maintenance on equipment to minimise the probability of fault conditions;
- Use appropriate electrical equipment and wiring methods;
- Control smoking, open flames, and sparks;

- Avoid the possibility of a thermite reaction, e.g. aluminium reacting with iron oxide;
- Use separator devices to remove foreign materials capable of igniting combustibles from process materials; and
- Separate heated surfaces and heating systems from dusts.

5.3.4 Inerting

The suspension of a flammable dust in air may be rendered non-explosive by the addition of an inert gas. The main gases used for inerting of dust handling equipment are nitrogen, carbon dioxide, flue gas and inert gas from a generator, e.g. argon or helium.

Inerting by adding an inert dust is another means to prevent dust explosions. This is mainly done in mining, e.g. coal dust is mixed with ground stone to render the coal dust non-explosive.

5.3.5 Explosion Containment

One option for dealing with a dust explosion is total containment, i.e. design the equipment to withstand the maximum generated pressure. For dust explosions, the maximum generated pressures are quoted as 7 to 12 barg for atmospheric processes or up to 12 times the initial pressure in the equipment item. Hence, if the equipment has a design pressure equal to or exceeding these values then the explosion will be contained with no flames being emitted. Grinding mills are an example of such equipment items which may be made strong enough to withstand a dust explosion.

5.3.6 Explosion Isolation

The two basic methods for explosion isolation are:

- Automatic isolation, e.g. a pressure sensor will send a signal to a fast closing valve to shut and isolation the equipment item or pipe; and
- Material chokes such as rotary valves, screw conveyors with baffle plates and/or part of the helix removed to prevent the conveyor emptying on no feed flow, and self-actuating float valves.

5.3.7 Explosion Suppression

Typically, an increase in operating pressure is detected (e.g. pressure rises to 5 kPag) which then results in a suppressant being injected into the equipment item to suppress the flame. By suppressing the flame early, the pressure rise is limited. Suppressants include dry powder and water.

5.3.8 Explosion Venting

Explosion venting is an effective and economic way to provide protection against dust explosions, however, it is only suitable if there is a safe discharge for the material being vented. For equipment within a building, ducting the vent to outside should be done provided it is short, e.g. less than 10 m (detonations can occur in pipes of 10 to 30 m in length). Otherwise, flameless vents can be used as proposed for the new mill.

5.3.9 Equipment Separation

It is possible that an explosion from one equipment item or building could propagate to another. This could be via secondary explosions due to dust lifting and forming a cloud or from projectiles embedding into thin-walled equipment and hence being a point of ignition due to heat. If layout considerations permit, adequately separate higher risk process items or buildings is an inherently safe option.

In practice (Ref 5), the assessment of dust explosion hazards is bound to be subjective because the problem is too complex for quantitative analytical methods to yield an indisputable answer. Therefore, the acceptable safeguards for any given design will vary from company to company. Ref 5 quotes work by Pinkwasser and Haberli who suggest most of the dust explosion hazards in the grain, feed and flour industry can be eliminated by soft means such as training, motivation, improving the organisation, good housekeeping and proper maintenance. All of these safeguards are in-place at Shoalhaven Starches.

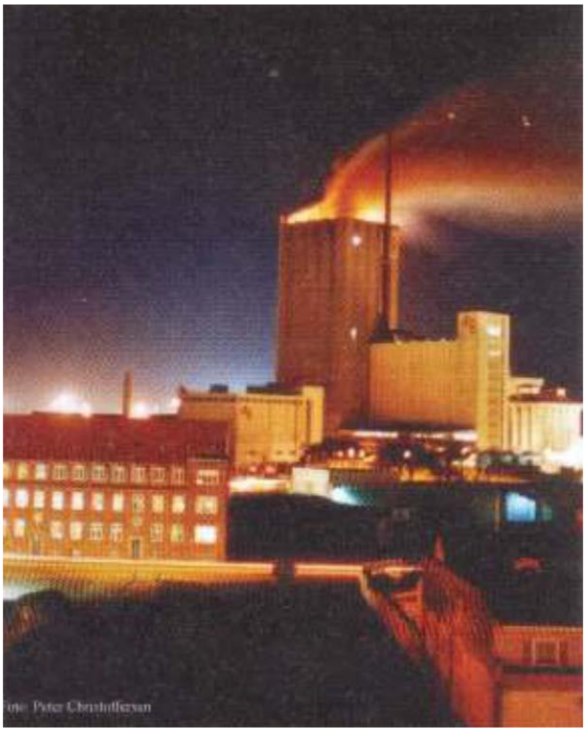
When these are combined with the additional measures proposed for the new equipment then further risk reduction is achieved. These additional measures include all equipment handling potentially explosive dust is to be designed to IECEX standards including rotary valves for seals, explosion vents (flameless to be used as much as possible), spark arrestors, interlocks, metal trap to minimise the risk of ignition in the mills, equipment bonding and earthing, minimisation of horizontal surfaces in the buildings where dust can collect, screw feeders to contain plugs to prevent flame propagation and hazardous area zoning with the electrics and instruments to suit the requirements.

