Riverina Oils & Bio Energy Pty Ltd Integrated Oilseed Processing Plant (IOPP)

Wagga Wagga – NSW Preliminary Hazard Analysis - Blending Tank Project

- Final document. Version 0.0
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EXECUTIVE SUMMARY

Introduction, Objectives & Scope

Riverina Oils & Bio Energy Pty Ltd, Australia (hereafter known as ROBE) is operating an integrated oilseed processing plant just outside of Wagga Wagga, NSW. As part of the plant operations, we are storing and handling Dangerous Goods in quantities that exceed the threshold levels listed in State Environmental Planning Policy (SEPP) No.33, "Hazardous and Offensive Industries" (Ref.1). Under such conditions, it is necessary to prepare and submit a preliminary hazard analysis (PHA) covering the proposal. Hence it was done prior of operation in past. In current setup ROBE wish to install 2 oil tanks as blending oil tank project. As we fall under Hazardous and offensive industry, we are preparing this report otherwise for the said project it's not required.

ROBE, has inhouse prepared and document preliminary hazard analysis (PHA) with technical team.

This document details the results of the PHA study for the proposed blending tank project at Integrated Oilseed Processing Plant at Wagga Wagga, NSW.

Methodology

The methodology used for the study was that prescribed in Multi-Level Risk Assessment (Ref.3) and HIPAP No.6 (Ref.2).

Brief Description of the Integrated Oilseed Processing Plant

The facility will be located approximately 10 km north of the township of Wagga Wagga, NSW. The land is zoned No.1 Rural in the Local Environmental Plan (LEP) for the area. It is understood that the surrounding land uses are proposed for future industrial land uses and a current industrial site is located to the south and east of the plant, namely Riverina Wool Combing Facility.

The existing Oilseed Processing Plant is crushing canola seeds to produce oil that will produce unrefined vegetable oil, refined vegetable oil and solid meal product. Seeds will be delivered to site and stored in silos. The seed will then be crushed, and the oil extracted, with the crushed seed product being subjected to a solvent extraction operation that will remove the remaining oil from the seed.

The finished vegetable oil product is then refined in Refinery plant, cooled, filtered, dosed with anti-oxidant and pumped to the storage tanks, awaiting distribution.

The proposed blending tank project include installation, commissioning and operation of 2 tanks. One tank (300 MT) is similar type of existing 12 oil tanks and second (50 MT) blending / churn tank with agitation and steam. The proposed tank will be kept under new tank farm which will be a part of existing tank farm. The tank location will be south-east side of main oil tankfarm. Additional piperacks, cables and 2 pumps will be installed to load and unload oil. For unloading Riverina Oils will same loadout facility.

Hazard Analysis

The following incidents were carried forward from the hazard identification phase of the study for consequence analysis.

Table 1 : Hazard Analysis

Event #	Event	Description
1	RTkr Pool Fire	Flammable liquid leak at the delivery bay, ignition and pool fire in the bunded area of the delivery bay;
2	Tks 207 & CT51 Bund Fire	Full bund fire in the Vegetable oil liquids storage tank bunds T207 & CT51.

Consequences Analysis

Above incident is subjected to a detailed consequence analysis (refer Section 5.2 – Hazard Analysis) to identify the heat radiation impact at the site boundary. Table 2 summarises the result of the analysis.

TABLE - 2 - SUMMARY OF CONSEQUENCE IMPACTS FROM POSTULATED INCIDENTS AT THE OILSEED PLANT

Event	Plant	Area (m^2)	Pool Diameter	Distance (m) to Heat Flux kW/m^2				Distance to Boundary (m)	Heat Flux at Boundary (kW/m^2)	Risk Level at Boundary ($\times 10^{-6}$ per annum)
				35	25	12.6	4.7			
1	Road Tkr Unloading	75	13.60	12	15	22	35	65	2.1	-
2	Tank Bund	40	9.93	9	11	16	27	120	2.1	-

Risk Analysis

The risk levels computed at the site boundary are approximately 4 x 10^{-6} p.a., as shown in the table 3 below. Such risk levels, when viewed against the NSW DOP Risk Criteria (50 x 10^{-6} p.a. for industrial land use) under the NSW Department of Planning guidelines are considered acceptable.

TABLE 3 - OVERALL RISK EVALUATION

EVENT # / Item	Base Freq (x 10^{-6} per annum)	Pf(E)	Individual Risk x 10^{-6} At Boundary adjacent to Byrnes Rd	Effect Zone / Fatality Radius
1. Road Tkr Pool fire	21	0	0	35
2. Tanks ST207 & CT51 Bund fire	4	0	0	52
TOTAL RISK LEVEL at BOUNDARY			**0**	

It is therefore concluded that the risk criteria levels at the boundary of the site do not exceed the risk criteria published by the NSW Department of Planning (Ref.4) at the boundary.

Recommendations

Notwithstanding the above risk analysis results, following recommendation were made in order to enhance the safety systems at the site and ensure the risks are maintained as low as reasonably practicable (ALARP). The following recommendation are made:

1. **Safety Management System (HIPAP No 9)** – A safety management system in accordance with the NSW DoP Advisory Paper no 9 should be developed for the site. Already in place.
2. **Spill Kits** - It was identified that vegetable oil is being stored in tanks. Spills of these materials, whilst contained within bunded areas will require rapid clean-up to minimize the potential for release beyond the containment or for contact with personnel. Already in place at tank farm area.
3. **Sub-Bunds for Main Tank Farm** – The heat flux computations show that the main Oil tank farm bund must be divided into at least two equal sub-bunds to ensure heat flux levels of 4.7 kW / m^2 do not extend beyond the Byrnes Rd boundary. This is only two tanks and separate bunding will come will cover this aspect.

Contents

ABBREVIATIONS

Abbreviation	Description
ALARP	As Low As Reasonably Practicable
API	American Petroleum Industry
AS	Australian Standard
DoP	Department of Planning
FAME	Fatty Acid Methyl Esters
HIPAP	Hazardous Industry Planning Advisory Paper
kL	Kilo Litres
kms	kilometres
kPa	kilo Pascals
kPag	kilo Pascals (gauge)
kV	kilo Volts
kW/m^2	kilo Watts per square metres
LEP	Local Environmental Plan
m	metres
m^2	square metres
m^3	cubic metres
m^3/hr	cubic metres per hours
Nm3/hr	Normal cubic metres per hour
p.a.	per annum
PFD	Process Flow Diagram
PG	Packaging Group
PHA	Preliminary Hazard Analysis
pmpy	per million per year
PSA	Pressure Swing Absorption
ROBE	Riverina Oils & Bioenergy Pty Ltd Australia
SEP	Surface Emissive Power
SEPP	State Environmental Planning Policy
SKM	Sinclair Knight Merz
SS	stainless steel
t	tonnes
tpd	tonnes per day
tph	tonnes per hour

1. INTRODUCTION

1.1. Background

Riverina Oils and Bio Energy Pty Ltd (hereafter known as ROBE) propose to establish a new blending tank project at existing Integrated Oilseed Processing Plant at 177 Trahairs Road, which is about 10 kilometres north of Wagga Wagga.

This plant is located on a 39.5 hectare rural site located to the north of the Bomen industrial estate. In the past this site was used by the nearby Wool Combing Facility for wastewater storage and irrigation.

The area surrounding the site is dominated by rural and rural-residential development and is sparsely populated. There are only 6 residences within a 2.5 kilometre radius of the site, with the closest residence being located about 1.1 kilometres from the site.

The plant is producing oil seed related products such as vegetable protein meal and edible vegetable oil. The proposed blending tank project will gives blended oil and will be loaded into tankers for shipment.

As part of the current plant operations, we are storing and handling Dangerous Goods in quantities that exceed the threshold levels listed in State Environmental Planning Policy (SEPP) No.33, “Hazardous and Offensive Industries” (Ref.1). Under such conditions, it is necessary to prepare and submit a preliminary hazard analysis (PHA) covering the proposal. Such approval has been taken in past. The current blending tank project does not involve any hazardous chemical but as its part the facility hence this report is required.

1.2. Objectives

The objectives of the study are to:

- Prepare a PHA study of the proposed Blending tank project at ROBE Integrated Oilseed Processing Plant - Wagga Wagga, NSW in accordance with Hazardous Industry Planning Advisory Paper No.6, “Guidelines for Hazard Analysis”(Ref.2); and
- Report on the findings of the study for submission to the NSW DoP.

