SCREENING MAJOR HAZARD INSTALLATION RISK ASSESSMENT OF THE PROPOSED SQUARE KILOMETER ARRAY SITE COMPLEX NEAR CARNARVON, NORTHERN CAPE

Author: M P Oberholzer
Date of Issue: 7th of August 2016
Report No.: R/16/CSIR-01 Rev 1
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<td>Initial release</td>
<td>21 May 2016</td>
<td>0</td>
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<tr>
<td>5.2/vii</td>
<td>Updated</td>
<td>7 Aug 2016</td>
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- RISCOM does not have any shareholding in processing companies nor companies performing risk assessment functions;
- RISCOM does not design equipment or processes.

Mike Oberholzer is a professional engineer, holds a Bachelor of Science in Chemical Engineering and is an approved signatory for MHI risk assessments, thereby meeting the competency requirements of SANAS for assessment of the risks of hazardous components, including fires, explosions and toxic releases.

M P Oberholzer Pr. Eng. BSc (Chem. Eng.) MIChemE MSAIChE

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EXECUTIVE SUMMARY

1 INTRODUCTION

The Square Kilometre Array (hereinafter referred to as SKA) requires diesel storage tanks a backup fuel supply for the site complex near Carnarvon.

Since off-site incidents may result due to hazards of some of the chemical components to be stored on, produced at or delivered to site, RISCOM (PTY) LTD was commissioned to conduct a screening risk assessment to determine if a Major Hazard Risk assessment (MHI) would be required in terms of the MHI regulations.

1.1 Terms of Reference

The main aim of the investigation was to determine if the proposed SKA facility in Carnarvon, would require a MHI risk assessment in accordance to the legislation.

The scope of the risk assessment included:

Assess if any materials to be stored on site would be classifies as notifiable, Development of accidental spill and fire scenarios for the facility;

- For each incident developed in Step 1, determination of consequences (such as thermal radiation, domino effects, toxic-cloud formation and so forth) for the 1% fatality;
- Should the 1% fatality, determined in step 2, extend beyond the site boundary, under worst meteorological circumstances, the facility has potential to be classified as a MHI and a full MHI risk assessment would be triggered.

Purpose and Main Activities

The main activity at the SKA facility near Carnarvon is the operation centre of the radio telescope operation as well at recording of information. The diesel stored on site would be used to generate electricity, in the event of power loss from Eskom.

1.2 Main Hazards Due to Substance and Process

The main hazards that would occur with a loss of containment of hazardous components at the proposed SKA facility near Carnarvon include exposure to thermal radiation from fires.
2 ENVIRONMENT

The SKA site complex is located on the Meysdam farm, approximately 80 km north west of Carnarvon, as shown in Figure 2-1.

![Figure 2-1: Location of the proposed SKA facility near Carnarvon (Courtesy SKA)](image)

The site complex is located in an arid area with no residential (informal or formal) areas outside of the complex for some distance.
3 PROCESS DESCRIPTION

3.1 Site

The proposed SKA facility near Carnarvon would consist of storage vessels, offices, workshops, warehouses and hazardous chemical installations, as shown in Figure 3-1.

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</tr>
<tr>
<td>7</td>
<td>Future Diesel Storage</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 3-1: Site layout
3.2 Process Description

The current diesel tank farm consists of 3 x 23 000 ℓ above ground tanks inside a bunded area intended to catch hydrocarbon spillages from the storage tanks and auxiliary equipment, as shown in Figure 3-2.

Diesel would be delivered to site by road tanker and offloaded into the dirty tank. Diesel from the dirty tank is then sent through a water trap and filter and stored in the clean tank (2 off). Each clean tank has a filtration unit which further removes particles to the desired specification. Diesel from the clean tanks can either be used to fill vehicles or sent to the emergency generators, when required.

Five electrical generators are located inside the plant room. Each generator has a 1 000 ℓ head tank that would be filled from one of the diesel clean tanks, on demand.

Overfill protection on the bulk diesel tanks as well as the generator head tanks has been provided to prevent overfilling.

No evidence of spill containment for offloading tankers or loading vehicles has been provided. SKA should satisfy themselves that no hydrocarbons could enter the ground in violation of environmental legislation.