5.4 FIRES

As stated in Table 1, it is possible to ignite the combustible material involved in the process, e.g. grain, if a strong ignition source is present.

Fires have occurred previously with these types of processes and are typically of a smouldering nature given the moisture content of the material and confinement within silos and other equipment (see Figure 4). The moisture content is typically 10 to 12%.

Figure 4 – Example Silo Fire



From Ref 7, fires involving flammable or combustible powder are not believed to place the public at risk but could be a threat to employees.

Given that the new mill is approximately 110 m away from Bolong Road then the risk criteria in Table 2 will be satisfied.

5.5 AIRCRAFT IMPACT AND OTHER EXTERNAL EVENTS

Previous risk assessments (e.g. Ref 10) have shown that the likelihood of an aircraft crash is acceptably low within Australia. Typical frequencies associated with aircraft crashes are:

- Scheduled aircraft $1x10^{-8}$/year; and
- Unscheduled aircraft $4x10^{-7}$/year.

The likelihood of this type of event is acceptably low for a site of this size and location.

Other external events that may lead to propagation of incidents on any site include:

Subsidence

Burst Dam

Storm and high winds

Storm surge

Earthquake

Breach of security

Tidal waves

Landslide

Vermin/insect infestation

Forest fire

Rising water courses

Storm water runoff

Lightning

These events were reviewed and none of them were found to pose any significant risk to the new facility given the proposed safeguards. Flooding can occur at this site, however, the structural design for the new mill building, tempering silos and mill feed silo includes allowances for this hazard.

5.6 CUMULATIVE RISK

As shown in this PHA, the proposed changes to the Shoalhaven Starches site will have negligible impact on the cumulative risk results for the local area as the significant radiant heat levels and explosion overpressures are local to the equipment.

Therefore, it is reasonable to conclude that the proposed changes do not make a significant contribution to the existing cumulative risk in the area.

A review of the potential propagation risks both from and to the new mill was conducted.

There is only one explosion vent that vents externally to the building. This vent points north, is located along the new mill building's northern wall and is 35.4 m above grade. From Table 3, the estimated flame length is approximately 21 m. The only structure this could potentially impact is the No 3 Gluten Dryer building wall (approximately 17 m away). As this building is only 17 m high, i.e. below the elevation of the new explosion vent, the risk of propagation from this short duration event is low.

For this externally vented explosion vent, the distance to 7 kPa is less than 10 m. Therefore, propagation due to explosion overpressures is not expected.

Given Mill B will be located adjacent to Mill A and there are external explosion vents from the equipment in Mill A pointed directly at Mill B then the project includes replacing these explosion vents with flameless vents to prevent propagation.

The potential smouldering fires in the wheat handling areas do not pose significant propagation risks given the plant layout shown in Figure 2, e.g. losses of containment from the new tempering bins. These are relatively local events and are managed via firewater application.

Should the combustible dust containment systems fail in the existing or new mills and the safety management systems, e.g. equipment not rated to the hazardous zones, also fail then ignition can occur with a dust explosion within either building. This could cause damage to the adjacent building. As discussed in Section 5.2, building dust explosions in mills is a known hazard and both hardware (e.g. design for containment and electrics and instruments rated for hazardous zones) and safety management systems (e.g. daily housekeeping) are required to lower the risk to an acceptable level. These measures are planned to be used in both mills to keep this propagation risk at an acceptable level.

