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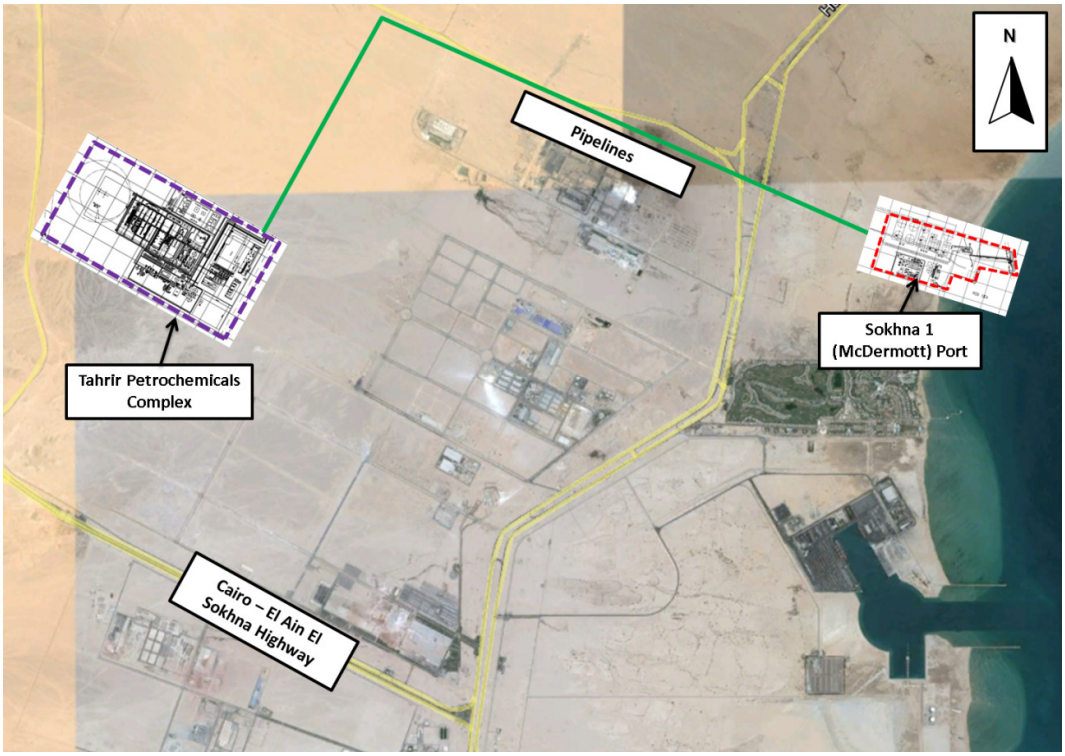
TAHRIR PETROCHEMICALS

Quantitative Risk Assessment

Tahrir Petrochemicals Complex, Economic Zone, Ain Sokhna, Egypt



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PROJECT 455/EJ6195 - QUANTITATIVE RISK ASSESSMENT

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EXECUTIVE SUMMARY

Tahrir Petrochemicals Corporation is planning to develop the proposed Petrochemicals Complex in the Economic Zone in Ain Sokhna, Suez, Arab Republic of Egypt. The main components of the Complex are: Ethylene Plant (P1) along with Derivatives Units, Polyethylene Plant (P2) and Utilities & Offsite (including but not limited to; seawater intake and outfall, power plant, desalination plant, wastewater treatment unit and storage tanks).

The project involves the loading/unloading of chemicals (e.g. Benzene and Naphtha) at the Sokhna 1 (McDermott) Port and transport via underground pipelines in the utility corridor to/from the Sokhna 1 (McDermott) Port and the Tahrir Petrochemicals Complex Main Plant area. The total length of these pipelines is approximately 11 km. A distance of 7.5 km separates the Main Plant from the Port Area. A Tank Farm is located at the Sokhna 1 (McDermott) Port as well for both raw materials and liquid products storage. The Main Plant area consists of an Ethylene Plant along with Derivatives Units and a Polyethylene Plant in addition to the utilities. The Ethylene Plant includes but not limited to the furnace area, a gas hydrogeneration unit (GHU), a Butadiene unit a Benzene unit and Hexene-1 Unit. The Polyethylene Plant is comprised of the Polyethylene process area and the product handling and storage area. The Polyethylene process area includes ethylene treating and pelletizing, while the product handling and storage area includes a conveying, bagging and handling system.

The following conclusions are made for the assessment of individual risk criteria for Tahrir Petrochemicals Complex different components (as shown in Table 1). It can be noted that the different components of the proposed Complex meet the relevant risk criteria.

Table 1 Risk Assessment Summary

Individual Risk Contour	Distance Offsite (m)	Criteria	Extent	Satisfy Individual Risk Criteria? (Y / N)
Sokhna 1 (McDermott) Port				
5×10^{-5} per year	0	Not extend beyond site boundary	Not generated	Y
5×10^{-6} per year	~138	Not extend into commercial developments, including offices, retail centres and showrooms	Within an industrial area.	Y
1×10^{-6} per year	~727	Not extend into residential areas	Extended within Sokhna 1 (McDermott) Port area and not extended into residential areas	Y
Pipelines (Between Main Plant and Tank Farm and Between Jetty area and Tank Farm) (1)				
5×10^{-5} per year	0	Not extend beyond site boundary	Not generated	Y

Individual Risk Contour	Distance Offsite (m)	Criteria	Extent	Satisfy Individual Risk Criteria? (Y / N)
5 x 10^{-6} per year	0	Not extend into commercial developments, including offices, retail centres and showrooms	Not generated	Y
1 x 10^{-6} per year	0	Not extend into residential areas	Not generated	Y
Tahrir Petrochemicals Complex-Main Plant Area				
5 x 10^{-5} per year	0	Not extend beyond site boundary	Within the site Boundary.	Y
5 x 10^{-6} per year	~88	Not extend into commercial developments, including offices, retail centres and showrooms	Within an industrial area.	Y
1 x 10^{-6} per year	~321	Not extend into residential areas	Not extended into vulnerable or sensitive areas but extended into industrial area.	Y

Notes:

(1) The highest IR contour generated for the underground pipelines is 1 x 10^{-8} per year.

It is worth mentioning that the present study is conducted based on the Pre-FEED data. An update will be required to the present study in case of any modifications/changes to the Pre-FEED data.

1. INTRODUCTION

1.1 General

Tahrir Petrochemicals Corporation is planning to develop the proposed Petrochemicals Complex in the Economic Zone in Ain Sokhna, Suez, Arab Republic of Egypt. The Main Plant's total area is approximately 2.6 million m^2 in addition to 800,000 m^2 storage area located at Sokhna 1 (McDermott) Port. The main components of the Complex are: Ethylene Plant (P1) along with Derivatives Units, Polyethylene Plant (P2) and Utilities &Offsite including but not limited to; seawater intake and outfall, power plant, desalination plant, waste water treatment unit and storage tanks.

The Ethylene Plant (P1) includes but not limited to furnace area, a gas Hydrogenation unit (GHU), a Butadiene unit, a Benzene unit and Hexene-1 Unit. The Polyethylene Plant (P2) is comprised of the polyethylene process area and the product handling and storage area. The Polyethylene process area includes Ethylene treating and pelletizing, while the product handling and storage area includes a conveying, bagging and handling system.

The main raw material of the proposed Complex is Naphtha. A dedicated jetty located at Sokhna 1 (McDermott) Port will be constructed for importing Naphtha feed, Diesel Fuel oil and other Chemicals as well as some of the proposed Complex Liquid products exporting, namely, Benzene, excess Ethylene, Hexene-1, Propylene; whereas, the existing Quayside Dolphin will be used for Butadiene product export. The liquid products will be pumped from the ISBL to the storage tanks located at Sokhna 1 (McDermott) Port dedicated Tank Farm via pipelines. Polyethylene product will be exported in solid phase from different ports.

WorleyParsons has been engaged by the Tahrir Petrochemicals to conduct an Environmental and Social Impact Assessment (ESIA) Study for the proposed Complex to assess the potential environmental and social impacts due to the development of the project. As part of the ESIA, a Quantitative Risk Assessment (QRA) is conducted to assess the safety risks associated with the operations of the proposed Complex based on the Pre-FEED information. This document presents the methodology and results of the QRA for the project.

It is worth mentioning that Pre-FEED Data has been used to the maximum extent in the present study *(Documents provided by EPC Contractors*). In the case of inputs for which no information was available, estimations have been made based on information available from previous similar assignments and international references (*External References*) such as The Netherlands Organisation, Guidelines for Quantitative Risk Assessment, "Purple Book" and UK HSE, Offshore Hydrocarbon Releases Statistics. Detailed reference list is presented in 9.

1.2 Objectives

The objectives of conducting this QRA study are to:

1. Identify potential hazard scenarios associated with loading/unloading hazardous material at the port, the underground pipelines and the different Tahrir Petrochemicals Complex components that may lead to major accident events (MAEs);

2. Quantify the effects of the MAEs and determine its occurrence likelihood;
3. Determine individual risks (IR) associated with the facilities in terms of iso-risk contours;
4. Assess the risk levels against the adopted Risk Tolerability Criteria; and
5. Recommend mitigation measures where necessary.

1.3 Scope of Work

The following facilities are covered under the QRA study for the Project:

1. Marine Terminal (OSBL) area including but not limited to loading/unloading arms and associated equipment;
2. Underground pipelines between Tahrir Petrochemicals Main Plant area (ISBL) and Tank Farm (OSBL); and
3. Tahrir Petrochemicals Complex Main Plant (ISBL) area including but not limited to P1 , P2 and A1

The assessment will be based on the hazards that may occur during the operations of the project according to the Pre-FEED information. The scope of work is limited to the different components associated with the proposed Complex, namely Marine Terminal area, underground pipelines between ISBL and OSBL and the Main Plant area only. Any other facilities that are not part of the proposed Complex operations are not included as part of this study.

1.4 List of Abbreviations

ALARP	As Low As Reasonably Practicable
DCS	Distributed Control System
ESD	Emergency Shutdown
ESDV	Emergency Shutdown Valve
ETA	Event Tree Analysis
HAZID	Hazard Identification
HDA Unit	Hydrodealkylation Unit
GHU	Gas Hydrogeneration Unit
ICA	Inducing Condenser Agent
IR	Individual Risk
ISBL	Inside Plant Boundary Limit
LFL	Lower Flammability Limit
OSBL	Outside plant Boundary Limit

PFO	Pyrolysis Fuel Oil
PGO	Pyrolysis Gas Oil
PLC	Programmable Logic Controllers
QRA	Quantitative Risk Assessment
RO	Reverse Osmosis
U&O	Utilities and Offsite

2. STUDY METHODOLOGY

2.1 Overview

The traditional QRA approach has been followed, which comprises the following steps:

1. Hazard Identification;
2. Consequence Analysis;
3. Frequency Analysis;
4. Risk Summation and Evaluation; and
5. Risk Mitigation.

Figure 2-1 presents a flowchart that illustrates the QRA process.

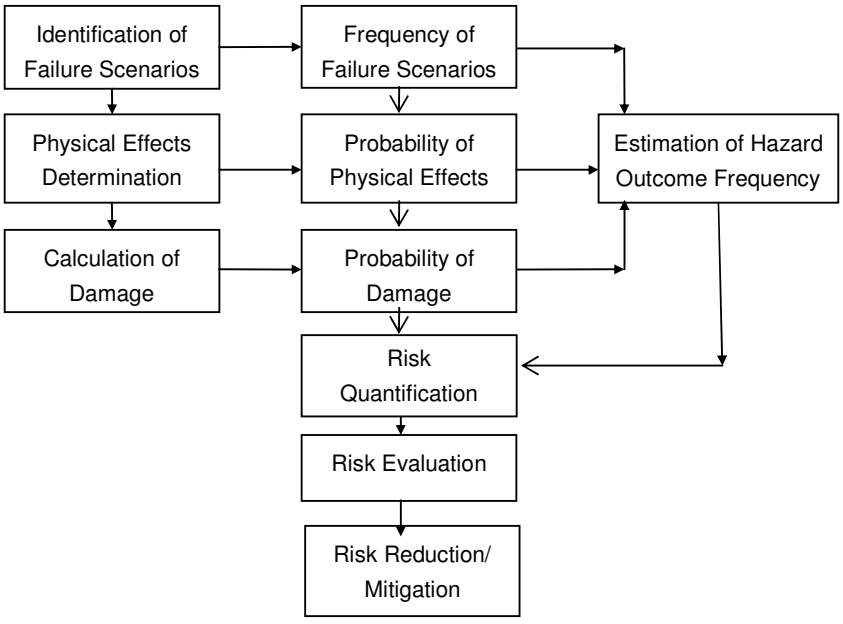

Figure 2-1 QRA Methodology Flow Chart

2.2 Hazard Identification and Selection of Failure Scenarios

Hazard Identification is a key step in Risk Analysis. Many techniques are available for hazard identification depending upon the objective of the study. The most relevant technique of risk assessment to the proposed project is the review of release sources of hazardous materials.

The processes under study are broken up into isolatable sections based on the isolation points that may be provided. For each isolatable section, failure scenarios are developed depending upon the failure mode causing loss of containment, and for each failure scenario a set of consequences chains is developed showing the hazard outcomes.

2.3 Effects and Consequence Calculations

Effects and Consequence Calculations are carried out to determine the potential for injury to people from the identified failure scenarios. The hazard outcomes are analysed using release rate, dispersion, and fire and explosion models. Appropriate models available in the software package of DNV PHAST 7.1 are used for calculation of physical effects.

Key assumptions made in the calculations are highlighted in the Assumption Register in Appendix A, where applicable.

2.4 Frequency Analysis

Likelihood of leak associated with each failure scenario is estimated based on generic leak frequencies from historical databases which include the TNO Purple Book [Ref. 1], UK HSE [Ref. 2], and UKOPA Pipeline Fault Database [Ref. 3].

Once the failure frequency of the failure scenario has been estimated, event trees are developed to represent the sequence of events from the onset of the initial failure. Using probabilities for each event branch, the event tree eventually determines the frequency of the final hazard outcomes.

Key assumptions made in the calculations are highlighted in the Assumption Register in Appendix A, where applicable.

2.5 Risk Summation

Risk Summation combines the consequences and likelihood of all incident outcomes from all selected incidents to provide a measure of risk. TNO software RiskCurve 6.0.16 was employed for Risk Summation. Based on the consequence and likelihood of each outcome and the associated fatality (given in the Assumption Register), the likelihood of the outcome resulting in a fatality is determined within the software and the overall risks are generated. The results of the Risk Quantification or Summation are presented in the form of iso-risk contours.

2.6 Comparison with Risk Acceptance Criteria

2.6.1 Overview of Risk Tolerability Criteria

Given that there is no Risk Tolerability Criteria in Egypt, an overview of international Risk Tolerability Criteria and the Risk Tolerability Criteria adopted for this QRA is given in this section. The risk measures obtained are compared to the risk tolerability criteria discussed in the following sections.

Individual risk (IR) may be defined as the frequency at which an individual may be expected to sustain a given level of harm from the realization of specified hazards. It refers to the likelihood that a

particular person might be harmed due to the occurrence of a particular hazard. This is usually expressed as the probability that an individual will be harmed during the course of one year.

Risk acceptance criteria can be based on the ALARP principle (As Low As Reasonably Practicable), as defined by the UK HSE [Ref. 2] and illustrated in Figure 2-2 below.

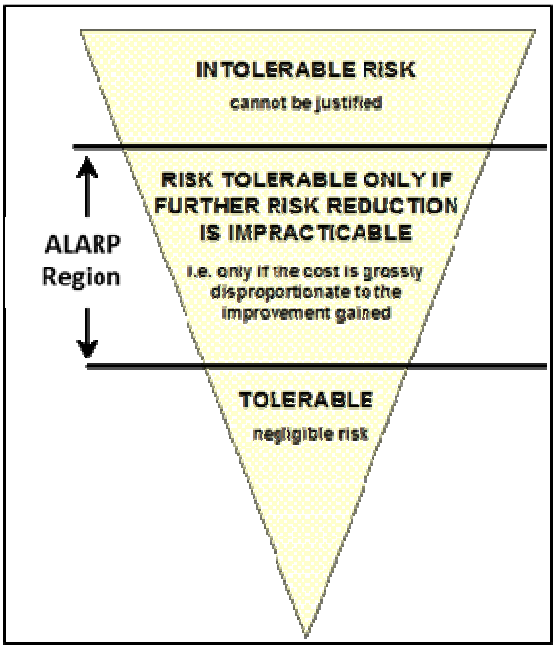

Figure 2-2 ALARP Principle

A review of risk tolerability criteria in various countries was conducted and summarized in this section below.

SINGAPORE

The Individual Risk Criteria adopted in Singapore is specified by the National Environmental Agency in the QRA Guidelines [Ref. 4]. The criteria are applied to hazardous installations for offsite populations and are as summarised in Table 2-1.

Table 2-1 Individual Risk Criteria in Singapore

Individual Risk Level	Remarks
Greater than 5×10^{-5} per year	Must remain within plant boundary
From 5×10^{-5} to 5×10^{-6} per year	Extend to Industrial Developments only
From 5×10^{-6} to 1×10^{-6} per year	Extend to Industrial and Commercial Developments only

The table above states that the 5×10^{-5} per year IR contour should be restricted to the site. The 5×10^{-6} and 1×10^{-6} per year IR contours should fall within the industrial zone and commercial zone respectively. All residential areas should be located outside the 1×10^{-6} per year IR contour.

MALAYSIA

The risk tolerability guidelines adopted by the Malaysian Department of Environment state that individual risks from an assessed facility should not exceed 1 x 10^{-6} fatalities per year for residential areas and 1 x 10^{-5} fatalities per year at neighbouring industrial sites [Ref. 5].

UNITED KINGDOM

In United Kingdom, suggestions on the appropriate regulatory levels of tolerable and negligible personal individual risk have been presented in HSE publications [Ref. 6], [Ref. 7] and [Ref. 8]. These levels are summarised in Table 2-2. The upper and lower individual risk bounds for personnel working in an installation where there is a recognised level of risk are 1 in a thousand (10^{-3}) and 1 in a million (10^{-6}) per year respectively. For individual risks to public, the upper bound is taken to be 1 in ten thousand (10^{-4}) per year.

Table 2-2 UK HSE Individual Risk Criteria

Measure	Individual Risk (per year)
Maximum tolerable risk level:	
1. For workers; and	10^{-3}
2. For public	10^{-4}
Negligible risk level for both workers and public	10^{-6}

WESTERN AUSTRALIA

The Western Australia Environmental Protection Agency (EPA) is an independent statutory authority which advises the Government on environmental issues. The EPA has set the following off-site individual risk criteria for assessing the acceptability of risks from a hazardous installation:

1. A risk level in residential zones of one in a million per year (1 x 10^{-6} per year) or less, is so small as to be acceptable to the EPA;
2. Risk level in “sensitive developments”, such as hospitals, schools, child care facilities and aged care housing developments of one half in a million per year (5 x 10^{-7} per year) or less is so small as to be acceptable to the EPA;
3. In the case of risk generators within the grounds of the “sensitive developments” which are necessary for the amenity of the residents, the risk level can exceed the risk level of one half in a million per year (5 x 10^{-7} per year) to a maximum of one in a million per year (1 x 10^{-6} per year), for areas that are intermittently occupied, such as garden areas and car parks;
4. Risk levels from industrial facilities should not exceed a target of fifty in a million per year (5 x 10^{-5} per year) at the site boundary for each individual industry;
5. A risk level for any non-industrial activity located in buffer zones between industrial facilities and residential zones of ten in a million per year (1 x 10^{-5} per year) or lower, is so small as to be acceptable to the EPA; and

6. A risk level for commercial developments, including offices, retail centres and showrooms located in buffer zones between industrial facilities and residential zones, of five in a million per year (5 x 10^{-6} per year) or lower, is so small as to be acceptable to the EPA.

The EPA Guidelines do not include criteria concerning onsite personnel. It is generally accepted that persons who are knowingly involved in an activity where there is a recognised level of risk are termed voluntary risk takers as they voluntarily accept the risks to which they are exposed in return for a direct benefit to themselves in terms of remuneration, for example. Clearly though, such personnel will expect that the risks are minimised by the company and thus although their "risk tolerability" may be higher, their risks should still be considered.

THE NETHERLANDS

In The Netherlands the maximum permissible individual risk level to exposed population is 10^{-6} per year for new situations and 10^{-5} for existing situations, that is, individual risks above these levels are considered 'unacceptable'. Furthermore, land use policy requires that no new developments are permitted inside the 10^{-6} contour around an existing installation except in special circumstances.

2.6.2 Individual Risk Criteria

As Egypt does not have any regulations regarding risk criteria, the most stringent Individual Risk Tolerability Criteria based on the review of international risk criteria in the section above (Section 2.6.1) is adopted for the Tahrir Petrochemicals Complex as follows:

1. Risk level from industrial facilities should not exceed fifty in a million per year, i.e. 5 x 10^{-5} per year at the site boundary for each individual facility;
2. Risk level for commercial developments, including offices, retail centres and showrooms should not exceed five in a million per year, i.e. 5 x 10^{-6} per year or less; and
3. Maximum level of offsite individual risk permissible for residential areas should not exceed one in million per year, i.e. 1 x 10^{-6} per year.

3. PROJECT DESCRIPTION

3.1 Project Location

The Tahrir Petrochemicals Complex Main Plant area will be located within the Economic Zone of Ain Sokhna, Suez, Egypt. Furthermore, Sokhna 1 (McDermott) Port is used for Naphtha importing as well as different liquid products exporting. The location of Tahrir Petrochemicals Complex, Sokhna 1 (McDermott) Port, as well as the route of the dedicated Naphtha and liquid products pipelines between the Sokhna 1 (McDermott) Port and the Tahrir Petrochemicals Complex Main Plant area, are shown in Figure 3-1 below.

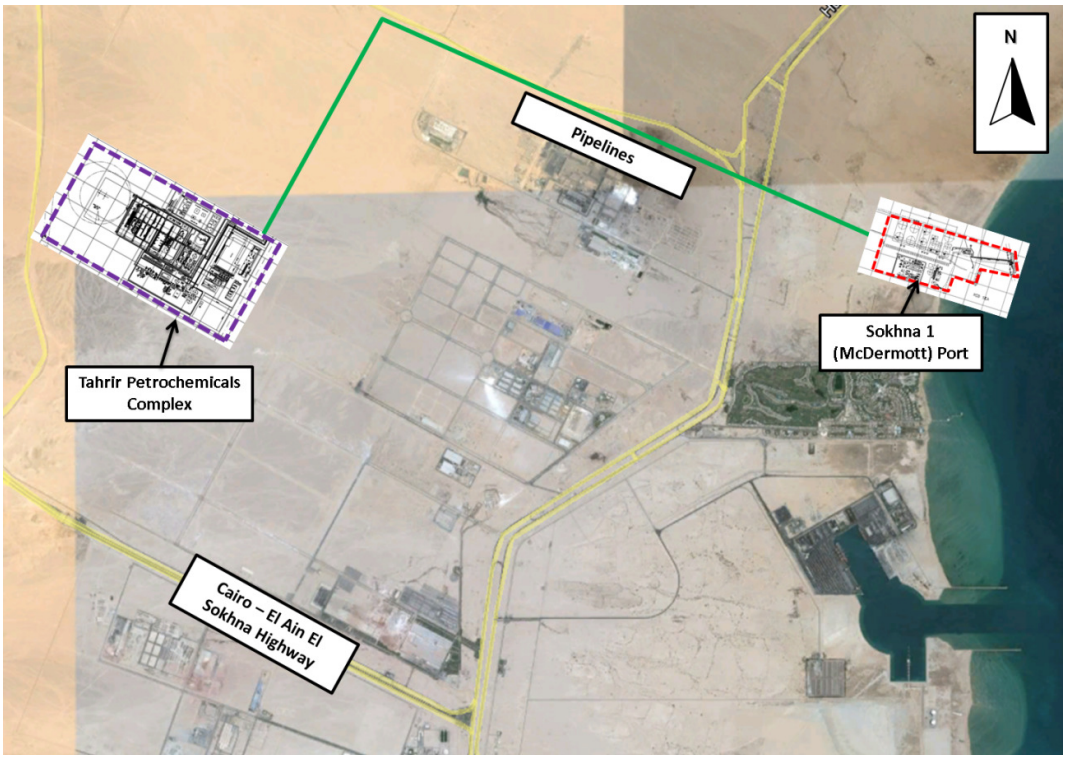

Figure 3-1 Location of the Tahrir Petrochemicals Complex and Sokhna 1 (McDermott) Port

The nearby existing residential area, which is defined as areas with *non-zero occupancy*, is Stella Di Mare Golf and Country Club. Figure 3-2 below shows the nearby existing residential area, with its associated distance from the nearest proposed Complex component, namely Sokhna 1 (McDermott) Port.

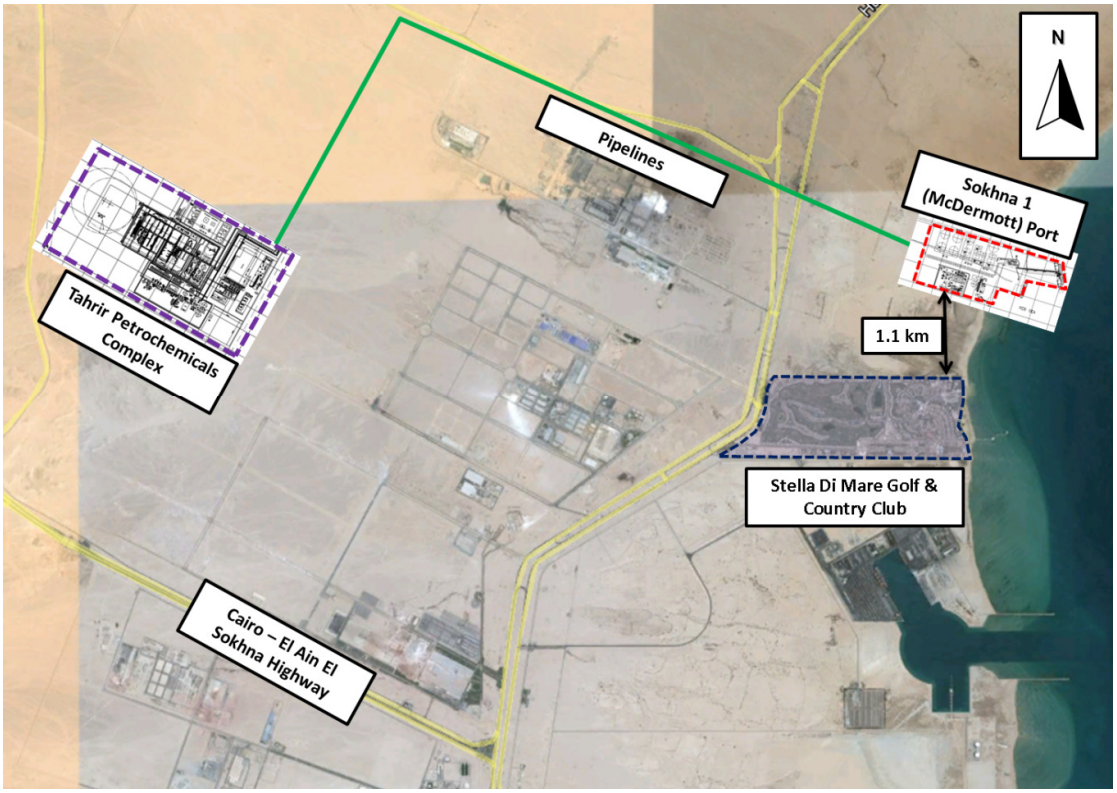

Figure 3-2 Nearby Existing Residential Area

3.2 Site Layout

3.2.1 Sokhna 1 (McDermott) Port

The Naphtha unloading facilities are located at the Sokhna 1 (McDermott) Port in addition to liquid products loading facilitates. Furthermore, storage tanks of the different liquid products are located at a dedicated Tank Farm at the port area. Desalination Plant is also located at Sokhna 1 (McDermott) Port. The Sokhna 1 (McDermott) Port layout is shown in

Figure **3-3**.

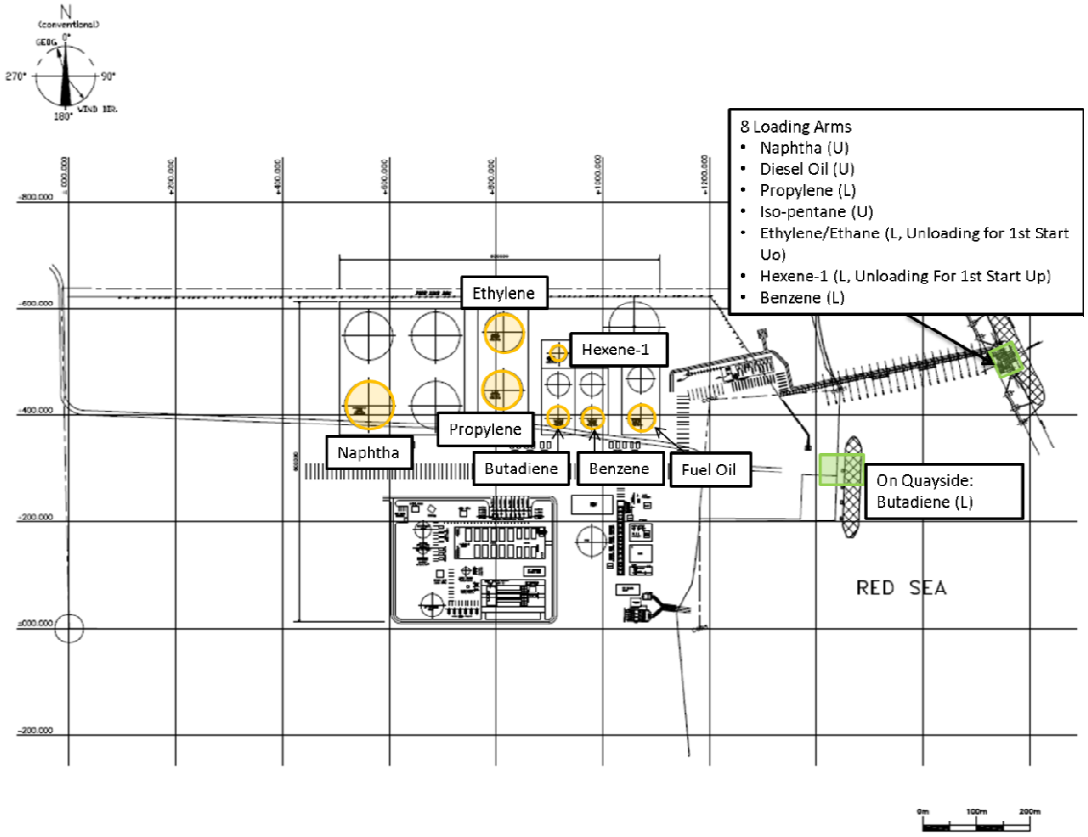

Figure 3-3 Sokhna 1 (McDermott) Port Layout

3.2.2 Tahrir Petrochemicals Complex Main Plant Area

Figure 3-4 presents the overall plot plan for the Main Plant area of Tahrir Petrochemicals Complex.