Figure 3-2: Diesel tank farm layout

A future expansion of the tank farm is being contemplated and would consist of an additional 5 x 23 000 ℓ storage tanks with the same ancillary equipment e.g. pumps and filters.
3.3 Summary of Bulk Materials to be Stored on Site

A summary of bulk materials that can give hazardous effects that are to be stored on site is given in Table 3-1.

Table 3-1: Summary of hazardous components to be stored on site

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<td>Current</td>
<td>Diesel</td>
<td>68334-30-5</td>
<td>3 x 23 m³</td>
</tr>
<tr>
<td>Future</td>
<td>Diesel</td>
<td>68334-30-5</td>
<td>8 x 23 m³ (Total after project completion)</td>
</tr>
</tbody>
</table>
4 METHODOLOGY

The first step in any risk assessment is to identify all hazards. The merit of including a hazard for further investigation is then determined by how significant it is, normally by using a cut-off or threshold value.

Once a hazard has been identified, it is necessary to assess it in terms of the risk it presents to the employees and the neighbouring community. In principle, both probability and consequence should be considered, but there are occasions where, if either the probability or the consequence can be shown to be sufficiently low or sufficiently high, decisions can be made based on just one factor.

During the hazard identification component of the report, the following considerations are taken into account:

- Chemical identities;
- Location of on-site installations that use, produce, process, transport or store hazardous components;
- Type and design of containers, vessels or pipelines;
- Quantity of material that could be involved in an airborne release;
- Nature of the hazard most likely to accompany hazardous materials spills or releases, e.g. airborne toxic vapours or mists, fires or explosions, large quantities to be stored and certain handling conditions of processed components.

The evaluation methodology assumes that the facility will perform as designed in the absence of unintended events such as component and material failures of equipment, human errors, external events and process unknowns.

Due to the absence of South African legislation regarding determination methodology for quantitative risk assessment (QRA), the methodology of this assessment is based on the legal requirements of the Netherlands, outlined in CPR 18E (Purple Book; 1999) and RIVM (2009). The evaluation of the acceptability of the risks is done in accordance with the UK Health and Safety Executive (HSE) ALARP criteria that clearly cover land use, based on determined risks.

Scenarios included in this study was assessed for potential impacts external to the establishment. The 1% fatality from acute affects (thermal radiation, blast overpressure and toxic exposure) was determined as the endpoint (RIVM 2009). Thus, a scenario producing a fatality of more than 1% at the establishment boundary, under worst-case meteorological conditions, would trigger a MHI study in accordance to legislation.
5  CONCLUSIONS

Risk calculations are not precise. Accuracy of predictions is determined by the quality of base data and expert judgements.

This risk assessment included the consequences of fires from releases at the proposed SKA facility in Carnarvon. A number of well-known sources of incident data were consulted and applied to determine the likelihood of an incident to occur.

5.1  Notifiable Substances

The General Machinery Regulation 8 and its Schedule A on notifiable substances requires any employer who has a substance equal to or exceeding the quantity listed in the regulation to notify the divisional director. A site is classified as a Major Hazard Installation if it contains one or more notifiable substances or if the off-site risk is sufficiently high. The latter can only be determined from a quantitative risk assessment.

No material to be stored on site is listed as notifiable.

5.2  Fires

Pool fires, from a loss of containment at the storage and offloading installations of diesel and subsequent fires were simulated for both the current facility and planned future diesel storage.

The 1% fatality for diesel would not extend beyond the site boundary that could involve people in a major incident. As the health of the public would not be affected, the Scope of Application of the Major Hazard Installation Regulations would not apply and the facility would not be considered a major hazardous installation.
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1 INTRODUCTION

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Since off-site incidents may result due to hazards of some of the chemical components to be stored on, produced at or delivered to site, RISCOM (PTY) LTD was commissioned to conduct a screening risk assessment to determine if a Major Hazard Risk assessment (MHI) would be required in terms of the MHI regulations.

1.1 Legislation

Major Hazard Installations (“MHI”) Regulations, GNR 692 published on 30 July 2001 in terms of the section 43 (1) (c) of the Occupational Health and Safety Act, 85 of 1993, as amended (“OHSA”) is the applicable legislation in the determination of a MHI.

Section 1 of the OHSA states that a:

"major hazard installation" means an installation

(a) where more than the prescribed quantity of any substance is or may be kept, whether permanently or temporarily; or

(b) where any substance is produced, processed, used, handled or stored in such a form and quantity that it has the potential to cause a major incident;

It should be noted that if either (a) or (b) is satisfied, the Regulations will apply.