5.7 SOCIETAL RISK

The abovementioned criteria for individual risk do not necessarily reflect the overall risk associated with any proposal. In some cases, for instance, where the 1 pmpy contour approaches closely to residential areas or sensitive land uses, the potential may exist for multiple fatalities as the result of a single accident. One attempt to make comparative assessments of such cases involves the calculation of societal risk.

Societal risk results are usually presented as F-N curves, which show the frequency of events (F) resulting in N or more fatalities. To determine societal risk, it is necessary to quantify the population within each zone of risk surrounding a facility. By combining the results for different risk levels, a societal risk curve can be produced.

In this study of the new mill, the risk of fatality does not extend significantly from the equipment and is therefore well away from the residential areas or other highly populated, off-site areas. The societal risk from the new mill is therefore acceptable.

5.8 Risk to the Biophysical Environment

The main concern for risk to the biophysical environment is generally with effects on whole systems or populations.

As there are no Dangerous Goods associated with the new mill, significant environmental impact is not expected. Whilst fires can also effect the environment due to combustion products, these events are low likelihood given the history of these types of processes. Importantly, any spilt material will be contained in the area or via the environmental farm.

Whereas any adverse effect on the environment is obviously undesirable, the results of this study show that the risk of losses of containment impacting the environment is broadly acceptable.

From the analysis in this report, no incident scenarios were identified where the risk of whole systems or populations being affected by a release to the atmosphere, waterways or soil is intolerable.

5.9 Transport Risk

There are no Dangerous Goods involved with the new mill and no changes to the site transport requirements. Therefore, transport risk has not changed and is deemed broadly acceptable.

6 CONCLUSION AND RECOMMENDATIONS

The risks associated with the proposed new flour mill at the Shoalhaven Starches Bomaderry site have been assessed and compared against the DoP risk criteria.

In summary:

- The potential hazardous events associated with the new flour mill are dust explosions and smouldering fires. Given the nearest public land is approximately 110 m away and the river is 25 m away then no adverse off-site impacts are expected;
- All risk criteria in HIPAP 4 is expected to be satisfied for this development;
- The risk of propagation to neighbouring equipment is low given that the potential dust explosions are either to be vented to atmosphere or of limited consequential impact and the potential fires are of a smouldering nature; and
- Societal risk, environmental risk and transport risk are all considered to be broadly acceptable.

The recommendations included in the Hazardous Event Word Diagram (Table 1 in this report) will require addressing as part of the design for the new flour mill. There are no other recommendations from the assessment performed in this PHA.

Appendix 1

Process Flow Diagrams

Preliminary Hazard Analysis, Shoalhaven Starches,

Proposed Flour Mill B

ALARM HORN & EMERGENCY SWITCH NUMBERS				
LEVEL	ALARM	ALARM	E-STOP	E-STOP
._insert				
._insert				
._insert				
._insert				
._insert				
._insert				
._insert				

PROCESS-NUMBERS			ADDITIONAL PARTS PROCESS-NUMBERS	
GENERAL PLANT COMPONENTS	=B-0001	=B-0101	STANDARD SPOUTING	=B-2070
INTAKE / WHEAT SILO			HEAVY SPOUTING	=B-2071
CLEANING	=B-2001	=B-2073	STEEL CONSTRUCTIONS	=B-2072
OFFAL GRINDING			ASSEMBLY MATERIAL	=B-2073
MILL	=B-4001	=B-4008		

REV.	APPD. DATE	DESCRIPTION	DRAWN BY	APPD. BY	ISSUED BY
01	18.08.2016	UPDATE ACCORDING TO G. THALMANN / GMIM611	M. Aberer	G. Thalmann	
02	07.09.2016	UPDATE ACCORDING TO G. THALMANN / GMIM611	M. Aberer	G. Thalmann	
03	15.09.2016	UPDATE ACCORDING TO G. SCHAFLER / GMIM6	M. Aberer	A. Kunadt	
04	16.09.2016	FADE OUT TECHN-TEXT ACCORDING TO A. KUNSDT / GMIM61	M. Aberer	A. Kunadt	