1.3. Scope of Work

The scope of this Preliminary Hazard Analysis (PHA) study covers the:

- Proposed blending tank project at ROBE Integrated Oilseed Processing Plant - Wagga Wagga, NSW and identification of potential hazards associated with the receival, storage and dispatch of vegetable oils.
- For those hazards identified, determination of their potential consequences and whether risks posed affect adjacent land users,
- A quantitative estimation of those risks that may have off site effects and their cumulative impact, and
- A review of emergency planning principles and fire safety management systems, particularly containment systems for the worst-case fire scenario(s).

The format of the study and context is generally defined within the guidelines provided by the NSW DOP Hazardous Industry Planning series, including:

- Advisory Paper No:6 “Guidelines for Hazard Analysis “
- SEPP33 & Multilevel Risk Assessment.

Note: For Completeness this study should be read in conjunction with the Project Development Application and supporting documentation and earlier SKM PHA report 2012.

1.4. Assumptions and Limitations

The following limitations apply to the assessment:-

- Generally the assessment does not incorporate the detailed requirements of the relevant Australian Standards.
- Life safety objectives are limited to those identified in the PHA. The PHA scope specifically does not consider the issue of property damage or liability to neighbours or environmental damage or damage to the biophysical environment.
- The PHA does not consider the road transport of goods i.e. vegetable oils by road tanker (other than the on-site activities, e.g., tanker unloading operations outside ROBE, transportation etc.)

2. Site Location

2.1. Land Zoning and Adjacent Land Uses

The proposed blending tank project is within existing ROBE oil seed refining facility is located about 10 km north of the Township of Wagga Wagga., NSW, as shown in **Figure 1 – Site Location map**. The land is zoned No.IN1 General Industrial as per Wagga Wagga Development Control Plan (2010) which indicates that the proposed facility is permitted in this zoning providing the facility is not classified as “Hazardous or Offensive”. The facility currently has only one industrial site within close proximity, the remaining adjacent areas are undeveloped and are currently open rural land. The surrounding facilities are listed below:

- **East –** Open rural land (Rural property, “Kalingur”, about 1000m directly to the east of the proposed plant);
- **North –** Open rural land, no rural/residential properties located to the north;
- **West –**Main southern railway immediately adjacent to the site boundary, west; Olympic Way about 1,500m to the west (no rural/residential properties located to the west between the site and the Olympic Way, and
- **South** – Wool Combing Facility (site water collection ponds located adjacent to the southern boundary of the site, wool factory buildings located about 750m from the southern site boundary.

The closest zoned rural/residential area is located about 2.5 km to the south in the township of Bomen.

2.2. Site Layout

The facility comprises a number of raw materials storages, process plant areas and product storages. In addition to the production and storages areas, the site is also contain ancillary services such as steam generation, compressed air facilities, electrical power supply, amenities, etc.

The site is operating on a continuous process (24 hours per day, 7 days per week), with planned shutdowns for maintenance only.

Please refer annexure 1 as site layout showing existing plant structure and proposed blending tank projects.

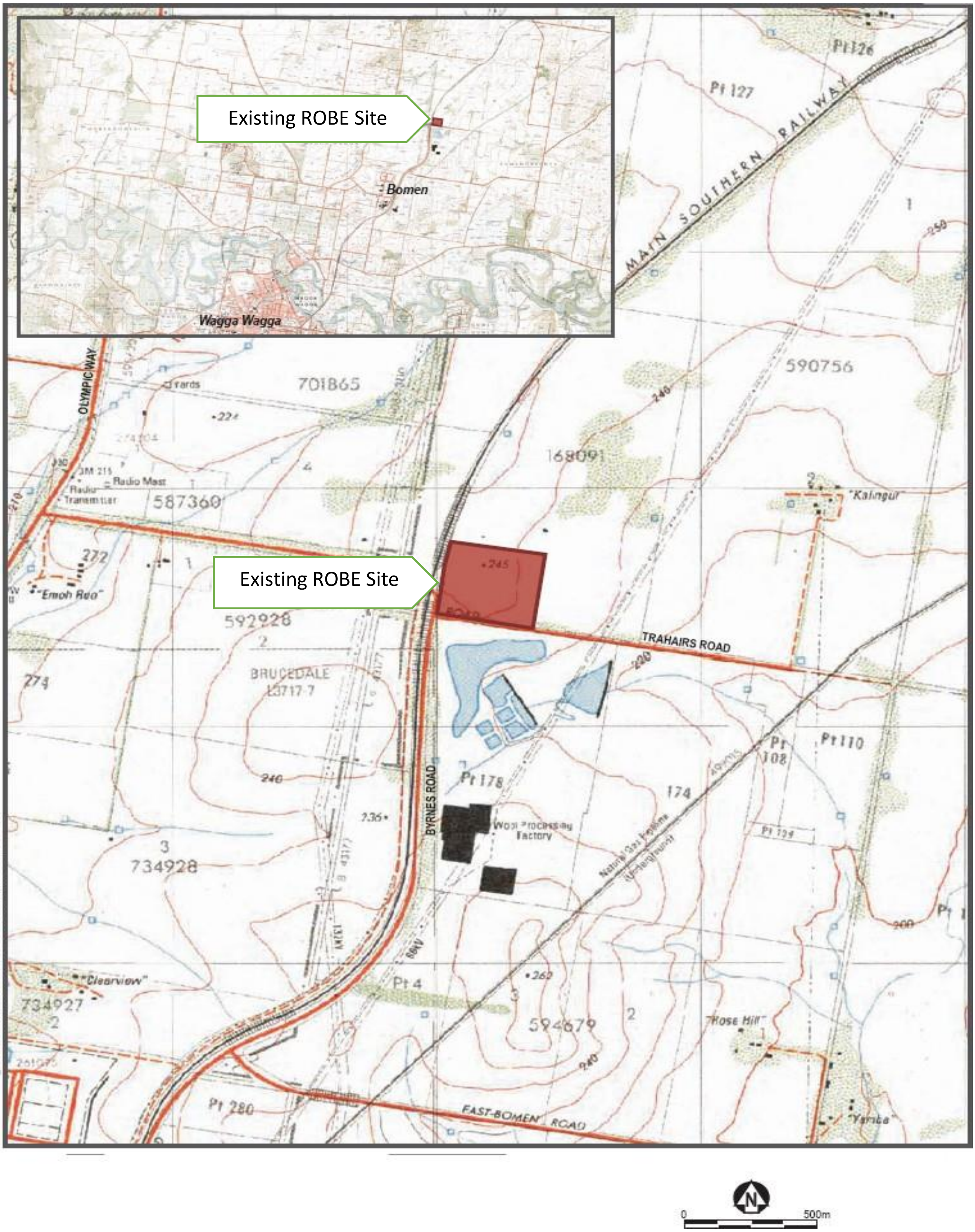


Figure 1 : Site Location showing existing ROBE site where Blending project approval is required