In accordance with legislation, the risk assessment must be done by an approved inspection authority (AIA), which is registered with the Department of Labour and accredited by the South African Accreditation Systems (SANAS). Copies of relevant certificates are given in Appendix A and Appendix B.
1.2 Terms of Reference

The main aim of the investigation was to determine if the proposed SKA facility in Carnarvon, would require a MHI risk assessment in accordance to the legislation.

The scope of the risk assessment included:

1. Assess if any materials to be stored on site would be classified as notifiable,
2. Development of accidental spill and fire scenarios for the facility;
3. For each incident developed in Step 1, determination of consequences (such as thermal radiation, domino effects, toxic-cloud formation and so forth) for the 1% fatality;
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1.3 Purpose and Main Activities

The main activity at the SKA facility near Carnarvon is the operation centre of the radio telescope operation as well as recording of information. The diesel stored on site would be used to generate electricity, in the event of power loss from Eskom.

1.4 Main Hazards Due to Substance and Process

The main hazards that would occur with a loss of containment of hazardous components at the proposed SKA facility near Carnarvon include exposure to thermal radiation from fires.

1.5 Software

Physical consequences were calculated with DNV’s PHAST v. 6.7. All calculations were performed by Mr M P Oberholzer.
2 ENVIRONMENT

2.1 General Background

The SKA site complex is located on the Meysdam farm, approximately 80 km north west of Carnarvon, as shown in Figure 2-1.

![Image of the SKA site complex location](image-url)

Figure 2-1: Location of the proposed SKA facility near Carnarvon (Courtesy SKA)

The site complex is located in an arid area with no residential (informal or formal) areas outside of the complex for some distance.
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Figure 3-1: Site layout
3.2 Process Description – Diesel Storage

The current diesel tank farm consists of 3 x 23 000 ℓ above ground tanks inside a bunded area intended to catch hydrocarbon spillages from the storage tanks and auxiliary equipment, as shown in Figure 3-2.

Diesel would be delivered to site by road tanker and offloaded into the dirty tank. Diesel from the dirty tank is then sent through a water trap and filter and stored in the clean tank (2 off). Each clean tank has a filtration unit which further removes particles to the desired specification. Diesel from the clean tanks can either be used to fill vehicles or sent to the emergency generators, when required.

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Overfill protection on the bulk diesel tanks as well as the generator head tanks has been provided to prevent overfilling.

No evidence of spill containment for offloading tankers or loading vehicles has been provided. SKA should satisfy themselves that no hydrocarbons could enter the ground in violation of environmental legislation.

Figure 3-2: Diesel tank farm layout

A future expansion of the tank farm is being contemplated and would consist of an additional 5 x 23 000 ℓ storage tanks with the same ancillary equipment e.g. pumps and filters.
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- Chemical identities;
- Location of on-site installations that use, produce, process, transport or store hazardous components;
- Type and design of containers, vessels or pipelines;
- Quantity of material that could be involved in an airborne release;
- Nature of the hazard most likely to accompany hazardous materials spills or releases, e.g. airborne toxic vapours or mists, fires or explosions, large quantities to be stored and certain handling conditions of processed components.

The evaluation methodology assumes that the facility will perform as designed in absence of unintended events, such as component and material failures of equipment, human errors, external events and process unknowns.

4.1 Notifiable Substances

The General Machinery Regulation 8 and its Schedule A on notifiable substances requires any employer who has a substance equal to or exceeding the quantity listed in the regulation to notify the divisional director. A site is classified as a Major Hazard Installation if it contains one or more notifiable substances or if the off-site risk is sufficiently high. The latter can only be determined from a quantitative risk assessment.

No material to be stored on site is listed as notifiable.
4.2 Substance Hazards

All components on site were assessed for potential hazards according to the criteria discussed in this section.

4.2.1 Chemical Properties

A short description of bulk hazardous components to be stored on, produced at or delivered to site is given in the following subsections

- Diesel

Diesel is a hydrocarbon mixture with variable composition with a boiling-point range of between 252 and 371°C. It is a pale yellow liquid with a petroleum odour. Due to the flash point of diesel between 38 and 65°C, this material is not considered highly flammable but will readily ignite under suitable conditions.

Diesel is stable under normal conditions. It will react with strong oxidising agents and nitrate compounds. This reaction may cause fires and explosions.