PLANT OWNER :

MANILDRA GROUP
NOWRA, AUSTRALIA

CONTRACTOR :

PROJECT :
PRODUCT /
CAPACITY:

1ST + 2ND CLEANING
HARD WHEAT, 90 t/h / 2 x 42

TITLE :

CLEANING "B"
CLEANING "C" [5]

ISSUE FOR:

State 00

Drawn	M. Aberer	GMIM611	15.09.2016	Contract No.		Project No.	
Approved	A. Kunadt	GMIM61	16.09.2016	Replace Drawing No.		Replaced by Drawing No.	
Issued				Plant Owner Drawing No.			

Bühler AG
CH-9240 Uzwil/Switzerland

Scale %

Drawing-Number MUDC-85112

Revision 04

CAD DIN A0

ROLLER LENGTH 850 t/24h

BK - PASS.	34. 00 m	=	4. 00 mm/100kg/24h
C - PASS.	30. 00 m	=	3. 53 mm/100kg/24h
TOTAL	64. 00 m	=	7. 53 mm/100kg/24h

SIFTER SURFACE = 0. 035 m²/100kg/24h

FINISHED PRODUCTS

FLOUR 1 < 250µ → SEE MUDM-63790
FLOUR 2 < 250µ [1. 1] → SEE MUDM-63790
BRAN → SEE MUDM-63791

MACHINE LIST:

4 x MDDZ-1500/250
6 x MDDQ-1250/250
4 x MDDP-1250/250
3 x MPAV-8
1 x MPAV-6
13 x MJZF-51-15-3000
4 x MJZE-43-5. 5-3000 PL
4 x MKLA-45/110-D PL
2 x MKZH-6012 B
1 x MZMA-100 PL WITH FC & MAGNET

ACCESSORIES:

0 x AUTOM. FLAP BOX
10 x MANUAL FLAP BOX WITH LS
34 x SENSOR (PN LIFTS / SPOUTING)
0 x SPEED SENSOR FOR PN AIRLOCKS
0 x ROLL TEMP. MONITORING FOR MDDR/T
0 x BEARING TEMP. MONITORING FOR MDDR/T
0 x DIRECT PICK-UP FOR MDDR/T
0 x AUTOM. ROLL GAP ADJUSTEMENT FOR MDDR/T
4 x OUTLET PIPE MONITORING FOR MPAK
4 x LEVEL MONITORING FOR MPAP
2 x MKLA-45/110 SPARES SIEVE ø 2. 5mm

NEW
[1. 1] NEW OFFER
[7] EXISTING RELOCATED

REV.	APPD. DATE	DESCRIPTION	DRAWN BY	APPD. BY	ISSUED BY
01	16.08.2016	UPDATE ACCORDING TO G.THALMANN/ GMIM 611	D. Kellner	G. Thalmann	
02	07.09.2016	UPDATE ACCORDING TO G. THALMANN / GMIM611	M. Aberer	G. Thalmann	
03	15.09.2016	UPDATE ACCORDING TO G. SCHAFLER / GMIM6	V. Schulte	A. Kunadt	
04	15.09.2016	FADE OUT TECHN-TEXT ACCORDING TO A. KUNSDT / GMIM61	M. Aberer	A. Kunadt	

PLANT OWNER : MANILDRA GROUP
NOWRA, AUSTRALIA

CONTRACTOR :

PROJECT : MILL
PRODUCT / CAPACITY: HARD WHEAT, 850 t/24h

TITLE : MILL "B"