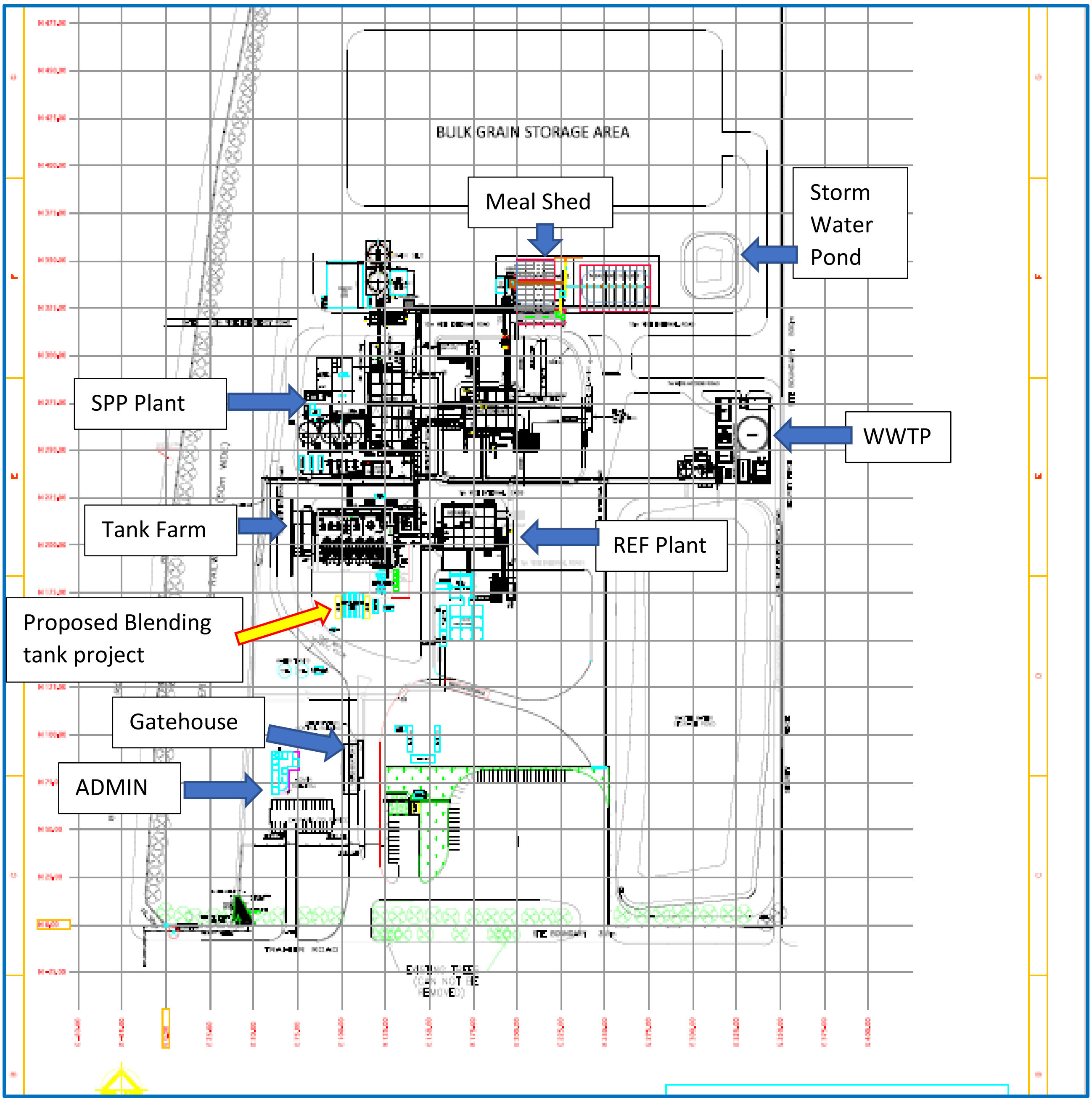


Figure 2 : Site Layout Plan showing proposed blending tank project

Flow Diagram of Proposed Blending Project at ROBE - Wagga

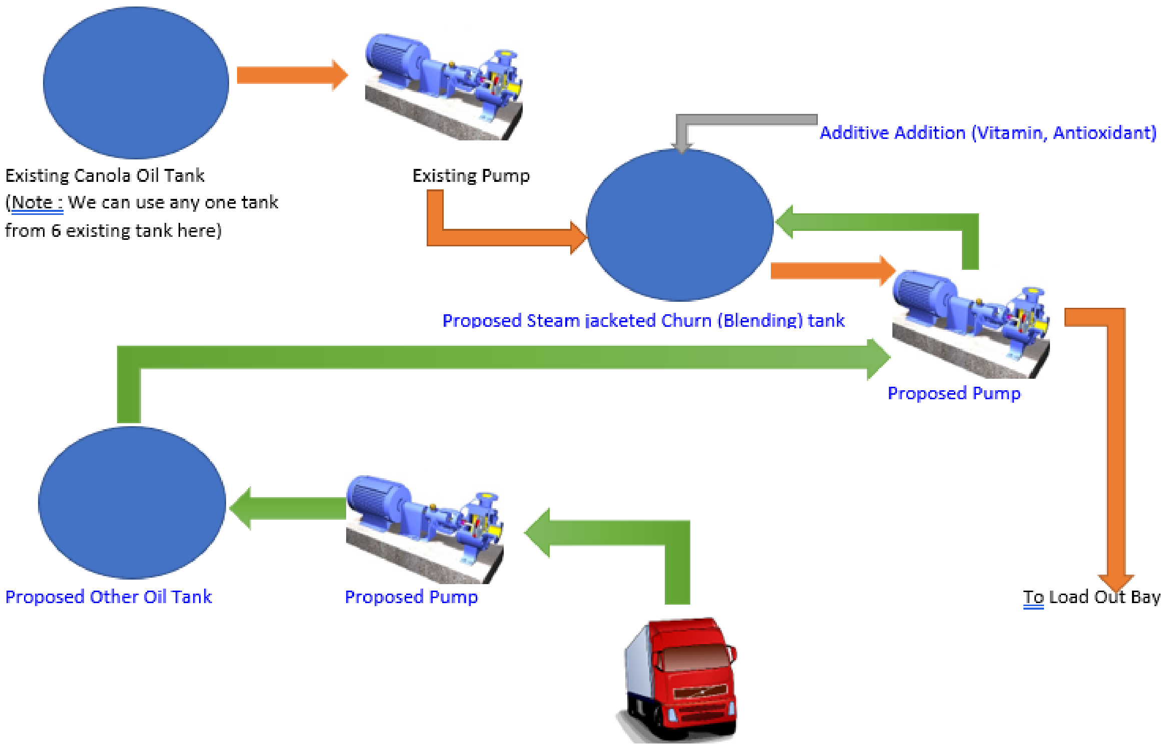


Figure 3 : Flow Diagram of Proposed blending Tank Project

3. General Proposed Site Operation (Blending tank project)

In Current set-up we do have 12 oil tanks in main oil tank farm. All tanks are identical and having capacity of 350 KL / 300 tons.

Currently we / Riverina Oils sale 99 % pure canola oil & only 1 % blended oil; emerging market is for high performance blended oil created demand of blended oil of significant quantity which we cannot make with existing tanks. To achieve this, we have to install another 300 MT similar storage tank with a 50 MT churn tank (blending tank). We will fill new tank with other than canola oil as per market demand it could be Sunflower, Safflower oil etc. Oil stored in a new tank is blended with our Canola oil in certain % to make demanded blend using 50 MT churn tank (Blending tank with an agitator & steam heating coil). This new installation of tanks will be on south-west of the existing tank farm behind tank no. T-201(as per Figure 2 and Figure 3). Blended oil in the churn tank will be loaded into Tankers/flexi bags at our existing load out bay using transfer pump & pipeline. With this proposed project overall site production capacity as per MOD 2 approval remain same. There is no production increase at site & ROBE will remain with production and storage capacity as per approval after this project approved.

3.1 Product Transfer Facilities

Products (edible oil) will be transferred from tanker to storage tanks and based on market demand we will make a blended oil in churn tank. Final blended oil will be dispatched from tank to road tanker at rate of 30 to 50 m^3/hr capacity and at 200 kPa. Quantities of materials transferred will be measured by the respective level indicator in the storage tank. Additional assay measurements will be performed using a calibrated and certified weighbridge. Products delivered to site will be transported by road tanker and unloaded to the respective tanks by tanker mounted pumps. In cases where the road tankers are not fitted with tanker mounted pumps, the liquids will be transferred using site pumps with the same capacity as those used to transfer liquids to tankers (e.g. 30 to 50 m^3/hr and at 200 kPa). Measurement for raw material deliveries will be performed by means of tank level indicators and counter checked over the weighbridge.

3.2 Vegetable Oil Storage :

Vegetable oils will be stored in TK-ST-207 vertical cylindrical tanks with a sloping flat bottom and conical roof. Tanks will be constructed from mild steel or 304 stainless steel, designed and constructed relevant Australian standards. Churn tank CT-51 Vegetable Oil tanks will be provided agitator and steam heating coils to maintain the temperature at about 50^{o}C to ensure viscosity is sufficiently low for ease of transfer. Both tanks will be provided with nitrogen blanketing systems.

The vegetable oils group consists of a number of oils including palm oil, safflower oil, cottonseed oils, etc. These will be stored in a ST207 tank. Tank farm storage tank details are presented in **Table 3: ROBE – POPOSED BLENDING TANK STORAGE DETAILS**.

Tank storage details are preliminary subject to the most efficient and cost-effective storage options.

Table 3 – ROBE Blending tank Storage Details

Tank No.	Product	Cap KL	Cap MT	Dia-Mtr	Ht-Mtr	MOC	Heating coil	Nitrogen Blanket
ST207	Canola Oil	350	300	5.4	15	MS304	No	Yes
CT51	Blended Vegetable Oil	72	50	3.0	12.5	MS304	Yes	Yes

3.3 Building, Utilities and Services

The following ancillary building and services will be provided as part of the new project (Blending Tank project).