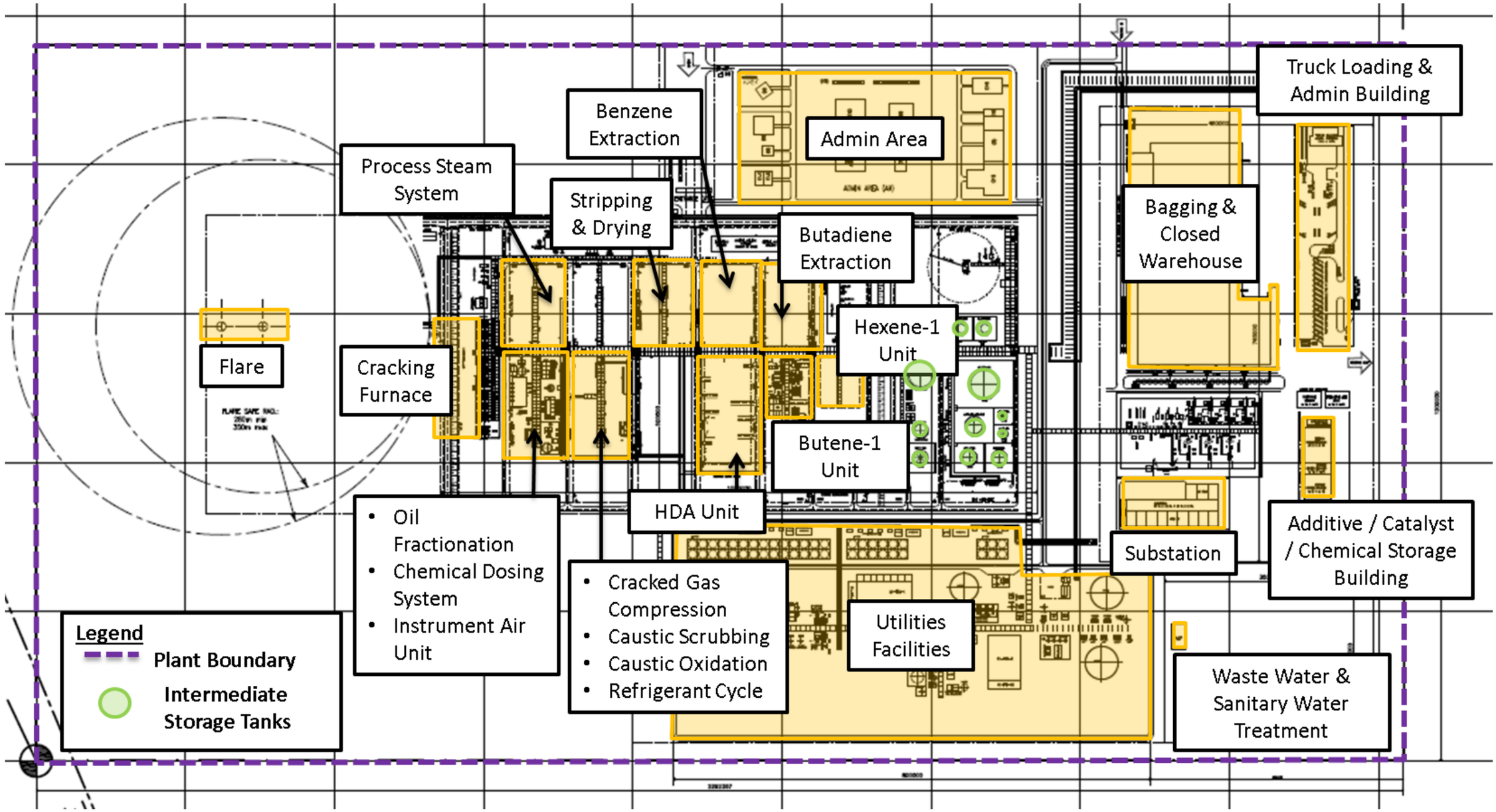

Figure 3-4 Plot Plan for Tahrir Petrochemicals Complex Main Plant Area

3.3 Facilities Description

The Tahrir Petrochemicals Complex will be built as a stand-alone and self-sufficient in utilities. The basic process units will include an Ethylene Plant along with Derivatives Units (P1) and a Polyethylene Plant (P2) in addition to the utilities and offsite. The main raw material will be Naphtha that will be delivered to the site by onshore underground pipelines from Sokhna 1 (McDermott) Port approximately 11 km away. P1 is designed to produce Ethylene, Propylene, Butadiene, Benzene, Butene-1 and Hexene-1 as well as other products, whereas, P2 is designed to produce Polyethylene (both HDPE and LLDPE). It is worth mentioning that some of the P1 products will be partially or entirely consumed in P2 such as Ethylene and Butene-1, respectively.

The different liquid products will be transported and stored in the Tank Farm at Sokhna 1 (McDermott) Port. The main components of the project include:

Sokhna 1 (McDermott) Port Facilities

1. Naphtha unloading arm (11BH001);
2. Naphtha underground pipeline at Sokhna 1 (McDermott) Port;
3. Tank farm at Sokhna 1 (McDermott) Port;
4. Iso-pentane unloading arms and pipeline;
5. Propylene export pipeline and ship loading;
6. Butadiene export pipeline and ship loading;
7. Benzene export pipeline and ship loading;
8. Hexene-1 export pipeline and ship loading;
9. Ethylene export pipeline and Ship Loading;
10. Ethylene Tank Farm at the Port;
11. Fuel oil piping and ship receiving
12. Sea water intake;
13. Sea water supply; and
14. Desalination Plant.

Pipelines to Tahrir Petrochemicals Complex

All the hazardous chemicals pipelines between Tahrir Petrochemical Complex ISBL (Main Plant Area) and Tahrir Petrochemicals Complex OSBL (Tank Farm).

Tahrir Petrochemicals Complex Main Plant

1. Ethylene Plant, which consists of the following areas:
    - Furnace area (Eight furnaces in cracking operation and one furnace is used as stand by);

- Hexene-1 unit;
- Butadiene unit;
- Hydrodealkylation unit;
- Butene-1 unit;
- Benzene unit; and
- PSA Unit

2. Polyethylene Plant, which consists of the following areas:
   - Polyethylene process areas, including ethylene treating and pelletizing; and
   - Product handling and storage area, including a conveying and bagging system.
3. Utilities and Offsite (U&O), which including the following, but are not limited to:
   - Power generation;
   - Demin water supply & condensate polishing;
   - Waste water treatment and disposal;
   - Cooling water towers, circulation and make-up; and
   - Nitrogen, N2
   - Plant Air & Instrument Air Supply
   - Steam Requirements for Process and Power Generation

3.4 Process Description

3.4.1 Naphtha Receiving, Storage and Transfer System

The Naphtha transfer system consists of pipelines, unloading arm, and naphtha transfer pumps and associated equipment. The unloading takes place at Berth 1 (Sokhna 1 (McDermott) Port) and Naphtha is transferred to Tank Farm tanks (D5003A/B/C/D).

3.4.2 Ethylene Plant

The feedstock, Naphtha, and recycles are first collected into two main furnace feed headers, namely the C2/C3 header and the Naphtha header, respectively. From these headers the furnace feed material streams are routed separately to the Cracking Furnace Section where they are distributed to the nine furnaces. In the furnace, naphtha is cracked to form the main products ethylene and propylene.

The cracked gas coming from the quench exchangers of the cracking furnaces is then cooled by direct oil injection into the transfer line. It enters the Primary Fractionator column at the bottom for further cooling by quench oil flowing counter-currently to the cracked gas. The primary fractionator 27-

T01 consists of three sections. In the lower section, cracked gas is cooled to about 194 ℃ where heavy oil components condense and form Pyrolysis Fuel Oil (PFO). In the middle section cracked gas is cooled down further to about 126 ℃ and light oil components condense and form the Pyrolysis Gas Oil (PGO) cycle.

After leaving the furnace, the intermediates go through various processes as shown in the block flow diagram of ethylene plant in Figure 3-5. The end products from ethylene plant are ethylene, propylene, butadiene, benzene, Pyrolysis Gas Oil (PGO) / Pyrolysis Fuel Oil (PFO) and linear alpha olefin products (butene-1 will be consumed totally in Poly Ethylene Production and hexene-1). The major processes are discussed in the following sections.

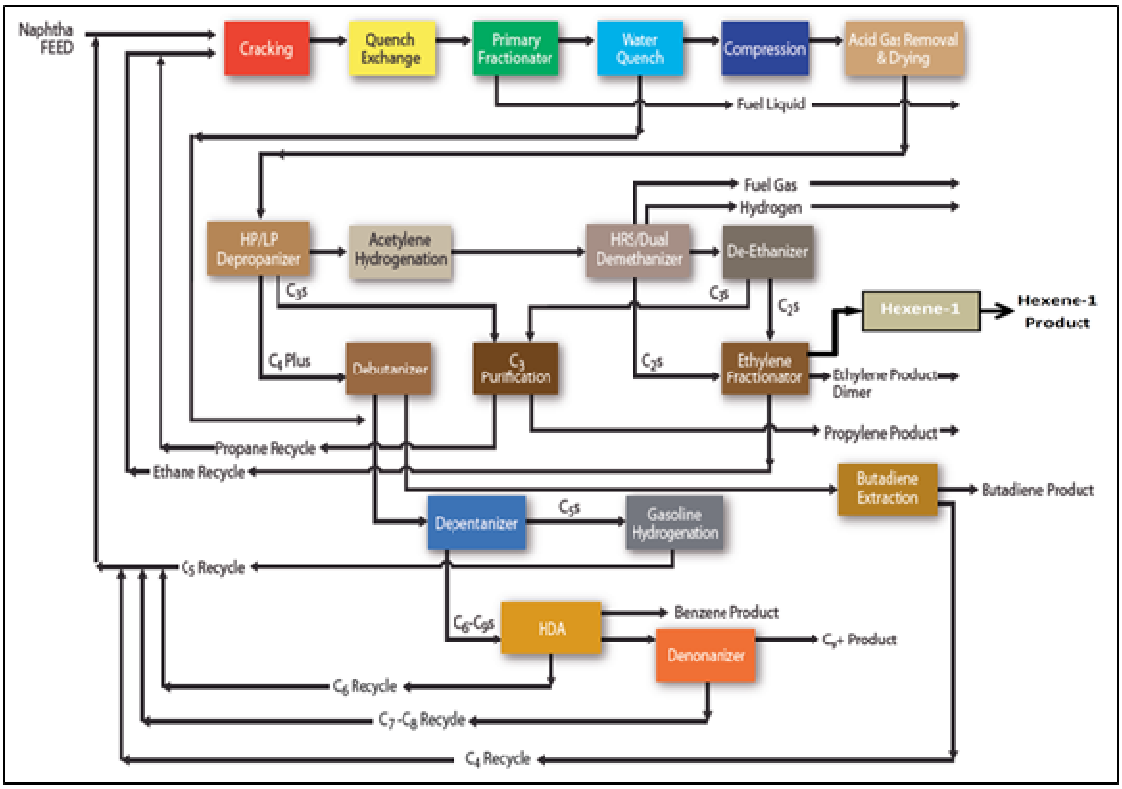

Figure 3-5 Block Flow Diagram of Ethylene Plant

HEXENE-1 UNIT

The Hexene-1 Unit will produce Hexene-1 by catalytic dimerization of ethylene from the ethylene plant. 1-Hexene will be used as co-monomer for certain polyethylene (PE) polymer grades. Minor C4- and C8+ by-product streams will be recycled to the feed preheating unit of the ethylene plant / naphtha cracker and ethylene purge stream will be recycled to the cracker as well.

HYDRODEALKYLATION (HDA) UNIT

The hydrodealkylation takes place at high pressure and temperature. Alkylated mono cyclic aromatic components such as toluene, xylenes and ethyl benzene react with hydrogen to form benzene and methane or ethane respectively. Accompanying paraffin is simultaneously hydro-cracked to methane and ethane. Excess hydrogen is recovered and recycled internally to the reactor. Methane rich off-gas is routed to the fuel gas system for export to the offsite fuel gas network. A small C1/C2 purge stream is recycled to the cracked gas compression system. The benzene rich effluent from the hydro dealkylation reactor is routed to a benzene separation column. Benzene product is withdrawn from the column top and sent to offsite for storage. A small stream of heavy hydrocarbons, diluted with a PGO side stream, is withdrawn from the unit as PGO product.

BENZENE EXTRACTION UNIT

The purpose of the Benzene Extraction Unit is to recover benzene from the C6 fraction from the C6/C7 Separation section. This separation uses a solvent in an extractive distillation process, producing pure benzene product and a non-aromatic C6 stream that is recycled as cracking feedstock. Benzene product is sent to the Benzene Product Storage Tanks in the tank farm at the Sokhna Port.

BUTADIENE UNIT

C4-Hydrocarbon containing butadiene is fed to first Extractive Distillation Column. Simultaneously solvent is fed to the column. Butanes and butenes are drawn off from its top. Crude butadiene and acetylenes are fed to second Extractive Distillation Column and vinyl- and ethyl-acetylenes are drawn off from the Column. The solvent containing C4-hydrocarbons is fed to Solvent Stripper. Finally vinyl- and ethyl-acetylenes are drawn off from the side stream of Solvent Stripper. The residual C4-hydrocarbons are stripped from the solvent in the Stripper. Such stripped C4-hydrocarbons are returned to the Extractive Distillation Column without pressurizing by a compressor. The pure butadiene product are produced by separation of heavies such as 1,2-butadiene, butadiene dimer, C5, etc. in Heavy Cut Column and of methylacetylene in Light Cut Column from the crude butadiene.

BUTENE-1 UNIT

Ethylene vapour product from the Ethylene product header is routed to Butene-1 unit where ethylene is converted in a dimerization reaction to Butene-1 product. The reaction takes place in the liquid phase and is homogenously catalyzed. Butene-1 is withdrawn after purification as the main product. Byproducts include a small C6 fraction returned to the naphtha feed preheating section, and an ethylene purge recycled to the cracked gas compression system. A continuous spent catalyst waste stream is produced for external disposal.

3.4.3 Polyethylene Plant

Ethylene, comonomer, ICA, hydrogen and nitrogen are purified before being fed continuously into the reaction system. In the reactor, resin is produced by polymerization of reactants. Resin from the reactor Product Discharge System then enters the Product Purge Bin through four transfer lines.

Purging of hydrocarbons is achieved by injecting nitrogen in the upper section, while a steam / nitrogen mixture is used to hydrolyze the residual alkyls and active catalyst in the lower section.

Exiting the Product Purge Bin Rotary Feeder, the resin is transferred by gravity flow to the Particle Screener, where any oversized chunks are separated from the resin. Resin Additive Handling begins at the outlet of the Particle Screener and ends at the inlet of the Mixer. In the mixer, granular resin and solid additives are melted and mixed. The molten polymer discharges directly into the Melt Pump. Material exiting the Melt Pump enters the Underwater Pelletizer. The pellet-water slurry is pumped to an Agglomerate Remover and Pellet Dryer. Then, dried pellets are discharged to the Resin Handling System. The block flow diagram of polyethylene plant is shown in Figure 3-6.

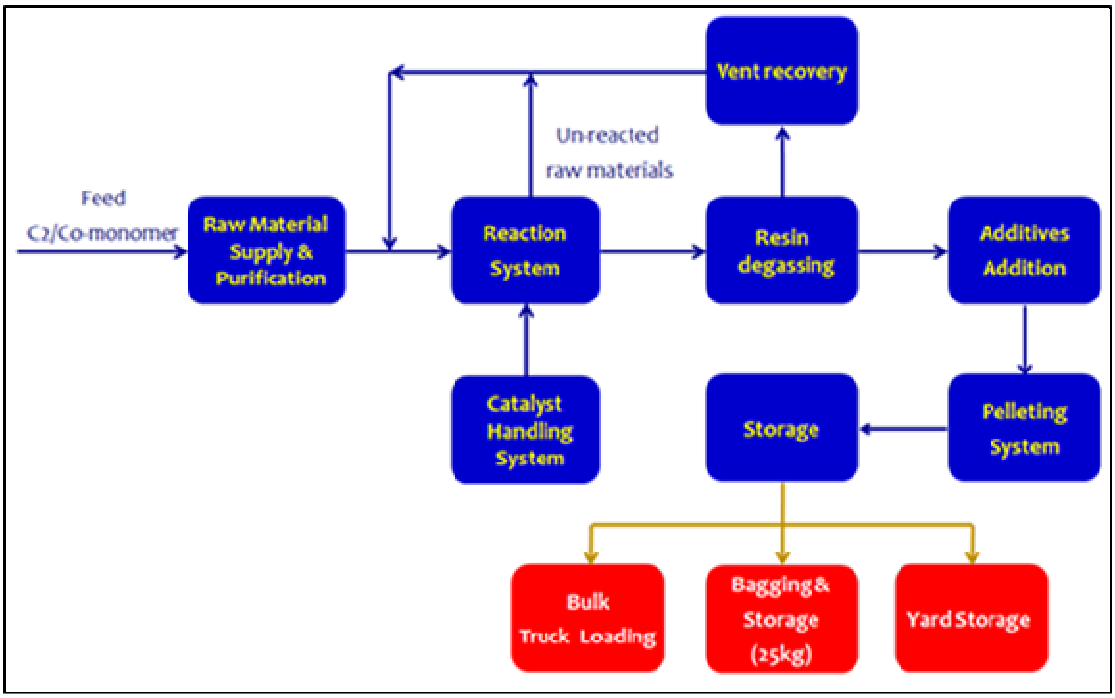

Figure 3-6 Block Flow Diagram of Polyethylene Plant

3.5 Utility and Support Facilities

3.5.1 Water Supply System

Sea water intake and outflow system shall be located in Sokhna 1 (McDermott) Port.

3.5.1.1 Offshore Works and Sea Water Extraction System

The engineering and construction of the seawater extraction systems including and not limited to extraction sea bed piping, effluent discharge sea bed piping, civil works for the sumps, initial coarse filtering or treatments of the extracted seawater and pumps to the desalination station.

3.5.1.2 SEAWATER DESALINATION

The seawater desalination unit shall be designed to provide sufficient capacity and quality of desalinated water to support cooling water, service water, firewater, potable water, and demineralized water production and make-up requirements.

3.5.1.3 EFFLUENT DISCHARGE FACILITIES

The Main Plant area (P1, P2 and A1) wastewater will be appropriately treated for reuse in irrigation using two wastewater treatment plants. The treated wastewater will be used for irrigation purposes.

As for the Desalination Plant wastewater, the desalination process reject/brine will be directed to marine disposal in a manner complying with the relevant environmental limits.

3.5.2 Firewater System

Horizontal centrifugal fire pumps will be provided: a motor-driven primary and a diesel engine-driven standby, drivers, controllers, fuel tank. Fire water will be supplied at plant battery limits from OSBL. The fire water system shall be able to provide fire water for at least 4 – (6) hours with a pressure of at least 12 barg at the tie-in at maximum flow rate about 3000 m^3/hr.

The fire water will be supplied by two independent tie-in points. The fire water system shall a permanently pressurized system. If there is no fire water consumption, the jockey pump shall provide a uniform pressure on the fire water main system. In the case that sea water is used as back-up, the entire fire main system shall be flushed with fresh water after use.

The main fire water ring will be installed around the whole plant with, depending on the size of the plant, several branch lines in order to get a better water distribution. The fire water system will be installed underground below the maximum frost penetration. The diameter (24") of the fire water ring main depends on the required flow rate, pressure drop and topology.

3.5.3 Plant and Instrument Air Unit

Plant and instrument air will be provided by package air compressor units. These units will consist of appropriate capacity trains such that at least 50% spare capacity will be available in the compressor and dryer equipment. Plant air and instrument air distribution will be segregated such that service is biased towards the instrument air demands. Units will be fully self-contained packaged systems with programmable logic controllers (PLC), with link to the overall plant control DCS system.

3.5.4 Nitrogen Supply Unit

An air separation system package will be provided to supply nitrogen to the facility. Separated liquid nitrogen will be stored to provide adequate inventory for demand. A vaporizer will be provided to vaporize liquid nitrogen as needed. Units will be fully self-contained packaged systems with PLC controllers, with link to the overall plant control DCS system.

3.5.5 Power Generation System

The power generation system will provide electrical power for the operation of the plant. The power generation for the plant is backed up by an emergency diesel generator to ensure safe operation and control shut down of the plant in the case of failure of the power supply, if necessary.

3.5.6 Emergency Diesel Generator System

The diesel will serve as the fuel source in the emergency generator.

3.5.7 Diesel Fuel Station

Diesel fuel will be consumed by the stacker cranes and trucks transporting to the port, etc. Purchased diesel will be unloaded to the diesel storage tank. .

3.6 Protection Systems

1. The toxic and flammable gas detection system will be installed;
2. All ordinary structures and buildings will be lightning protected according to NFPA-780 Installation of the lightning protection system;
3. Impressed current cathodic protection systems will be provided for corrosion protection of underground steel piping and bottom plates of storage tanks which will be in direct contact with earth. Besides, cathodic protection by sacrificial anode system may be provided for corrosion protection of water tank internal surfaces;
4. The Ethylene Plant, Polyethylene Plant, and offsite and utilities will have their own Uninterruptable Power Supply system;
5. The following firefighting equipment will be provided in the complex:
    - Horizontal centrifugal fire pumps will be provided: a motor-driven primary and a diesel engine-driven standby;
    - Looped, underground firewater piping distribution system will be provided for the Complex. The system will supply an extensive network of hydrants, fire monitors, elevated monitors, hose reels, and foam hose reels;
    - Firewater mains and post-indicator gate valves (PIVs) will be strategically located, ensuring that firewater will always be available to each area for a minimum of two directions as well as to minimize system impairment due to line failure or maintenance. PIVs will be provided in the system so as to minimize the length of pipe and number of hydrants, firewater monitors or hose reels that may be lost due to any line failure;
    - Local foam stations will be provided in areas that may be susceptible to pool fires;
    - Installation of flame detectors will be in pump houses/compressor buildings in areas that have the highest potential for a fire to develop;

- Hand-portable fire extinguishers will be wall-mounted in the control, administration, warehouse/maintenance, safety equipment and canteen buildings. Portable fire extinguishers will also be located throughout the plants and specified per NFPA10;
- Fixed firewater spray (deluge) systems, designed and installed in accordance with NFPA 15, will be provided for the compressor bearing housings, the turbine driver bearing housings and the lube oil consoles. Each water spray system will be automatically actuated by a pneumatic heat (fire) detection system consisting of pressurized air piping and sealed fusible element sprinkler heads located near the protected equipment. Manual actuation will also be possible from the deluge valve location / from multiple locations around the protected equipment / from the main control room; and
- Substation building, the rack room, main control room, computer area and supervisor's office in the control building, will be protected by means of an automatically actuated clean agent fire suppression system. The clean agent fire suppression agent will be discharged above ceiling tiles and under and above raised floor panels. Motorized dampers will close prior to agent discharge in order to isolate the protected spaces.

6. Safety equipment, namely emergency showers and first aid points will be provided in the plant.

4. HAZARD IDENTIFICATION

4.1 Overview

A hazard is defined as a chemical or physical condition that has the potential to cause damage to people, property and/ or the environment. This section of the report describes the hazard identification process and presents the loss of containment scenarios considered in the QRA study that are based on the Pre-FEED information of the project.

A structured and systemic approach to hazard identification has been adopted in this study to identify all potential major hazard scenarios which can lead to fatalities. Typically, the potential major hazardous incidents arising from the proposed facility and its associated supporting facilities are mainly related to the loss of containment of the hazardous materials stored onsite.

As such, the properties of the hazardous materials was reviewed and presented in this section. The review of the properties of the hazardous materials forms the basis for developing a representative set of hazardous scenarios to be considered further in the QRA study.

4.2 Hazardous Materials Onsite

The hazardous materials present on the facilities that are identified with the potential to cause offsite impact from fires, explosions or toxic exposure based on review of their chemical properties, quantity to be used in the proposed operations, Material Safety Datasheets and etcetera are:

1. Ethylene;
2. Polyethylene;
3. Propylene;
4. Butadiene;
5. Benzene;
6. Butene-1;
7. Hexene-1;
8. Hydrogen
9. Fuel Gas, i.e. tail gas produced by cracker;
10. Pyrolysis Gas Oil (PGO) / Pyrolysis Fuel Oil (PFO);
11. Naphtha;
12. Methanol;
13. Natural Gas;
14. Ethane;

15. Diesel oil; and
16. Iso-pentane.

More details on the hazardous of each of the above listed materials are presented below.

4.2.1 Ethylene

Ethylene, which is a colourless gas and of sweet hydrocarbon odour, is an extremely flammable and explosive compound with flammability limits between 2.3% - 36%. Due to its high volatility, ethylene disperses as a highly flammable vapour cloud when release into the atmosphere. The release vapour may travel to some distant source of ignition and flash back. Ethylene is not considered acutely toxic. However, excessive exposures may cause headache, muscular weakness, dizziness, nausea, loss of coordination, and in extreme conditions coma and possibly death. Excessive amounts of ethylene in the air in an enclosed or confined space will decrease the amount of oxygen and may cause asphyxiation.

4.2.2 Polyethylene

Polyethylene is an odourless solid. It is non-flammable with a flash point of 341 ℃. In addition, it poses very low toxicity to humans or animals. Therefore, it is not further accessed in this QRA.

4.2.3 Propylene

Propylene is a colourless gas with faint petroleum like odour. Propylene is extremely flammable and explosive, with flammability limits between 2% – 11%. As propylene vapour is heavier than air, the release vapour may travel across the ground and reach remote ignition sources causing a flashback fire hazard. Propylene is not considered acutely toxic; however, high propylene gas concentrations will displace available oxygen from air resulting in asphyxiation hazard.

4.2.4 Butadiene

Butadiene is an extremely flammable compound. Butadiene is a colourless liquid (under pressure) and has a mild aromatic with flammability limits between 1.4% - 16.3%. It poses an immediate fire hazard following a leak event and explosion hazard if the liquid accumulates in confined or congested areas. Butadiene poses chronic toxicity and is believed to cause acute toxicity effect only at considerably high concentration with longer exposure, i.e. 129,000 ppm with 4 hours exposure.

4.2.5 Benzene

Benzene is colourless liquid with aromatic odour. It is flammable and explosive, with flammability limits between 1.4% – 7.1%. Benzene poses chronic toxicity and exposure to benzene may occur via inhalation, ingestion, skin absorption, skin or eye contact, and accidental ingestion. It is believed that exposure to high concentration of benzene may cause central nervous system depression resulting in headaches, dizziness and nausea; continued inhalation may result in unconsciousness and/or death.

4.2.6 Butene-1

Butene-1 is a colourless gas with aromatic odour. It is flammable gas with a flash point of -80 ℃ and flammability limits between 1.6% –10%. Vapour of 1-butene is explosive. As its vapour is heavier than air, the release vapour may travel across the ground and reach remote ignition sources causing a flashback fire hazard. 1-Butene is not considered acutely toxic.

4.2.7 Hexene-1

Hexene-1 is a colourless liquid with mild odour. Hexene-1 is highly flammable, with flammability limits between 1.2% and 7%. As Hexene-1 vapour is heavier than air, the release vapour may travel across the ground and reach remote ignition sources causing a flashback fire hazard. Hexene-1 is not considered acutely toxic; however, high Hexene-1 gas concentrations will displace available oxygen from air resulting in asphyxiation hazard.

4.2.8 Hydrogen

Hydrogen is a flammable gas and the vapour can explode if ignited in an enclosed and/ or congested area. If inhaled in high concentrations it will cause difficulty breathing, or loss of consciousness. In low concentrations it may cause narcotic effects. Contact with skin may result in frostbite. These inhalation effects are anticipated to impact the workers and not anticipated to extend offsite. Hydrogen is highly reactive and can easily be ignited. The material's Minimum Ignition Energy is in the order of a magnitude lower compared to gaseous hydrocarbons, such as ethane or propane. This property, together with the wide flammability limits (4% - 75%), increases the risk of handling/ processing hydrogen. However, as hydrogen is light, it tends to be buoyant and can disperse faster in air. In addition, the Auto-Ignition Temperature of this material is lower than other gaseous hydrocarbons, e.g. ethane or propane.

4.2.9 Fuel Gas

Fuel gas is one of the by-products from the production of ethylene. Fuel gas is a flammable, colourless -pressure gas. In the event of leakage, fuel gas can cause rapid suffocation due to oxygen deficiency. Exposure to oxygen-deficient atmospheres may produce dizziness, nausea, vomiting, loss of consciousness, and death.

4.2.10 Pyrolysis Gas Oil (PGO) / Pyrolysis Fuel Oil (PFO)

Fuel oil is a complex combination of hydrocarbons with carbon numbers in the range C9 and higher. Excessive exposure of fuel oil vapours or mists may cause headache, dizziness, unconsciousness, coma, respiratory failure and death. A pool fire may occur if ignition source is present in the event of storage tank failure, pipe or equipment leak. Pool fire will be accompanied by smoke with potentially toxic gases. However, for pool fires in open areas, the smoke plumes will be disperse upward due to rising temperature, and will not result in any fatalities on the ground.