Diesel is not considered a toxic material. Contact with vapours may result in slight irritation to nose, eyes and skin. Vapours may cause headache; dizziness; loss of consciousness or suffocation; lung irritation with coughing; gagging; dyspnoea; substernal distress and rapidly developing pulmonary oedema.

If swallowed, diesel may cause nausea or vomiting, swelling of the abdomen, headache, CNS depression, coma and death.

The long-term effects of diesel exposure have not been determined. However, this may affect the lungs and may cause the skin to dry out and become cracked.

Diesel floats on water and can result in environmental hazards with large spills into waterways. It is harmful to aquatic life in high concentrations.

4.2.2 Corrosive Liquids

Corrosive liquids considered under this subsection are those components that have a low or high pH and that may cause burns if they come into contact with people or may attack and cause failure of equipment.

Diesel is not considered corrosive.

4.2.3 Reactive Components

Reactive components are components that when mixed or exposed to one another react in a way that may cause a fire, explosion or release a toxic component.

Diesel is considered thermally stable in atmospheric conditions.
4.2.4 Flammable and Combustible Components

Flammable and combustible components are those that can ignite and give a number of hazardous effects, depending on the nature of the component and conditions. These effects may include pool fires, jet fires and flash fires as well as explosions and fireballs.

The flammable and combustible components to be stored on site are listed in Table 4-1. These components have been analysed for fire and explosion risks.

Table 4-1: Flammable and combustible components stored on site

<table>
<thead>
<tr>
<th>Compound</th>
<th>Flash Point (°C)</th>
<th>Boiling Point (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel</td>
<td>&gt; 55</td>
<td>290</td>
</tr>
</tbody>
</table>

4.2.5 Toxic and Asphyxiating Components

Toxic or asphyxiating components of interest to this study are those that could produce dispersing vapour clouds upon release into the atmosphere. These could then cause harm through inhalation or absorption through the skin. Typically, the hazard posed by toxic or asphyxiating components will depend on both concentration of the component in the air and the exposure duration.

No bulk components stored on, produced at or delivered to site are considered acutely toxic or asphyxiating.

4.3 Physical Properties

For this study, petrochemical components were modelled as a pure component, as given in Table 4-2. The physical properties used in the simulations were based on the DIPPR1 data base.

Table 4-2: Representative components

<table>
<thead>
<tr>
<th>Component</th>
<th>Modelled as</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diesel</td>
<td>n-Dodecane</td>
</tr>
</tbody>
</table>

1 Design Institute for Physical Properties
5 PHYSICAL AND CONSEQUENCE MODELLING

In order to establish which impacts follow an accident, it is first necessary to estimate the physical process of the spill (i.e. rate and size), spreading of the spill, evaporation from the spill, subsequent atmospheric dispersion of the airborne cloud and, in the case of ignition, the burning rate and resulting thermal radiation from a fire and the overpressures from an explosion.

The second step is then to estimate the consequences of a release on humans, fauna, flora and structures in terms of the significance and extent of the impact in the event of a release. The consequences could be due to toxic or asphyxiating vapours, thermal radiation or explosion overpressures. They may be described in various formats.

The simplest methodology would show a comparison of predicted concentrations, thermal radiation or overpressures to short-term guideline values.

In a different but more realistic fashion, the consequences may be determined by using a dose-response analysis. Dose-response analysis aims to relate the intensity of the phenomenon that constitutes a hazard to the degree of injury or damage that it can cause. Probit analysis is possibly the method mostly used to estimate probability of death, hospitalisation or structural damage. The probit is a lognormal distribution and represents a measure of the percentage of the vulnerable resource that sustains injury or damage. The probability of injury or death (i.e. the risk level) is in turn estimated from this probit (risk characterisation).

Consequence modelling gives an indication of the extent of the impact for selected events and is used primarily for emergency planning. A consequence that would not cause irreversible injuries would be considered insignificant, and no further analysis would be required. The effects from major incidents are summarised in the following subsections.
5.1 Fires

Combustible and flammable components within their flammable limits may ignite and burn if exposed to an ignition source of sufficient energy. On process plants releases with ignition normally occur as a result of a leakage or spillage. Depending on the physical properties of the component and the operating parameters, combustion may take on a number of forms, such as pool fires, jet fires, flash fires and so forth.