- **Power Supply** : Will utilize existing 11 kV supply and will be transformed to various voltages for use by pumps and agitator at new blending tank tank farm.
- **Water** – Industrial water is in use via underground water mains from local water supply i.e. Riverina Water. No additional water will be used on site in this activity.
- **Natural Gas** : We will use existing natural gas supplied by underground pipe from nearest high pressure gas pipeline. The gas is supplied through a let-down and metering station at the site boundary. We will use 0.9 GJ/day of extra gas. For 2018 annual reporting period ROBE natural gas consumption was 232,789 GJ. Even after this project the usage of natural gas will remain well below than predicted in EA 2010 report i.e. 540,000 GJ.
- **Steam** – Steam is being generated by boiler and will be supplied to jacketed tank i.e. blending tank by pipework. We will use approx. 300 kg/day steam in addition to existing steam usage.
- **Tanker Loading / Unloading Bays** – We are going to use existing loadout bay and hence no other construction is required.
- **Fire potentially contaminated water detention** – All such contaminated

water will be stored in tank farm. The collected water will be analyzed first and treated at WWTP or disposed off outside based on analysis.

4. Methodology

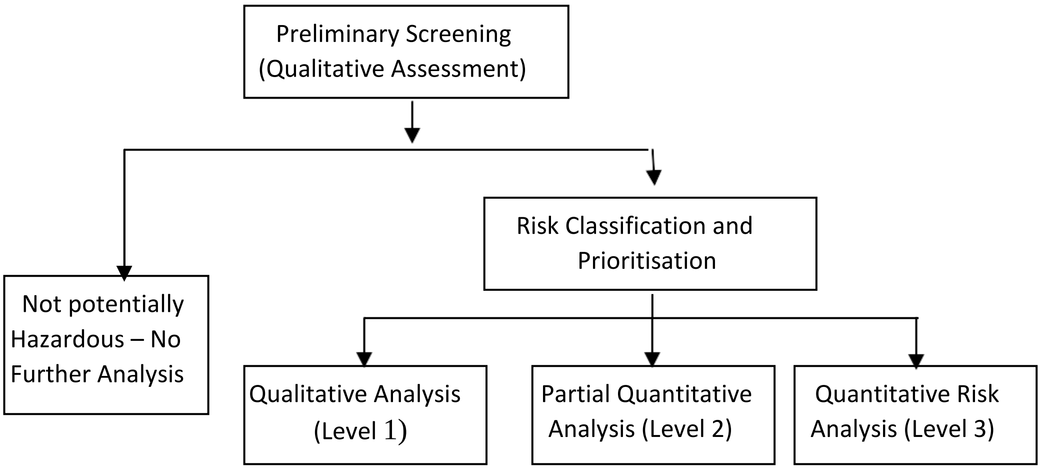
4.1 General Approach

The NSW Department of Planning (DoP) Multi Level Risk Assessment (Ref.3) approach was used for this study. The approach considered the development in context of its location and its technical and safety management control. The Multi Level Risk Assessment Guidelines are intended to assist industry, consultants and the consent authorities to carry out and evaluate risk assessments at an appropriate level for the facility being studied.

The Multi Level Risk Assessment approach is summarized in **Figure 4**. There are three levels of assessment, depending on the outcome of preliminary screening. These are:

- **Level 1 – Qualitative Analysis**, primarily based on the hazard identification techniques and qualitative risk assessment of consequences, frequency and risk;
- **Level 2 – Partially Quantitative Analysis**, using hazard identification and the focused quantification of key potential offsite risks; and
- **Level 3 – Quantitative Risk Analysis (QRA)** based on the full detailed quantification of risks, consistent with Hazardous Industry Planning Advisory paper No.6 – Guidelines for Hazard Analysis.

FIGURE 4 - THE MULTI LEVEL RISK ASSESSMENT APPROACH



The document “Applying SEPP 33” (Ref.1) guideline may also be used to assist in the selection of the appropriate level of assessment. This guideline states the following:

“It is considered that a qualitative PHA may be sufficient in the following circumstances:

- *where materials are relatively non-hazardous (for example corrosive substances and some classes of flammables);*
- *where the quantity of materials used are relatively small;*
- *where the technical and management safeguards are self-evident and readily implemented; and*
- *where the surrounding land uses are relatively non-sensitive.*

In these cases, it may be appropriate for a PHA to be relatively simple. Such a PHA should:

- *identify the types and quantities of all dangerous goods to be stored and used;*
- *describe the storage/processing activities that will involve these materials;*
- *identify accident scenarios and hazardous incidents that could occur (in some cases, it would also be appropriate to include consequence distances for hazardous events);*
- *consider surrounding land uses (identify any nearby uses of particular sensitivity); and*
- *identify safeguards that can be adopted (including technical, operational and organisational), and assess their adequacy (having regards to the above matters).*

A sound qualitative PHA which addresses the above matters could, for some proposals, provide the consent authority with sufficient information to form a judgement about the level of risk involved in a particular proposal”.

Detailed technical and management safeguards are proposed for the Integrated Oilseed Processing Plant and the predominant Dangerous Goods at the site are all combustible liquids and relatively low risk. Hence, under these circumstances, a qualitative assessment may be considered for the project. However, it is noted that the anticipated growth of industries close to the proposed Seed Oil site could result in impacts to the adjacent sites in the event of an incident at the plant. Hence, there could be a potential for “domino” effects from incidents at the Integrated

Oilseed Processing Plant to adjacent future sites.

Based on the separation from sensitive receptors and the potential for domino incidents to adjacent industrial sites, a level 2 analysis has been selected as the most appropriate level of assessment for the site.

4.2 Detailed Approach

Essentially four major steps are involved in the analysis, namely incident identification, consequence analysis, probability and frequency estimations, leading to a quantitative risk assessment result. In practice however, as shown in Figure 5, there are many factors to be considered.

The detailed study approach follows that recommended in HIPAP No.6, “Hazard Analysis Guidelines” (Ref.2).

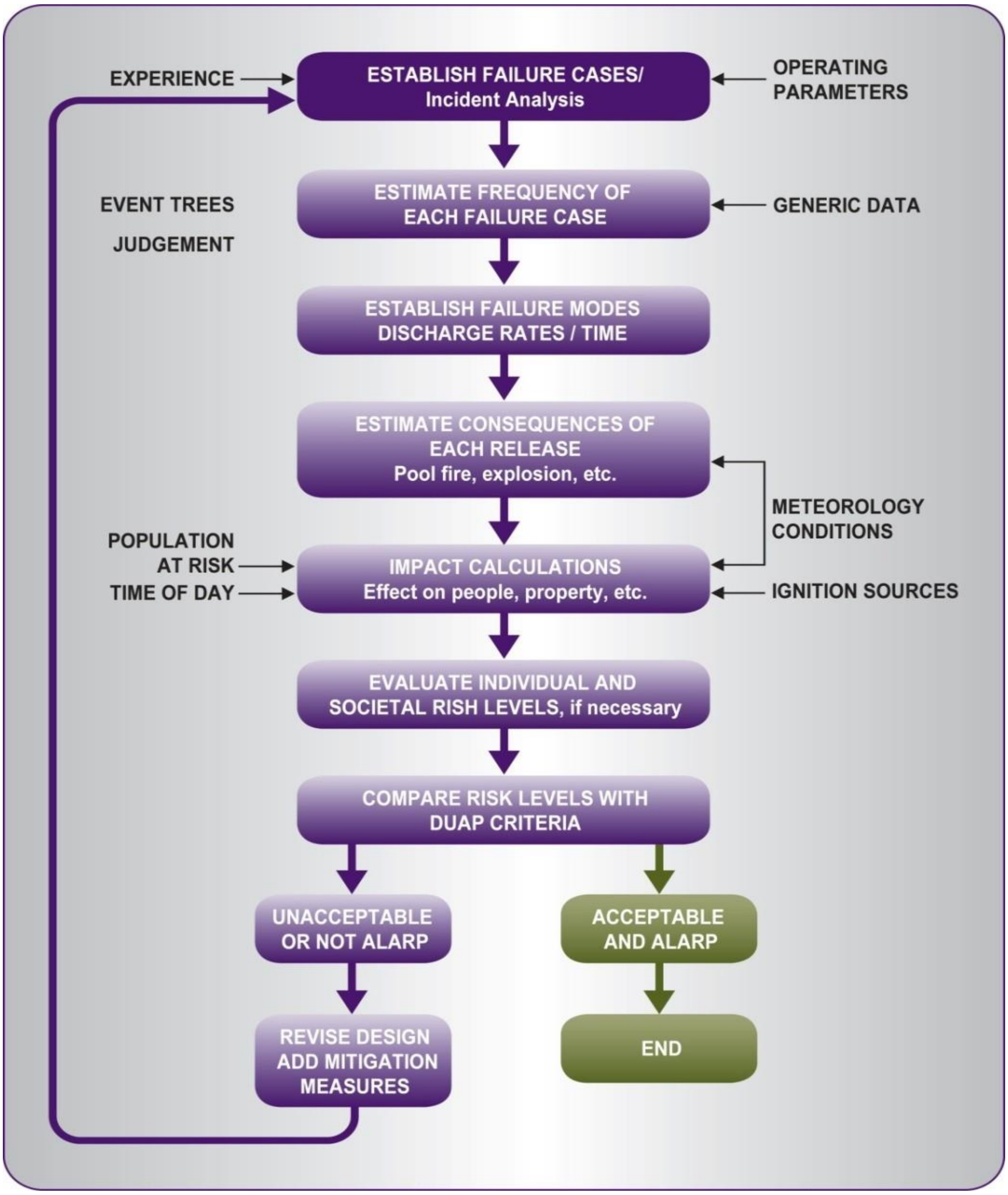


FIGURE 5 – OVERVIEW OF PHA PROCESS

The approach is summarised as follows;