4.2.11 Naphtha

Naphtha is a liquid mixture of hydrocarbons, which consists of N-hexane, xylene, toluene, cyclohexane, pentane, heptane, ethyl benzene, benzene, 1,2,4-trimethylbenzene. It is flammable with a flash point of -21.7 ℃ and flammability limits between 1.2% – 6.9%. As naphtha contains benzene, overexposure to naphtha may be headache, dizziness, tiredness, nausea and vomiting. Exposure to very high levels can result in unconsciousness and death.

4.2.12 Methanol

Methanol is colourless watery liquid with alcohol odour under atmosphere conditions. It is flammable with a flash point of 12 ℃ and flammability limits between 6.7% – 36%. Methanol has a vapour pressure of 12.9 kPa at 20 ℃. Exposure to excessive methanol vapour may cause eye irritation, head- ache, fatigue and drowsiness. It is believed that exposure to high concentration of methanol can produce central nervous system depression and optic nerve damage; while 50,000 ppm will probably cause death in 1 to 2 hours.

4.2.13 Natural Gas - Methane

Methane (CH_4) is a highly flammable, colourless and odourless gas with flammability limits between 5%-15%. It poses an immediate fire hazard following a leak event and explosion hazard if the gas accumulates in confined or congested areas. In the event of equipment or a line break, methane can displace oxygen in air and cause asphyxiation. Exposure to oxygen-deficient atmospheres may produce dizziness, nausea, vomiting, loss of consciousness, and death. However, the affected area will only be localized, i.e. in direct vicinity of the leak location and it is not anticipated to affect offsite population.

4.2.14 Diesel Oil

Diesel has a minimum flash point of 140-160 ºF (60 - 70 ºC). Industry incidents suggest that the majority of diesel oil fires result from leaks onto insulation causing a fuel rich fire producing black smoke. In open areas these are not likely to pose a major hazard to personnel due to the localised effects. Hence, diesel fires have not been carried forward for further analysis in this QRA.

4.2.15 Iso-pentane

It is flammable liquid with a flash point of -51 ℃ and flammability limits between 1.3% –8.3%. As iso pentane vapour is heavier than air, the release vapour may travel across the ground and reach remote ignition sources causing a flashback fire hazard. Hexene-1 is not considered acutely toxic.

4.2.16 Ethane

It is flammable gas with a flash point of -135 ℃ and flammability limits between 3% –12.5%. Exposure to oxygen-deficient atmospheres may produce dizziness, nausea, vomiting, loss of consciousness, and death. However, the affected area will only be localized, i.e. in direct vicinity of the leak location and it is not anticipated to affect offsite population.

4.2.17 Summary of Hazardous Material Properties

The pertinent properties of the hazardous materials described above are listed in Table 4-1

Table 4-1: Properties of Hazardous Materials

Property	Ethylene	Polyethylene	Propylene	Butadiene	Benzene	1-Butene	Natural Gas	Diesel Oil
State	Gas	Solid	Liquid	Liquid	Liquid	Gas	Gas	Liquid
Flammability limits [vol% in air]	2.7% - 36%	N.A.	2% – 11%	1.4% – 16.3%	1.4% – 7.1%	1.6% – 10%	5.0% – 15.0%	0.6% – 7.5%
Auto ignition temperature (˚C)	450 ℃	349 ℃	455 ℃	415℃	498 ℃	385 ℃	540 ℃	257 ℃
Boiling point at 1.013 bar (˚C)	-103.7 ºC	-	-47.7 ℃	-4.4℃	80.1 ℃	-6.47 ℃	-161.5 ℃	NA
Flash point (˚C)	-136 ºC	341 ℃	-108 ℃	-76 ℃	-11 ℃	-80 ℃	-176.2 ℃	60 - 70 ℃
IDLH	-	-	-	2000 ppm	500 ppm	-	-	-
NFPA rating [(1)]: Health Fire Reactivity	 1 4 2	 0 1 0	 1 4 1	 2 4 2	 2 3 0	 1 4 0	 1 4 0	 1 2 0
Notes: 0 – Negligible; 1 – Slight; 2 – Moderate; 3 – High; 4 – Severe.								

Property	1-Hexene	Pyrolysis Gas Oil / Fuel Oil	Fuel Gas	Hydrogen	Naphtha	Methanol	Iso-pentane	Ethane
State	Liquid	Liquid	Gas	Gas	Liquid	Liquid	Liquid	Liquid
Flammability limits [vol% in air]	1.2% – 7%	Note 2	5.0% – 15.0%	4% – 75%	1.6% – 6.9%	6% – 36.5%	1.3% –8.3%	3% –12.5%

Property	1-Hexene	Pyrolysis Gas Oil / Fuel Oil	Fuel Gas	Hydrogen	Naphtha	Methanol	Iso-pentane	Ethane
Auto ignition temperature (˚C)	265℃	Note 2	540 ℃	565.5 ℃	225 ℃	464 ℃	420 ℃	515 ℃
Boiling point at 1.013 bar (˚C)	63 ℃	Note 2	-161.5 ℃	-253.0 ℃	26.7 ℃ – 148.9 ℃	64.5 ℃	27.85 ℃	-88.6 ℃
Flash point (˚C)	-26ºC (Closed Cup)	Note 2	-176.2 ℃	-	-21.7 ℃	12 ℃	-51 ℃	-135 ℃
IDLH	-	Note 2	-	-	-	6000 ppm	-	-
NFPA rating (1): Health Fire Reactivity	2 3 0	Note 2	1 4 0	0 4 0	1 3 0	1 3 0	1 4 0	1 4 0
Notes: (1) 0 – Negligible; 1 – Slight; 2 – Moderate; 3 – High; 4 – Severe. (2) Information not available at this stage of the project								

4.3 Loss of Containment Scenarios

Based on the review of properties of the hazardous materials, hazard scenarios associated with the proposed Complex are identified. These scenarios are typically due to the loss of containment of the hazardous materials listed in Section 4.2.

To identify the loss of containment scenarios, the proposed Complex is divided into isolatable sections based on the isolation valves as indicated in the PFDs and locations. These isolatable sections are further broken down into subsections based on the material types, phase and conditions of the material. The loss of containment scenarios are listed in Table 4-2. The consequences associated with each hazard scenario are discussed further in Section 6.

Table 4-2 List of Isolatable Sections and Failure Scenarios

No.	Isolatable Section ID	Section Description	Phase	P (bara)	T (°C)	Isolatable Inventory (kg)	Isolatable Volume (m^3)	MAE(s)
Tahrir Petrochemicals Complex – Main Plant Area (Excluding P2)								
1	S01	Naphtha from battery limit to manifold and to 08 unit of furnace F-01	Liquid	14	45	60461	100	PF,FF,FB,EX
2	S02	From 08 unit of furnace discharge to manifold to 27-T01 Primary Fractionator	Liquid	2	224	435	100	JF,FF,EX,FB,TX
3	S03	From 27-T01 Top discharge to inlet 28-T01 Quench Tower	Vapour	2	103	421	100	JF,FF,EX,FB,TX
4	S04	From Quench Tower Top Discharge to compressor 31-C01.I/II/III including 31-D31	Vapour	1	39	373	100	JF,FF,EX,FB,TX
5	S05	3 stage of compressor 31-C01.I/II/III	Vapour	11	45	1276	100	JF,FF,EX,FB,TX
6	S06	4th and fifth stage of compressor 31-C01.IV and discharge from 31-D35 to inlet of 34-T01 Caustic Scrubber	Vapour	21	45	2444	100	JF,FF,EX,FB,TX
7	S07	34-T01 Caustic Scrubber top discharge to 5th compressor 31-C01.V	Vapour	20	45	2109	100	JF,FF,EX,FB,TX
8	S08	5th compressor and discharge to 36-A41A/B/S Cracked gas drier include 28-T01 bottom discharge to 38-T02 Deethanizer top discharge to 31-D3	Vapour	41	45	4388	100	JF,FF,EX,FB
9	S09	From 36-41A/B/S to inlet of 36-E13	Vapour	40	-20	5216	100	JF,FF,EX,FB,TX
10	S10	From 36-D33 to 38-T01 C3 absorber	Vapour	40	-20	4110	100	JF,FF,EX,FB

No.	Isolatable Section ID	Section Description	Phase	P (bara)	T (°C)	Isolatable Inventory (kg)	Isolatable Volume (m^3)	MAE(s)
11	S11	From38-T01 top discharge to inlet of 39-R01 C2 hydrogenation Reactor	Vapour	39	72	2653	100	JF,FF,EX,FB
12	S12	From 39R-01 to inlet of 40-D31 low temp. separation drum I	Vapour	37	-53	5087	100	JF,FF,EX,FB
13	S13	Discharge from separation drum 40-D31/2/3 to inlet of 41-T01 demethanizer	Liquid	35	-53	41438	100	JF,FF,EX,FB
14	S14	Top discharge from 41T-01 to 35-T01 Caustic Stripper	Gas	35	-53	4014	100	JF,FF,EX,FB
15	S15	Bottom discharge from 28-T01 and 31-D32 (Cracked gas suction drum) to 56-T01Gasoline stabilizer	Liquid	2	41	80204	100	PF,FF,EX,FB,TX
16	S16	56-T01 bottom discharge to 61-P70A/s pump suction	Liquid	10	117	67243	100	JF,FF,EX,FB,TX
17	S17	From 61-P71A/S GH I Feed Pump to 61-D32 GH I Separator and inlet to 62-T01	Liquid	6	119	2385	100	JF,FF,EX,FB,TX
18	S18	From 62-T01 Depentanizer to inlet of 63-T01	2-phase	2	113	70608	100	PF,FF,EX,FB,TX
19	S19	63-T01 Deoctanizer Top discharge to 64-R01A/s	2-phase	34	93	11631	100	JF,FF,EX,FB,TX
20	S20	64-R01A/S Reactor gasoline Hydrogenation 2nd stage to discharge of 64-D32 GH II Separator II and inlet to 65-T01	Liquid	31	140	#N/A	100	JF,FF,EX,FB,TX
21	S21	From 65-T01 Dehexanizer top discharge to XXXX	Liquid	1	45	77389	100	PF,FF,EX,FB,TX
22	S22	From 65-T01 Dehexanizer bottom discharge to 68-Y01 hydro dealkylation unit	Liquid	5	39	1072	100	JF,FF,EX,FB,TX

No.	Isolatable Section ID	Section Description	Phase	P (bara)	T (°C)	Isolatable Inventory (kg)	Isolatable Volume (m^3)	MAE(s)
23	S23	Discharge from 27-T01 to 27-E12A/B Pyrolysis Gas oil as product and recycle line back to 27-T01	Liquid	9	90	55219	100	PF,FF,FB,EX
24	S24	Discharge from 27-T01 to 27-E11 Pyrolysis Fuel oil as product and recycle line back to furnace	Liquid	6	170	1632	100	PF,FF,FB,EX
25	S25	From bottom discharge of 38-T02 to inlet of 51-T01 depropanizer	Liquid	26	45	53116	100	JF,FF,EX,FB,TX
26	S26	From top discharge of 51-T01 to inlet of 52-R001A/S C3 hydrogenation reactor	Liquid	29	17	51674	100	JF,FF,EX,FB
27	S27	From bottom discharge of 51-T01 to inlet of 57-T01 debutanizer	Liquid	6	65	58638	100	JF,FF,EX,FB
28	S28	From 52-R001A/S C3 hydrogenation reactor to inlet of 53-T01 C3 stripper	Vapour	14	29	4158	100	JF,FF,EX,FB
29	S29	From 53-T01 stripper discharge to inlet 55-T01A/B C3 Splitter	Liquid	23	36	96439	100	JF,FF,EX,FB
30	S30	Discharge from 55-T01A/B to pump inlet 55-P71A/S	Liquid	24	43	93705	100	JF,FF,EX,FB
31	S31	Discharge from pump 55-P71A/S to Propylene Storage Tank	Liquid	24	-33	118156	100	JF,FF,EX,FB
32	S32	Top discharge from 57-T01 to inlet of Butadiene Extraction unit 58-Y01	Liquid	8	15	122359	100	PF,FF,EX,FB,TX
33	S33	Butadiene Extraction unit 58-Y01 to Butadiene Battery Limit and inlet to 60-D31	Liquid	9	15	125625	100	PF,FF,EX,FB,TX

No.	Isolatable Section ID	Section Description	Phase	P (bara)	T (°C)	Isolatable Inventory (kg)	Isolatable Volume (m^3)	MAE(s)
34	S34	Raffinate discharge from 58-Y01 to C4 Recycle line	Liquid	14	79	100270	100	JF,FF,EX,FB
35	S35	From Top discharge of 62-T01 to C5 recycle line	Liquid	14	46	120098	100	JF,FF,EX,FB
36	S36	67-Y01 Benzene Extraction Unit to Battery Limit	Liquid	6	45	170529	100	PF,FF,EX,FB,TX
37	S37	Hydro dealkylation unit 68-Y01 to battery limit of benzene product	Liquid	5	40	171560	100	PF,FF,EX,FB,TX
38	S38	Bottom discharge of 36-D31, 36-D33 and 38-T01 to 38-T01	Liquid	41	15	#N/A	100	JF,FF,EX,TX
39	S39	C2/C3 recycle line to Furnace 07-09 from 55-T01A/B	Vapour	8	70	2261	100	JF,FF,EX,FB
40	S40	C4 recycle line - From 60-D31 to Naphtha manifold	Liquid	14	79	100270	100	JF,FF,EX,FB
41	S41	Bottom discharge from 63-T01 to 27-E12A/B (C9+ recycle line)	Liquid	9	204	4566	100	JF,FF,EX,FB
42	S42	Methanol phase Separator 39-D31 and Methanol unit from Battery limit	Liquid	3	Amb	153773	100	PF,FF,FB,EX
43	S43	41-T01 bottom discharge to inlet of 43-T01 C2 Splitter	2-phase	37	-53	10170	100	JF,FF,EX,FB
44	S44	Top discharge from 43-T01 to ethylene compressor inlet 44-C0I.III/IV	Vapour	8	20	2566	100	JF,FF,EX,FB
45	S45	ethylene compressor 44-C0I.III/IV and Ethylene manifold and battery limit	Vapour	34	44	9410	100	JF,FF,EX,FB
46	S46	From 44-D31 to 44-C01.I	Vapour	8	20	9410	100	JF,FF,EX,FB

No.	Isolatable Section ID	Section Description	Phase	P (bara)	T (°C)	Isolatable Inventory (kg)	Isolatable Volume (m^3)	MAE(s)
47	S47	Propylene Filling Unit to inlet of 53-T01	Vapour	18	70	7232	100	JF,FF,EX,FB
48	S48	40-D33 Hydrogen Separator to 48-Y01 PSA unit	Vapour	35	40	554	100	JF,FF,EX,FB
49	S49	48-Y01 PSA unit to hydrogen distribution line	Vapour	35	40	554	100	JF,FF,EX,FB
50	S50	79-Y01 Butene-1 unit to 73-D31 and battery limit	Liquid	10	45	112129	100	JF,FF,EX,FB
51	S51	Truck inlet to 76-D31 n-hexane tank to inlet of 79-Y01	Liquid	NA	Amb	15915	100	PF,FF,FB,EX
52	S52	Fuel Gas System	Gas	6	15	272	50	JF,FF,EX,FB
82	S82	Ethylene Tank 71-D31	Liquid	10	-90	10970000	20000	JF,FF,EX,FB
83	S83	Ethane Tank 71-D32	Liquid	10	-90	4097000	7500	JF,FF,EX,FB
84	S84	Mixed C4 Tank 59-D31	Liquid	8	15	4711000	7500	JF,FF,EX,FB
85	S85	Naphtha Feed Buffer Tank 24-D31	Liquid	5	Amb	6578000	10000	JF,PF,FF,EX
86	S86	Mixed C6 Tank 66-D31	Liquid	Atm	45	6395000	7500	JF,PF,FF,EX
87	S87	PGO/PFO Tank 77-D31	Liquid	6	110	1366000	2000	JF,PF,FF,EX
88	S88	Hexene-1 Tank 75-D31	Liquid	8	Amb	5033000	7500	JF,PF,FF,EX
Pipelines (Between Main Plant and Tank Farm and Between Jetty area and Tank Farm)								
53	S53	14” Naphtha pipeline from Marine Loading Arm to Tank	Liquid	5	Amb	102621	149	JF,FF,EX

No.	Isolatable Section ID	Section Description	Phase	P (bara)	T (°C)	Isolatable Inventory (kg)	Isolatable Volume (m^3)	MAE(s)
54	S54	18 Propylene pipeline from tank to jetty	Liquid	34	-33	109581	246	JF,FF,EX
55	S55	6" Hexene-1 pipeline from tank to jetty	Liquid	7.9	Amb	17730	27	JF,FF,EX
56	S56	6" Benzene pipeline from tank to jetty	Liquid	6	45	23328	27	JF,FF,EX,TX
57	S57	4" Butadiene pipeline from tank to jetty	Liquid	11	-5	7930	12	JF,FF,EX,TX
58	S58	6" Butene-1 (Isopentane) pipeline from tank to jetty	Liquid	5	Amb	15297	27	JF,FF,EX
59	S59	14" Naphtha underground pipeline from OSBL storage tank to ISBL	Liquid	5	Amb	747136	1092	JF,FF,EX
60	S60	6" Hexene-1 underground pipeline from ISBL to OSBL storage tank	Liquid	7.9	Amb	130032	201	JF,FF,EX
61	S61	8” Propylene underground pipeline from ISBL to OSBL storage tank	Liquid	16	-33	210781	357	JF,FF,EX
62	S62	6” Benzene underground pipeline from ISBL to OSBL storage tank	Liquid	6	45	171092	201	JF,FF,EX,TX
63	S63	6” Butene-1 (isopentene) underground pipeline from ISBL to OSBL storage tank	Liquid	5	Amb	112189	201	JF,FF,EX
64	S64	6” Ethylene underground pipeline from ISBL to OSBL storage tank	Liquid	10	-90	110042	201	JF,FF,EX
65	S65	4” Butadiene underground pipeline from ISBL to OSBL storage tank	Liquid	11	-5	58161	89	JF,FF,EX,TX
66	S66	28” Natural Gas underground pipeline from ISBL to OSBL storage tank	Gas	6	15	23816	4370	JF,FF,EX

No.	Isolatable Section ID	Section Description	Phase	P (bara)	T (°C)	Isolatable Inventory (kg)	Isolatable Volume (m^3)	MAE(s)
81	S81	6" Ethane pipeline from Jetty to ISBL	Liquid	11	-100	127410	228	JF,FF,EX
Sokhna 1 (McDermott) Port-Tank Farm								
67	S67	Naphtha Storage Tank D5000A/B/C/D	Liquid	Atm	Amb	85900100	140000	PF,FF,EX
68	S68	Propylene Storage Tank D5006	Liquid	Atm	-46	34683200	57000(2)	JF,FF,EX
69	S69	Butadiene Tank D5007A/B	Liquid	Atm	-5	12391300	19000(2)	JF,FF,EX,TX
70	S70	Benzene Tank D5008 A/B	Liquid	Atm	Amb	14475600	17000(2)	JF,FF,EX,TX
71	S71	Hexene-1 Export Storage Tank D5010	Liquid	Atm	Amb	6491410	10000(2)	JF,FF,EX
72	S72	Ethylene Storage Tank D5014	Liquid	Atm	-104	23874900	42000(2)	JF,FF,EX
Tahrir Petrochemicals Complex – Main Plant Area (P2) (3)								
73	S73	Comonomer FEED To PE Reactor Unit	Liquid	9	40	123313	100	JF,FF,EX
74	S74	Ethylene Feed to PE reactor	Liquid	34	40	9803	100	JF,FF,EX
75	S75	Hydrogen Feed to PE reactor	Gas	43	40	678	100	JF,FF,EX
76	S76	ICA FEED to PE reactor	Liquid	9	40	123313	100	JF,FF,EX
77	S77	Alkyl Supply to PE reactor	Liquid	9	40	123313	100	JF,FF,EX
78	S78	Reactor	Liquid	34	40	9803	100	JF,FF,EX
Sokhna 1 (McDermott) Port – Jetty area (3)								
79	S79	Marine Loading Arm(4)	Liquid	16	-33	44498	100	JF,FF,EX
80	S80	Butadiene Marine Loading Arm	Liquid	11	-5	65217	100	JF,FF,EX,TX

No.	Isolatable Section ID	Section Description	Phase	P (bara)	T (°C)	Isolatable Inventory (kg)	Isolatable Volume (m^3)	MAE(s)

Note:

(1) Isolatable Volume in Main Plant area and Marine loading Arm is assumed to 100m^3 based on similar assignments.

(2) The volume presented in the table is the tank design capacity. In the modelling, operating volume shall be considered.

(3) Please refer to Appendix A

(4) Assuming that all loading arms will be operating under the same conditions (worst case scenario)

5. FREQUENCY ANALYSIS

5.1 Introduction

This section presents the failure frequency for the hazard scenarios identified in Table 4-2. The frequency analysis was undertaken based on the use of published hydrocarbon release database in TNO Purple Book [Ref. 1], UK HSE [Ref. 2], and UKOPA Pipeline Fault Database [Ref. 3].

The classical method of calculating the failure rate of an isolatable section of equipment or a chosen set of equipment items is to count the different items and associated line lengths. The failure rate for a certain item is then broken down into the correct proportions for required release rate bands. The overall frequency for a particular set of equipment as represented by Equation 5-1:

$$F_t = \sum F\ N \qquad \text{Equation 5-1}$$

Where,

F_t = total failure frequency (per year per unit)

F = individual item frequency (per year)

N = number of items or length of piping unit

Having determined the failure frequency for each isolatable section, event tree analysis is used to determine the probability of various hazard outcomes, in this case, ignition leading to a jet fire/pool fire, flash fire and explosion.

5.2 Equipment and Piping Failure Frequencies

Historical failure frequency and hole size distribution data for equipment and process piping are based on the TNO Purple Book [Ref. 1], as shown in Assumption Sheet A2.1 of Appendix A. The pipeline frequency is obtained from UKOPA Pipeline Fault Database [Ref. 3] and is further elaborated in the Section 5.3.

To determine the equipment failure frequency of each isolatable section presented in Assumption Sheet A1.1 of Appendix A, a parts count was conducted based on the Piping & Instrumentation Diagrams (P&ID's) as shown in Assumption Sheet A2.2 of Appendix A. The failure frequency of each isolatable section was calculated by multiplying the generic failure frequency by the number of parts.

5.3 Pipeline Leak Frequency Data

The pipeline frequency was obtained from UKOPA Pipeline Fault Database [Ref. 3], which is a well-established database that covers a wide variety of transported materials such as butane, condensate, crude oil, ethane, ethylene, hydrogen, LPG, natural gas, propane, propylene, gasoline, etc.

Pipeline leak frequencies by the various failure causes from UKOPA Pipeline Fault Database [Ref. 3] are given in Table 5-1.

Table 5-1 Summary of Failure Frequency Results

Failure Cause	Contribution	Pipeline Leak Frequency (per km-year)			
		10 mm	50 mm	Rupture	Total
External Interference	61%	1.82E-05	1.83E-05	1.07E-05	**4.73E-05**
External Corrosion	9%	6.83E-06	0.00E+00	1.58E-07	**6.99E-06**
Internal Corrosion	0%	2.74E-07	0.00E+00	0.00E+00	**2.74E-07**
Material & Construction	24%	1.80E-05	2.48E-07	0.00E+00	**1.82E-05**
Ground Movement	3%	1.77E-06	5.22E-07	3.15E-07	**2.60E-06**
Other/ Unknown	3%	1.98E-06	1.29E-07	5.06E-08	**2.16E-06**
Total	**100.0%**	**4.70E-05**	**1.92E-05**	**1.13E-05**	**7.75E-05**

5.4 Summary of Leak Frequencies

The leak frequencies for different hole sizes for each sub-isolatable section are summarised in **Table 5-2**.

Table 5-2 Summary of Leak Frequency

No.	Isolatable Section ID		Leak Frequency (per year)		
			10 mm	50 mm	Rupture
Tahrir Petrochemicals Complex – Main Plant Area (Excluding P2)					
1	S01	Naphtha from battery limit to manifold and to 08 unit of furnace F-01	0.00E+00	1.10E-02	1.20E-03
2	S02	From 08 unit of furnace discharge to manifold to 27-T01 Primary Fractionator	0.00E+00	1.50E-04	3.01E-05
3	S03	From 27-T01 Top discharge to inlet 28-T01 Quench Tower	2.00E-04	5.00E-05	3.00E-05
4	S04	From Quench Tower Top Discharge to compressor 31-C01.I/II/III including 31-D31	2.00E-04	5.00E-05	3.00E-05
5	S05	3 stage of compressor 31-C01.I/II/III	1.41E-02	1.00E-04	4.07E-04
6	S06	4th and fifth stage of compressor 31-C01.IV and discharge from 31-D35 to inlet of 34-T01 Caustic Scrubber	4.60E-03	5.00E-05	1.29E-04
7	S07	34-T01 Caustic Scrubber top discharge to 5th compressor 31-C01.V	9.10E-03	2.01E-02	2.26E-03
8	S08	5th compressor and discharge to 36-A41A/B/S Cracked gas drier include 28-T01 bottom discharge to 38-T02 Deethanizer top discharge to 31-D3	2.00E-04	1.01E-02	1.04E-03
9	S09	From 36-41A/B/S to inlet of 36-E13	2.00E-04	1.00E-02	1.02E-03

No.	Isolatable Section ID		Leak Frequency (per year)		
			10 mm	50 mm	Rupture
10	S10	From 36-D33 to 38-T01 C3 absorber	1.00E-04	5.00E-05	2.00E-05
11	S11	From38-T01 top discharge to inlet of 39-R01 C2 hydrogenation Reactor	1.00E-04	2.00E-02	2.02E-03
12	S12	From 39R-01 to inlet of 40-D31 low temp. separation drum I	4.00E-04	0.00E+00	4.00E-05
13	S13	Discharge from separation drum 40-D31/2/3 to inlet of 41-T01 demethanizer	3.00E-04	0.00E+00	3.00E-05
14	S14	Top discharge from 41T-01 to 35-T01 Caustic Stripper	4.50E-03	0.00E+00	1.09E-04
15	S15	Bottom discharge from 28-T01 and 31-D32 (Cracked gas suction drum) to 56-T01Gasoline stabilizer	9.10E-03	1.00E-04	2.48E-04
16	S16	56-T01 bottom discharge to 61-P70A/s pump suction	9.30E-03	5.00E-04	3.48E-04
17	S17	From 61-P71A/S GH I Feed Pump to 61-D32 GH I Separator and inlet to 62-T01	9.10E-03	2.00E-02	2.23E-03
18	S18	From 62-T01 Depentanizer to inlet of 63-T01	1.00E-04	0.00E+00	1.00E-05
19	S19	63-T01 Deoctanizer Top discharge to 64-R01A/s	4.90E-03	0.00E+00	1.49E-04
20	S20	64-R01A/S Reactor gasoline Hydrogenation 2nd stage to discharge of 64-D32 GH II Separator II and inlet to 65-T01	4.00E-04	2.00E-02	2.04E-03
21	S21	From 65-T01 Dehexanizer top discharge	2.00E-04	2.00E-05	2.20E-04
22	S22	From 65-T01 Dehexanizer bottom discharge to 68-Y01 hydro dealkylation unit	4.60E-03	0.00E+00	1.19E-04
23	S23	Discharge from 27-T01 to 27-E12A/B Pyrolysis Gas oil as product and recycle line back to 27-T01	4.90E-03	1.03E-02	1.21E-03
24	S24	Discharge from 27-T01 to 27-E11 Pyrolysis Fuel oil as product and recycle line back to furnace	9.30E-03	1.01E-02	1.28E-03
25	S25	From bottom discharge of 38-T02 to inlet of 51-T01 depropanizer	2.00E-04	0.00E+00	2.00E-05
27	S27	From top discharge of 51-T01 to inlet of 52-R001A/S C3 hydrogenation reactor	1.00E-04	0.00E+00	1.00E-05
28	S28	From bottom discharge of 51-T01 to inlet of 57-T01 debutanizer	3.00E-04	0.00E+00	3.00E-05
30	S30	From 52-R001A/S C3 hydrogenation reactor to	4.80E-03	0.00E+00	1.39E-04

No.	Isolatable Section ID		Leak Frequency (per year)		
			10 mm	50 mm	Rupture
		inlet of 53-T01 C3 stripper			
31	S31	From 53-T01 stripper discharge to inlet 55-T01A/B C3 Splitter	2.00E-04	3.09E-02	3.21E-03
32	S32	Discharge from 55-T01A/B to pump inlet 55-P71A/S	4.70E-03	1.00E-02	1.14E-03
33	S33	Discharge from pump 55-P71A/S to Propylene Storage Tank	5.00E-04	8.00E-04	2.10E-04
34	S34	Top discharge from 57-T01 to inlet of Butadiene Extraction unit 58-Y01	2.00E-04	5.00E-05	3.00E-05
35	S35	Butadiene Extraction unit 58-Y01 to Butadiene Battery Limit and inlet to 60-D31	9.30E-03	0.00E+00	2.48E-04
36	S36	Raffinate discharge from 58-Y01 to C4 Recycle line	9.20E-03	1.01E-02	1.26E-03
37	S37	From Top discharge of 62-T01 to C5 recycle line	1.84E-02	7.08E-02	7.65E-03
38	S38	67-Y01 Benzene Extraction Unit to Battery Limit	3.00E-04	5.00E-05	4.01E-05
39	S39	Hydro dealkylation unit 68-Y01 to battery limit of benzene product	4.00E-04	2.50E-04	9.01E-05
40	S40	Bottom discharge of 36-D31, 36-D33 and 38-T01 to 38-T01	9.20E-03	1.00E-02	1.24E-03
41	S41	C2/C3 recycle line to Furnace 07-09 from 55-T01A/B	4.50E-03	2.00E-04	1.49E-04
42	S42	C4 recycle line - From 60-D31 to Naphtha manifold	4.70E-03	1.05E-03	3.39E-04
43	S43	Bottom discharge from 63-T01 to 27-E12A/B (C9+ recycle line)	1.00E-04	0.00E+00	1.00E-05
44	S44	Methanol phase Separator 39-D31 and Methanol unit from Battery limit	1.00E-04	0.00E+00	1.00E-05
45	S45	41-T01 bottom discharge to inlet of 43-T01 C2 Splitter	9.00E-03	2.00E-02	2.22E-03
46	S46	Top discharge from 43-T01 to ethylene compressor inlet 44-C0I.III/IV	9.40E-03	3.00E-04	3.18E-04
47	S47	Ethylene compressor 44-C0I.III/IV and Ethylene manifold and battery limit	1.38E-02	0.00E+00	3.57E-04
48	S48	From 44-D31 to 44-C01.I	1.00E-04	1.02E-02	1.05E-03
49	S49	Propylene Filling Unit to inlet of 53-T01	5.00E-04	4.00E-04	1.30E-04
50	S50	40-D33 Hydrogen Separator to 48-Y01 PSA	3.18E-02	2.08E-02	2.96E-03