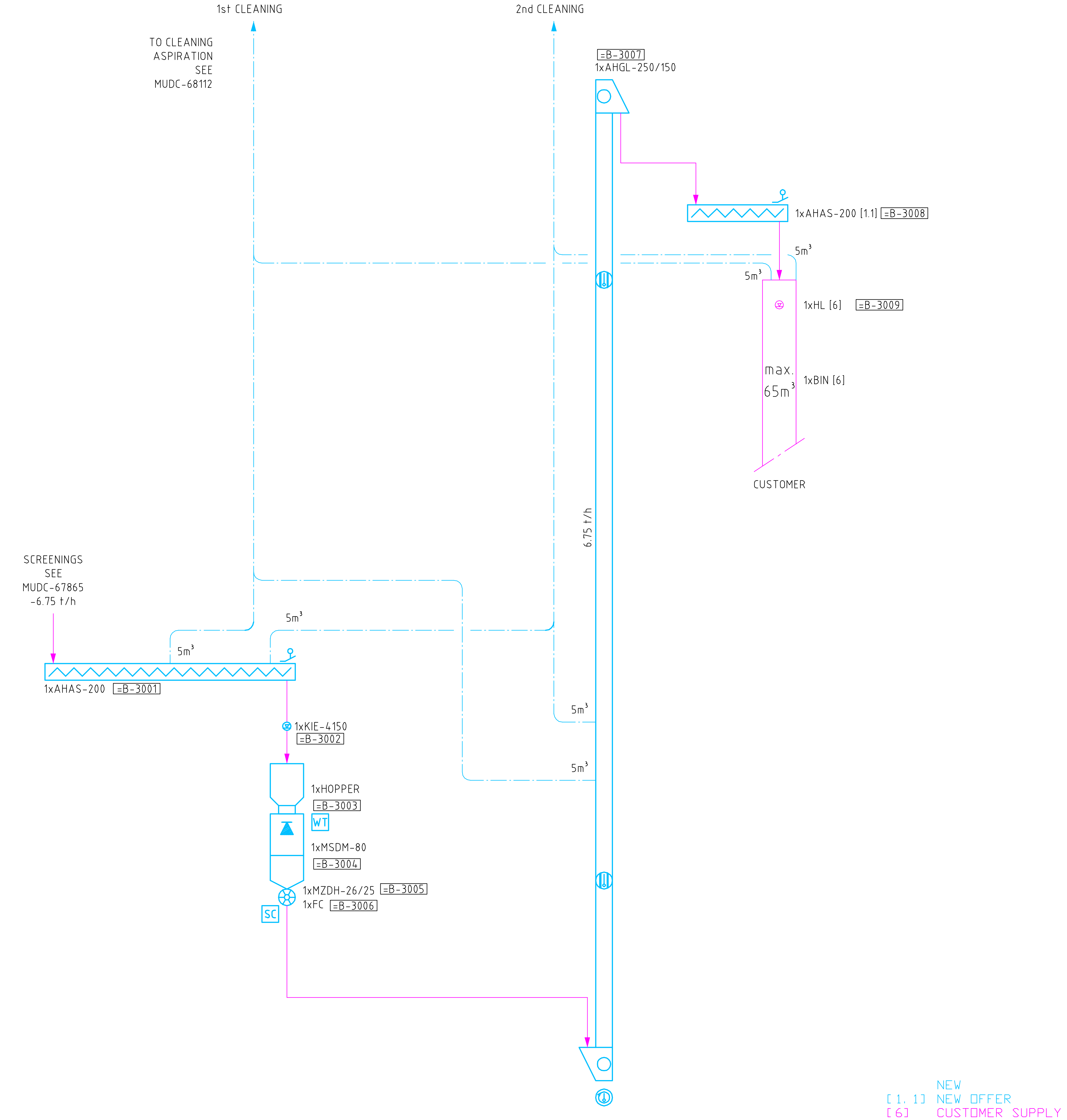
ISSUE FOR: State 00

Drawn	M. Aberer	GMIM611	15.09.2016	Contract No.		Project No.	
Approved	A. Kunadt	GMIM61	15.09.2016	Replace Drawing No.		Replaced by Drawing No.	
Issued				Plant Owner Drawing No.			