4.2.1. Hazard Analysis

A detailed hazard identification was conducted for the site facilities and operations described in **Section 3**. Where an incident was identified to have potential off site impact, it was included in the recorded hazard identification word diagram (**Table 6**). The hazard identification word diagram lists Event / Facility, causes, consequences and prevention / safeguards. This was performed using the word diagram format suggested in HIPAP No.6 (Ref.2). Each postulated hazardous incident was assessed qualitatively in light of proposed safeguards (technical and management controls). Where a potential offsite impact was identified, the incident was carried into the main report for further analysis. Where the qualitative review in the main report determined that the safeguards were adequate to control the hazard, or that the consequence would obviously have no offsite impact, no further analysis was performed.

The hazard analysis and safety systems review was conducted in discussion with the ROBE operations and management team.

4.2.2. Consequence Analysis

For those incidents qualitatively identified in the hazard analysis to have a potential offsite impact, a detailed consequence analysis and risk assessment was conducted to determine the risk levels at the boundary of the site. The analysis modelled the various postulated hazardous incidents and determined impact distances from the incident source. The results were compared to the consequence criteria listed in HIPAP No.4 (Ref.4). Where an incident was identified to result in offsite effect, it was carried forward for frequency analysis. Where an incident was identified to have an offsite effect, and a simple solution was evident (i.e. move the proposed equipment further away from the site boundary), the solution was recommended and no further analysis was performed.

4.2.3. Frequency Analysis

In the event a simple solution for managing consequence impacts was not evident, each incident identified to have potential offsite impact was subjected to a frequency analysis. The analysis considered the initiating event and probability of failure of the safeguards (both hardware and software). Generic failure frequencies for the Oil and Petrochemical industries were used to provide the risk estimates at the boundary. The references for the Generic failure frequencies are provided in the Summary (Table 10).

4.2.4. Risk Assessment

As the selected approach for this analysis was a Level 2 assessment (Ref.3), where incidents were identified to impact offsite and where a consequence and frequency analysis was conducted, the consequence and frequency analysis for each incident was combined to give a risk result, the risk results added to give a cumulative risk result at the boundary, which was then compared to the risk criteria published in HIPAP No.4 (Ref.4). Recommendations were then made regarding risk reduction measures, regardless of the risk levels achieved (following the ALARP principle).

5. HAZARD ANALYSIS

The four major steps are involved in the analysis, namely incident identification, consequence analysis, probability and frequency estimations, leading to a quantitative risk assessment result are presented in this section.

5.1. HAZARD IDENTIFICATION

The nature of the materials stored or processed on site is an important part of the PHA because it establishes whether fire, explosion or toxic releases are possible and to what degree. For example, the storage and transfer of flammable liquids presents potential fire and explosion hazards.

5.1.1. Nature and Quantity of Materials Stored and Used On Site

As part of the Seed Oil process, it is necessary to store and handle a number of Dangerous Goods. For this operation only vegetable oil will be stored in tanks which is not dangerous but as such site falls under this regulation its required to deem classification according to dangerous goods. These are listed in Table 4 – Dangerous Goods Stored.

TABLE 4 - DANGEROUS GOODS STORED

Proper Chemical Name	Type of Storage	Class	PG	Hazchem Code	Tank Capacity (total)
Vegetable Oil & Canola Oil	Aboveground tanks (2)*	C2	N/A	N/A	350 MT

* Indicated number of tanks

Potential hazards of dangerous goods stored and the safeguards employed by ROBE are described in Table 5 – Hazardous Nature of Materials. Material Safety data sheets are provided for Canola oil and Blended vegetable oil in Appendix A.

5.1.2. Hazard Identification and selection of Major Accident Events

A hazard identification word diagram has been developed and is presented in **Table 6 – General Hazard Identification Table and Selected MAE's**. Those hazards identified to have a potential impact offsite are assessed in detail in the following section of this document. **Table 4** lists the type and quantity of DGs stored and handled at the proposed Integrated Oilseed Processing Plant at Wagga Wagga, NSW. It is noted that all goods listed are either flammable/combustible liquids or corrosive liquids and will be stored and handled with reference to the Australian Standard AS1940-2004 (Ref.5) or AS3780 (Ref.10) respectively.

The detailed analysis below has been performed as a screening study to identify the major incidents that could occur at the site and determine whether any of these incidents has the potential to impact offsite (i.e. consequence analysis). This approach is commensurate with the methodology recommended in the Multi-Level Risk Assessment approach (Ref.3). The approach has been to review areas where initiating incidents could occur (e.g. minor fires) and then identify the worst case incident should the initiating incident fail to be controlled. The worst case incidents are then carried forward for consequence analysis where (for example) heat radiation impacts are assessed and compared to published criteria (Ref.4). Where no offsite impact is identified, the incident is not carried forward for further analysis. Where a worst case incident is identified to impact adjacent offsite areas, a more detailed review of specific incidents within the worst case incident envelope are assessed to ensure that should these incidents impact offsite areas the appropriate risk is addressed.

TABLE 5: HAZARDOUS NATURE OF MATERIALS

MATERIAL / QTY	HEALTH HAZARDS & PHYSICAL PROPERTIES	ENVIRONMENTAL HAZARDS	SAFEGUARDS
Combustible Liquid – Vegetable Oils (and other oils)	Class C2 - combustible liquids, with a flash point in excess of 300 deg C. Oils do not flash readily unless heated above 150 deg C, hence, at ambient temperature flash fires and pool fires are unlikely. (Note: In process temperatures may be elevated above flash point and hence behave as a flammable liquid)	Will burn if involve in a fire but not considered to be a significant fire risk. CO_2 and CO may form when heated to decomposition May contaminate groundwater if seeped into the soil	No ignition direct source allowed on site i.e. lighter, matchstick, open flame etc. Oil Spills will be collected within the primary oil storage pit or bund Comprehensive emergency plan and procedures provided for the site. MSDS held for all materials. Emergency Spill kits provided. Annual fire and evacuation training to be conducted.

Note: Further details of safety handling procedures and emergency response are provided in the Material Safety data Sheets (MSDS) – Appendix A.

Table 6 – General Hazard Identification Table and Selected MAE's

Facility / Event	Cause /	Possible Results / Consequence	Safeguards Employed
Road tanker loading bays / **Transfer hose failure, ignition and pool fire**	- Tanker impacts pipework adjacent to the bay - Tanker drive away whilst connected - Flexible hose failure (leak/rupture) - Operator error – incorrect connection of flexible hose (connection fails)	- Release of flammable/ combustible liquid into the loading bay - Potential spill and impact to the environment	- Loading bay area is bunded to contain spills ("speed-hump" style bund) - Road tanker unloading/loading operation is monitored by tanker drivers and plant operators during the full transfer operations - Delivery and despatch trucks are fitted with drive away protection to prevent drivers leaving the site whilst the truck is connected to the delivery/loading pipework (via the flexible hose) - Hoses are inspected and tested in accordance with the requirements of the ADG7 – Australian dangerous Goods Code #7 (Ref.12) - Pipework is installed behind protective bund walls to prevent truck impact on entering and leaving the bays
Liquid transfer via pipeline throughout the plant / **Pipeline leak & pool fire**	- Pipeline leak due to corrosion, overpressure, poor construction (welding), external interference	- Leak of liquid to environment - Ignition of leak and fire at leak point	- Pipeline will be fully welded steel along the full length (no flanges creating leak sources) - Pipeline will be non-destructively tested by hydrostatic pressure on completion of construction & prior to commissioning - Pipeline will be designed to withstand full pump "dead-head" with a conservative factor of safety (i.e. no rupture) - Pipelines will be installed above ground and will be fully visible for regular inspection

Tank Farm / **Tank fire**	- Overfill of tank during tank filling - Spill of flammable/ combustible liquid into the bund - Failure of level sensor - Failure of PLC and pump can't stop on high level	- Potential offsite release, environmental impact - Fire in worst-case if ignition source available on spilled material	- All flammable & combustible liquid storages are bunded, no offsite release - Tanks are monitored during filling using level instrumentation (level in tanks repeated in the site control room) - All tanks are fitted with high level instruments and alarms (audible & visual in the site control room) - Visual inspection and checking of tank/bund area is performed during the transfer/filling operation - No ignition source allowed inside factory i.e. lighter, matchstick, live flame etc.