5.1.1 Thermal Radiation

The effect of thermal radiation is very dependent on the type of fire and duration of exposure. Certain codes, such as the American Petroleum Institute API 520 and API 2000 codes, suggest values for the maximum heat absorbed by vessels to facilitate adequate relief designs in order to prevent failure of the vessel. Other codes, such as API 510 and the British Standards BS 5980 code, give guidelines for the maximum thermal radiation intensity and act as a guide to equipment layout, as shown in Table 5-1.

The effect of thermal radiation on human health has been widely studied, relating injuries to the time and intensity of exposure.

Table 5-1: Thermal radiation guidelines (BS 5980 of 1990)

<table>
<thead>
<tr>
<th>Thermal Radiation Intensity (kW/m²)</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5</td>
<td>Will cause no discomfort for long exposure</td>
</tr>
<tr>
<td>2.1</td>
<td>Sufficient to cause pain if unable to reach cover within 40 seconds</td>
</tr>
<tr>
<td>4.5</td>
<td>Sufficient to cause pain if unable to reach cover within 20 seconds</td>
</tr>
<tr>
<td>12.5</td>
<td>Minimum energy required for piloted ignition of wood and melting of plastic tubing</td>
</tr>
<tr>
<td>25</td>
<td>Minimum energy required to ignite wood at indefinitely long exposures</td>
</tr>
<tr>
<td>37.5</td>
<td>Sufficient to cause serious damage to process equipment</td>
</tr>
</tbody>
</table>

CPR 18E (Purple Book; 1999) gives 10 kW/m², the level that represents the 1% fatality for 20 seconds of unprotected exposure and at which plastic and wood may start to burn, transferring the fire to other areas;
5.1.2 Bund and Pool Fires

Pool fires, either tank or bund fires, consist of large volumes of a flammable liquid component burning in an open space at atmospheric pressure.

The flammable component will be consumed at the burning rate, depending on factors including prevailing winds. During combustion heat will be released in the form of thermal radiation. Temperatures close to the flame centre will be high but will reduce rapidly to tolerable temperatures over a relatively short distance. Any building or persons close to the fire or within the intolerable zone will experience burn damage with severity depending on the distance from the fire and time exposed to the heat of the fire.

In the event of a pool fire, the flames will tilt according to the wind speed and direction. The flame length and tilt angle affect the distance of thermal radiation generated.

- Current Facility

The current facility consists of 3 x 23 000 ℓ diesel storage tanks and an offloading point. A loss of containment diesel could be either in the bunded area or the diesel offloading point. Within the bunded area, diesel would be restricted by the bund wall having a maximum pool fire equal to the area of the enclosed bund.

A loss of containment from the tanker offloading would result in the spilt diesel flowing to a point where it could flow no more, or be contained by natural barriers. In this case the maximum size pool was determined by the distance from the road to the berm, an area of 380 m².
The worst-case (maximum distance) 10 kW/m² thermal radiation isopleths, representing a 1% fatality, for diesel fires within the bunded areas and the offloading area are shown in Figure 5-1. Fatalities could result within the respective curves, but would remain onsite.

The requirements for a major hazardous installation (MHI), in accordance with Section 2 of the regulation requires that the health and safety of both works and the public must be affected. As the health of the public would not be affected, the Scope of Application of the Major Hazard Installation Regulations would not apply and the facility would not be considered a major hazardous installation.

**Figure 5-1:** 1% fatality for bund pool fires resulting from a release that is not considered catastrophic.
The maximum distance to the 4 kW/m² thermal radiation isopleths are shown in Figure 5-2. The 4 kW/m² thermal radiation isopleth, representing secondary degree burns from a 20 second exposure, are used for emergency planning with respect to gathering points and evacuation routes.

**Figure 5-2**: 4 kW/m² thermal isopleths for bund pool fires resulting from a release that is not considered catastrophic.
Future Facility

It is anticipated that a further 5 x 23 000 ℓ diesel storage tanks would be added, across the road, to the north of the current diesel storage tanks. For this study, the new diesel tank bund was taken as 360 m³, twice that of the existing bund and the tanker pool fire was limited to 300 m².

1% fatality, for diesel fires within the bunded areas and offloading are shown in Figure 5-1. Fatalities could result within the respective curves, but would remain onsite.