No.	Isolatable Section ID		Leak Frequency (per year)		
			10 mm	50 mm	Rupture
		unit			
51	S51	48-Y01 PSA unit to hydrogen distribution line	4.50E-03	3.00E-04	1.69E-04
52	S52	79-Y01 Butene-1 unit to 73-D31 and battery limit	1.00E-04	2.00E-03	3.09E-04
82	S82	Ethylene Tank 71-D31	1.33E-02	0.00E+00	3.07E-04
83	S83	Ethane Tank 71-D32	1.00E-04	0.00E+00	1.00E-05
84	S84	Mixed C4 Tank 59-D31	4.40E-03	0.00E+00	9.91E-05
85	S85	Naphtha Feed Buffer Tank 24-D31	1.00E-04	0.00E+00	1.00E-05
86	S86	Mixed C6 Tank 66-D31	4.50E-03	0.00E+00	1.09E-04
87	S87	PGO/PFO Tank 77-D31	1.00E-04	0.00E+00	1.00E-05
88	S88	Hexene-1 Tank 75-D31	4.50E-03	0.00E+00	1.09E-04
Pipelines (Between Main Plant and Tank Farm and Between Jetty area and Tank Farm)					
53	S53	14” Naphtha pipeline from Marine Loading Arm to Tank	4.70E-05	1.92E-05	1.13E-05
54	S54	18 Propylene pipeline from tank to jetty	4.70E-05	1.92E-05	3.35E-06
55	S55	6" Hexene-1 pipeline from tank to jetty	4.70E-05	1.92E-05	1.13E-05
56	S56	6" Benzene pipeline from tank to jetty	4.70E-05	1.92E-05	1.13E-05
57	S57	4" Butadiene pipeline from tank to jetty	4.70E-05	1.92E-05	1.13E-05
58	S58	6" Butene-1 (Isopentane) pipeline from tank to jetty	4.70E-05	1.92E-05	1.13E-05
59	S59	14" Naphtha underground pipeline from OSBL storage tank to ISBL	4.70E-05	1.92E-05	1.13E-05
60	S60	6" Hexene-1 underground pipeline from ISBL to OSBL storage tank	3.45E-04	1.41E-04	8.26E-05
61	S61	8” Propylene underground pipeline from ISBL to OSBL storage tank	3.45E-04	1.41E-04	8.26E-05
62	S62	6” Benzene underground pipeline from ISBL to OSBL storage tank	3.45E-04	1.41E-04	8.26E-05
63	S63	6” Butene-1 (isopentene) underground pipeline from ISBL to OSBL storage tank	3.45E-04	1.41E-04	8.26E-05
64	S64	6” Ethylene underground pipeline from ISBL to OSBL storage tank	3.45E-04	1.41E-04	8.26E-05
65	S65	4” Butadiene underground pipeline from ISBL to OSBL storage tank	3.45E-04	1.41E-04	8.26E-05
66	S66	28” Natural Gas underground pipeline from	3.45E-04	1.41E-04	8.26E-05

No.	Isolatable Section ID		Leak Frequency (per year)		
			10 mm	50 mm	Rupture
		ISBL to OSBL storage tank			
81	S81	6" Ethane pipeline from Jetty to ISBL	3.92E-04	1.60E-04	9.39E-05
Sokhna 1 (McDermott) Port-Tank Farm					
67	S67	Naphtha Storage Tank D5000A/B/C/D	4.00E-04	0.00E+00	4.00E-05
68	S68	Propylene Storage Tank D5006	1.00E-04	0.00E+00	1.00E-05
69	S69	Butadiene Tank D5007A/B	2.00E-04	0.00E+00	2.00E-05
70	S70	Benzene Tank D5008 A/B	2.00E-04	0.00E+00	2.00E-05
71	S71	1-Hexene Export Storage Tank D5010	1.00E-04	0.00E+00	1.00E-05
72	S72	Ethylene Storage Tank D5014	1.00E-04	0.00E+00	1.00E-05
Tahrir Petrochemicals Complex – Main Plant Area (P2)					
73	S73	Comonomer FEED To PE Reactor Unit	9.40E-03	0.00E+00	2.58E-04
74	S74	Ethylene Feed to PE reactor	3.00E-04	0.00E+00	3.00E-05
75	S75	Hydrogen Feed to PE reactor	0.00E+00	1.50E-04	3.01E-05
76	S76	ICA FEED to PE reactor	4.60E-03	1.00E-02	1.12E-03
77	S77	Alkyl Supply to PE reactor	8.90E-03	0.00E+00	2.08E-04
78	S78	Reactor	4.90E-03	1.00E-02	1.15E-03
Sokhna 1 (McDermott) Port – Jetty area					
79	S79	Marine Loading Arm	0.00E+00	6.81E-03	6.82E-04
80	S80	Butadiene Marine Loading Arm	0.00E+00	5.16E-04	5.22E-05

5.5 Event Tree Analysis

Having estimated the isolatable sections frequencies as presented in Section 5.2, the range of possible consequences that could occur after the initiating failure is developed using event tree analysis (ETA) and the probabilities of alternative outcomes are also estimated. The event tree shown in **Figure 5-1 was used in this study for gas and liquid releases, considering the following factors within the event tree:**

1. Ignition and early ignition probabilities; and
2. Explosion given ignition probability.

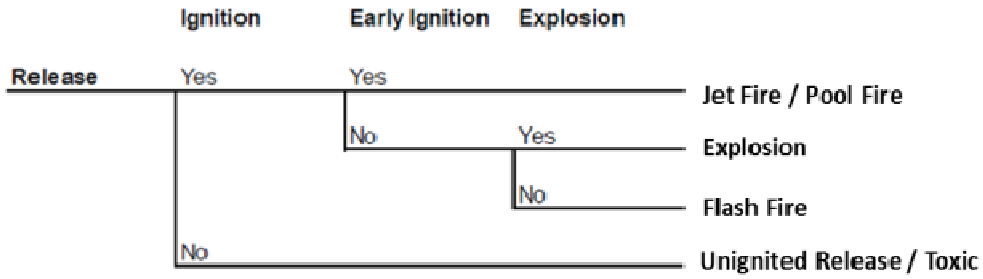

Figure 5-1 Event Tree for Gas and Liquid Releases

5.5.1 Ignition and Early Ignition

A fire will develop if a leak is ignited. Ignition probabilities used for event trees are based on release rates given in Cox, Lees and Ang [Ref. 9], as shown in Assumption Sheet A2.3.

If the release is ignited immediately, a jet or pool fire is assumed to develop before any mitigating measures can be taken. However, if the leak is not immediately ignited, i.e. delayed ignition, the release may disperse to some distance before coming in contact with an ignition source. For volatile or gaseous substance, it will result in a flash fire or explosion if the gas accumulates in a congested area.

The distribution of overall ignition probability into immediate and delayed ignition is presented in Assumption Sheet A2.3.

5.5.2 Explosion

In case of delayed ignition of flammable gas, unignited vapours may have started to accumulate in congested areas and may result in an explosion. An explosion is defined as an ignited event that generates sufficient overpressure to produce immediate escalation of the event.

The probability of delayed ignition leading to an explosion is based on historical data as presented by Cox, Lees and Ang [Ref. 9]. These explosion probabilities are presented in Assumption Sheet A2.4.

5.6 Outcome Consequences

As shown in

Figure 5-1, the event tree outcomes are grouped together into the following event outcomes, with the consequences of each group modelled to determine the overall risk (event tree outcome frequency multiplied by the consequence). This section outlines the event tree outcomes for the facility as modelled in this analysis.

5.6.1 Immediate Fires

Generally, for low-pressure liquid releases, pool fires are modelled with the fire size depending on the inventory available to the fire, any containment (such as bunding) and drainage. In the case of pressurised releases of above 4 barg, liquid jet fires (spray fires) are usually modelled.

For gas releases, jet fires are typically modelled. Jet fires are directional and of high intensity. For rupture scenarios, ignited gas releases are modelled as fireball scenarios as typically the whole inventory of the isolatable section is discharged within seconds. For isolatable sections with only piping, gas jet fires are modelled for rupture of the piping.

5.6.2 Delayed Fires

In the case of a delayed ignition, the ensuing flash fires flash back to the release source and generally continue as a jet fire, depending on the hazard scenario under consideration. Equipment and piping congestion and a lack of adequate ventilation may result in an explosion causing damage to the surrounding area.

5.6.3 Unignited Releases

In the case of unignited releases, only toxic vapours i.e. Hydrogen Sulphur (H_2S) are considered a concern. For materials that are not toxic, an unignited release is not of a concern and is not further modelled.

6. CONSEQUENCE ANALYSIS

6.1 Overview

Consequence analysis methodology comprises *source term* and *physical effects* modelling. Software package DNV PHAST 7.1 has been used for the calculation of the consequence effects.

Consequence modelling has been carried out for the identified hazard scenarios, including release rates, thermal radiation extent, dispersion and explosion overpressure distance.

6.2 Source Term Modelling

A source term describes the flow rate in the event of a leak. The release rate was modelled using the consequence modelling software package, DNV PHAST v7.1. Determination of the source term would depend on the release conditions e.g. pressure, temperature, phase of release, mode of release i.e. a hole from an equipment and etc.

Based on the representative hole sizes presented in Assumption Sheet A1.2, the initial release rates generated by PHAST v7.1 due to release from each isolatable sections are presented in Table 6-1.

Table 6-1 Initial Release Rate

No.	Isolatable Section ID		Release Rate (kg/s)		
			10 mm	50 mm	Rupture
Tahrir Petrochemicals Complex – Main Plant Area (Excluding P2)					
1	S01	Naphtha from battery limit to manifold and to 08 unit of furnace F-01	2.1	53	NA
2	S02	From 08 unit of furnace discharge to manifold to 27-T01 Primary Fractionator	0.3	1.3	NA
3	S03	From 27-T01 Top discharge to inlet 28-T01 Quench Tower	0.1	1.3	NA
4	S04	From Quench Tower Top Discharge to compressor 31-C01.I/II/III including 31-D31	0.05	1.2	NA
5	S05	3 stage of compressor 31-C01.I/II/III	0.2	4.5	NA
6	S06	4th and fifth stage of compressor 31-C01.IV and discharge from 31-D35 to inlet of 34-T01 Caustic Scrubber	0.3	8.4	NA
7	S07	34-T01 Caustic Scrubber top discharge to 5th compressor 31-C01.V	0.3	7.7	NA
8	S08	5th compressor and discharge to 36-A41A/B/S Cracked gas drier include 28-T01 bottom discharge to 38-T02 Deethanizer top discharge to 31-D3	0.6	15.6	NA

No.	Isolatable Section ID		Release Rate (kg/s)		
			10 mm	50 mm	Rupture
9	S09	From 36-41A/B/S to inlet of 36-E13	0.7	17	NA
10	S10	From 36-D33 to 38-T01 C3 absorber	0.6	15	NA
11	S11	From38-T01 top discharge to inlet of 39-R01 C2 hydrogenation Reactor	0.5	12	NA
12	S12	From 39R-01 to inlet of 40-D31 low temp. separation drum I	0.7	16	NA
13	S13	Discharge from separation drum 40-D31/2/3 to inlet of 41-T01 demethanizer	2.5	62	NA
14	S14	Top discharge from 41T-01 to 35-T01 Caustic Stripper	0.6	14	NA
15	S15	Bottom discharge from 28-T01 and 31-D32 (Cracked gas suction drum) to 56-T01Gasoline stabilizer	1.1	27	NA
16	S16	56-T01 bottom discharge to 61-P70A/s pump suction	1.9	47	NA
17	S17	From 61-P71A/S GH I Feed Pump to 61-D32 GH I Separator and inlet to 62-T01	2.2	4.4	NA
18	S18	From 62-T01 Depentanizer to inlet of 63-T01	1.1	27	NA
19	S19	63-T01 Deoctanizer Top discharge to 64-R01A/s	0.9	23	NA
20	S20	64-R01A/S Reactor gasoline Hydrogenation 2nd stage to discharge of 64-D32 GH II Separator II and inlet to 65-T01	3.8	95	NA
21	S21	From 65-T01 Dehexanizer top discharge to XXXX	0.9	23	NA
22	S22	From 65-T01 Dehexanizer bottom discharge to 68-Y01 hydro dealkylation unit	0.1	3.0	NA
23	S23	Discharge from 27-T01 to 27-E12A/B Pyrolysis Gas oil as product and recycle line back to 27-T01	1.6	47	NA
24	S24	Discharge from 27-T01 to 27-E11 Pyrolysis Fuel oil as product and recycle line back to furnace	0.1	3.6	NA
25	S25	From bottom discharge of 38-T02 to inlet of 51-T01 depropanizer	2.7	67	NA
26	S26	From top discharge of 51-T01 to inlet of 52-R001A/S C3 hydrogenation reactor	2.7	68	NA
27	S27	From bottom discharge of 51-T01 to inlet of	1.4	36	NA

No.	Isolatable Section ID		Release Rate (kg/s)		
			10 mm	50 mm	Rupture
		57-T01 debutanizer			
28	S28	From 52-R001A/S C3 hydrogenation reactor to inlet of 53-T01 C3 stripper	0.3	6.4	NA
29	S29	From 53-T01 stripper discharge to inlet 55-T01A/B C3 Splitter	2.4	60	NA
30	S30	Discharge from 55-T01A/B to pump inlet 55-P71A/S	2.5	61	NA
31	S31	Discharge from pump 55-P71A/S to Propylene Storage Tank	2.6	66	NA
32	S32	Top discharge from 57-T01 to inlet of Butadiene Extraction unit 58-Y01	1.6	41	NA
33	S33	Butadiene Extraction unit 58-Y01 to Butadiene Battery Limit and inlet to 60-D31	1.7	44	NA
34	S34	Raffinate discharge from 58-Y01 to C4 Recycle line	1.9	48	NA
35	S35	From Top discharge of 62-T01 to C5 recycle line	2.1	52	NA
36	S36	67-Y01 Benzene Extraction Unit to Battery Limit	1.7	43	NA
37	S37	Hydro dealkylation unit 68-Y01 to battery limit of benzene product	1.9	48	NA
38	S38	Bottom discharge of 36-D31, 36-D33 and 38-T01 to 38-T01	2.8	71	NA
39	S39	C2/C3 recycle line to Furnace 07-09 from 55-T01A/B	0.1	3.6	NA
40	S40	C4 recycle line - From 60-D31 to Naphtha manifold	1.9	48	NA
41	S41	Bottom discharge from 63-T01 to 27-E12A/B (C9+ recycle line)	0.2	5.3	NA
42	S42	Methanol phase Separator 39-D31 and Methanol unit from Battery limit	1.2	29	NA
43	S43	41-T01 bottom discharge to inlet of 43-T01 C2 Splitter	0.7	16	NA
44	S44	Top discharge from 43-T01 to ethylene compressor inlet 44-C0I.III/IV	0.2	4.0	NA
45	S45	ethylene compressor 44-C0I.III/IV and Ethylene manifold and battery limit	0.6	15	NA
46	S46	From 44-D31 to 44-C01.I	0.6	15	NA

No.	Isolatable Section ID		Release Rate (kg/s)		
			10 mm	50 mm	Rupture
47	S47	Propylene Filling Unit to inlet of 53-T01	0.4	9	NA
48	S48	40-D33 Hydrogen Separator to 48-Y01 PSA unit	0.1	3.7	NA
49	S49	48-Y01 PSA unit to hydrogen distribution line	0.1	3.7	NA
50	S50	79-Y01 Butene-1 unit to 73-D31 and battery limit	1.7	42	NA
51	S51	Naphtha from battery limit to manifold and to 08 unit of furnace F-01	0.1	2.4	NA
52	S52	From 08 unit of furnace discharge to manifold to 27-T01 Primary Fractionator	0.1	2.4	NA
82	S82	Ethylene Tank 71-D31	1.5	NA	NA
83	S83	Ethane Tank 71-D32	1.5	NA	NA
84	S84	Mixed C4 Tank 59-D31	1.5	NA	NA
85	S85	Naphtha Feed Buffer Tank 24-D31	1.1	NA	NA
86	S86	Mixed C6 Tank 66-D31	0.7	NA	NA
87	S87	PGO/PFO Tank 77-D31	1.4	NA	NA
88	S88	Hexene-1 Tank 75-D31	1.5	NA	NA
Pipelines (Between Main Plant and Tank Farm and Between Jetty area and Tank Farm)					
53	S53	14” Naphtha pipeline from Marine Loading Arm to Tank	1.8	44.7	1116
54	S54	18 Propylene pipeline from tank to jetty	1.9	48.6	437
55	S55	6" Hexene-1 pipeline from tank to jetty	1.8	46	84
56	S56	6" Benzene pipeline from tank to jetty	1.7	43	112
57	S57	4" Butadiene pipeline from tank to jetty	1.9	48.6	55
58	S58	6" Butene-1 (Isopentane) pipeline from tank to jetty	1.3	14	14
59	S59	14" Naphtha underground pipeline from OSBL storage tank to ISBL	4	106	154
60	S60	6” Hexene-1 underground pipeline from ISBL to OSBL storage tank	2	8	8
61	S61	8” Propylene underground pipeline from ISBL to OSBL storage tank	2	33	33
62	S62	6” Benzene underground pipeline from ISBL to OSBL storage tank	2	12	12

No.	Isolatable Section ID		Release Rate (kg/s)		
			10 mm	50 mm	Rupture
63	S63	6” Butene-1 (isopentene) underground pipeline from ISBL to OSBL storage tank	2	12	12
64	S64	6” Ethylene underground pipeline from ISBL to OSBL storage tank	2	5	5
65	S65	4” Butadiene underground pipeline from ISBL to OSBL storage tank	2	9	9
66	S66	28” Natural Gas underground pipeline from ISBL to OSBL storage tank	0.1	2	10
81	S81	6" Ethane pipeline from Jetty to ISBL	2	38	70
Sokhna 1 (McDermott) Port-Tank Farm					
67	S67	Naphtha Storage Tank D5000A/B/C/D	0.2	4	NA
68	S68	Propylene Storage Tank D5006	2	61	NA
69	S69	Butadiene Tank D5007A/B	0.6	14	NA
70	S70	Benzene Tank D5008 A/B	2	39	NA
71	S71	1-Hexene Export Storage Tank D5010	1	34	NA
72	S72	Ethylene Storage Tank D5014	1	31	NA
Tahrir Petrochemicals Complex – Main Plant Area (P2)					
73	S73	Comonomer FEED To PE Reactor Unit	2	42	NA
74	S74	Ethylene Feed to PE reactor	0.6	15	NA
75	S75	Hydrogen Feed to PE reactor	0.2	5	NA
76	S76	ICA FEED to PE reactor	2	42	NA
77	S77	Alkyl Supply to PE reactor	2	42	NA
78	S78	Reactor	0.6	15	NA
Sokhna 1 (McDermott) Port – Jetty area					
79	S79	Marine Loading Arm	2	32	32
80	S80	Butadiene Marine Loading Arm	2	9	9

6.3 Physical Effects Modelling

The type of event outcome following a loss of containment scenario depends on many factors such as the material, its phase, the operating conditions and the location of the release. The hazardous outcomes to be modelled are namely jet fires, pool fires, flash fires, fireballs, toxic gas dispersion, gas explosion. More details on the modelled outcomes are presented below.

6.3.1 Jet Fires

A jet fire describes the flame produced due to the ignition of a continuous pressurised leak or discharge from process vessels and piping. It is a burning jet of gas or atomised liquid of defined shape based on the momentum and dispersion of the release. This type of fire represents the most hazardous fire attack on a vessel as it acts like a blowtorch directed at the vessel, both annealing and eroding the metal surface of the equipment.

Jet fires may also result from releases of high-pressure liquid containing dissolved gas, due to the gas flashing off and turning the liquid into a spray of small droplets.

6.3.2 Pool Fires

A pool fire is a burning pool of liquid that has collected on a horizontal surface. If the liquid pool formed after a spill is ignited soon after release, the flammable atmosphere will only exist close to the surface of the pool. The heat generated by the fire above the surface of the pool causes the evaporation of more fuel for the fire and the fire then becomes self-sustaining. The fire will cover the entire surface of the pool. Pool fires do not create extreme temperatures; usually resulting in incomplete combustion and producing a smoky cloud, since the interior of the pool is starved of oxygen. They are unlikely to cause failure of structural members but may cause failure of other vessels that are engulfed in the fire or the 37.5 kW/m^2 thermal radiation.

6.3.3 Flash Fires

A flash fire is a fire that burns back from an ignition source to its point of release origin and is of extremely short duration lasting only a few seconds. Therefore it will not cause structural damage. However the intensity of the thermal radiation is sufficient to result in fatalities for those engulfed in the flash fire. After flash back, it will continue to burn as a jet fire depending on the source conditions.

The size of a flash fire is dependent on the time delay before ignition and the flammability limits of the gas. If the gas plume is allowed to fully develop to its stoichiometric concentration before ignition, the extent of the flash fire will be the volume of the plume that is within the flammability limits, beyond which the gas will not ignite as its concentration is no longer flammable. Thus, the flash fire results are presented in terms of distance to the Lower Flammability Limit (LFL) in this study.

6.3.4 Fireballs

A fireball is an intense spherical fire resulting from a sudden release of pressurised liquid or gas that is immediately ignited, burning as it expands, forming a ball of fire, rising in the air. A fireball expand rapidly may cause fatalities among people within it. Fireball durations are typically 5 – 20 seconds, and so the heat loads are unlikely to damage any equipment.

6.3.5 Toxic Dispersion

Dispersion modelling is used to determine the extent of a toxic cloud, i.e. the distances that a toxic cloud may be result in fatality cases. The toxic effects of toxic release are evaluated using the probit equations given in DNV PHAST v7.1. The probit uses dispersion data from the consequence

modelling to determine the probability of fatality for a person at a given distance from the release, over the entire duration of the release.

The probit function, generally used for calculating fatality consequences from toxic releases is a measure of time dependent probability of fatality from exposure to toxic chemicals as shown below:

$$P = k_1 + k_2 \ln\left[C^n t\right]$$ Equation 6-1

where

P = Probit

C = Concentration of interest, ppm

T = Time exposed to concentration, C, minutes

k_1, k_2, n = constants specific to each material, dimensionless

6.3.6 Gas Explosions

An explosion is the uncontrolled release of energy from a flame front propagating through a flammable medium, characterised by the generation of heat, light and pressure; it is the pressure generated that causes explosions to be a hazard outside the flame. The potential for generating pressure is determined by the flame speed, defined as the rate of propagation of the flame front.

The laminar burning velocity is the velocity at which a plane combustion wave propagates through an infinite stationary flammable mixture and is a fundamental property of any flammable mixture. For most fuels, the maximum laminar burning velocity occurs at fuel concentrations slightly richer than stoichiometric. The flame speed is not in general equal to the laminar burning velocity due to the effects of the geometry of the explosion, the expansion of the flammable mixture and gas turbulence.

For each release, the extent of the vapour cloud to its LFL level is compared against the confined areas identified on the Sokhna 1 (McDermott) Port/ Tahrir Petrochemicals Complex. Those vapour clouds that extend into confined areas are modelled for explosion given that explosion in the confined area may lead to an explosion. Explosion modelling were performed with the *TNO Multi-Energy* model in the DNV PHAST v7.1.

6.4 Summary of Consequence and Event Frequency Results

The consequence and event frequency results for all the hazard scenarios identified are summarised in Appendix B.

7. CRITERIA RISK SUMMATION AND DISCUSSION

7.1 Overview

The frequencies and consequences of the various outcomes were integrated to give measures of the Individual Risk (IR) level. IR is the statistical likelihood of an identified individual perishes during a year of facility operation. It is a measure of "inherent" risk and is applicable regardless of population density. IR is the calculated probability of fatality per annum to a hypothetical individual who is present at the site 24 hours a day, 365 days a year, i.e. it does not take into account the actual amount of time a person spends at site. IR is defined in Equation 8-1 as:

$$IR = \text{frequency of an event} \times \text{probability of fatality} \qquad \text{Equation 7-1}$$

TNO software, RiskCurve, was used to calculate the risks associated with the proposed Complex.

7.2 Risk Evaluation

The IR contours for the identified accident events of the proposed Complex are presented in this section. The integrated IR contours for Sokhna 1 (McDermott) Port, underground pipelines and Tahrir Petrochemical Complex Main Plant area are shown in Figure 7-1.

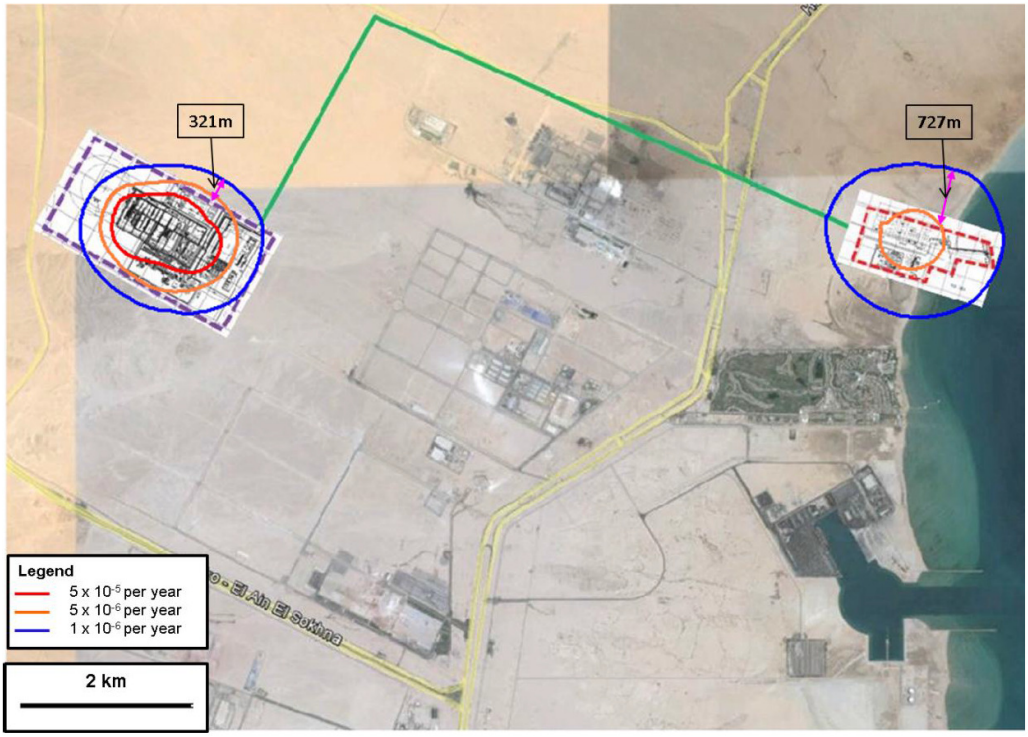

Figure 7-1 Integrated Individual Risk Contours for Tahrir Petrochemicals Complex

Table **7-1** summarises the extent of the individual risk contours for the various facilities of the Project.

Table 7-1 Summary of Individual Risk Results

Individual Risk Contour	Distance Offsite (m)	Criteria	Extent	Satisfy Individual Risk Criteria? (Y / N)
Sokhna 1 (McDermott) Port				
5 x 10^{-5} per year	0	Not extend beyond site boundary	Not generated	Y
5 x 10^{-6} per year	~138	Not extend into commercial developments, including offices, retail centres and showrooms	Within an industrial area.	Y
1 x 10^{-6} per year	~727	Not extend into residential areas	Extended within Sokhna 1 (McDermott) Port area and not extended into residential areas	Y
Pipelines (Between Main Plant and Tank Farm and Between Jetty area and Tank Farm) (1)				
5 x 10^{-5} per year	0	Not extend beyond site boundary	Not generated	Y
5 x 10^{-6} per year	0	Not extend into commercial developments, including offices, retail centres and showrooms	Not generated	Y
1 x 10^{-6} per year	0	Not extend into residential areas	Not generated	Y
Tahrir Petrochemicals Complex-Main Plant Area				
5 x 10^{-5} per year	0	Not extend beyond site boundary	Within the site Boundary.	Y
5 x 10^{-6} per year	~88	Not extend into commercial developments, including offices, retail centres and showrooms	Within an industrial area.	Y
1 x 10^{-6} per year	~321	Not extend into residential areas	Not extended into vulnerable or sensitive areas but extended into industrial area.	Y

Note:

(1) The highest IR contour generated for the underground pipelines is 1 x 10^{-8} per year (not shown on Figure 7-1).

7.3 Major Risk Contributors

One of the model outputs is the determination of the major risk contributors. For 1 x 10^{-6} individual risk per year contour that extends outside the property boundaries, the major risk contributors are the fire case in the Main Plant Area (ISBL) and Sokhna 1 (McDermott) Port area (OSBL) property boundary, as shown in Table 7-2 and Table 7-3 below

Table 7-2 Major Risk Contributions (Near ISBL Property Boundary)

No.	Isolatable Section ID	Description	% Contribution	IR (per Year)
1.	S50_R	Rupture release from 79-Y01 Butene-1 unit to 73-D31 and battery limit due fireball Heat radiation	51	2.53E-07
2.	S40_R	Rupture release from C4 recycle line – From 60-D31 to Naphtha manifold due fireball Heat radiation	45	2.24E-07
3.	S29_R	Rupture release from From 53-T01 stripper discharge to inlet 55-T01A/B C3 Splitter due fireball Heat radiation	2	1.18E-08
4.	S34_R	Rupture release from Raffinate discharge from 58-Y01 to C4 Recycle line due fireball Heat radiation	1	4.63E-09
5.	S30_R	Rupture release Discharge from 55-T01A/B to pump inlet 55-P71A/S due fireball Heat radiation	1	2.34E-09

Table 7-3 Top Risk Contributions (Near OSBL Property Boundary)

No.	Isolatable Section ID	Description	% Contribution	IR (per Year)
1.	S72_R	Rupture release of Ethylene Storage Tank D5014 end with Flash Fire	12.7	3.92E-07
2.	S68_R	Rupture release of Propylene Storage Tank D5006, Flash Fire end with Flash Fire	12.7	3.92E-07
3.	S70_R	Rupture release of Benzene Tank D5008 A/B end with Flash Fire	9.8	3.02E-07
4.	S69_R	Rupture release of Butadiene Tank D5007A/B end with Flash Fire	9.6	2.97E-07
5.	S71_R	Rupture release of 1-Hexene Export Storage Tank D5010 end with Flash Fire	9.6	2.27E-07

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

A QRA has been conducted for the Tahrir Petrochemicals Complex Project which includes the unloading and storage equipment for the raw materials, Naphtha, as well as products at the Sokhna 1 (McDermott) Port, the underground pipelines to/from the Sokhna 1 (McDermott) Port and Tahrir Petrochemical Main Plant (the Ethylene Unit and the Polyethylene Unit).