Facility / Event	Cause /	Possible Results / Consequence	Safeguards Employed
Tank Farm / **Bund Fire**	- Overfill of tank during tank filling - Spill of flammable/ combustible liquid into the bund - Ignition and bund fire	- Potential on and offsite heat radiation impact to surrounding areas - Potential for fire growth into adjacent areas	- Fire main (complying with AS2419-Ref.8), fire pumps (complying with NFPA20 – Ref.15) and fire water tank / retention pond. - Fire hydrants and hose reels close to the storage - Foam generation equipment will be available at the site for use by the Fire Brigades - Fire contained to bund – bund capacity exceeds largest tank in bund (in accordance with the requirements of AS1940 – Ref.5) - Majority of materials on site are combustible liquids stored at ambient temperature (low ignition potential) - Control of ignition sources in the process area. Areas will be classified as a hazardous area in accordance with Australian Standards where oils behave as class 2 combustibles – e.g. AS2430 (Ref.6) & AS60079 (Ref.7) - All tanks will be regularly inspected for potential leaks and corrosion impact; in the unlikely event of water build up in the tanks it will be drained regularly to prevent internal corrosion potential. - Tank level monitoring will be conducted at all times to identify potential rapid tank level loss indicating potential leaks

5.2. CONSEQUENCE ANALYSIS

The following incidents were carried forward from the hazard identification phase of the study for consequence analysis:

Table 7 : Description of Event considered for analysis

Event #	Event	Description
1	RTkr Pool Fire	Flammable liquid leak at the delivery bay, ignition and pool fire in the bunded area of the delivery bay;
2	Tks 207 & CT51 Bund Fire	Full bund fire in the Vegetable oil liquids storage tank bunds T207 & CT51.

Each incident has been assessed in detailed in this section.

5.2.1 Road Tanker Loading/Unloading Fire

In the event of a release of flammable or combustible liquid during a transfer operation, the liquid would pool in the transfer area "bund" and if ignited would result in a pool fire in the containment bund / kerb. The distance to heat flux is provided in Table 8 below.

Table 8 summarises the results of the heat radiation impacts as a result of this incident. Appendix C – Heat Radiation Modelling, provides the method for heat flux computation at distance from the source.

TABLE 8 - Road Tanker Unloading Pool Fire

Plant	Area (m^2)	Pool Diameter	Distance (m) to Heat Flux kW/m^2			
			35	25	12.6	4.7
Road Tkr Unloading	75	13.60	12	15	22	35

The distance from the road tanker unloading area (oil) is around 65m, hence the heat flux at the boundary will be lower (estimated to be around 2 kW/m^2) than the max desirable heat flux of 4.7 kW/m^2.

5.2.2 Bund Fires

Combustible liquids i.e. vegetable oil is stored in tanks within bunded areas. In the event of a tank leak and release of combustible liquid the material would collect in the bund forming a pool.

In the event of an ignition, a pool fire would form, resulting in a full bund fire in the worst case. A detailed bund fire analysis for each of the tank farms has been conducted in **Appendix B**. **Table 9** summarizes the results of this analysis and **Figure 6** shows the heat radiation contours at 4.7 kW/m^2.

TABLE 9 - FULL BUND FIRES

Plant	Area (m^2)	Pool Diameter	Distance (m) to Heat Flux kW/m^2				Distance to Boundary (m)
			35	25	12.6	4.7	
Tanks 207 & CT51 Bund	162	19.23	17	20	31	52	120

Using the heat radiation criteria at the site boundary of 4.7 kW/m^2 (Ref.4), it can be seen from **Figure 6**, that a fire involving the entire tank bund (comprising tanks 207 & CT51) whilst of low probability results in excessive heat flux levels at the boundary.

5.3. Summary of Consequence Impact

The NSW Department of Planning (DOP) published heat radiation impact criteria in HIPAP No.4 (Ref.4). This document indicates that the maximum permissible level of heat radiation at the site boundary is 4.7 kW/m^2.

Further it can be seen from **Figure 6** that none of the postulated plant fire incidents exceed the 4.7 kW/m^2 criteria (provided the main bund for the oil tanks T207 & CT51 is provided with sub-bunds).

Event 1- Road Tkr Pool Fire Event 2 – Tanks ST207 & CT51 Bund Fire

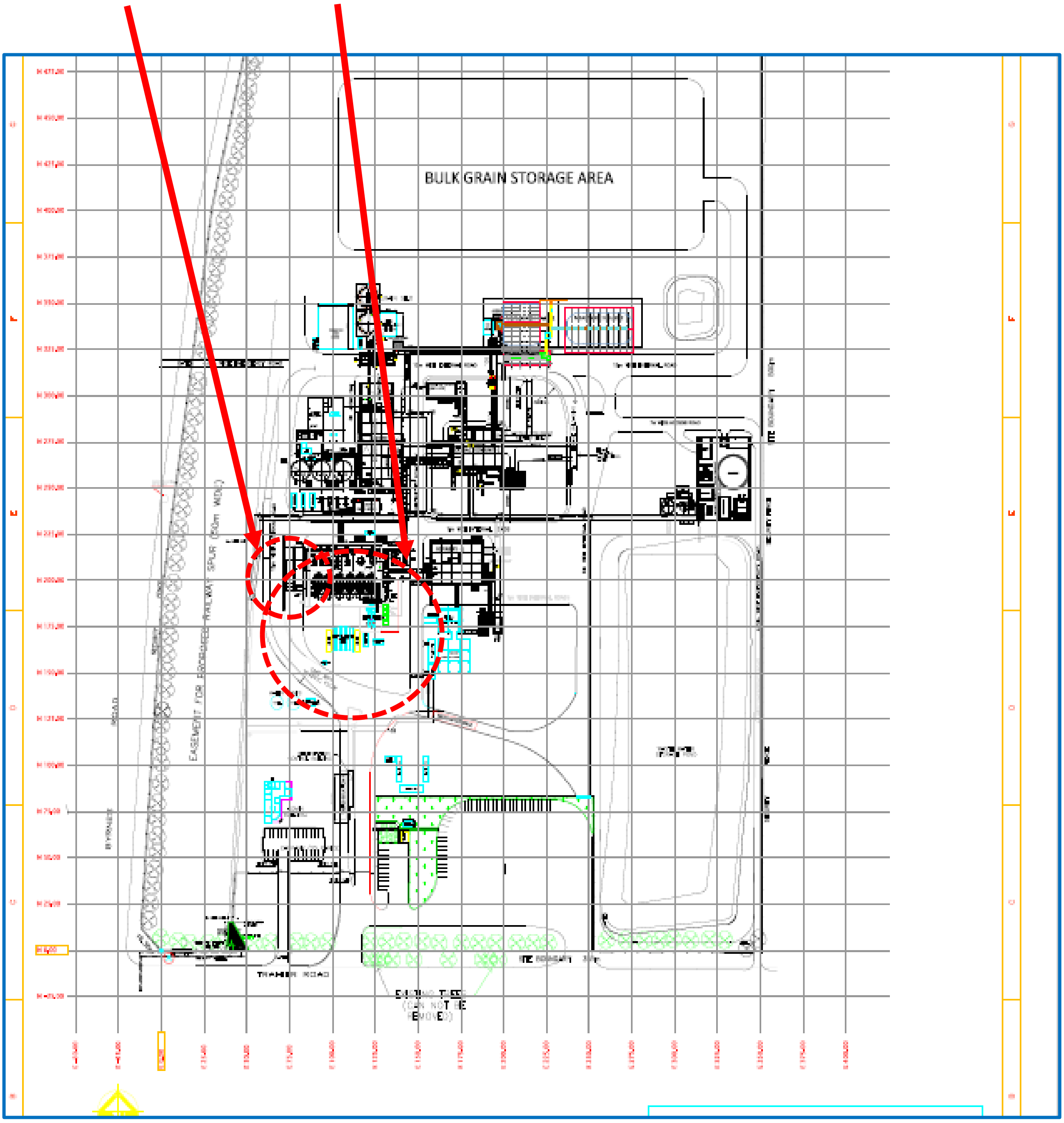


Figure 6 – Heat Radiation Contours (4.7 kW/m^2)

5.4. Frequency Analysis

Generalised Probability/Frequency data is given in Table 10 for the potential events considered most relevant to this analysis. The data is generally expressed on a per annum basis; the exception to this is road tanker unloading, which is expressed as 4 $\times 10^{-8}$ per hour. Based on truck movements and filling rates of around 300 litres/minute (20 m^3 / hr) it is estimated that transfer operations amount to 528 hrs/yr/hose; hence the failure rate/yr is estimated to be 2.1 x 10^{-5}/yr.