The requirements for a major hazardous installation (MHI), in accordance with Section 2 of the regulation requires that the health and safety of both works and the public must be affected. As the health of the public would not be affected, the Scope of Application of the regulations would not apply and the facility would not be considered a major hazardous installation.

Figure 5-3: 1% fatality for bund pool fires resulting from a release that is not considered catastrophic
The maximum distance to the 4 kW/m² thermal radiation isopleths are shown in Figure 5-2. The 4 kW/m² thermal radiation isopleth, representing secondary degree burns from a 20 second exposure, are used for emergency planning with respect to gathering points and evacuation routes.

Figure 5-4: 4 kW/m² thermal isopleths for bund pool fires resulting from a release that is not considered catastrophic
5.1.3 Jet Fires

Jet fires occur when a flammable component is released with a high exit velocity ignites.

In process industries this may be due to design (such as flares) or due to accidental releases. Ejection of a flammable component from a vessel, pipe or pipe flange may give rise to a jet fire and in some instances the jet flame could have substantial 'reach'.

Depending on wind speed, the flame may tilt and impinge on other pipelines, equipment or structures. The thermal radiation from these fires may cause injury to people or damage equipment some distance away from the source of the flame.

No jet fires were predicted from the simulations.

5.1.4 Flash Fires

A loss of containment of a flammable component may mix with air, forming a flammable mixture. The flammable cloud would be defined by the lower flammable limit (LFL) and the upper flammable limit (UFL). The extent of the flammable cloud would depend on the quantity of the released and mixed component, physical properties of the released component, wind speed and weather stability.

An ignition within a flammable cloud can result in an explosion if the front is propagated by pressure. If the front is propagated by heat, then the fire moves across the flammable cloud at the flame velocity and is called a flash fire. Flash fires are characterised by low overpressure, and injuries are caused by thermal radiation. The effects of overpressure due to an exploding cloud are covered in the subsection dealing with vapour cloud explosions (VCEs).

A flash fire would extend to the lower flammable limit; however, due to the formation of pockets, it could extend beyond this limit to the point defined as the ½ LFL. It is assumed that people within the flash fire would experience lethal injuries while people outside of the flash fire would remain unharmed. The ½ LFL is used for emergency planning to evacuate people to a safe distance in the event of a release.

No flash fires were predicted from the simulations.
5.2 Explosions

The concentration of a flammable component would decrease from the point of release to below the lower explosive limits (LEL), at which concentration the component can no longer ignite. The sudden detonation of an explosive mass would cause overpressures that could result in injury or damage to property.

No explosions were predicted for the storage of diesel

5.2.1 Boiling Liquid Expanding Vapour Explosions (BLEVEs)

A boiling liquid expanding vapour explosion (BLEVE) can occur when a flame impinges on a pressure cylinder, particularly in the vapour space region where cooling by evaporation of the contained material does not occur; the cylinder shell would weaken and rupture with a total loss of the contents, and the issuing mass of material would burn as a massive fireball.

The major consequences of a BLEVE are intense thermal radiation from the fireball, a blast wave and propelled fragments from the shattered vessel. These fragments may be projected to considerable distances. Analyses of the travel range of fragment missiles from a number of BLEVEs suggest that the majority land within 700 m from the incident. A blast wave from a BLEVE is fairly localised but can cause significant damage to immediate equipment.

A BLEVE occurs sometime after the vessel has been engulfed in flames. Should an incident occur that could result in a BLEVE, people should be evacuated to beyond the 1% fatality line.

No BLEVEs were predicted from the simulations.

5.3 Summary of Impacts

Maximum distances from the point of release to the 1% fatality are summarised for each scenario in Table 5-2.

Table 5-2: Maximum distance to 1% fatality from the point of release

<table>
<thead>
<tr>
<th>Scenarios</th>
<th>Max. Distance to 1% Fatality (m)</th>
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<tbody>
<tr>
<td><strong>Current Facility</strong></td>
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</tr>
<tr>
<td>Bund fire</td>
<td>29</td>
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<tr>
<td>Pool fire from tanker operations</td>
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<td><strong>Future Diesel Tanks</strong></td>
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<tr>
<td>Bund fire (current bund)</td>
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<td>Bund fire (Future bund)</td>
<td>32</td>
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<tr>
<td>Pool fire from tanker operations</td>
<td>31</td>
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</table>

Note – From the pool centre.
6 CONCLUSIONS

Risk calculations are not precise. Accuracy of predictions is determined by the quality of base data and expert judgements.