In general, the different components of the proposed Complex meet the relevant criteria. The following conclusions are made for the assessment of Individual Risk criteria for Sokhna 1 (McDermott) Port, all pipelines and Tahrir Petrochemicals Complex Main Plant (as shown in Table 8-1):

Table 8-1 Risk Assessment Summary

Facility	Risk Level (/year)	Criteria	Criteria Met?
Sokhna 1 (McDermott) Port	$5x10^{-5}$	Maximum level at the site boundary for each individual facility;	Y
	$5x10^{-6}$	Maximum level permissible for commercial developments, including offices, retail centres and showrooms	Y
	$1x10^{-6}$	Maximum level of offsite individual risk permissible for residential areas	Y
Pipelines(1)	$5x10^{-5}$	Maximum level at the site boundary for each individual facility;	Y
	$5x10^{-6}$	Maximum level at commercial developments, including offices, retail centres and showrooms	Y
	$1x10^{-6}$	Maximum level of offsite individual risk permissible for residential areas	Y
Tahrir Petrochemicals Complex-Main Plant Area	$5x10^{-5}$	Maximum level at the site boundary for each individual facility;	Y
	$5x10^{-6}$	Maximum level at commercial developments, including offices, retail centres and showrooms	Y
	$1x10^{-6}$	Maximum level of offsite individual risk permissible for residential areas	Y

Notes:

(2) The highest IR contour generated for the underground pipelines is 1 x 10^{-8} per year.

8.2 Recommendations

The study is conducted at early stage of the project and based on Pre-FEED data. Should there are any differences between the Pre-FEED data and As-built design, the present QRA study shall be updated to reflect the risk expose to onsite and offsite population/facilities.

9. REFERENCES

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Appendix A - Assumption Register

A1 CONSEQUENCE MODELLING

ASSUMPTION FORM SHEET

A1.1 Isolatable and Sub-Isolatable Sections | Revision: B

Assumptions:

The isolatable sections for the facilities are identified below.

Table A1-1 Isolatable Sections

Section ID	Isolatable Section Description
Pipeline	
S53	14” Naphtha pipeline from Marine Loading Arm to Tank
S54	18 Propylene pipeline from tank to jetty
S55	6” Hexene-1 pipeline from tank to jetty
S56	6” Benzene pipeline from tank to jetty
S57	4” Butadiene pipeline from tank to jetty
S58	6” Butene-1 (Isopentane) pipeline from tank to jetty
S59	14” Naphtha underground pipeline from OSBL storage tank to ISBL
S60	6” Hexene-1 underground pipeline from ISBL to OSBL storage tank
S61	8” Propylene underground pipeline from ISBL to OSBL storage tank
S62	6” Benzene underground pipeline from ISBL to OSBL storage tank
S63	6” Butene-1 (isopentene) underground pipeline from ISBL to OSBL storage tank
S64	6” Ethylene underground pipeline from ISBL to OSBL storage tank
S65	4” Butadiene underground pipeline from ISBL to OSBL storage tank
S66	28” Natural Gas underground pipeline from ISBL to OSBL storage tank
S*81*	6" Ethane pipeline from Jetty to ISBL
Sokhna 1 (McDermott) Port - OSBL	
S67	Naphtha Storage Tank D5000A/B/C/D
S68	Propylene Storage Tank D5006
S69	Butadiene Tank D5007A/B
S70	Benzene Tank D5008 A/B
S71	1-Hexene Export Storage Tank D5010
S72	Ethylene Storage Tank D5014
S79	Marine Loading Arm

S80	Butadiene Marine Loading Arm
Tahrir Petrochemicals Complex – ISBL	
S01	Naphtha from battery limit to manifold and to 08 unit of furnace F-01
S02	From 08 unit of furnace discharge to manifold to 27-T01 Primary Fractionator
S03	From 27-T01 Top discharge to inlet 28-T01 Quench Tower
S04	From Quench Tower Top Discharge to compressor 31-C01.I/II/III including 31-D31
S05	3 stage of compressor 31-C01.I/II/III
S06	4th and fifth stage of compressor 31-C01.IV and discharge from 31-D35 to inlet of 34-T01 Caustic Scrubber
S07	34-T01 Caustic Scrubber top discharge to 5th compressor 31-C01.V
S08	5th compressor and discharge to 36-A41A/B/S Cracked gas drier include 28-T01 bottom discharge to 38-T02 Deethanizer top discharge to 31-D3
S09	From 36-41A/B/S to inlet of 36-E13
S10	From 36-D33 to 38-T01 C3 absorber
S11	From38-T01 top discharge to inlet of 39-R01 C2 hydrogenation Reactor
S12	From 39R-01 to inlet of 40-D31 low temp. separation drum I
S13	Discharge from separation drum 40-D31/2/3 to inlet of 41-T01 demethanizer
S14	Top discharge from 41T-01 to 35-T01 Caustic Stripper
S15	Bottom discharge from 28-T01 and 31-D32 (Cracked gas suction drum) to 56-T01Gasoline stabilizer
S16	56-T01 bottom discharge to 61-P70A/s pump suction
S17	From 61-P71A/S GH I Feed Pump to 61-D32 GH I Separator and inlet to 62-T01
S18	From 62-T01 Depentanizer to inlet of 63-T01
S19	63-T01 Deoctanizer Top discharge to 64-R01A/s
S20	64-R01A/S Reactor gasoline Hydrogenation 2nd stage to discharge of 64-D32 GH II Separator II and inlet to 65-T01
S21	From 65-T01 Dehexanizer top discharge to XXXX
S22	From 65-T01 Dehexanizer bottom discharge to 68-Y01 hydro dealkylation unit
S23	Discharge from 27-T01 to 27-E12A/B Pyrolysis Gas oil as product and recycle line back to 27-T01
S24	Discharge from 27-T01 to 27-E11 Pyrolysis Fuel oil as product and recycle line back to furnace
S25	From bottom discharge of 38-T02 to inlet of 51-T01 depropanizer
S26	From top discharge of 51-T01 to inlet of 52-R001A/S C3 hydrogenation reactor
S27	From bottom discharge of 51-T01 to inlet of 57-T01 debutanizer

S28	From 52-R001A/S C3 hydrogenation reactor to inlet of 53-T01 C3 stripper
S29	From 53-T01 stripper discharge to inlet 55-T01A/B C3 Splitter
S30	Discharge from 55-T01A/B to pump inlet 55-P71A/S
S31	Discharge from pump 55-P71A/S to Propylene Storage Tank
S32	Top discharge from 57-T01 to inlet of Butadiene Extraction unit 58-Y01
S33	Butadiene Extraction unit 58-Y01 to Butadiene Battery Limit and inlet to 60-D31
S34	Raffinate discharge from 58-Y01 to C4 Recycle line
S35	From Top discharge of 62-T01 to C5 recycle line
S36	67-Y01 Benzene Extraction Unit to Battery Limit
S37	Hydro dealkylation unit 68-Y01 to battery limit of benzene product
S38	Bottom discharge of 36-D31, 36-D33 and 38-T01 to 38-T01
S39	C2/C3 recycle line to Furnace 07-09 from 55-T01A/B
S40	C4 recycle line - From 60-D31 to Naphtha manifold
S41	Bottom discharge from 63-T01 to 27-E12A/B (C9+ recycle line)
S42	Methanol phase Separator 39-D31 and Methanol unit from Battery Limit
S43	41-T01 bottom discharge to inlet of 43-T01 C2 Splitter
S44	Top discharge from 43-T01 to ethylene compressor inlet 44-C0I.III/IV
S45	ethylene compressor 44-C0I.III/IV and Ethylene manifold and battery limit
S46	From 44-D31 to 44-C01.I
S47	Propylene Filling Unit to inlet of 53-T01
S48	40-D33 Hydrogen Separator to 48-Y01 PSA unit
S49	48-Y01 PSA unit to hydrogen distribution line
S50	79-Y01 Butene-1 unit to 73-D31 and battery limit
S51	Truck inlet to 76-D31 n-hexane tank to inlet of 79-Y01
S52	Fuel Gas System
S73	Comonomer FEED To PE Reactor Unit
S74	Ethylene Feed to PE reactor
S75	Hydrogen Feed to PE reactor
S76	ICA FEED to PE reactor
S77	Alkyl Supply to PE reactor
S78	Reactor
S82	Ethylene Tank 71-D31

S83	Ethane Tank 71-D32
S84	Mixed C4 Tank 59-D31
S85	Naphtha Feed Buffer Tank 24-D31
S86	Mixed C6 Tank 66-D31
S87	PGO/PFO Tank 77-D31
S88	Hexene-1 Tank 75-D31

ASSUMPTION FORM SHEET	
A1.2 Representative Hole Sizes	Revision: B

Assumptions:

Process release modelling is based on the following representative hole sizes:

1. Small leak (10 mm);
2. Medium leak (50 mm); and
3. Line Rupture (Pipe Diameter) / Catastrophic Rupture.

ASSUMPTION FORM SHEET

A1.3 Wind Data	Revision: B

Assumptions:

The following combinations of wind speeds and Pasquill stability classes will be used for the modelling:

1. 1.5 F;
2. 3 C; and
3. 5 D.

The wind directional probabilities used in the study are given in Table A1-2. These are derived from previous assignments conducted in Ain Sokhna area [Ref. 10].

Table A1-2 Wind Directional Probabilities

Wind Condition	North	North East	East	South East	South	South West	West	North West
1.5 F	0.0491	0.0377	0.0718	0.0429	0.0036	0.0015	0.0263	0.0790
3 C	0.0377	0.0103	0.0222	0.0119	0.0010	0.0052	0.0981	0.1204
5 D	0.0145	0.0031	0.0227	0.0088	0.0005	0.0191	0.2144	0.0981

The ambient temperature and relative humidity used for the study for the Project facilities are shown in Table A1-3.

Table A1-3 Ambient Temperature and Relative Humidity [Ref.1]

Air Temperature	Day	46.1℃
	Night	14℃
Relative Humidity	Average	60%

Ambient temperature of 23˚C and relative humidity of 53% have been used in the consequence modelling in this study.

The surface roughness parameter used for modelling in this study taken to 50 cm, which best represents the terrain around the facility.

ASSUMPTION FORM SHEET	
A1.4 Detection and Isolation Time	Revision: B

Assumptions:

The shutdown can be activated remotely by the operator upon confirmed leak or fire. The detection and isolation time were assumed to be 15 minutes for small and medium leaks, and 5 minutes for all large and rupture leaks.

ASSUMPTION FORM SHEET	
A1.5 Event Outcomes Modelled	Revision: B

Assumptions:

For the consequence modelling, the following assumptions were made:

1. Immediate ignition from gas releases was modelled as jet fires (horizontal) using initial release rate from PHAST;
2. Immediate ignition from gas releases (rupture) was modelled as fireball using the isolatable section inventory. The only exception is the failure case associated with only piping where a gas jet fire scenario was modelled in the event of a piping rupture;
3. Immediate ignition from pressurized liquid releases was modelled as jet fires. Immediate ignition from atmospheric liquid releases was modelled as pool fires. Liquid jet or pool fires were modelled using the initial release rate in the consequence modelling;
4. Delayed ignition of gas release was modelled as flash fire in open area, and as explosions if it disperses into PED; and
5. Unignited releases of gases will be considered as normal dispersion.

ASSUMPTION FORM SHEET

A1.6 Model used for Flammable Gas Explosion Overpressure Modelling | Revision: B

Assumptions:

The modelled explosion does not lead to escalation of the other explosions.

The blast strength index referenced from TNO Yellow Book [Ref. 11] is presented in Table A1-4.

Table A1-4 Initial Blast Strength Index [Ref. 11]

Blast Strength Category	Ignition Energy		Obstruction			Parallel Plane Confine-ment	Multi-Energy Un-confined	Class/ Curve Strength
	Low (L)	High (H)	High (H)	Low (L)	No (N)			
1		H	H			C		7-10
2		H	H				U	7-10
3	L		H			C		5-7
4		H		L		C		5-7
5		H		L			U	4-6
6		H			N	C		4-6
7	L		H				U	4-5
8		H			N		U	4-5
9	L			L		C		3-5
10	L			L			U	2-3
11	L				N	C		1-2
12	L				N		U	1

Explosion is being modelled as an unconfined vapour cloud explosion. The applicable curve strength is referring to Table A1-4 above.

For Sokhna Port/Jetty,

1. Ignition Energy = Low;
2. Obstruction = Low; and
3. Multi-Energy Confinement = Unconfined.

Based on Table A1-4 above, the applicable curve strength was estimated to be Curve 3. These inputs were used for modelling explosion in PHAST Software. Based on the curves used for the TNO Multi-Energy model as shown in Figure A1-1, the maximum overpressure is likely 0.05 bar.

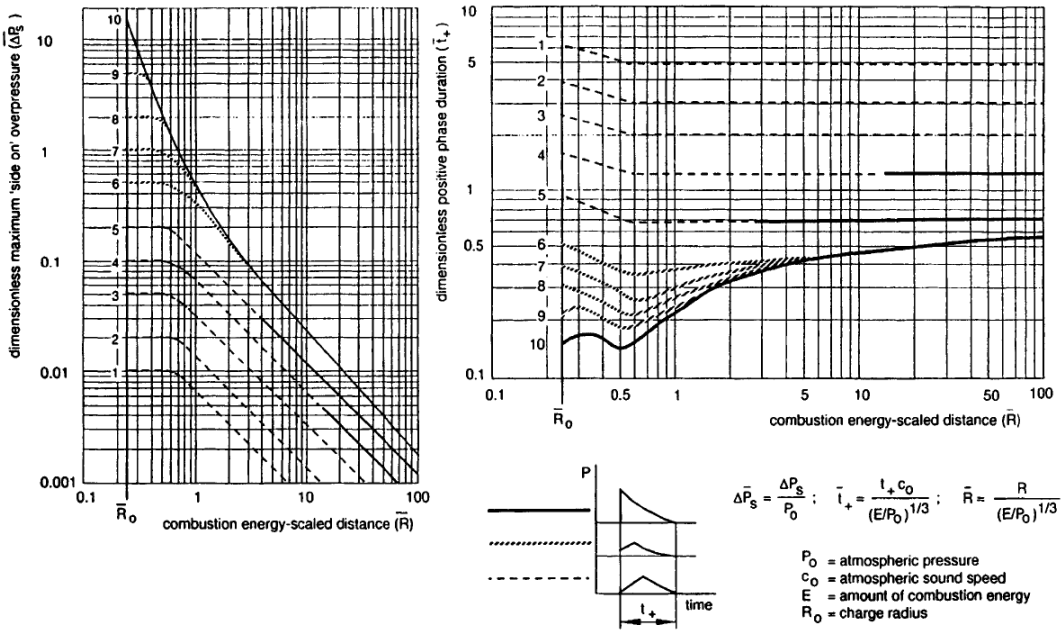
For Tahrir Petrochemicals Complex,

ASSUMPTION FORM SHEET	
A1.6 Model used for Flammable Gas Explosion Overpressure Modelling	Revision: B

1. Ignition Energy = Low;
2. Obstruction = Yes; and
3. Multi-Energy Confinement = Parallel Plane Confinement.

Based on Table A1-4 above, the applicable curve strength was estimated to be Curve 7. These inputs were used for modelling explosion in PHAST Software. Based on the curves used for the TNO Multi-Energy model as shown in Figure A1-1, the maximum overpressure is likely 1 bar.

Figure A1-1 TNO Multi-Energy Model for Vapour Cloud Explosions [Ref. 11]



ASSUMPTION FORM SHEET

A2.1 Generic Process Equipment/ Pipework Leak Frequencies | Revision: B

Assumptions:

Historical failure frequency data for the process equipment has been obtained from the public domain sources that are presented in Table A2-1.

Table A2-1 Process Equipment Failure Frequency and Hole Size Distribution

No.	Equipment	Historical Frequency (per year)	Unit	Hole Size Distribution (%)			Reference
				10 mm	50 mm	Rupture	
1.	Loading Arm	3.30E-07	/equipment.hr	0%	91%	9%	[Ref. 1]
2.	Filters	1.10E-04	/equipment.yr	91%	0%	9%	
3.	Heat Exchangers (Plate)	1.10E-04	/equipment.yr	91%	0%	9%	
4.	Heat Exchanger: Shell & Tube (HC in shell)	1.10E-04	/equipment.yr	91%	0%	9%	
5.	Heat Exchangers: Shell & Tube (HC in tube)	1.10E-02	/equipment.yr	0%	91%	9%	
6.	Pressure Vessel (Horizontal, K.O. Drum)	1.10E-06	/equipment.yr	91%	0%	9%	
7.	Pumps (Centrifugal, Double Seal)	4.50E-03	/equipment.yr	98%	0%	2%	
8.	Pumps (Reciprocating)	4.50E-03	/equipment.yr	98%	0%	2%	
9.	Centrifugal Compressor	4.50E-03	/equipment.yr	98%	0%	2%	

ASSUMPTION FORM SHEET

A2.1 Generic Process Equipment/ Pipework Leak Frequencies | Revision: B

10.	Process Vessel/Reactor	1.10E-04	/equipment.yr	91%	0%	9%	
11.	Distilation Colomn	1.10E-04	/equipment.yr	91%	0%	9%	
12.	Piping, D = 2"	6.00E-06	/metre.yr	0%	83%	17%	
13.	Piping, 2" <D<=6"	2.30E-06	/metre.yr	0%	87%	13%	
14.	Piping, 6" <D <10"	6.00E-07	/metre.yr	0%	83%	17%	
15.	Piping, 10" <D <14"	6.00E-07	/metre.yr	0%	83%	17%	
16.	Piping, 14" <D <20"	6.00E-07	/metre.yr	0%	83%	17%	
17.	Piping, 20" <D <40"	6.00E-07	/metre.yr	0%	83%	17%	
18.	Atmospheric Storage Tank	1.10E-04	/equipment.yr	91%	0%	9%	
19.	Pressure Vessel	1.10E-06	/equipment.yr	91%	0%	9%	
20.	Pressure Vessel (Horizontal, Other)	1.10E-06	/equipment.yr	91%	0%	9%	

ASSUMPTION FORM SHEET

A2.2 Overall Ignition Probability	Revision: B

Assumptions:

A fire will develop if a leak is ignited. The type of the fire will depend on the hazardous material being released, the operating conditions and initial release phase (i.e. gas, liquid or solid). Ignition probabilities have been presented to be based on release rates by Cox, Lees and Ang [Ref. 9], as shown in Table A2-2.

Table A2-2 Ignition Probabilities based on Release Rate

Leak	Probability of Ignition	
	Gas	Liquid
Minor (< 1kg/s)	0.01	0.01
Major (1 – 50 kg/s)	0.07	0.03
Massive (> 50 kg/s)	0.3	0.08

If the release is ignited immediately, a fire is assumed to develop before any mitigating measures can be taken. However, if the leak is not immediately ignited, i.e. delayed ignition, the release may disperse to some distance before coming in contact with an ignition source, resulting in a flash fire or explosion, if the gas accumulates in a congested/ confined area. The following assumptions are thus made for distribution of overall ignition probability into immediate and delayed ignition.

Table A2-3 Immediate and Delayed Ignition Probability Distribution

Release rate category	Release rate category (kg/s)	Immediate Ignition	Delayed ignition	Remarks
Small	0.1 to 1.0	0.8	0.2	For hydrogen only
Medium	1.0 - 50	0.8	0.2	For hydrogen only
Large	> 50	0.8	0.2	For hydrogen only
Small	0.1 to 1.0	0.3	0.7	For all compounds except hydrogen
Medium	1.0 - 50	0.3	0.7	For all compounds except hydrogen
Large	> 50	0.3	0.7	For all compounds except hydrogen

ASSUMPTION FORM SHEET	
A2.3 Explosion Probability	Revision: B

Assumptions:

For flammable releases with delayed ignition, unignited vapours may have started to accumulate in confined or congested areas and may result in an explosion. An explosion is defined as an ignited event that generates sufficient overpressure to produce immediate escalation of the event.

The probability of delayed ignition leading to an explosion is based on historical data as presented by Cox, Lees and Ang (Ref. 9). These explosion probabilities are presented in Table A2-4.

Table A2-4 Estimates of Explosion Following Ignition of a Vapour Release

Leak Size	Probability of Explosion
Minor (< 1kg/s)	0.04
Major (1 - 50 kg/s)	0.12
Massive (> 50 kg/s)	0.30

ASSUMPTION FORM SHEET	
A2.4 Facility Operations	Revision: B

Assumptions:

1. Jet Fire, Pool Fire and Fireball
   - Any area that falls within the envelope of 37.5 kW/m^2 radius from the hazard source will be subjected to a 100% fatality.
2. Flash Fire
   - Any area that falls within the envelope of 100% LFL will be subjected to a fatality of 100%.
3. Flammable Gas Explosion
   - Any area that falls within the envelope of 70 kPa will be subjected to a fatality of 100%.
   - Any area that falls within the envelope of 35 kPa will be subjected to a fatality of 50%.
   - Any area that falls within the envelope of 3.4 kPa will be subjected to a fatality of 1%.

ASSUMPTION FORM SHEET	
A2.5 Facility Operations /Operation Factor	Revision: B

Assumptions:

It is assumed that:

i. All operations are continuously on a 24-hour basis throughout the year.

ii. Marine Loading Arm at Sokhna Port: 7 loading arm used and one spare and usage factor is 270 days/year [Ref. 2] and 8hours/day.

iii. Marine Loading Arm for Butadiene at Quayside: one arm use and usage factor is 142 day/year [Ref. 2] and 8 hours/day

ASSUMPTION FORM SHEET

A3.1 Consequence Modelling use data: Process Condition & Inventory | Revision: B

Assumptions:

No.	Section ID	Section Description	Stream Fluid	Temperature (°C)	Pressure (bara)	Inventory (m^3)
1	S01	Naphtha from battery limit to manifold and to 08 unit of furnace F-01	25-01[Ref. 3]	45	14	100(1)
2	S02	From 08 unit of furnace discharge to manifold to 27-T01 Primary Fractionator	27-01[Ref. 3]	224	2	100(1)
3	S03	From 27-T01 Top discharge to inlet 28-T01 Quench Tower	27-02[Ref. 3]	103	2	100(1)
4	S04	From Quench Tower Top Discharge to compressor 31-C01.I/II/III including 31-D31	28-03[Ref. 3]	39	1	100(1)
5	S05	3 stage of compressor 31-C01.I/II/III	31-17[Ref. 3]	45	11	100(1)
6	S06	4th and fifth stage of compressor 31-C01.IV and discharge from 31-D35 to inlet of 34-T01 Caustic Scrubber	31-25[Ref. 3]	45	21	100(1)
7	S07	34-T01 Caustic Scrubber top discharge to 5th compressor 31-C01.V	31-26[Ref. 3]	45	20	100(1)
8	S08	5th compressor and discharge to 36-A41A/B/S Cracked gas drier include 28-T01 bottom discharge to 38-T02 Deethanizer top discharge to 31-D3	31-30[Ref. 3]	45	41	100(1)

ASSUMPTION FORM SHEET

A3.1 Consequence Modelling use data: Process Condition & Inventory | Revision: B

9	S09	From 36-41A/B/S to inlet of 36-E13	36-05[Ref. 3]	-20	40	100(1)
10	S10	From 36-D33 to 38-T01 C3 absorber	36-07[Ref. 3]	-20	40	100(1)
11	S11	From38-T01 top discharge to inlet of 39-R01 C2 hydrogenation Reactor	39-08[Ref. 3]	72	39	100(1)
12	S12	From 39R-01 to inlet of 40-D31 low temp. separation drum I	40-01[Ref. 3]	-53	37	100(1)
13	S13	Discharge from separation drum 40-D31/2/3 to inlet of 41-T01 demethanizer	40-11 [Ref. 3]	-53	35	100(1)
14	S14	Top discharge from 41T-01 to 35-T01 Caustic Stripper	Methane	-53	35	100(1)
15	S15	Bottom discharge from 28-T01 and 31-D32 (Cracked gas suction drum) to 56-T01Gasoline stabilizer	31-57[Ref. 3]	41	2	100(1)
16	S16	56-T01 bottom discharge to 61-P70A/s pump suction	61-70[Ref. 3]	117	10	100(1)
17	S17	From 61-P71A/S GH I Feed Pump to 61-D32 GH I Separator and inlet to 62-T01	61-25[Ref. 3]	119	6	100(1)
18	S18	From 62-T01 Dependanizer to inlet of 63-T01	62-18[Ref. 3]	113	2	100(1)
19	S19	63-T01 Deoctanizer Top discharge to 64-R01A/s	64-01[Ref. 3]	93	34	100(1)

ASSUMPTION FORM SHEET

A3.1 Consequence Modelling use data: Process Condition & Inventory | Revision: B

20	S20	64-R01A/S Reactor gasoline Hydrogenation 2nd stage to discharge of 64-D32 GH II Separator II and inlet to 65-T01	64-35[Ref. 3]	140	31	100(1)
21	S21	From 65-T01 Dehexanizer top discharge to XXXX	65-42[Ref. 3]	45	1	100(1)
22	S22	From 65-T01 Dehexanizer bottom discharge to 68-Y01 hydro dealkylation unit	68-01[Ref. 3]	39	5	100(1)
23	S23	Discharge from 27-T01 to 27-E12A/B Pyrolysis Gas oil as product and recycle line back to 27-T01	27-74[Ref. 3]	90	9	100(1)
24	S24	Discharge from 27-T01 to 27-E11 Pyrolysis Fuel oil as product and recycle line back to furnace	27-64[Ref. 3]	170	6	100(1)
25	S25	From bottom discharge of 38-T02 to inlet of 51-T01 depropanizer	51-01[Ref. 3]	45	26	100(1)
26	S26	From top discharge of 51-T01 to inlet of 52-R001A/S C3 hydrogenation reactor	51-09[Ref. 3]	17	29	100(1)
27	S27	From bottom discharge of 51-T01 to inlet of 57-T01 debutanizer	51-11[Ref. 3]	65	6	100(1)
28	S28	From 52-R001A/S C3 hydrogenation reactor to inlet of 53-T01 C3 stripper	53-01[Ref. 3]	29	14	100(1)
29	S29	From 53-T01 stripper discharge to inlet 55-T01A/B C3 Splitter	53-03[Ref. 3]	36	23	100(1)

ASSUMPTION FORM SHEET

A3.1 Consequence Modelling use data: Process Condition & Inventory | Revision: B

30	S30	Discharge from 55-T01A/B to pump inlet 55-P71A/S	55-17[Ref. 3]	43	24	100(1)
31	S31	Discharge from pump 55-P71A/S to Propylene Storage Tank	55-83[Ref. 3]	-33	24	100(1)
32	S32	Top discharge from 57-T01 to inlet of Butadiene Extraction unit 58-Y01	57-14[Ref. 3]	15	8	100(1)
33	S33	Butadiene Extraction unit 58-Y01 to Butadiene Battery Limit and inlet to 60-D31	58-11[Ref. 3]	15	9	100(1)
34	S34	Raffinate discharge from 58-Y01 to C4 Recycle line	60-20[Ref. 3]	79	14	100(1)
35	S35	From Top discharge of 62-T01 to C5 recycle line	62-14[Ref. 3]	46	14	100(1)
36	S36	67-Y01 Benzene Extraction Unit to Battery Limit	67-.02[Ref. 3]	45	6	100(1)
37	S37	Hydro dealkylation unit 68-Y01 to battery limit of benzene product	68-0[Ref. 3]3	40	5	100(1)
38	S38	Bottom discharge of 36-D31, 36-D33 and 38-T01 to 38-T01	36-22[Ref. 3]	15	41	100(1)
39	S39	C2/C3 recycle line to Furnace 07-09 from 55-T01A/B	25-40[Ref. 3]	70	8	100(1)

ASSUMPTION FORM SHEET

A3.1 Consequence Modelling use data: Process Condition & Inventory | Revision: B

40	S40	C4 recycle line - From 60-D31 to Naphtha manifold	60-20[Ref. 3]	79	14	100(1)
41	S41	Bottom discharge from 63-T01 to 27-E12A/B (C9+ recycle line)	63-30[Ref. 3]	204	9	100(1)
42	S42	Methanol phase Separator 39-D31 and Methanol unit from Battery limit	Methanol	amb	3	100(1)
43	S43	41-T01 bottom discharge to inlet of 43-T01 C2 Splitter	41-01[Ref. 3]	-53	37	100(1)
44	S44	Top discharge from 43-T01 to ethylene compressor inlet 44-C0I.III/IV	43-04[Ref. 3]	20	8	100(1)
45	S45	ethylene compressor 44-C0I.III/IV and Ethylene manifold and battery limit	44-13[Ref. 3]	44	34	100(1)
46	S46	From 44-D31 to 44-C01.I	43-04[Ref. 3]	20	8	100(1)
47	S47	Propylene Filling Unit to inlet of 53-T01	46-06[Ref. 3]	70	18	100(1)
48	S48	40-D33 Hydrogen Separator to 48-Y01 PSA unit	49-29[Ref. 3]	40	35	100(1)
49	S49	48-Y01 PSA unit to hydrogen distribution line	49-29[Ref. 3]	40	35	100(1)
50	S50	79-Y01 Butene-1 unit to 73-D31 and battery limit	Butene-1	45	10	100(1)