The reference sources for all data used are also given in the table.

TABLE 10 - GENERALISED PROBABILITY DATA

Event	Item	Failure Possibility	Reference
Bund Fires	Storage Road Tanker Area (hose failure)	4.2 x 10^{-6}/yr 4 x 10^{-8}/hr	Covo Study Covo Study
Tank Fires	Bulk Liquid Tanks Floating Roof Fixed Roof	1.4 x 10^{-6}/yr 1.4 x 10^{-5}/yr	R. Montano
Centrifugal Pumps	Casing failure Shaft failure Seal failure	3.8 x 10^{-6}/yr 1 x 10^{-4}/yr 1 x 10^{-2}/yr	USAEC

5.5. Risk Analysis

The risk assessment now requires we combine the event frequencies and consequence distances (effects) and provide the risk levels at the boundary of the site. The land use safety implications for the proposed development are summarised in Table
11 – Overall Risk Evaluation.

The table summarises the events, event probability, probability of fatality, and risk levels at the boundary. The parameters as provided in the table are defined as follows:

Event – the event is taken from the risk identification table, and is comprised of an office fire

Base Frequency x 10^{-6} – is the failure frequency of each event

PF (E) – is the probability of fatality to a person on the boundary from the event. Due to the fact that those external to the office would take shelter or emergency action the probability of fatality is estimated at less than 1.0. For the purpose of this study, the following probability of fatalities are estimated (for detailed computations refer to Appendix D - Probit Computations);

- Event 2 – PF(E) = 0

Risk x 10^{-6} – is the product of the frequency x probability of injury/fatality and is defined as the risk of exposure from the event.

Fatality Injury – is the hazard distance to fatality from the fire, in this case typically deemed to be the distance to 4.7 kW/m^2,

CF-Risk – is the cumulative addition of the individual risk results.

TABLE 11 - OVERALL RISK EVALUATION

EVENT # / Item	Base Freq (x 10^{-6} per annum)	Pf(E)	Individual Risk x 10^{-6} At Boundary adjacent to Byrnes Rd	Effect Zone / Fatality Radius
1. Road Tkr Pool fire	21	0	0	35
2. Tanks ST207 & CT51 Bund fire	4	0	0	52
TOTAL RISK LEVEL at BOUNDARY			**0**	

The risk levels expected at the boundary of the site are around 4 x 10^{-6} pa. Such risk levels are considered acceptable (Ref: NSW DEPT. OF PLANNING Risk Criteria at Boundary of site = 50 x 10^{-6} p.a. for industrial land use) under the NSW Department of Planning guidelines.

6. Fire Prevention and Protection Measures

6.1.1. Process Safeguards Provided

A number of safety features have been installed at the site to minimise the potential for impact as a result of incidents or to manage or mitigate incident impacts. These are summarised below.

- **Spillage Containment –** Both storage tanks area will be constructed with spillage containment. Tank storages will comply with the spill containment requirements of AS1940 (Ref.5). Process areas will be designed, as a minimum, to contain spillage from the largest process vessel in the plant around which the bund is constructed.
- **Ignition Control –** Both tanks containing combustible liquids i.e. vegetable oil will be blanketed with nitrogen (inert atmosphere) to prevent the potential for flammable vapour build up in the tanks. In addition, both tanks will be designed in accordance with the relevant Hazardous Area Classification as required in AS2430 (Ref.6) or AS60079 (Ref.7).

6.1.2. Fire Protection Systems

- **First Attack Fire Protection –** fire extinguishers will be provided near tankfarm in accordance with the various Dangerous Goods storage standards and AS2444 (Ref.9). Fire hose reels will be provided in accordance with the requirements of the various Australian Standards (e.g. AS1940, Ref.5) and AS2441 (Ref.16).

- **Fire Main –** the site will be fitted with a fire main, installed in accordance with the requirements of AS2419 (Ref.8). The fire main will be fitted with hydrants, located throughout the site.
- **Fire Water Supply –** fire water will be supplied from a fire water tank capable of supplying a minimum of four hours fire water (in compliance with AS2419, Clause 4.2). The water will be supplied by one electrically driven pump and one diesel engine driven pump. The fire main will be maintained at a pressure of 1000 kPa by a jockey pump.

RIVERINA OILS

6.1.3. Containment of Fire Water and runoff

In the event that a fire does occurs at the site, there will be a need to apply a fire extinguishing medium, such as dry powder from extinguishers or water from fire hose reels or hoses, and those systems previously described to extinguish the fire.

In the event of relatively small fires in the process or storage areas, a fire extinguisher or hose reel (with foam attachment) will be adequate to control the fire. ROBE have foam generation attachment for the fire hoses (one for each plant area where flammable & combustible liquids are stored and handled) and maintained a storage of at least 20 L of foam concentrate adjacent to the locations where a foam generating attachment is held. However, in the event of a fully developed fire, in any of the plants and storages, it will be necessary for the Fire Brigade to apply foam or water, via hoses, to control the fire. In this event, there is a potential for the applied water to become contaminated with the leaked products. Should the contaminated water escape the site, there is a potential for an environmental incident outside the site boundary.

The quantity of fire water to be retained on site is estimated by calculating the number of fire hoses used to fight the fire (e.g. the water flow onto the fire) and the time required to extinguish the fire. Using Table 2.1 from AS2419-2005 (Ref.8), the recommended fire hydrant requirements for fighting fires in structures/buildings at the site is two (2) (which is based on the floor area of the largest plant at the site). For open yards, Table 3.3 of AS2419 (Ref.8) is used and the number of hydrants required is THREE (3), also based on the yard area. Table 2.2 of AS2419 lists the flow rate of fire hoses as 10 L per second or 600 L per minute. Using this flow rate and the recommended maximum number of hoses (3), the total flow rate applied to a fire in the Integrated Oilseed Processing Plant is 3 x 600 = 1,800 L/minute.

The NSW Government's Best Practice Guidelines for Contaminated Water Retention and Treatment Systems, requires 90 minutes of fire water to be retained on site. Hence, for a fire water application rate of 1,800 L per minute for 90 minutes, the total fire water required for retention on site is 1.8 m^3 x 90 = 162 m^3.

AS per SKM recommendation in previous PHE report, ROBE has constructed Storm water pond having at least 162 m^3 of freeboard capacity. In case of fire in tank farm all water will be collected in tank farm and we can either take that water to WWTP or divert to evaporation pond or we can dispose it outside based on their characteristics. Some fire combatant water will make its way to storm water where again we can analyses the water and decide to treat that water at our WWTP.

7. Conclusions and Recommendations

7.1. Conclusions

A review of Hazardous Industry Planning Advisory paper No.4, Risk Criteria for Land Use Safety Planning (Ref.4), indicates that heat radiation from fires at potentially hazardous facilities should not exceed 4.7kW/m^2. Comparing the distance to heat radiation impacts from postulated worst-case incidents at each of the hazardous areas at the proposed Integrated Oilseed Processing Plant, shows that none of the incidents exceed the level of 4.7kW/m^2 beyond the site boundary.

Risk levels are computed at the nearest site boundary (along Byrnes Rd) to the tank farm and processing units.

The risk levels expected at the boundary of the site are around 4 x 10^{-6} pa. Such risk levels are considered acceptable (Ref: NSW DEPT. OF PLANNING Risk Criteria at Boundary of site = 50 x 10^{-6} p.a. for industrial land use) under the NSW Department of Planning guidelines (Reference 1).

It is therefore concluded that the risk criteria levels at the boundary of the site do not exceed the risk criteria published by the NSW Department of Planning (Ref.4). And further, the ROBE plant, as proposed, is not considered potentially hazardous or offensive and is therefore permissible within the current land zoning.

7.2. Recommendations

Notwithstanding the above analysis, a number of recommendations were made in order to enhance the safety systems at the site and ensure the risks are maintained as low as reasonably practicable (ALARP). The following recommendations are made:

1. **Foam Stocks** - The most appropriate fire fighting medium for flammable and combustible liquids is foam. It is therefore recommended that ROBE obtain a foam generation attachment for the fire hoses and maintain a storage of at least 20 L of foam concentrate adjacent to the location where a foam generating attachment is held.