Bühler AG
CH-9240 Uzwil/Switzerland

Scale %
Drawing-Number MUDC-85113
Revision 04

CAD DIN A1



ALARM HORN & EMERGENCY SWITCH NUMBERS				
LEVEL	ALARM	ALARM	E-STOP	E-STOP
._insert				
._insert				
._insert				
._insert				
._insert				
._insert				
._insert				

PROCESS-NUMBERS			ADDITIONAL PARTS PROCESS-NUMBERS	
GENERAL PLANT COMPONENTS			STANDARD SPOUTING	=B-3010
INTAKE / WHEAT SILO			HEAVY SPOUTING	=B-3011
CLEANING			STEEL CONSTRUCTIONS	=B-3012
OFFAL GRINDING	=B-3001	=B-3013	ASSEMBLY MATERIAL	=B-3013
MILL				

REV.	APPD. DATE	DESCRIPTION	DRAWN BY	APPD. BY	ISSUED BY

PLANT OWNER :

MANILDRA GROUP
NOWRA, AUSTRALIA

CONTRACTOR :

PROJECT :
PRODUCT / CAPACITY:

SCREENINGS HANDLING
HARD WHEAT, -6.75 t/h

TITLE :

ISSUE FOR:

State 00

Drawn	D. Kellner	GMIM613	16.08.2016	Contract No.		Project No.	
Approved	G. Thalmann	GMIM611	16.08.2016	Replace Drawing No.		Replaced by Drawing No.	
Issued				Plant Owner Drawing No.			

Bühler AG
CH-9240 Uzwil/Switzerland

Scale %

Drawing-Number MUDC-85114

Revision 00

CAD DIN A2

REV.	APPD. DATE	DESCRIPTION	DRAWN BY	APPD. BY	ISSUED BY
01	15.09.2016	UPDATE THE DIAGRAM	D. Tobler	A. Kunadt	

PLANT OWNER : MANILDRA GROUP NOWRA, AUSTRALIA

CONTRACTOR :

PROJECT : PRODUCT / CAPACITY: FINISHED PRODUCTS HANDLING FLOUR, 2x850 t/24h MILL B+C

TITLE :