ASSUMPTION FORM SHEET

A3.1 Consequence Modelling use data: Process Condition & Inventory | Revision: B

51	S51	Truck inlet to 76-D31 n-hexane tank to inlet of 79-Y01	N-hexane	amb[Ref. 5]	NA[Ref. 5]	100(1)
52	S52	Fuel Gas System	Methane	15[Ref. 5]	6[Ref. 5]	50
53	S53	14” Naphtha pipeline from Marine Loading Arm to Tank	Naphtha	amb[Ref.6]	7[Ref.6]	149[Ref. 2]
54	S54	18 Propylene pipeline from tank to jetty	Ethylene	-33[Ref.6]	34[Ref.6]	246[Ref. 2]
55	S55	6" Hexene-1 pipeline from tank to jetty	1-Hexene	amb[Ref.6]	7.9[Ref.6]	27[Ref. 2]
56	S56	6" Benzene pipeline from tank to jetty	Benzene	45[Ref.6]	6[Ref.6]	27[Ref. 2]
57	S57	4" Butadiene pipeline from tank to jetty	Butadiene	-5[Ref.6]	11[Ref.6]	12[Ref. 2]
58	S58	6" Butene-1 (Isopentane) pipeline from tank to jetty	1-Butene	Amb [Ref.6]	5[Ref.6]	27[Ref. 2]
59	S59	14" Naphtha underground pipeline from OSBL storage tank to ISBL	Naphtha	Amb [Ref. 6]	5[Ref. 6]	1092[Ref. 2]
60	S60	6" Hexene-1 underground pipeline from ISBL to OSBL storage tank	1-Hexene	amb[Ref. 6]	7.9[Ref. 6]	201[Ref. 2]
61	S61	8” Propylene underground pipeline from ISBL to OSBL storage tank	Propylene	-33[Ref. 6]	16[Ref. 6]	357[Ref. 2]
62	S62	6” Benzene underground pipeline from ISBL to OSBL storage tank	1-Butene	45[Ref. 6]	6[Ref. 6]	201[Ref. 2]
63	S63	6” Butene-1 (isopentene) underground pipeline from ISBL to OSBL storage tank	1-Butene	amb[Ref. 6]	5[Ref. 6]	201[Ref. 2]
64	S64	6” Ethylene underground pipeline from ISBL to OSBL	Ethylene	-90[Ref. 6]	10[Ref. 6]	201[Ref. 2]

ASSUMPTION FORM SHEET

A3.1 Consequence Modelling use data: Process Condition & Inventory | Revision: B

		storage tank				
65	S65	4" Butadiene underground pipeline from ISBL to OSBL storage tank	Butadiene	-5[Ref. 6]	11[Ref. 6]	89[Ref. 2]
66	S66	28" Natural Gas underground pipeline from ISBL to OSBL storage tank	Methane	15[Ref. 6]	6 [Ref. 6]	4370[Ref. 2]
67	S67	Naphtha Storage Tank D5000A/B/C/D	Naphtha	amb[Ref. 5]	Atm[Ref. 5]	140000(3)[Ref. 2]
68	S68	Propylene Storage Tank D5006	Propylene	-46.36(2)	20(2)	57000(3) [Ref. 2]
69	S69	Butadiene Tank D5007A/B	Butadiene	-5(2)	atm(2)	19000(3) [Ref. 2]
70	S70	Benzene Tank D5008 A/B	Benzene	amb(2)	6(2)	17000(3) [Ref. 2]
71	S71	1-Hexene Export Storage Tank D5010	1-Hexene	45(2)	5(2)	10000(3) [Ref. 2]
72	S72	Ethylene Storage Tank D5014	Ethylene	-103.5(2)	5(2)	42000(3) [Ref. 2]
73	S73	Comonomer FEED To PE Reactor Unit	2[Ref. 4]	40(2)	9(2)	100(1)
74	S74	Ethylene Feed to PE reactor	1[Ref. 4]	40(2)	34(2)	100(1)
75	S75	Hydrogen Feed to PE reactor	4[Ref. 4]	40(2)	43(2)	100(1)
76	S76	ICA FEED to PE reactor	3[Ref. 4]	40(2)	9(2)	100(1)
77	S77	Alkyl Supply to PE reactor	13[Ref. 4]	40(2)	9(2)	100(1)
78	S78	Reactor	14[Ref. 4]	40(2)	34(2)	100(1)

ASSUMPTION FORM SHEET

A3.1 Consequence Modelling use data: Process Condition & Inventory | Revision: B

79	S79	Marine Loading Arm	Propylene	-33[(2)]	16[(2)]	100[(1)]
80	S80	Butadiene Marine Loading Arm	Butadiene	-5[(2)]	11[(2)]	100[(1)]
81	S81	6" Ethane pipeline from Jetty to ISBL	Ethane	-100[Ref. 6]	10 [Ref. 6]	228[Ref. 6]
82	S82	Ethylene Tank 71-D31	Ethylene	-90 [Ref. 6]	10 [Ref. 6]	20000[(1)]
83	S83	Ethane Tank 71-D32	Ethane	-90 [Ref. 6]	10 [Ref. 6]	7500[(1)]
84	S84	Mixed C4 Tank 59-D31	57-14 [Ref. 3]	15[(2)]	8[(2)]	7500[(1)]
85	S85	Naphtha Feed Buffer Tank 24-D31	Naphtha	Amb [Ref. 6]	5 [Ref. 6]	10000[(1)]
86	S86	Mixed C6 Tank 66-D31	65-42 [Ref. 3]	45[(2)]	Atm[(2)]	7500[(1)]
87	S87	PGO/PFO Tank 77-D31	PGO/PFO	110 [Ref. 6]	6 [Ref. 6]	2000[(1)]
88	S88	Hexene-1 Tank 75-D31	1-Hexene	Amb [Ref. 6]	8 [Ref. 6]	7500[(1)]

Note:

1. Information of vessel volume and size of the pipe was not within Pre-FEED information; hence, inventory of the iso-section will be general engineering assumption.
2. Process condition was not within Pre-FEED information; hence, the assumption will be made with similar to the material within the pipeline/process.
3. The volume presented in the table is the tank design capacity. In the modelling, operating volume shall be considered.

Appendix B - Consequence and Frequency Result

Table B1 Summary of Consequence and Frequency Results

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
1	S01_M	Medium release from Naphtha from battery limit to manifold and to 08 unit of furnace F-01	60461	50	53	1140	Pool Fire	37.5 kW/m^2	67	76	80	2.64E-04
								4 kW/m^2	131	130	129	
								3% fatality	59	59	59	
							Flash Fire	LFL	223	164	138	4.31E-04
							Explosion	5 psi	124	81	68	1.85E-04
								1 psi	402	262	221	
								0.5 psi	733	478	404	
2	S01_R	Rupture of Naphtha from battery limit to manifold and to 08 unit of furnace F-01	60461	Rupture	NA	NA	Flash Fire	LFL	202	173	182	4.71E-05
							Pool Fire	37.5 kW/m^2	179	206	237	2.88E-05
								4 kW/m^2	450	465	486	
								3% fatality	287	307	331	
							Explosion	5 psi	NR	NR	NR	2.02E-05
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
3	S02_S	Small release from From 08 unit of furnace discharge to manifold to 27-T01 Primary Fractionator	435	10	0.3	1466	Jet Fire	37.5 kW/m^2	NR	NR	NR	0.00E+00
								4 kW/m^2	4	4	4	
								3% fatality	3	3	3	
							Flash Fire	LFL	2	2	2	0.00E+00
							Explosion	5 psi	NR	NR	NR	0.00E+00
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
							Toxic	IDLH	NR	NR	NR	0.00E+00
								3% fatality	NR	NR	NR	
4	S02_M	Medium release from From 08 unit of furnace discharge to manifold to 27-T01 Primary Fractionator	435	50	1	310	Jet Fire	37.5 kW/m^2	13	14	15	1.35E-06
								4 kW/m^2	19	19	19	
								3% fatality	16	16	17	
							Flash Fire	LFL	10	9	8	2.77E-06
							Explosion	5 psi	6	5	5	3.78E-07
								1 psi	18	16	16	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								0.5 psi	33	30	28	
							Toxic	IDLH	NR	NR	NR	1.45E-04
								3% fatality	NR	NR	NR	
5	S02_R	Rupture of From 08 unit of furnace discharge to manifold to 27-T01 Primary Fractionator	435	Rupture	NA	NA	Flash Fire	LFL	14	18	24	1.18E-06
							Fireball	37.5 kW/m^2	NR	NR	NR	7.21E-07
								4 kW/m^2	191	191	191	
								3% fatality	86	86	86	
							Explosion	5 psi	NR	NR	NR	5.05E-07
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
							Toxic	IDLH	3	3	3	2.77E-05
								3% fatality	NR	NR	NR	
6	S03_S	Small release from From 27-T01 Top discharge to inlet 28-T01 Quench Tower	421	10	0.1	3600	Jet Fire	37.5 kW/m^2	NR	NR	NR	6.00E-07
								4 kW/m^2	4	4	4	
								3% fatality	3	3	3	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Flash Fire	LFL	2	2	2	1.34E-06
							Explosion	5 psi	NR	NR	NR	5.60E-08
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
							Toxic	IDLH	NR	NR	NR	1.98E-04
								3% fatality	NR	NR	NR	
7	S03_M	Medium release from From 27-T01 Top discharge to inlet 28-T01 Quench Tower	421	50	1	331	Jet Fire	37.5 kW/m^2	14	14	14	1.05E-06
								4 kW/m^2	19	19	19	
								3% fatality	16	16	17	
							Flash Fire	LFL	10	8	8	2.16E-06
							Explosion	5 psi	5	5	5	2.94E-07
								1 psi	17	15	15	
								0.5 psi	31	28	27	
							Toxic	IDLH	NR	NR	NR	4.65E-05
								3% fatality	NR	NR	NR	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
8	S03_R	Rupture of From 27-T01 Top discharge to inlet 28-T01 Quench Tower	421	Rupture	NA	NA	Flash Fire	LFL	14	18	24	4.42E-06
							Fireball	37.5 kW/m^2	NR	NR	NR	2.70E-06
								4 kW/m^2	188	188	188	
								3% fatality	84	84	84	
							Explosion	5 psi	44	50	56	1.89E-06
								1 psi	143	164	183	
								0.5 psi	261	299	334	
							Toxic	IDLH	NR	NR	NR	2.10E-05
								3% fatality	NR	NR	NR	
9	S04_S	Small release from From Quench Tower Top Discharge to compressor 31-C01.I/II/III including 31-D31	373	10	0.05	3600	Jet Fire	37.5 kW/m^2	NR	NR	NR	6.00E-07
								4 kW/m^2	4	4	2	
								3% fatality	3	3	3	
							Flash Fire	LFL	2	2	2	1.34E-06
							Explosion	5 psi	NR	NR	NR	5.60E-08
								1 psi	NR	NR	NR	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								0.5 psi	NR	NR	NR	
							Toxic	IDLH	NR	NR	NR	1.98E-04
								3% fatality	NR	NR	NR	
10	S04_M	Medium release from From Quench Tower Top Discharge to compressor 31-C01.I/II/III including 31-D31	373	50	1	309	Jet Fire	37.5 kW/m^2	13	6	14	1.05E-06
								4 kW/m^2	19	19	19	
								3% fatality	16	16	16	
							Flash Fire	LFL	10	9	8	2.16E-06
							Explosion	5 psi	5	5	5	2.94E-07
								1 psi	18	16	15	
								0.5 psi	32	29	28	
							Toxic	IDLH	NR	NR	NR	4.65E-05
								3% fatality	NR	NR	NR	
11	S04_R	Rupture of From Quench Tower Top Discharge to compressor 31-C01.I/II/III including 31-D31	373	Rupture	NA	NA	Flash Fire	LFL	14	18	25	4.42E-06
							Fireball	37.5 kW/m^2	NR	NR	NR	2.70E-06
								4 kW/m^2	183	183	183	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								3% fatality	83	83	83	
							Explosion	5 psi	46	50	55	1.89E-06
								1 psi	148	161	179	
								0.5 psi	270	294	326	
							Toxic	IDLH	4	4	4	2.10E-05
								3% fatality	NR	NR	NR	
12	S05_S	Small release from 3 stage of compressor 31-C01.I/II/III	1276	10	0.2	3600	Jet Fire	37.5 kW/m^2	4	4	4	4.23E-05
								4 kW/m^2	7	7	6	
								3% fatality	6	6	4	
							Flash Fire	LFL	4	4	3	9.48E-05
							Explosion	5 psi	NR	NR	NR	3.95E-06
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
							Toxic	IDLH	NR	NR	NR	1.40E-02
								3% fatality	NR	NR	NR	
13	S05_M	Medium release from 3 stage of	1276	50	5	286	Jet Fire	37.5 kW/m^2	24	24	25	2.10E-06

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
		compressor 31-C01.I/II/III						4 kW/m^2	36	36	36	
								3% fatality	30	30	31	
							Flash Fire	LFL	24	21	20	4.31E-06
							Explosion	5 psi	12	10	10	5.88E-07
								1 psi	38	33	32	
								0.5 psi	69	60	58	
							Toxic	IDLH	NR	NR	NR	9.30E-05
								3% fatality	NR	NR	NR	
14	S05_R	Rupture of 3 stage of compressor 31-C01.I/II/III	1276	Rupture	NA	NA	Flash Fire	LFL	20	23	29	5.98E-05
							Fireball	37.5 kW/m^2	35	35	35	3.66E-05
								4 kW/m^2	350	350	350	
								3% fatality	180	180	180	
							Explosion	5 psi	87	86	79	2.56E-05
								1 psi	284	280	276	
								0.5 psi	518	512	503	
							Toxic	IDLH	6	6	6	2.85E-04

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								3% fatality	NR	NR	NR	
15	S06_S	Small release from 4th and fith stage of compressor 31-C01.IV and discharge from 31-D35 to inlet of 34-T01 Caustic Scrubber	2444	10	0.3	3600	Jet Fire	37.5 kW/m^2	7	7	7	1.38E-05
								4 kW/m^2	9	9	9	
								3% fatality	8	8	8	
							Flash Fire	LFL	5	5	4	3.09E-05
							Explosion	5 psi	NR	NR	NR	1.29E-06
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
							Toxic	3% fatality	NR	NR	NR	4.55E-03
								IDLH	NR	NR	NR	
16	S06_M	Medium release from 4th and fith stage of compressor 31-C01.IV and discharge from 31-D35 to inlet of 34-T01 Caustic Scrubber	2444	50	8	293	Jet Fire	37.5 kW/m^2	32	33	34	1.05E-06
								4 kW/m^2	50	50	50	
								3% fatality	40	41	42	
							Flash Fire	LFL	34	31	30	2.16E-06
							Explosion	5 psi	16	14	14	2.94E-07

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								1 psi	53	47	46	
								0.5 psi	97	86	84	
							Toxic	IDLH	NR	NR	NR	4.65E-05
								3% fatality	NR	NR	NR	
17	S06_R	Rupture of 4th and fith stage of compressor 31-C01.IV and discharge from 31-D35 to inlet of 34-T01 Caustic Scrubber	2444	Rupture	NA	NA	Flash Fire	LFL	25	27	34	1.90E-05
							Fireball	37.5 kW/m^2	93	93	93	1.16E-05
								4 kW/m^2	485	485	485	
								3% fatality	259	259	259	
							Explosion	5 psi	102	105	110	8.13E-06
								1 psi	332	341	357	
								0.5 psi	605	622	652	
							Toxic	IDLH	7	7	7	9.03E-05
								3% fatality	NR	NR	NR	
18	S07_S	Small release from 34-T01 Caustic Scrubber top discharge to 5th compressor 31-	2109	10	0.3	3600	Jet Fire	37.5 kW/m^2	7	7	4	2.73E-05
								4 kW/m^2	9	9	9	
								3% fatality	8	8	8	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
		C01.V					Flash Fire	LFL	5	5	4	6.12E-05
							Explosion	5 psi	NR	NR	NR	2.55E-06
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
							Toxic	IDLH	NR	NR	NR	9.01E-03
								3% fatality	NR	NR	NR	
19	S07_M	Medium release from 34-T01 Caustic Scrubber top discharge to 5th compressor 31-C01.V	2109	50	8	274	Jet Fire	37.5 kW/m^2	31	32	33	4.23E-04
								4 kW/m^2	48	48	48	
								3% fatality	39	40	40	
							Flash Fire	LFL	38	33	32	8.69E-04
							Explosion	5 psi	17	15	15	1.18E-04
								1 psi	56	49	48	
								0.5 psi	103	89	87	
							Toxic	IDLH	NR	NR	NR	1.87E-02
								3% fatality	NR	NR	NR	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
20	S07_R	Rupture of 34-T01 Caustic Scrubber top discharge to 5th compressor 31-C01.V	2109	Rupture	NA	NA	Flash Fire	LFL	24	27	33	3.32E-04
							Fireball	37.5 kW/m^2	87	87	87	2.03E-04
								4 kW/m^2	461	461	461	
								3% fatality	246	246	246	
							Explosion	5 psi	95	99	104	1.42E-04
								1 psi	310	322	339	
								0.5 psi	565	587	618	
							Toxic	IDLH	18	19	21	1.58E-03
								3% fatality	NR	NR	NR	
21	S08_S	Small release from 5th compressor and discharge to 36-A41A/B/S Cracked gas drier include 28-T01 bottom discharge to 38-T02 Deethanizer top discharge to 31-D3	2109	10	1	2201	Jet Fire	37.5 kW/m^2	10	10	10	6.00E-07
								4 kW/m^2	13	13	13	
								3% fatality	11	11	11	
							Flash Fire	LFL	8	7	6	1.34E-06
							Explosion	5 psi	4	4	3	5.60E-08
								1 psi	13	11	11	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								0.5 psi	23	21	20	
22	S08_M	Medium release from 5th compressor and discharge to 36-A41A/B/S Cracked gas drier include 28-T01 bottom discharge to 38-T02 Deethanizer top discharge to 31-D3	2109	50	16	144	Jet Fire	37.5 kW/m^2	42	43	45	2.12E-04
								4 kW/m^2	68	68	68	
								3% fatality	54	55	56	
							Flash Fire	LFL	61	55	56	4.35E-04
							Explosion	5 psi	27	23	23	5.94E-05
								1 psi	87	75	75	
								0.5 psi	158	137	136	
23	S08_R	Rupture of 5th compressor and discharge to 36-A41A/B/S Cracked gas drier include 28-T01 bottom discharge to 38-T02 Deethanizer top discharge to 31-D3	2109	Rupture	NA	NA	Flash Fire	LFL	31	33	43	1.53E-04
							Fireball	37.5 kW/m^2	155	155	155	9.37E-05
								4 kW/m^2	656	656	656	
								3% fatality	360	360	360	
							Explosion	5 psi	131	121	130	6.56E-05
								1 psi	425	423	423	
								0.5 psi	776	773	772	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
24	S09_S	Small release from From 36-41A/B/S to inlet og 36-E13	5216	10	1	3600	Jet Fire	37.5 kW/m^2	10	10	11	6.00E-07
								4 kW/m^2	14	14	14	
								3% fatality	12	12	12	
							Flash Fire	LFL	8	7	7	1.34E-06
							Explosion	5 psi	4	4	4	5.60E-08
								1 psi	14	12	12	
								0.5 psi	25	23	22	
							Toxic	IDLH	NR	NR	NR	1.98E-04
								3% fatality	NR	NR	NR	
25	S09_M	Medium release from From 36-41A/B/S to inlet og 36-E13	5216	50	17	308	Jet Fire	37.5 kW/m^2	44	45	47	2.10E-04
								4 kW/m^2	71	72	72	
								3% fatality	57	58	59	
							Flash Fire	LFL	71	65	67	4.31E-04
							Explosion	5 psi	30	26	26	5.88E-05
								1 psi	97	84	84	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								0.5 psi	177	153	153	
							Toxic	IDLH	NR	NR	NR	9.30E-03
								3% fatality	NR	NR	NR	
26	S09_R	Rupture of From 36-41A/B/S to inlet og 36-E13	5216	Rupture	NA	NA	Flash Fire	LFL	35	40	52	1.50E-04
							Fireball	37.5 kW/m^2	166	166	166	9.19E-05
								4 kW/m^2	697	697	697	
								3% fatality	383	383	383	
							Explosion	5 psi	138	139	145	6.43E-05
								1 psi	448	453	472	
								0.5 psi	818	826	861	
							Toxic	IDLH	NR	NR	NR	7.15E-04
								3% fatality	NR	NR	NR	
27	S10_S	Small release from From 36-D33 to 38-T01 C3 absorber	2109	10	1	2201	Jet Fire	37.5 kW/m^2	10	10	10	3.00E-07
								4 kW/m^2	13	13	13	
								3% fatality	11	12	12	
							Flash	LFL	8	7	7	6.72E-07

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Fire					
							Explosion	5 psi	4	4	4	2.80E-08
								1 psi	14	12	12	
								0.5 psi	25	23	22	
28	S10_M	Medium release from From 36-D33 to 38-T01 C3 absorber	2109	50	15	156	Jet Fire	37.5 kW/m^2	42	43	45	1.05E-06
								4 kW/m^2	68	68	69	
								3% fatality	54	55	57	
							Flash Fire	LFL	73	66	68	2.16E-06
							Explosion	5 psi	30	26	26	2.94E-07
								1 psi	98	84	84	
								0.5 psi	179	153	153	
29	S10_R	Rupture of From 36-D33 to 38-T01 C3 absorber	2109	Rupture	NA	NA	Flash Fire	LFL	33	37	48	2.94E-06
							Fireball	37.5 kW/m^2	156	156	156	1.80E-06
								4 kW/m^2	650	650	650	
								3% fatality	358	358	358	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Explosion	5 psi	121	125	132	1.26E-06
								1 psi	420	419	428	
								0.5 psi	767	765	782	
30	S11_S	Small release from From38-T01 top dischage to inlet of 39-R01 C2 hydrogenation Reactor	2109	10	0.5	3600	Jet Fire	37.5 kW/m^2	9	9	9	3.00E-07
								4 kW/m^2	12	12	11	
								3% fatality	10	10	10	
							Flash Fire	LFL	7	6	6	6.72E-07
							Explosion	5 psi	4	3	3	2.80E-08
								1 psi	12	11	10	
								0.5 psi	22	20	19	
31	S11_M	Medium release from From38-T01 top dischage to inlet of 39-R01 C2 hydrogenation Reactor	2109	50	12	222	Jet Fire	37.5 kW/m^2	38	39	41	4.21E-04
								4 kW/m^2	61	61	61	
								3% fatality	49	50	51	
							Flash Fire	LFL	59	53	54	8.64E-04
							Explosion	5 psi	26	22	22	1.18E-04

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								1 psi	84	72	72	
								0.5 psi	154	132	131	
32	S11_R	Rupture of From38-T01 top dischage to inlet of 39-R01 C2 hydrogenation Reactor	2109	Rupture	NA	NA	Flash Fire	LFL	2	30	36	2.97E-04
							Fireball	37.5 kW/m^2	132	132	132	1.82E-04
								4 kW/m^2	560	560	560	
								3% fatality	307	307	307	
							Explosion	5 psi	117	116	119	1.27E-04
								1 psi	378	378	385	
								0.5 psi	691	689	704	
33	S12_S	Small release from From 39R-01 to inlet of 40-D31 low temp. separation drum I	2109	10	1	3600	Jet Fire	37.5 kW/m^2	10	10	11	1.20E-06
								4 kW/m^2	14	14	14	
								3% fatality	12	12	12	
							Flash Fire	LFL	9	7	7	2.69E-06
							Explosion	5 psi	4	4	4	1.12E-07
								1 psi	14	13	12	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								0.5 psi	26	23	22	
34	S12_R	Rupture of From 39R-01 to inlet of 40-D31 low temp. separation drum I	2109	Rupture	NA	NA	Flash Fire	LFL	36	42	57	5.89E-06
							Fireball	37.5 kW/m^2	165	165	165	3.60E-06
								4 kW/m^2	691	691	691	
								3% fatality	380	380	380	
							Explosion	5 psi	140	141	146	2.52E-06
								1 psi	455	458	474	
								0.5 psi	830	835	865	
35	S13_S	Small release from Dischage from separation drum 40-D31/2/3 to inlet of 41-T01 demethanizer	2109	10	2	1164	Jet Fire	37.5 kW/m^2	16	14	13	2.70E-06
								4 kW/m^2	26	24	22	
								3% fatality	20	18	16	
							Flash Fire	LFL	50	34	30	5.54E-06
							Explosion	5 psi	21	15	13	7.56E-07
								1 psi	67	48	44	
								0.5 psi	122	87	79	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
36	S13_R	Rupture of Dischage from separation drum 40-D31/2/3 to inlet of 41-T01 demethanizer	2109	Rupture	NA	NA	Flash Fire	LFL	70	74	96	1.18E-06
							Fireball	37.5 kW/m^2	NR	NR	NR	7.21E-07
								4 kW/m^2	NR	NR	NR	
								3% fatality	NR	NR	NR	
							Explosion	5 psi	291	288	294	5.05E-07
								1 psi	944	934	955	
								0.5 psi	1722	1704	1743	
37	S14_S	Small release from Top discharge from 41T-01 to 35-T01 Caustic Stripper	2109	10	1	3467	Jet Fire	37.5 kW/m^2	9	10	10	1.35E-05
								4 kW/m^2	13	13	13	
								3% fatality	11	11	11	
							Flash Fire	LFL	7	6	5	3.02E-05
							Explosion	5 psi	3	3	NR	1.26E-06
								1 psi	11	10	NR	
								0.5 psi	21	19	NR	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
38	S14_R	Rupture of Top discharge from 41T-01 to 35-T01 Caustic Stripper	2109	Rupture	NA	NA	Flash Fire	LFL	30	33	41	1.60E-05
							Fireball	37.5 kW/m^2	147	147	147	9.81E-06
								4 kW/m^2	632	632	632	
								3% fatality	346	346	346	
							Explosion	5 psi	113	110	122	6.87E-06
								1 psi	368	366	397	
								0.5 psi	671	668	725	
39	S15_S	Small release from Bottom discharge from 28-T01 and 31-D32 (Cracked gas suction drum) to 56-T01Gasoline stablizer	80204	10	1	3600	Pool Fire	37.5 kW/m^2	9	10	11	8.19E-05
								4 kW/m^2	19	19	20	
								3% fatality	14	15	16	
							Flash Fire	LFL	32.29.38	20	15	1.68E-04
							Explosion	5 psi	22	11	9	2.29E-05
								1 psi	70	37	28	
								0.5 psi	128	67	51	
							Toxic	3% fatality	12	4	4	8.83E-03

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								IDLH	69	55	51	
40	S15_M	Medium release from Bottom discharge from 28-T01 and 31-D32 (Cracked gas suction drum) to 56-T01Gasoline stablizer	80204	50	27	2966	Pool Fire	37.5 kW/m^2	28	31	34	9.00E-07
								4 kW/m^2	70	72	72	
								3% fatality	46	49	50	
							Flash Fire	LFL	147	102	83	1.85E-06
							Explosion	5 psi	142	64	53	2.52E-07
								1 psi	460	208	172	
								0.5 psi	840	379	315	
							Toxic	IDLH	297	220	202	9.70E-05
								3% fatality	98	63	50	
41	S15_R	Rupture of Bottom discharge from 28-T01 and 31-D32 (Cracked gas suction drum) to 56-T01Gasoline stablizer	80204	Rupture	NA	NA	Flash Fire	LFL	88	96	140	9.72E-06
							Fireball	37.5 kW/m^2	NR	NR	NR	5.95E-06
								4 kW/m^2	NR	NR	NR	
								3% fatality	NR	NR	NR	
							Explosion	5 psi	341	336	341	4.17E-06

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								1 psi	1106	1090	1108	
								0.5 psi	2019	1989	2023	
							Toxic	IDLH	410	423	613	2.28E-04
								3% fatality	52	54	63	
42	S16_S	Small release from 56-T01 bottom discharge to 61-P70A/s pump suction	67243	10	2	3600	Jet Fire	37.5 kW/m^2	24	21	19	8.37E-05
								4 kW/m^2	36	33	62	
								3% fatality	26	24	22	
							Flash Fire	LFL	24	17	14	1.72E-04
							Explosion	5 psi	12	9	8	2.34E-05
								1 psi	40	30	27	
								0.5 psi	72	54	49	
							Toxic	IDLH	107	82	73	9.02E-03
								3% fatality	NR	NR	NR	
43	S16_M	Medium release from 56-T01 bottom discharge to 61-P70A/s pump suction	67243	50	47	1430	Jet Fire	37.5 kW/m^2	99	89	81	4.50E-06
								4 kW/m^2	150	141	136	
								3% fatality	112	102	95	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Flash Fire	LFL	245	168	143	9.24E-06
							Explosion	5 psi	111	73	66	1.26E-06
								1 psi	359	236	213	
								0.5 psi	655	430	390	
							Toxic	IDLH	573	370	326	4.85E-04
								3% fatality	53	45	45	
44	S16_R	Rupture of 56-T01 bottom discharge to 61-P70A/s pump suction	67243	Rupture	NA	NA	Flash Fire	LFL	328	345	401	1.37E-05
							Fireball	37.5 kW/m^2	121	121	121	8.36E-06
								4 kW/m^2	1179	1179	1179	
								3% fatality	615	615	615	
							Explosion	5 psi	158	173	186	5.85E-06
								1 psi	1053	1037	1048	
								0.5 psi	1922	1892	1913	
							Toxic	IDLH	944	873	971	3.20E-04
								3% fatality	70	82	128	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
45	S17_S	Small release from From 61-P71A/S GH I Feed Pump to 61-D32 GH I Separator and inlet to 62-T01	2385	10	2.2	1197	Jet Fire	37.5 kW/m^2	3	3	3	2.73E-05
								4 kW/m^2	7	7	7	
								3% fatality	7	6	6	
							Flash Fire	LFL	4	3	3	6.12E-05
							Explosion	5 psi	NR	NR	NR	2.55E-06
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
							Toxic	IDLH	39	15	NR	9.01E-03
								3% fatality	NR	NR	NR	
46	S17_M	Medium release from From 61-P71A/S GH I Feed Pump to 61-D32 GH I Separator and inlet to 62-T01	2385	50	4	595	Jet Fire	37.5 kW/m^2	23	25	27	1.80E-04
								4 kW/m^2	37	38	38	
								3% fatality	30	31	32	
							Flash Fire	LFL	20	18	16	3.70E-04
							Explosion	5 psi	11	9	9	5.04E-05
								1 psi	34	30	29	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								0.5 psi	62	55	52	
							Toxic	IDLH	242	178	157	1.94E-02
								3% fatality	NR	NR	NR	
47	S17_R	Rupture of From 61-P71A/S GH I Feed Pump to 61-D32 GH I Separator and inlet to 62-T01	2385	Rupture	NA	NA	Flash Fire	LFL	24	29	39	8.74E-05
							Fireball	37.5 kW/m^2	NR	NR	NR	5.35E-05
								4 kW/m^2	376	376	376	
								3% fatality	184	#N/A	#N/A	
							Explosion	5 psi	88	96	103	3.75E-05
								1 psi	301	313	336	
								0.5 psi	550	572	612	
							Toxic	IDLH	89	102	145	2.05E-03
								3% fatality	15	15	17	
48	S18_S	Small release from From 62-T01 Depentanizer to inlet of 63-T01	70608	10	1	3600	Pool Fire	37.5 kW/m^2	13	14	15	2.10E-06
								4 kW/m^2	20	20	20	
								3% fatality	16	17	18	
							Flash	LFL	19	11	9	4.31E-06