8. REFERENCES

1. "Applying SEPP33-Hazardous and Offensive Development Application Guidelines", NSW Department of Planning (Jan 2011).

2. Hazardous Industry Planning Advisory Paper No.6, Guidelines for Hazard Analysis", NSW Department of Planning (Jan 2011).

3. Multi-Level Risk Assessment, Department of Planning and Infrastructure (May 2011).

4. Hazardous Industry Planning Advisory Paper No.4, Risk Criteria for Land Use Safety Planning (Jan 2011).

5. AS1940-2017, "The storage and handling of flammable and combustible liquids", Standards Association of Australia, Sydney.

6. AS2430-2004, "Classification of Hazardous Areas (various Parts)", Standards Association of Australia, Sydney.

7. AS60079-Electrical apparatus for explosive gas atmospheres - Part 10: Classification of Hazardous Areas (IEC 60079-10:2002 MOD), Standards Association of Australia, Sydney.

8. AS2419-2017,"Fire Hydrant Installations – Part 1: System design, installation and commissioning", Standards Association of Australia, Sydney.

9. The Australian Code for the Transport of Dangerous Goods by Road and Rail (known as the Australian Dangerous Goods Code or ADG), 7th ed., National Transport Commission, Canberra, 2007.

10. AS3780-2008, "The storage and handling of corrosive substances", Standards Association of Australia, Sydney.

11. NFPA68-2018, "Guide for the Venting of Deflagrations", National Fire Protection Association, Quincy, Ma, USA.

12. Lees, F.P. (1996), "Loss Prevention in the Process Industries", Butterworth-Heinemann, London.

13. Tweeddale, H.M. (1993), "Hazard Analysis and Reduction", University of Sydney, School of Chemical Engineering.

14. The Australian Dangerous Goods Code Edition 7.5

15. NFPA20, "Standard for the installation of stationary pumps for Fire Protection".

16. AS2441-2005, "Installation of Fire Hose reel".

APPENDIX A (Annexure 2) – Material Safety Data Sheets

1. Canola Oil – Please refer annexure 2a
2. Blended Oil - Please refer annexure 2b

APPENDIX B – Heat Flux Computation Methods

POOL FIRE CALCULATIONS

Program Functions

1. For a given set of heat fluxes received, calculates the distance from the flame to the receiver.
2. Calculates the heat flux received at a given distance from the flame.

Calculation Methods

1. Inverse Square and API methods
   - They can be used to calculate the direct distance from the flame centre to the receiver r2 (m)
   - They do not allow for attentuation effects
2. View Factor ICI method
   - This can be used to calculate the horizontal distance from the flame centre to receiver R (m)
   - Includes correlations for effect of attentuation** (in the form of transmissivity T) of the base of the pool and the receiver
   - If R < 30m, then attentuation is negligible & T = 1 (This gives a conservative estimate of the heat radiated)
   - If 30m <= R <= 200m, then the Lihou & Maund correlation (depends only on R) is used
   - If R > 200m, go to inputs of % relative humidity & the ambient temperature to account for the effect of water vapour

**NOTE: If attentuation is significant, the distance R can be recalculated in the spreadsheet by replacing the initial values of T (cells I42-I45) by those of T(cells G42-G45)

Assumption

Flame height = 2 times the pool diameter

Calculations

Calculation of the surface flux q1 from the pool fire (kW/m^2)

Pool diameter (D)	30	m
Burning rate of fuel (r)	4	mm/min
Fuel density (p)	850	kg/m^3
Proportion of heat radiated to surrounds (n)	0.3	
Heat of combustion of fuel (Hc)	40	MJ/kg
Heat radiated per unit area of flame (q1)	**85**	**kW/m^2**

<u>Calculation of water vapour partial pressure Pw</u>

% relative humidity	70	
Ambient temperature	30	deg C
Water vapour partial pressure Pw	**2959.22**	

DISTANCE FROM THE FLAME TO HEAT FLUX q2 AT THE RECEIVER

Flux q2 (kW/m^2)	Direct distance to q2		Horizontal distance to q2		Initial T values	View Factor f	R/x1	Slope a	Y-intercept b	Mean Dist
	API	Inverse Square	ICI View Factor	Calculated Attenuation						
40	30.92	21.87	19.75	1.00	1	0.4706	1.3165	-1.2297	-0.1805	24.17904143
35	33.06	23.38	22.01	1.00	1	0.4118	1.4675	-1.2297	-0.1805	26.14903489
30	35.71	25.25	24.95	1.00	1	0.3529	1.6635	-1.2297	-0.1805	28.63622715
25	39.12	27.66	28.94	1.00	1	0.2941	1.9294	-1.2297	-0.1805	31.9048616
20	43.73	30.92	34.70	0.98	1	0.2353	2.3133	-1.2297	-0.1805	36.45148985
12.6	55.10	38.96	50.52	0.97	1	0.1482	3.3682	-1.2297	-0.1805	48.19356182
9	65.19	46.10	64.88	0.96	1	0.1059	4.3255	-1.6005	0.0428	58.7240912
5	87.46	61.85	93.67	0.94	1	0.0588	6.2450	-1.6005	0.0428	80.99525377
2	138.29	97.79	148.44	0.90	1	0.0235	9.8960	-2.117	0.479	128.1737759

APPENDIX C –Probit Computations

Probit Equations

Probability Estimates[1] (probits) are used to calculate the percentage of an exposed population that will suffer a certain type of consequence from a given magnitude of an adverse effect. They can be used to estimate the consequences of toxic exposures, thermal radiation from fires and overpressure from explosions.

In mathematical terms probit is a straight line probability relationship developed to measure, for example, killing a certain proportion of the population, expressed as a standard deviation and related to a mean of 5. It has the advantage of being easily used without deep understanding of the underlying theory, provided suitable data is available.

Probit equations have the form

$$Y = k_1 + k_2 \ln V$$

Where Y is the probit, which is related to the percentage of the population suffering the set consequence. k_1 and k_2 are constants which are determined from historical data and V is the magnitude of the effect, for example the overpressure or thermal dose.

For fires and explosions the following vales of the constants are suggested[2]

Injury	Causative variable V	Probit equation constants	
		k_1	k_2
Burn deaths from pool fire	$tI^{4/3}/10^4$	-14.9	2.56
Explosions			
Death from lung haemorrhage	p^o	-77.1	6.91
Death from impact (see below)	p^o	-46.1	4.82
Eardrum rupture	p^o	-15.6	1.93

I is the intensity of radiation (W/m^2), t is the exposure time (s), p^o is the peak over pressure (N/m^2).

These are not definitive parameters, different values are used for the constants, depending on the original data used to determine them. Care should be taken to select appropriate probit equations from those available in the literature.

In this instance we are concerned with the heat radiation from seed oil, or combustible liquids pool fire.

Therefore we select the probit , $y = -14.9 + 2.56 \ln (t \times i^{4/3} / 10^4)$

The various PF(E) values are computed as

follows; Event 2 –

If we take heat flux received at the boundary from a potential bund fire (Road Tkr unloading) about 65 metres from the pool fire , the resultant heat flux (i) is around 2 kW/m^2 or 2,000 W / m^2 and we take the heat received as 5 minutes (as people would tend to move away from the intense heat) , i.e. t = 300 seconds.

Then Y = -14.9 + 2.56 ln (300 x (2000) 4/3 / 10,000) = 6.6 - 14.9 = 0

From the Probit ,

Transformation of percentages into probits, %

%	0	1	2	3	4	5	6	7	8	9
0	-	2.67	2.95	3.12	3.25	3.36	3.45	3.52	3.59	3.66
10	3.72	3.77	3.82	3.87	3.92	3.96	4.01	4.05	4.08	4.12
20	4.16	4.19	4.23	4.26	4.29	4.33	4.36	4.39	4.42	4.45
30	4.48	4.50	4.53	4.56	4.59	4.61	4.64	4.67	4.69	4.72
40	4.75	4.77	4.80	4.82	4.85	4.87	4.90	4.92	4.95	4.97
50	5.00	5.03	5.05	5.08	5.10	5.13	5.15	5.18	5.20	5.23
60	5.25	5.28	5.31	5.33	5.36	5.39	5.41	5.44	5.47	5.50
70	5.52	5.55	5.58	5.61	5.64	5.67	5.71	5.74	5.77	5.81
80	5.84	5.88	5.92	5.95	5.99	6.04	6.08	6.13	6.18	6.23
90	6.28	6.34	6.41	6.48	6.55	6.64	6.75	6.88	7.05	7.33