This risk assessment included the consequences of fires from releases at the proposed SKA facility in Carnarvon. A number of well-known sources of incident data were consulted and applied to determine the likelihood of an incident to occur.

6.1 Notifiable Substances

The General Machinery Regulation 8 and its Schedule A on notifiable substances requires any employer who has a substance equal to or exceeding the quantity listed in the regulation to notify the divisional director. A site is classified as a Major Hazard Installation if it contains one or more notifiable substances or if the off-site risk is sufficiently high. The latter can only be determined from a quantitative risk assessment.

No material to be stored on site is listed as notifiable.

6.2 Fires

Pool fires, from a loss of containment at the storage and offloading installations of diesel and subsequent fires were simulated for both the current facility and planned future diesel storage.

The 1% fatality for diesel would not extend beyond the site boundary that could involve people in a major incident. As the health of the public would not be affected, the Scope of Application of the Major Hazard Installation Regulations would not apply and the facility would not be considered a major hazardous installation.
7 REFERENCES


Republic of South Africa

Department of Labour

Certificate

This is to certify that

RISCOM (PTY) LTD

Has been approved as an

APPROVED INSPECTION AUTHORITY

Type A; Explosive Chemicals, Gases, Flammable Gases, Non-Flammable, Non toxic gases (asphyxiants), Toxic gases and Flammable liquids, Flammable solids, Substances liable to spontaneous combustion, Substances that on contact with water release flammable gasses, Oxidizing substances and organic peroxides, Toxic liquids and Solids.

In terms of the Occupational Health and Safety Act, 1993, read with the Major Hazard Installation Regulations 5(5) (a) regarding risk assessments

Chief Inspector

Valid From: 27 May 2013

Expires: 26 May 2017

MHI 0005

Certificate Number
APPENDIX B: SANAS CERTIFICATES

CERTIFICATE OF ACCREDITATION

In terms of section 22(2)(b) of the Accreditation for Conformity Assessment, Calibration and Good Laboratory Practice Act, 2006 (Act 19 of 2006), read with sections 23(1), (2) and (3) of the said Act, I hereby certify that:

RISCOM (PTY) LTD
Co. Reg. No.: 2002/019697/07
JOHANNESBURG

Facility Accreditation Number: MHI0013

is a South African National Accreditation System accredited Inspection Body to undertake

**TYPE A** inspection provided that all SANAS conditions and requirements are complied with

This certificate is valid as per the scope as stated in the accompanying schedule of accreditation, Annexure "A", bearing the above accreditation number for

**THE ASSESSMENT OF RISK ON MAJOR HAZARD INSTALLATIONS**

The facility is accredited in accordance with the recognised International Standard

**ISO/IEC 17020:2012**

The accreditation demonstrates technical competency for a defined scope and the operation of a quality management system

While this certificate remains valid, the Accredited Facility named above is authorised to use the relevant SANAS accreditation symbol to issue facility reports and/or certificates

Mr R Josias
Chief Executive Officer

Effective Date: 27 May 2013
Certificate Expires: 26 May 2017

This certificate does not, on its own confer authority to act as an Approved Inspection Authority as contemplated in the Major Hazard Installation Regulations. Approval to inspect within the regulatory domain is granted by the Department of Labour.
ANNEXURE A

SCHEDULE OF ACCREDITATION

Facility Number: MHI0013

TYPE A

<table>
<thead>
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<th>Permanent Address:</th>
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<td>P O Box 2541</td>
</tr>
<tr>
<td>33 Birjish Dr</td>
<td>Cresta</td>
</tr>
<tr>
<td>Northcliff</td>
<td>Johannesburg</td>
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<tr>
<td>Johannesburg</td>
<td>2118</td>
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<tbody>
<tr>
<td>(011) 431-2198</td>
<td>086 624 9423</td>
<td>082 457 3258</td>
<td><a href="mailto:mike@risco.co.za">mike@risco.co.za</a></td>
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<td>MHI regulation par. 5 (5) (b)</td>
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<td>5) Oxidizing substances and organic peroxides</td>
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<td>6) Toxic liquids and solids</td>
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Original date of accreditation: 27 May 2005

ISSUED BY THE SOUTH AFRICAN NATIONAL ACCREDITATION SYSTEM

Field Manager