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Fire					
							Explosion	5 psi	9	7	6	5.88E-07
								1 psi	28	22	20	
								0.5 psi	51	40	36	
							Toxic	IDLH	76	59	51	9.30E-05
								3% fatality	NR	NR	NR	
49	S18_R	Rupture of From 62-T01 Depentanizer to inlet of 63-T01	70608	Rupture	NA	NA	Flash Fire	LFL	418	393	424	1.47E-06
							Fireball	37.5 kW/m^2	NR	NR	NR	9.01E-07
								4 kW/m^2	912	912	912	
								3% fatality	432	432	432	
							Explosion	5 psi	212	225	213	6.31E-07
								1 psi	815	881	909	
								0.5 psi	1957	1925	1947	
							Toxic	IDLH	983	922	1022	7.01E-06
								3% fatality	137	172	223	
50	S19_S	Small release from 63-T01 Deoctanizer	11631	10	1	3600	Jet Fire	37.5 kW/m^2	11	12	6	1.47E-05

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
		Top discharge to 64-R01A/s						4 kW/m^2	17	17	7	
								3% fatality	14	14	7	
							Flash Fire	LFL	8	7	6	3.29E-05
							Explosion	5 psi	4	4	4	1.37E-06
								1 psi	14	13	12	
								0.5 psi	25	23	22	
							Toxic	IDLH	111	85	71	4.85E-03
								3% fatality	NR	NR	NR	
51	S19_R	Rupture of 63-T01 Deoctanizer Top discharge to 64-R01A/s	11631	Rupture	NA	NA	Flash Fire	LFL	42	47	62	2.19E-05
							Fireball	37.5 kW/m^2	176	176	176	1.34E-05
								4 kW/m^2	830	830	830	
								3% fatality	450	450	450	
							Explosion	5 psi	180	178	178	9.39E-06
								1 psi	585	578	579	
								0.5 psi	1067	1055	1058	
							Toxic	IDLH	176	205	301	1.04E-04

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								3% fatality	26	27	30	
52	S20_S	Small release from 64-R01A/S Reactor gasoline Hydrogenation 2nd stage to discharge of 64-D32 GH II Separator II and inlet to 65-T01	5244	10	4	1345	Jet Fire	37.5 kW/m^2	18	26	30	3.60E-06
								4 kW/m^2	34	29	33	
								3% fatality	25	27	32	
							Flash Fire	LFL	45	29	26	7.39E-06
							Explosion	5 psi	21	14	13	1.01E-06
								1 psi	67	46	43	
								0.5 psi	123	85	78	
							Toxic	IDLH	145	109	97	3.88E-04
								3% fatality	NR	NR	NR	
53	S20_M	Medium release from 64-R01A/S Reactor gasoline Hydrogenation 2nd stage to discharge of 64-D32 GH II Separator II and inlet to 65-T01	5244	50	95	54	Jet Fire	37.5 kW/m^2	79	104	118	4.80E-04
								4 kW/m^2	148	136	144	
								3% fatality	107	115	128	
							Flash Fire	LFL	340	222	189	7.84E-04
							Explosion	5 psi	169	103	91	3.36E-04

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								1 psi	549	333	296	
								0.5 psi	1002	608	540	
							Toxic	IDLH	1286	487	431	1.84E-02
								3% fatality	101	96	101	
54	S20_R	Rupture of 64-R01A/S Reactor gasoline Hydrogenation 2nd stage to discharge of 64-D32 GH II Separator II and inlet to 65-T01	5244	Rupture	NA	NA	Flash Fire	LFL	642	644	632	8.00E-05
							Fireball	37.5 kW/m^2	NR	NR	NR	4.90E-05
								4 kW/m^2	NR	NR	NR	
								3% fatality	NR	NR	NR	
							Explosion	5 psi	21	14	13	3.43E-05
								1 psi	67	46	43	
								0.5 psi	123	85	78	
							Toxic	IDLH	983	922	1022	1.88E-03
								3% fatality	344	390	345	
55	S21_S	Small release from 65-T01 Dehexanizer top discharge	77389	10	1	3600	Pool Fire	37.5 kW/m^2	9	10	11	6.00E-07
								4 kW/m^2	20	21	21	
								3% fatality	14	16	16	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Flash Fire	LFL	28	19	13	1.34E-06
							Explosion	5 psi	15	7	7	5.60E-08
								1 psi	48	24	23	
								0.5 psi	87	44	42	
							Toxic	IDLH	78	55	51	1.98E-04
								3% fatality	24	14	NR	
56	S21_R	Rupture of 65-T01 Dehexanizer top discharge	77389	Rupture	NA	NA	Flash Fire	LFL	269	187	185	7.85E-07
							Fireball	37.5 kW/m^2	NR	NR	NR	4.80E-07
								4 kW/m^2	NR	NR	NR	
								3% fatality	NR	NR	NR	
							Explosion	5 psi	154	125	116	3.36E-07
								1 psi	528	484	476	
								0.5 psi	964	899	886	
							Toxic	IDLH	923	575	540	1.84E-05
								3% fatality	220	156	149	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
57	S22_S	Small release from From 65-T01 Dehexanizer bottom discharge to 68-Y01 hydro dealkylation unit	1072	10	0.1	3600	Jet Fire	37.5 kW/m^2	3	3	3	1.38E-05
								4 kW/m^2	6	5	5	
								3% fatality	5	5	5	
							Flash Fire	LFL	3	3	3	3.09E-05
							Explosion	5 psi	NR	NR	NR	1.29E-06
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
							Toxic	IDLH	NR	NR	NR	4.55E-03
								3% fatality	NR	NR	NR	
58	S22_R	Rupture of From 65-T01 Dehexanizer bottom discharge to 68-Y01 hydro dealkylation unit	1072	Rupture	NA	NA	Flash Fire	LFL	18	22	28	4.67E-06
							Fireball	37.5 kW/m^2	NR	NR	NR	2.86E-06
								4 kW/m^2	285	285	285	
								3% fatality	138	138	138	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Explosion	5 psi	82	82	81	2.00E-06
								1 psi	267	267	264	
								0.5 psi	488	487	483	
							Toxic	IDLH	49	65	89	1.09E-04
								3% fatality	9	9	9	
59	S23_S	Small release from Discharge from 27-T01 to 27-E12A/B Pyrolysis Gas oil as product and recycle line back to 27-T01	55219	10	2	3600	Pool Fire	37.5 kW/m^2	24	21	20	4.41E-05
								4 kW/m^2	37	30	29	
								3% fatality	29	26	24	
							Flash Fire	LFL	46	28	21	9.06E-05
							Explosion	5 psi	27	14	12	1.24E-05
								1 psi	89	44	39	
								0.5 psi	163	81	70	
60	S23_M	Medium release from Discharge from 27-T01 to 27-E12A/B Pyrolysis Gas oil as product and recycle line back to 27-T01	55219	50	47	1258	Pool Fire	37.5 kW/m^2	99	88	81	9.27E-05
								4 kW/m^2	155	146	140	
								3% fatality	120	110	103	
							Flash	LFL	243	167	138	1.90E-04

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Fire					
							Explosion	5 psi	190	92	78	2.60E-05
								1 psi	615	300	254	
								0.5 psi	1123	547	464	
61	S23_R	Rupture of Discharge from 27-T01 to 27-E12A/B Pyrolysis Gas oil as product and recycle line back to 27-T01	55219	Rupture	NA	NA	Flash Fire	LFL	374	295	294	4.74E-05
							Pool Fire	37.5 kW/m^2	127	144	165	2.90E-05
								4 kW/m^2	320	327	340	
								3% fatality	204	215	232	
							Fireball	37.5 kW/m^2	NR	NR	NR	2.90E-05
								4 kW/m^2	NR	NR	NR	
								3% fatality	NR	NR	NR	
							Explosion	5 psi	225	215	208	2.03E-05
								1 psi	781	792	801	
								0.5 psi	1451	1497	1491	
62	S24_S	Small release from Discharge from 27-	1632	10	0.1	3600	Pool Fire	37.5 kW/m^2	NR	NR	NR	2.79E-05

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
		T01 to 27-E11 Pyrolysis Fuel oil as product and recycle line back to furnace						4 kW/m^2	NR	NR	NR	
								3% fatality	NR	NR	NR	
							Flash Fire	LFL	19	14	12	6.25E-05
							Explosion	5 psi	10	8	7	2.60E-06
								1 psi	33	26	23	
								0.5 psi	60	47	42	
63	S24_M	Medium release from Discharge from 27-T01 to 27-E11 Pyrolysis Fuel oil as product and recycle line back to furnace	1632	50	4	451	Pool Fire	37.5 kW/m^2	44	51	53	9.13E-05
								4 kW/m^2	63	64	63	
								3% fatality	53	57	58	
							Flash Fire	LFL	187	148	127	1.88E-04
							Explosion	5 psi	10	55	56	2.56E-05
								1 psi	243	199	182	
								0.5 psi	444	362	332	
64	S24_R	Rupture of Discharge from 27-T01 to 27-E11 Pyrolysis Fuel	1632	Rupture	NA	NA	Flash Fire	LFL	70	86	102	5.01E-05
							Fireball	37.5	NR	NR	NR	3.07E-05

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
		oil as product and recycle line back to furnace						kW/m^2				
								4 kW/m^2	338	338	338	
								3% fatality	167	167	167	
							Explosion	5 psi	54	57	50	2.15E-05
								1 psi	308	299	315	
								0.5 psi	562	546	575	
65	S25_S	Small release from From bottom dicharge of 38-T02 to inlet of 51-T01 depropanizer	55219	10	3	3600	Jet Fire	37.5 kW/m^2	27	23	21	1.80E-06
								4 kW/m^2	39	36	34	
								3% fatality	31	28	26	
							Flash Fire	LFL	23	18	17	3.70E-06
							Explosion	5 psi	12	10	9	5.04E-07
								1 psi	38	31	29	
								0.5 psi	69	57	53	
							Toxic	3% fatality	NR	NR	NR	1.94E-04
								IDLH	61	43	37	
66	S25_R	Rupture of From bottom dicharge of	55219	Rupture	NA	NA	Flash Fire	LFL	106	125	203	7.85E-07

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
		38-T02 to inlet of 51-T01 depropanizer					Explosion	5 psi	304	293	83	3.36E-07
								1 psi	986	973	986	
								0.5 psi	1800	1775	1800	
							Fireball	37.5 kW/m^2	300	300	300	4.80E-07
								4 kW/m^2	1356	1356	1356	
								3% fatality	743	743	743	
							Toxic	3% fatality	26	26	29	1.84E-05
								IDLH	331	366	469	
67	S26_S	Small release from From top discharge of 51-T01 to inlet of 52-R001A/S C3 hydrogenation reactor	51674	10	3	3600	Jet Fire	37.5 kW/m^2	28	24	22	8.10E-05
								4 kW/m^2	40	37	35	
								3% fatality	32	29	27	
							Flash Fire	LFL	24	20	18	1.66E-04
							Explosion	5 psi	12	10	9	2.27E-05
								1 psi	39	32	30	
								0.5 psi	71	59	55	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
68	S26_M	Medium release from From top discharge of 51-T01 to inlet of 52-R001A/S C3 hydrogenation reactor	51674	50	68	758	Jet Fire	37.5 kW/m^2	116	102	94	2.40E-04
								4 kW/m^2	169	156	149	
								3% fatality	136	123	114	
							Flash Fire	LFL	186	201	188	3.92E-04
							Explosion	5 psi	83	73	72	1.68E-04
								1 psi	270	236	233	
								0.5 psi	493	430	426	
69	S26_R	Rupture of From top discharge of 51-T01 to inlet of 52-R001A/S C3 hydrogenation reactor	51674	Rupture	NA	NA	Flash Fire	LFL	126	155	245	4.78E-05
							Fireball	37.5 kW/m^2	291	291	291	2.93E-05
								4 kW/m^2	1299	1299	1299	
								3% fatality	713	713	713	
							Explosion	5 psi	290	292	112	2.05E-05
								1 psi	974	959	974	
								0.5 psi	1778	1750	1777	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
70	S27_S	Small release from From bottom discharge of 51-T01 to inlet of 57-T01 debutanizer	58638	10	1	3600	Jet Fire	37.5 kW/m^2	21	19	17	9.00E-07
								4 kW/m^2	31	29	27	
								3% fatality	25	23	21	
							Flash Fire	LFL	17	12	11	1.85E-06
							Explosion	5 psi	9	7	7	2.52E-07
								1 psi	29	23	21	
								0.5 psi	53	42	39	
71	S27_R	Rupture of From bottom discharge of 51-T01 to inlet of 57-T01 debutanizer	58638	Rupture	NA	NA	Flash Fire	LFL	115	137	216	3.92E-07
							Fireball	37.5 kW/m^2	NR	NR	NR	2.40E-07
								4 kW/m^2	1110	1110	1110	
								3% fatality	569	569	569	
							Explosion	5 psi	118	130	142	1.68E-07
								1 psi	1020	1006	1019	
								0.5 psi	1862	1836	1860	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
72	S28_S	Small release from From 52-R001A/S C3 hydrogenation reactor to inlet of 53-T01 C3 stripper	4158	10	0.3	3600	Jet Fire	37.5 kW/m^2	6	6	6	9.00E-07
								4 kW/m^2	8	8	8	
								3% fatality	7	7	7	
							Flash Fire	LFL	5	4	4	2.02E-06
							Explosion	5 psi	NR	NR	NR	8.40E-08
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
73	S28_R	Rupture of From 52-R001A/S C3 hydrogenation reactor to inlet of 53-T01 C3 stripper	4158	Rupture	NA	NA	Flash Fire	LFL	31	36	47	4.41E-06
							Fireball	37.5 kW/m^2	89	89	89	2.70E-06
								4 kW/m^2	548	548	548	
								3% fatality	289	289	289	
							Explosion	5 psi	127	118	128	1.89E-06
								1 psi	412	408	414	
								0.5 psi	752	745	756	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
74	S29_S	Small release from From 53-T01 stripper discharge to inlet 55-T01A/B C3 Splitter	96439	10	2	3600	Jet Fire	37.5 kW/m^2	25	22	20	4.05E-05
								4 kW/m^2	36	33	31	
								3% fatality	29	26	24	
							Flash Fire	LFL	19	16	14	8.32E-05
							Explosion	5 psi	10	8	8	1.13E-05
								1 psi	31	27	25	
								0.5 psi	57	49	46	
75	S29_M	Medium release from From 53-T01 stripper discharge to inlet 55-T01A/B C3 Splitter	96439	50	60	1642	Jet Fire	37.5 kW/m^2	106	93	85	2.40E-06
								4 kW/m^2	153	142	135	
								3% fatality	124	112	104	
							Flash Fire	LFL	156	161	165	3.92E-06
							Explosion	5 psi	68	59	60	1.68E-06
								1 psi	221	191	194	
								0.5 psi	403	349	354	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
76	S29_R	Rupture of From 53-T01 stripper discharge to inlet 55-T01A/B C3 Splitter	96439	Rupture	NA	NA	Flash Fire	LFL	124	138	224	5.06E-06
							Fireball	37.5 kW/m^2	348	348	348	3.10E-06
								4 kW/m^2	1610	1610	1610	
								3% fatality	882	882	882	
							Explosion	5 psi	368	364	359	2.17E-06
								1 psi	1194	1183	1191	
								0.5 psi	2180	2159	2174	
77	S30_S	Small release from Discharge from 55-T01A/B to pump inlet 55-P71A/S	93705	10	3	3600	Jet Fire	37.5 kW/m^2	25	22	20	4.32E-05
								4 kW/m^2	36	33	31	
								3% fatality	29	26	24	
							Flash Fire	LFL	18	16	14	8.87E-05
							Explosion	5 psi	9	8	8	1.21E-05
								1 psi	30	26	24	
								0.5 psi	55	47	45	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
78	S30_R	Rupture of Discharge from 55-T01A/B to pump inlet 55-P71A/S	93705	Rupture	NA	NA	Flash Fire	LFL	116	130	201	5.45E-06
							Fireball	37.5 kW/m^2	346	346	346	3.34E-06
								4 kW/m^2	1597	1597	1597	
								3% fatality	875	875	875	
							Explosion	5 psi	363	359	361	2.34E-06
								1 psi	1179	1166	1186	
								0.5 psi	2151	2127	2165	
79	S31_S	Small release from Discharge from pump 55-P71A/S to Propylene Storage Tank	118156	10	3	3600	Jet Fire	37.5 kW/m^2	31	27	24	1.80E-06
								4 kW/m^2	44	41	39	
								3% fatality	36	32	30	
							Flash Fire	LFL	52	31	26	3.70E-06
							Explosion	5 psi	23	14	13	5.04E-07
								1 psi	76	47	42	
								0.5 psi	138	85	78	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
80	S31_M	Medium release from Discharge from pump 55-P71A/S to Propylene Storage Tank	118156	50	66	1770	Jet Fire	37.5 kW/m^2	126	111	102	7.43E-04
								4 kW/m^2	185	172	164	
								3% fatality	148	134	125	
							Flash Fire	LFL	336	220	186	1.21E-03
							Explosion	5 psi	183	102	89	5.20E-04
								1 psi	595	332	289	
								0.5 psi	1085	605	528	
81	S31_R	Rupture of Discharge from pump 55-P71A/S to Propylene Storage Tank	118156	Rupture	NA	NA	Flash Fire	LFL	628	532	551	1.26E-04
							Fireball	37.5 kW/m^2	217	217	217	7.71E-05
								4 kW/m^2	1024	1024	1024	
								3% fatality	557	557	557	
							Explosion	5 psi	341	340	322	5.40E-05
								1 psi	1193	1231	1246	
								0.5 psi	2286	2296	2352	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
82	S32_S	Small release from Top discharge from 57-T01 to inlet of Butadiene Extraction unit 58-Y01	93705	10	2	3600	Pool Fire	37.5 kW/m^2	14	NR	NR	4.23E-05
								4 kW/m^2	14	NR	NR	
								3% fatality	14	NR	NR	
							Flash Fire	LFL	36	19	15	8.69E-05
							Explosion	5 psi	17	10	9	1.18E-05
								1 psi	55	34	29	
								0.5 psi	100	62	54	
							Toxic	3% fatality	NA	NA	NA	4.56E-03
								IDLH	75	59	52	
83	S32_M	Medium release from Top discharge from 57-T01 to inlet of Butadiene Extraction unit 58-Y01	93705	50	41	2125	Pool Fire	37.5 kW/m^2	34	36	36	9.04E-05
								4 kW/m^2	58	54	51	
								3% fatality	45	44	43	
							Flash Fire	LFL	235	158	131	1.86E-04
							Explosion	5 psi	151	79	68	2.53E-05
								1 psi	490	256	222	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								0.5 psi	895	468	405	
							Toxic	3% fatality	NA	NA	NA	9.75E-03
								IDLH	365	271	237	
84	S32_R	Rupture of Top discharge from 57-T01 to inlet of Butadiene Extraction unit 58-Y01	93705	Rupture	NA	NA	Flash Fire	LFL	584	512	530	4.47E-05
							Fireball	37.5 kW/m^2	110	110	110	2.74E-05
								4 kW/m^2	1029	1029	1029	
								3% fatality	536	536	536	
							Explosion	5 psi	308	319	298	1.92E-05
								1 psi	1129	1184	1192	
								0.5 psi	2139	2239	2327	
							Toxic	3% fatality	NA	NA	NA	1.05E-03
								IDLH	991	871	944	
85	S33_S	Small release from Butadiene Extraction unit 58-Y01 to Butadiene Battery Limit and inlet to 60-D31	93705	10	2	3600	Pool Fire	37.5 kW/m^2	14	NR	NR	4.50E-06
								4 kW/m^2	17	NR	NR	
								3% fatality	15	NR	NR	
							Flash	LFL	31	17	14	9.24E-06

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Fire					
							Explosion	5 psi	15	10	9	1.26E-06
								1 psi	49	32	28	
								0.5 psi	89	59	52	
							Toxic	3% fatality	NA	NA	NA	4.85E-04
								IDLH	96	78	70	
86	S33_M	Medium release from Butadiene Extraction unit 58-Y01 to Butadiene Battery Limit and inlet to 60-D31	93705	50	44	2117	Pool Fire	37.5 kW/m^2	36	39	39	7.20E-06
								4 kW/m^2	64	61	59	
								3% fatality	49	49	48	
							Flash Fire	LFL	233	155	129	1.48E-05
							Explosion	5 psi	146	79	68	2.02E-06
								1 psi	473	255	220	
								0.5 psi	863	466	402	
							Toxic	3% fatality	NA	NA	NA	7.76E-04
								IDLH	473	345	310	
87	S33_R	Rupture of Butadiene Extraction unit 58-	93705	Rupture	NA	NA	Flash Fire	LFL	562	493	513	8.25E-06

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
		Y01 to Butadiene Battery Limit and inlet to 60-D31					Fireball	37.5 kW/m^2	120	120	120	5.05E-06
								4 kW/m^2	1022	1022	1022	
								3% fatality	535	535	535	
							Explosion	5 psi	293	312	308	3.53E-06
								1 psi	1113	1178	1226	
								0.5 psi	2162	2273	2326	
							Toxic	3% fatality	NA	NA	NA	1.94E-04
								IDLH	1183	1097	1198	
88	S34_S	Small release from Raffinate discharge from 58-Y01 to C4 Recycle line	100270	10	2	3600	Jet Fire	37.5 kW/m^2	23	20	18	1.80E-06
								4 kW/m^2	33	30	29	
								3% fatality	26	24	22	
							Flash Fire	LFL	17	14	12	3.70E-06
							Explosion	5 psi	9	7	7	5.04E-07
								1 psi	28	24	22	
								0.5 psi	51	43	40	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
89	S34_M	Medium release from Raffinate discharge from 58-Y01 to C4 Recycle line	100270	50	48	2052	Jet Fire	37.5 kW/m^2	95	84	77	4.50E-07
								4 kW/m^2	141	131	125	
								3% fatality	112	101	95	
							Flash Fire	LFL	140	144	144	9.24E-07
							Explosion	5 psi	62	53	54	1.26E-07
								1 psi	202	173	175	
								0.5 psi	369	317	319	
90	S34_R	Rupture of Raffinate discharge from 58-Y01 to C4 Recycle line	100270	Rupture	NA	NA	Flash Fire	LFL	131	146	238	1.18E-06
							Fireball	37.5 kW/m^2	286	286	286	7.21E-07
								4 kW/m^2	1535	1535	1535	
								3% fatality	828	828	828	
							Explosion	5 psi	377	373	358	5.05E-07
								1 psi	1222	1210	1220	
								0.5 psi	2231	2208	2242	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
91	S35_S	Small release from From Top discharge of 62-T01 to C5 recycle line	120098	10	2	3600	Jet Fire	37.5 kW/m^2	27	24	22	8.37E-05
								4 kW/m^2	40	37	36	
								3% fatality	32	29	27	
							Flash Fire	LFL	46	26	21	1.72E-04
							Explosion	5 psi	23	13	11	2.34E-05
								1 psi	74	42	37	
								0.5 psi	136	77	68	
92	S35_R	Rupture of From Top discharge of 62-T01 to C5 recycle line	120098	Rupture	NA	NA	Flash Fire	LFL	669	538	529	9.72E-06
							Fireball	37.5 kW/m^2	144	144	144	5.95E-06
								4 kW/m^2	906	906	906	
								3% fatality	480	480	480	
							Explosion	5 psi	360	362	329	4.17E-06
								1 psi	1251	1265	1285	
								0.5 psi	2372	2379	2357	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
93	S36_S	Small release from 67-Y01 Benzene Extraction Unit to Battery Limit	93705	10	2	3600	Pool Fire	37.5 kW/m^2	NR	NR	NR	8.28E-05
								4 kW/m^2	59	66	69	
								3% fatality	36	40	42	
							Flash Fire	LFL	44	29	36	1.70E-04
							Explosion	5 psi	23	13	11	2.32E-05
								1 psi	74	44	37	
								0.5 psi	135	80	67	
							Toxic	3% fatality	57	44	37	8.93E-03
								IDLH	126	94	88	
94	S36_M	Medium release from 67-Y01 Benzene Extraction Unit to Battery Limit	93705	50	43	2119	Pool Fire	37.5 kW/m^2	NR	NR	NR	9.09E-05
								4 kW/m^2	59	66	69	
								3% fatality	36	40	42	
							Flash Fire	LFL	192	135	109	1.87E-04
							Explosion	5 psi	171	83	69	2.54E-05
								1 psi	556	269	223	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								0.5 psi	1014	491	407	
							Toxic	3% fatality	235	183	154	9.80E-03
								IDLH	545	360	353	
95	S36_R	Rupture of 67-Y01 Benzene Extraction Unit to Battery Limit	93705	Rupture	NA	NA	Flash Fire	LFL	327	250	249	4.94E-05
							Fireball	37.5 kW/m^2	NR	NR	NR	3.02E-05
								4 kW/m^2	NR	NR	NR	
								3% fatality	NR	NR	NR	
							Explosion	5 psi	191	167	159	2.12E-05
								1 psi	659	652	648	
								0.5 psi	1234	1215	1235	
							Toxic	3% fatality	232	89	68	1.16E-03
								IDLH	1303	802	793	
96	S37_S	Small release from Hydro dealkylation unit 68-Y01 to battery limit of benzene product	93705	10	2	3600	Pool Fire	37.5 kW/m^2	13	14	15	1.66E-04
								4 kW/m^2	26	27	27	
								3% fatality	19	21	22	
							Flash	LFL	38	25	19	3.40E-04

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Fire					
							Explosion	5 psi	26	9	10	4.64E-05
								1 psi	84	30	32	
								0.5 psi	154	56	58	
							Toxic	3% fatality	50	38	33	1.79E-02
								IDLH	1294	286	329	
97	S37_M	Medium release from Hydro dealkylation unit 68-Y01 to battery limit of benzene product	93705	50	48	2107	Pool Fire	37.5 kW/m^2	NR	NR	NR	6.38E-04
								4 kW/m^2	54	61	64	
								3% fatality	32	35	37	
							Flash Fire	LFL	168	110	87	1.31E-03
							Explosion	5 psi	154	73	54	1.79E-04
								1 psi	500	236	175	
								0.5 psi	913	431	319	
							Toxic	3% fatality	204	152	128	6.87E-02
								IDLH	6072	1325	1664	
98	S37_R	Rupture of Hydro dealkylation unit 68-	93705	Rupture	NA	NA	Flash Fire	LFL	297	224	223	3.00E-04

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
		Y01 to battery limit of benzene product					Fireball	37.5 kW/m^2	NR	NR	NR	1.84E-04
								4 kW/m^2	NR	NR	NR	
								3% fatality	NR	NR	NR	
							Explosion	5 psi	179	148	142	1.29E-04
								1 psi	600	579	574	
								0.5 psi	1128	1085	1101	
							Toxic	3% fatality	220	72	52	7.04E-03
								IDLH	17818	2951	3486	
99	S38_S	Small release from Bottom discharge of 36-D31, 36-D33 and 38-T01 to 38-T01	93705	10	3	3600	Jet Fire	37.5 kW/m^2	17	22	27	2.70E-06
								4 kW/m^2	32	30	29	
								3% fatality	24	25	28	
							Flash Fire	LFL	23	26	38	5.54E-06
							Explosion	5 psi	18	13	12	7.56E-07
								1 psi	57	42	39	
								0.5 psi	104	77	71	
							Toxic	3% fatality	NR	NR	NR	2.91E-04

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								IDLH	75	49	42	
100	S38_M	Medium release from Bottom discharge of 36-D31, 36-D33 and 38-T01 to 38-T01	93705	50	71	1372	Jet Fire	37.5 kW/m^2	72	91	105	1.20E-06
								4 kW/m^2	140	131	132	
								3% fatality	99	106	116	
							Flash Fire	LFL	310	223	191	1.96E-06
							Explosion	5 psi	137	96	86	8.40E-07
								1 psi	445	310	278	
								0.5 psi	812	566	507	
							Toxic	3% fatality	NR	NR	NR	4.60E-05
								IDLH	429	281	239	
101	S38_R	Rupture of Bottom discharge of 36-D31, 36-D33 and 38-T01 to 38-T01	93705	Rupture	NA	NA	Flash Fire	LFL	696	731	576	1.57E-06
							Fireball	37.5 kW/m^2	NR	NR	NR	9.61E-07
								4 kW/m^2	NR	NR	NR	
								3% fatality	NR	NR	NR	
							Explosion	5 psi	140	194	263	6.73E-07