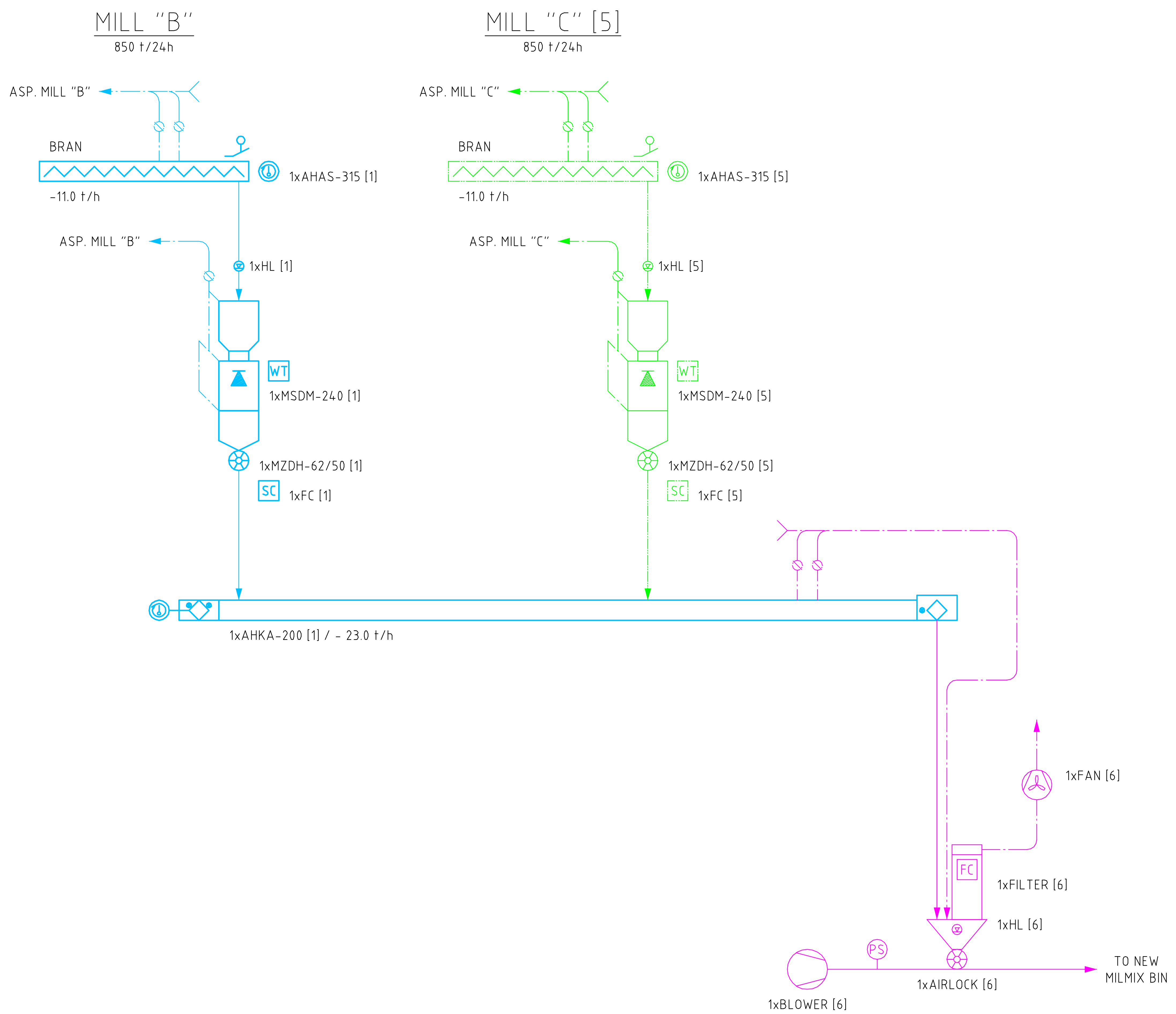
ISSUE FOR: State 00

Drawn	D. Tobler	GMIM612	15.09.2016	Contract No.		Project No.	
Approved	A. Kunadt	GMIM61	15.09.2016	Replace Drawing No.		Replaced by Drawing No.	
Issued				Plant Owner Drawing No.			

Bühler AG
CH-9240 Uzwil/Switzerland

Scale % | Drawing-Number MUDM-85067 | Revision 01

CAD DIN 2xA0



[1] NEW OFFER 2016
[5] FUTURE
[6] CUSTOMER SUPPLY

REV.	APPD. DATE	DESCRIPTION	DRAWN BY	APPD. BY	ISSUED BY
01	15.09.2016	UPDATE THE DIAGRAM	D. Tobler	A. Kunadt	

PLANT OWNER : MANILDRA GROUP
NOWRA, AUSTRALIA

CONTRACTOR :

PROJECT : BYPRODUCTS HANDLING
PRODUCT / CAPACITY: BRAN, 2x850 t/24h MILL B+C

TITLE :

ISSUE FOR:

State: 00

Drawn	D. Tobler	GMIM612	15.09.2016	Contract No.	Project No.
Approved	A. Kunadt	GMIM61	15.09.2016	Replace Drawing No.	Replaced by Drawing No.
Issued				Plant Owner Drawing No.	

Bühler AG
CH-9240 Uzwil/Switzerland
BÜHLER

Scale: %
Drawing-Number: MUDM-85068
Revision: 01

CAD DIN A2

7 REFERENCES

1 Cowman Stoddart Pty Ltd, **Environmental Assessment, Shoalhaven Starches, Proposed Modification in Relation to Location, Design and Footprint of the DDGSSSSS pelletising plant, Project Approval MP 06_0228**, February 2014

2 Department of Planning and Infrastructure (NSW) **Hazardous Industry Planning Advisory Paper No 6** – **Hazard Analysis,** January, 2011

3 Department of Planning and Infrastructure (NSW) **Hazardous Industry Planning Advisory Paper No 4** – **Risk Criteria for Land Use Safety Planning,** January, 2011

4 Lees, F., **Loss Prevention in the Process Industries**, 2005

5 Eckhoff, R. K., **Dust Explosions in the Process Industries**, 2003

6 HSE UK, **Grain Dust, Guidance Note EH66**, Third edition

7 Tweeddale, M., **Managing Risk and Reliability of Process Plants**, 2003

8 Wingerden, Kees van, **Prediction of Pressure and Flame Effects in the Direct Surroundings of Installations Protected by Dust Explosion Venting**, 1993

9 CCPS, **Guidelines for Safe Handling of Powders and Bulk Solids**, 2005

10 Pinnacle Risk Management, Preliminary Hazard Analysis, Stage 5 Expansion Modifications, Bitumen Storage and Handling, Terminals Pty Ltd, Port Botany, NSW, 5 April 2011