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								1 psi	1016	973	855	
								0.5 psi	1855	1775	1561	
							Toxic	3% fatality	NR	NR	NR	3.68E-05
								IDLH	925	872	698	
102	S39_S	Small release from C2/C3 recycle line to Furnace 07-09 from 55-T01A/B	2261	10	0.1	3600	Jet Fire	37.5 kW/m^2	3	3	3	1.20E-06
								4 kW/m^2	6	6	6	
								3% fatality	5	5	5	
							Flash Fire	LFL	3	3	2	2.69E-06
							Explosion	5 psi	NR	NR	NR	1.12E-07
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
103	S39_M	Medium release from C2/C3 recycle line to Furnace 07-09 from 55-T01A/B	2261	50	4	506	Jet Fire	37.5 kW/m^2	22	22	23	5.25E-06
								4 kW/m^2	32	32	32	
								3% fatality	26	27	27	
							Flash Fire	LFL	15	14	13	1.08E-05

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Explosion	5 psi	8	7	7	1.47E-06
								1 psi	26	24	23	
								0.5 psi	48	44	42	
104	S39_R	Rupture of C2/C3 recycle line to Furnace 07-09 from 55-T01A/B	2261	Rupture	NA	NA	Flash Fire	LFL	23	26	32	1.33E-05
							Fireball	37.5 kW/m^2	22	22	22	8.11E-06
								4 kW/m^2	408	408	408	
								3% fatality	208	208	208	
							Explosion	5 psi	84	95	103	5.68E-06
								1 psi	272	307	334	
								0.5 psi	497	561	609	
105	S40_S	Small release from C4 recycle line - From 60-D31 to Naphtha manifold	100270	10	2	3600	Jet Fire	37.5 kW/m^2	23	20	18	8.28E-05
								4 kW/m^2	33	30	29	
								3% fatality	26	24	22	
							Flash Fire	LFL	17	14	12	1.70E-04
							Explosion	5 psi	9	7	7	2.32E-05

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								1 psi	28	24	22	
								0.5 psi	51	43	40	
106	S40_M	Medium release from C4 recycle line - From 60-D31 to Naphtha manifold	100270	50	48	2107	Jet Fire	37.5 kW/m^2	95	84	77	9.00E-05
								4 kW/m^2	141	131	125	
								3% fatality	112	101	95	
							Flash Fire	LFL	140	144	144	1.85E-04
							Explosion	5 psi	62	53	54	2.52E-05
								1 psi	202	173	175	
								0.5 psi	369	317	319	
107	S40_R	Rupture of C4 recycle line - From 60-D31 to Naphtha manifold	100270	Rupture	NA	NA	Flash Fire	LFL	131	146	238	4.86E-05
							Fireball	37.5 kW/m^2	286	286	286	2.97E-05
								4 kW/m^2	1535	1535	1535	
								3% fatality	828	828	828	
							Explosion	5 psi	377	373	358	2.08E-05
								1 psi	1222	1210	1220	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								0.5 psi	2231	2208	2242	
108	S41_S	Small release from Bottom discharge from 63-T01 to 27-E12A/B (C9+ recycle line)	4566	10	0.2	3600	Jet Fire	37.5 kW/m^2	4	4	4	1.35E-05
								4 kW/m^2	7	7	7	
								3% fatality	6	6	7	
							Flash Fire	LFL	4	3	3	3.02E-05
							Explosion	5 psi	NR	NR	NR	1.26E-06
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
109	S41_M	Medium release from Bottom discharge from 63-T01 to 27-E12A/B (C9+ recycle line)	4566	50	5	967	Jet Fire	37.5 kW/m^2	25	26	28	1.80E-06
								4 kW/m^2	40	40	40	
								3% fatality	32	32	33	
							Flash Fire	LFL	20	18	17	3.69E-06
							Explosion	5 psi	11	10	9	5.04E-07
								1 psi	35	31	30	
								0.5 psi	64	57	55	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
110	S41_R	Rupture of Bottom discharge from 63-T01 to 27-E12A/B (C9+ recycle line)	4566	Rupture	NA	NA	Flash Fire	LFL	30	34	43	5.84E-06
							Fireball	37.5 kW/m^2	38	38	38	3.58E-06
								4 kW/m^2	516	516	516	
								3% fatality	265	265	265	
							Explosion	5 psi	127	125	127	2.50E-06
								1 psi	411	407	411	
								0.5 psi	751	743	751	
111	S42_S	Small release from Methanol phase Separator 39-D31 and Methanol unit from Battery limt	153773	10	1	3600	Pool Fire	37.5 kW/m^2	NR	NR	NR	4.23E-05
								4 kW/m^2	21	21	22	
								3% fatality	15	17	18	
							Flash Fire	LFL	9	8	6	8.69E-05
							Explosion	5 psi	4	4	3	1.18E-05
								1 psi	14	13	11	
								0.5 psi	26	23	21	
112	S42_M	Medium release from	153773	50	29	3600	Pool Fire	37.5	38	39	39	9.45E-06

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
		Methanol phase Separator 39-D31 and Methanol unit from Battery limt						kW/m^2				
								4 kW/m^2	74	75	76	
								3% fatality	51	55	58	
							Flash Fire	LFL	76	40	33	1.94E-05
							Explosion	5 psi	40	15	16	2.64E-06
								1 psi	129	49	51	
								0.5 psi	236	90	93	
113	S42_R	Rupture of Methanol phase Separator 39-D31 and Methanol unit from Battery limt	153773	Rupture	NA	NA	Flash Fire	LFL	102	92	101	1.33E-05
							Fireball	37.5 kW/m^2	NR	NR	NR	8.15E-06
								4 kW/m^2	NR	NR	NR	
								3% fatality	NR	NR	NR	
							Explosion	5 psi	69	143	147	5.70E-06
								1 psi	462	483	477	
								0.5 psi	843	882	870	
114	S43_S	Small release from 41-T01 bottom	10170	10	1	3600	Jet Fire	37.5 kW/m^2	10	10	11	3.00E-07

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
		discharge to inlet of 43-T01 C2 Splitter						4 kW/m^2	14	14	14	
								3% fatality	12	12	12	
							Flash Fire	LFL	9	7	7	6.72E-07
							Explosion	5 psi	4	4	4	2.80E-08
								1 psi	14	13	12	
								0.5 psi	26	23	22	
115	S43_M	Medium release from 41-T01 bottom discharge to inlet of 43-T01 C2 Splitter	10170	50	16	610	Jet Fire	37.5 kW/m^2	43	45	47	0.00E+00
								4 kW/m^2	71	71	71	
								3% fatality	55	56	58	
							Flash Fire	LFL	77	69	72	0.00E+00
							Explosion	5 psi	31	27	27	0.00E+00
								1 psi	102	87	87	
								0.5 psi	186	158	159	
116	S43_R	Rupture of 41-T01 bottom discharge to inlet of 43-T01 C2	10170	Rupture	NA	NA	Flash Fire	LFL	47	54	74	1.47E-06
							Fireball	37.5	198	198	198	9.01E-07

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
		Splitter						kW/m^2				
								4 kW/m^2	846	846	846	
								3% fatality	465	465	465	
							Explosion	5 psi	178	179	185	6.31E-07
								1 psi	579	580	600	
								0.5 psi	1057	1058	1094	
117	S44_S	Small release from Top discharge from 43-T01 to ethylene compressor inlet 44-C0I.III/IV	2566	10	0.2	3600	Jet Fire	37.5 kW/m^2	4	3	3	3.00E-07
								4 kW/m^2	6	6	6	
								3% fatality	6	6	6	
							Flash Fire	LFL	4	4	3	6.72E-07
							Explosion	5 psi	NR	NR	NR	2.80E-08
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
118	S44_R	Rupture of Top discharge from 43-T01 to ethylene compressor inlet 44-	2566	Rupture	NA	NA	Flash Fire	LFL	27	32	44	1.47E-06
							Fireball	37.5 kW/m^2	32	32	32	9.01E-07

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
		C0I.III/IV						4 kW/m^2	430	430	430	
								3% fatality	220	220	220	
							Explosion	5 psi	110	111	115	6.31E-07
								1 psi	357	362	373	
								0.5 psi	652	660	681	
119	S45_S	Small release from ethylene compressor 44-C0I.III/IV and Ethylene manifold and battery limit	9410	10	1	3600	Jet Fire	37.5 kW/m^2	9	9	10	2.70E-05
								4 kW/m^2	12	12	12	
								3% fatality	11	11	11	
							Flash Fire	LFL	8	7	6	6.05E-05
							Explosion	5 psi	4	3	3	2.52E-06
								1 psi	12	11	11	
								0.5 psi	23	21	20	
120	S45_M	Medium release from ethylene compressor 44-C0I.III/IV and Ethylene manifold and battery limit	9410	50	15	647	Jet Fire	37.5 kW/m^2	19	52	44	4.20E-04
								4 kW/m^2	65	65	66	
								3% fatality	51	52	53	
							Flash	LFL	61	55	56	8.62E-04

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Fire					
							Explosion	5 psi	26	23	23	1.18E-04
								1 psi	84	73	73	
								0.5 psi	154	134	134	
121	S45_R	Rupture of ethylene compressor 44-C0I.III/IV and Ethylene manifold and battery limit	9410	Rupture	NA	NA	Flash Fire	LFL	43	48	63	3.26E-04
							Fireball	37.5 kW/m^2	186	186	186	2.00E-04
								4 kW/m^2	814	814	814	
								3% fatality	446	446	446	
							Explosion	5 psi	182	181	184	1.40E-04
								1 psi	591	588	597	
								0.5 psi	1079	1073	1089	
122	S46_S	Small release from From 44-D31 to 44-C01.I	9410	10	1	3600	Jet Fire	37.5 kW/m^2	9	9	10	2.82E-05
								4 kW/m^2	12	12	12	
								3% fatality	11	11	11	
							Flash Fire	LFL	8	7	6	6.32E-05

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Explosion	5 psi	4	3	3	2.63E-06
								1 psi	12	11	11	
								0.5 psi	23	21	20	
123	S46_M	Medium release from From 44-D31 to 44-C01.I	9410	50	15	647	Jet Fire	37.5 kW/m^2	19	42	44	6.30E-06
								4 kW/m^2	65	65	66	
								3% fatality	51	52	53	
							Flash Fire	LFL	8	7	6	1.29E-05
							Explosion	5 psi	26	23	23	1.76E-06
								1 psi	84	73	73	
								0.5 psi	154	134	134	
124	S46_R	Rupture of From 44-D31 to 44-C01.I	9410	Rupture	NA	NA	Flash Fire	LFL	61	55	56	4.68E-05
							Fireball	37.5 kW/m^2	186	186	186	2.86E-05
								4 kW/m^2	814	814	814	
								3% fatality	446	446	446	
							Explosion	5 psi	182	181	184	2.00E-05

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								1 psi	591	588	597	
								0.5 psi	1079	1073	1089	
125	S47_S	Small release from Propylene Filling Unit to inlet of 53-T01	7232	10	0.4	3600	Jet Fire	37.5 kW/m^2	7	7	7	4.14E-05
								4 kW/m^2	10	10	10	
								3% fatality	8	8	9	
							Flash Fire	LFL	5	5	4	9.28E-05
							Explosion	5 psi	NR	NR	NR	3.86E-06
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
126	S47_R	Rupture of Propylene Filling Unit to inlet of 53-T01	7232	Rupture	NA	NA	Flash Fire	LFL	35	40	51	5.25E-05
							Fireball	37.5 kW/m^2	119	119	119	3.21E-05
								4 kW/m^2	667	667	667	
								3% fatality	355	355	355	
							Explosion	5 psi	152	153	154	2.25E-05
								1 psi	494	496	500	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								0.5 psi	901	906	913	
127	S48_S	Small release from 40-D33 Hydrogen Separator to 48-Y01 PSA unit	554	10	0.1	3600	Jet Fire	37.5 kW/m^2	4	5	5	8.00E-07
								4 kW/m^2	11	11	5	
								3% fatality	5	9	9	
							Flash Fire	LFL	14	11	10	1.92E-07
							Explosion	5 psi	7	6	6	8.00E-09
								1 psi	22	19	18	
								0.5 psi	40	36	33	
128	S48_M	Medium release from 40-D33 Hydrogen Separator to 48-Y01 PSA unit	554	50	4	136	Jet Fire	37.5 kW/m^2	28	31	36	5.71E-04
								4 kW/m^2	51	51	50	
								3% fatality	37	39	42	
							Flash Fire	LFL	48	42	40	1.26E-04
							Explosion	5 psi	32	28	26	1.71E-05
								1 psi	103	89	85	
								0.5 psi	188	163	155	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
129	S48_R	Rupture of 40-D33 Hydrogen Separator to 48-Y01 PSA unit	554	Rupture	NA	NA	Flash Fire	LFL	32	36	45	4.41E-05
							Fireball	37.5 kW/m^2	91	91	91	2.52E-04
								4 kW/m^2	360	360	360	
								3% fatality	199	199	199	
							Explosion	5 psi	97	96	90	1.89E-05
								1 psi	314	313	316	
								0.5 psi	574	571	577	
130	S49_S	Small release from 48-Y01 PSA unit to hydrogen distribution line	554	10	0.1	3600	Jet Fire	37.5 kW/m^2	4	5	5	4.00E-06
								4 kW/m^2	11	11	5	
								3% fatality	5	9	9	
							Flash Fire	LFL	14	11	10	9.60E-07
							Explosion	5 psi	7	6	6	4.00E-08
								1 psi	22	19	18	
								0.5 psi	40	36	33	
131	S49_M	Medium release from	554	50	4	136	Jet Fire	37.5	28	31	36	2.24E-05

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
		48-Y01 PSA unit to hydrogen distribution line						kW/m^2				
								4 kW/m^2	51	51	50	
								3% fatality	37	39	42	
							Flash Fire	LFL	48	42	40	4.93E-06
							Explosion	5 psi	32	28	26	6.72E-07
								1 psi	103	89	85	
								0.5 psi	188	163	155	
132	S49_R	Rupture of 48-Y01 PSA unit to hydrogen distribution line	554	Rupture	NA	NA	Flash Fire	LFL	32	36	45	5.47E-06
							Fireball	37.5 kW/m^2	NR	NR	NR	3.13E-05
								4 kW/m^2	NR	NR	NR	
								3% fatality	NR	NR	NR	
							Explosion	5 psi	97	96	90	2.34E-06
								1 psi	314	313	316	
								0.5 psi	574	571	577	
133	S50_S	Small release from 79-Y01 Butene-1 unit	112129	10	2	3600	Jet Fire	37.5 kW/m^2	23	20	19	2.86E-04

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
		to 73-D31 and battery limit						4 kW/m^2	34	31	30	
								3% fatality	27	25	23	
							Flash Fire	LFL	20	15	13	5.88E-04
							Explosion	5 psi	10	8	8	8.02E-05
								1 psi	34	26	24	
								0.5 psi	61	48	44	
134	S50_M	Medium release from 79-Y01 Butene-1 unit to 73-D31 and battery limit	112129	50	42	2620	Jet Fire	37.5 kW/m^2	96	86	78	1.87E-04
								4 kW/m^2	144	134	129	
								3% fatality	114	104	97	
							Flash Fire	LFL	181	164	143	3.84E-04
							Explosion	5 psi	84	65	61	5.24E-05
								1 psi	273	212	196	
								0.5 psi	498	387	359	
135	S50_R	Rupture of 79-Y01 Butene-1 unit to 73-D31 and battery limit	112129	Rupture	NA	NA	Flash Fire	LFL	257	312	431	1.16E-04
							Fireball	37.5	209	209	209	7.09E-05

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								kW/m^2				
								4 kW/m^2	1410	1410	1410	
								3% fatality	748	748	748	
							Explosion	5 psi	154	136	113	4.97E-05
								1 psi	1269	1254	1268	
								0.5 psi	2317	2288	2315	
136	S51_S	Small release from Truck inlet to 76-D31 n-hexane tank to inlet of 79-Y01	15915	10	0.1	3600	Pool Fire	37.5 kW/m^2	13	13	14	1.35E-05
								4 kW/m^2	36	34	34	
								3% fatality	22	24	25	
							Flash Fire	LFL	30	19	13	3.02E-05
							Explosion	5 psi	18	9	8	1.26E-06
								1 psi	58	31	25	
								0.5 psi	106	56	46	
137	S51_M	Medium release from Truck inlet to 76-D31 n-hexane tank to inlet of 79-Y01	15915	50	2	3600	Pool Fire	37.5 kW/m^2	NR	NR	NR	2.70E-06
								4 kW/m^2	71	78	86	
								3% fatality	38	38	38	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Flash Fire	LFL	119	88	72	5.54E-06
							Explosion	5 psi	107	53	47	7.56E-07
								1 psi	347	171	153	
								0.5 psi	633	312	279	
138	S51_R	Rupture of Truck inlet to 76-D31 n-hexane tank to inlet of 79-Y01	15915	Rupture	NA	NA	Flash Fire	LFL	144	114	111	6.63E-06
							Fireball	37.5 kW/m^2	NR	NR	NR	4.06E-06
								4 kW/m^2	NR	NR	NR	
								3% fatality	NR	NR	NR	
							Explosion	5 psi	96	85	85	2.84E-06
								1 psi	329	331	328	
								0.5 psi	629	604	599	
139	S52_S	Small release from Fuel Gas System	272	10	0.1	2784	Jet Fire	37.5 kW/m^2	3	3	3	3.00E-07
								4 kW/m^2	5	5	5	
								3% fatality	4	4	4	
							Flash	LFL	3	2	2	6.72E-07

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Fire					
							Explosion	5 psi	NR	NR	NR	2.80E-08
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
140	S52_M	Medium release from Fuel Gas System	272	50	2	154	Jet Fire	37.5 kW/m^2	18	19	20	4.20E-05
								4 kW/m^2	27	27	27	
								3% fatality	22	22	23	
							Flash Fire	LFL	14	12	11	8.63E-05
							Explosion	5 psi	7	7	6	1.18E-05
								1 psi	24	21	20	
								0.5 psi	43	39	37	
141	S52_R	Rupture of Fuel Gas System	272	Rupture	NA	NA	Flash Fire	LFL	11	13	16	4.54E-05
							Fireball	37.5 kW/m^2	NR	NR	NR	2.78E-05
								4 kW/m^2	197	197	197	
								3% fatality	98	98	98	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Explosion	5 psi	39	40	38	1.95E-05
								1 psi	127	129	122	
								0.5 psi	233	235	223	
142	S53_S	Small release from 14 " Naphtha pipeline from Marine Loading Arm to Tank	102621	10	2	3600	Jet Fire	37.5 kW/m^2	4	10	11	4.23E-07
								4 kW/m^2	26	27	26	
								3% fatality	15	16	17	
							Flash Fire	LFL	4	3	3	8.69E-07
							Explosion	5 psi	NR	NR	NR	1.19E-07
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
143	S53_M	Medium release from 14 " Naphtha pipeline from Marine Loading Arm to Tank	102621	50	45	2114	Jet Fire	37.5 kW/m^2	14	31	35	1.73E-07
								4 kW/m^2	98	94	90	
								3% fatality	54	57	54	
							Flash Fire	LFL	27	23	26	3.56E-07
							Explosion	5 psi	NR	NR	NR	4.85E-08

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								1 psi	NR	NR	NR	
								0.5 psi	42	35	30	
144	S53_R	Rupture of 14 " Naphtha pipeline from Marine Loading Arm to Tank	102621	Rupture	1116	95	Jet Fire	37.5 kW/m^2	37	82	104	2.70E-07
								4 kW/m^2	333	320	303	
								3% fatality	173	193	187	
							Flash Fire	LFL	456	246	112	4.42E-07
							Explosion	5 psi	NR	NR	NR	1.89E-07
								1 psi	NR	NR	NR	
								0.5 psi	259	165	146	
145	S54_S	Small release from 32"Ethylene and Propylene pipeline from tank to jetty	109581	10	2	3600	Jet Fire	37.5 kW/m^2	NR	0	4	4.23E-07
								4 kW/m^2	17	19	20	
								3% fatality	3	10	12	
							Flash Fire	LFL	2	2	2	8.69E-07
							Explosion	5 psi	NR	NR	NR	1.19E-07
								1 psi	NR	NR	NR	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								0.5 psi	NR	NR	NR	
146	S54_M	Medium release from 18"Ethylene and Propylene pipeline from tank to jetty	109581	50	49	2105	Jet Fire	37.5 kW/m^2	0	3	10	1.73E-07
								4 kW/m^2	80	82	78	
								3% fatality	28	41	45	
							Flash Fire	LFL	9	9	11	3.56E-07
							Explosion	5 psi	NR	NR	NR	4.85E-08
								1 psi	NR	NR	NR	
								0.5 psi	28	26	23	
147	S54_R	Rupture of 18"Ethylene and Propylene pipeline from tank to jetty	109581	Rupture	437	212	Jet Fire	37.5 kW/m^2	3	6	17	8.04E-08
								4 kW/m^2	203	193	186	
								3% fatality	73	88	100	
							Flash Fire	LFL	140	31	35	1.31E-07
							Explosion	5 psi	NR	NR	NR	5.63E-08
								1 psi	NR	NR	NR	
								0.5 psi	97	74	67	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
148	S55_S	Small release from 6" 1-Hexene pipeline from tank to jetty	17730	10	2	3600	Jet Fire	37.5 kW/m^2	3	10	11	4.23E-07
								4 kW/m^2	26	28	27	
								3% fatality	14	17	17	
							Flash Fire	LFL	3	3	3	8.69E-07
							Explosion	5 psi	NR	NR	NR	1.19E-07
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
149	S55_M	Medium release from 6" 1-Hexene pipeline from tank to jetty	17730	50	46	411	Jet Fire	37.5 kW/m^2	12	31	36	1.73E-07
								4 kW/m^2	103	98	95	
								3% fatality	56	60	57	
							Flash Fire	LFL	26	21	20	3.56E-07
							Explosion	5 psi	NR	NR	NR	4.85E-08
								1 psi	NR	NR	NR	
								0.5 psi	40	33	28	
150	S55_R	Rupture of 6" 1-	17730	Rupture	84	211	Jet Fire	37.5	15	37	45	2.70E-07

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
		Hexene pipeline from tank to jetty						kW/m^2				
								4 kW/m^2	129	123	120	
								3% fatality	70	76	72	
							Flash Fire	LFL	33	29	31	4.42E-07
							Explosion	5 psi	NR	NR	NR	1.89E-07
								1 psi	NR	NR	NR	
								0.5 psi	53	45	38	
151	S56_S	Small release from 6" Benzene pipeline from tank to jetty	93705	10	2	3600	Jet Fire	37.5 kW/m^2	2	10	11	4.23E-07
								4 kW/m^2	25	27	27	
								3% fatality	14	16	18	
							Flash Fire	LFL	5	4	4	8.69E-07
							Explosion	5 psi	NR	NR	NR	1.19E-07
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
							Toxic	3% fatality	NR	NR	NR	4.56E-05
								IDLH	150	26	22	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
152	S56_M	Medium release from 6" Benzene pipeline from tank to jetty	93705	50	43	2119	Jet Fire	37.5 kW/m^2	17	37	40	1.73E-07
								4 kW/m^2	109	109	103	
								3% fatality	62	66	62	
							Flash Fire	LFL	23	24	28	3.56E-07
							Explosion	5 psi	NR	NR	NR	4.85E-08
								1 psi	NR	NR	NR	
								0.5 psi	41	35	31	
							Toxic	3% fatality	NR	NR	NR	1.87E-05
								IDLH	870	356	285	
153	S56_R	Rupture of 6" Benzene pipeline from tank to jetty	93705	Rupture	112	845	Jet Fire	37.5 kW/m^2	28	51	56	2.70E-07
								4 kW/m^2	166	156	148	
								3% fatality	94	96	90	
							Flash Fire	LFL	54	33	43	4.42E-07
							Explosion	5 psi	NR	NR	NR	1.89E-07
								1 psi	NR	NR	NR	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								0.5 psi	63	55	50	
							Toxic	3% fatality	NR	NR	NR	1.04E-05
								IDLH	1870	610	535	
154	S57_S	Small release from 4" Butadiene pipeline from tank to jetty	93705	10	2	3600	Jet Fire	37.5 kW/m^2	1	9	12	4.23E-07
								4 kW/m^2	26	28	29	
								3% fatality	13	17	18	
							Flash Fire	LFL	2	3	3	8.69E-07
							Explosion	5 psi	NR	NR	NR	1.19E-07
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
							Toxic	3% fatality	NR	NR	NR	4.56E-05
								IDLH	36	NR	NR	
155	S57_M	Medium release from 4" Butadiene pipeline from tank to jetty	93705	50	49	1905	Jet Fire	37.5 kW/m^2	12	32	40	1.73E-07
								4 kW/m^2	114	108	106	
								3% fatality	61	66	64	
							Flash	LFL	25	18	17	3.56E-07

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Fire					
							Explosion	5 psi	NR	NR	NR	4.85E-08
								1 psi	NR	NR	NR	
								0.5 psi	39	32	27	
							Toxic	3% fatality	NR	NR	NR	1.87E-05
								IDLH	760	300	177	
156	S57_R	Rupture of 4" Butadiene pipeline from tank to jetty	93705	Rupture	55	1692	Jet Fire	37.5 kW/m^2	13	34	42	2.70E-07
								4 kW/m^2	119	113	111	
								3% fatality	64	70	67	
							Flash Fire	LFL	27	20	19	4.42E-07
							Explosion	5 psi	NR	NR	NR	1.89E-07
								1 psi	NR	NR	NR	
								0.5 psi	42	34	29	
							Toxic	3% fatality	NR	NR	NR	1.04E-05
								IDLH	707	275	159	
157	S58_S	Small release from 6" 1-Butene	15297	10	1	3600	Jet Fire	37.5 kW/m^2	NR	4	7	4.23E-07

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
		(Isopentane) pipeline from tank to jetty						4 kW/m^2	19	20	20	
								3% fatality	9	12	12	
							Flash Fire	LFL	1	1	1	8.69E-07
							Explosion	5 psi	NR	NR	NR	1.19E-07
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
158	S58_M	Medium release from 6" 1-Butene (Isopentane) pipeline from tank to jetty	15297	50	14	1067	Jet Fire	37.5 kW/m^2	1	7	16	4.62E-07
								4 kW/m^2	55	52	50	
								3% fatality	26	29	30	
							Flash Fire	LFL	5	5	5	7.54E-07
							Explosion	5 psi	NR	NR	NR	3.23E-07
								1 psi	NR	NR	NR	
								0.5 psi	16	14	13	
159	S58_R	Rupture of 6" 1-Butene (Isopentane) pipeline from tank to	15297	Rupture	14	1067	Jet Fire	37.5 kW/m^2	1	7	16	1.01E-07
								4 kW/m^2	55	52	50	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
		jetty						3% fatality	26	29	30	
							Flash Fire	LFL	5	5	5	2.08E-07
							Explosion	5 psi	NR	NR	NR	2.84E-08
								1 psi	NR	NR	NR	
								0.5 psi	16	14	13	
160	S59_S	Small release from 14" Naphtha underground pipeline from OSBL storage tank to ISBL	747136	10	4	3600	Jet Fire	37.5 kW/m^2	1	6	11	4.23E-07
								4 kW/m^2	31	29	29	
								3% fatality	16	17	17	
							Flash Fire	LFL	3	3	3	8.69E-07
							Explosion	5 psi	NR	NR	NR	1.19E-07
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
161	S59_M	Medium release from 14" Naphtha underground pipeline from OSBL storage tank to ISBL	747136	50	106	3600	Jet Fire	37.5 kW/m^2	NR	13	30	4.62E-07
								4 kW/m^2	110	105	101	
								3% fatality	51	59	62	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Flash Fire	LFL	22	18	19	7.54E-07
							Explosion	5 psi	NR	NR	NR	3.23E-07
								1 psi	NR	NR	NR	
								0.5 psi	44	39	35	
162	S59_R	Rupture of 14" Naphtha underground pipeline from OSBL storage tank to ISBL	747136	Rupture	154	3600	Jet Fire	37.5 kW/m^2	NR	15	34	2.70E-07
								4 kW/m^2	127	121	117	
								3% fatality	58	67	72	
							Flash Fire	LFL	31	22	24	4.42E-07
							Explosion	5 psi	NR	NR	NR	1.89E-07
								1 psi	NR	NR	NR	
								0.5 psi	53	48	42	
163	S60_S	Small release from 6" 1-Hexene underground pipeline from ISBL to OSBL storage tank	130032	10	2	3600	Jet Fire	37.5 kW/m^2	3	10	11	3.10E-06
								4 kW/m^2	26	28	27	
								3% fatality	14	17	17	
							Flash	LFL	3	3	3	6.37E-06

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Fire					
							Explosion	5 psi	NR	NR	NR	8.69E-07
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
164	S60_M	Medium release from 6" 1-Hexene underground pipeline from ISBL to OSBL storage tank	130032	50	8	3600	Jet Fire	37.5 kW/m^2	7	17	19	3.39E-06
								4 kW/m^2	50	50	48	
								3% fatality	28	30	30	
							Flash Fire	LFL	8	6	6	5.53E-06
							Explosion	5 psi	NR	NR	NR	2.37E-06
								1 psi	NR	NR	NR	
								0.5 psi	16	13	11	
165	S60_R	Rupture of 6" 1-Hexene underground pipeline from ISBL to OSBL storage tank	130032	Rupture	8	3600	Jet Fire	37.5 kW/m^2	7	17	19	7.44E-07
								4 kW/m^2	50	50	48	
								3% fatality	28	30	30	
							Flash Fire	LFL	8	6	6	1.53E-06

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Explosion	5 psi	NR	NR	NR	2.08E-07
								1 psi	NR	NR	NR	
								0.5 psi	16	13	11	
166	S61_S	Small release from 8" Propylene underground pipeline from ISBL to OSBL storage tank	210781	10	2	3600	Jet Fire	37.5 kW/m^2	0	6	11	3.10E-06
								4 kW/m^2	25	26	28	
								3% fatality	11	16	18	
							Flash Fire	LFL	3	3	3	6.37E-06
							Explosion	5 psi	NR	NR	NR	8.69E-07
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
167	S61_M	Rupture of 8" Propylene underground pipeline from ISBL to OSBL storage tank	210781	50	33	3600	Jet Fire	37.5 kW/m^2	5	21	32	3.39E-06
								4 kW/m^2	88	88	87	
								3% fatality	44	53	53	
							Flash Fire	LFL	17	13	14	5.53E-06
							Explosion	5 psi	NR	NR	NR	2.37E-06

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								1 psi	NR	NR	NR	
								0.5 psi	30	25	22	
168	S61_R	Rupture of 8" Propylene underground pipeline from ISBL to OSBL storage tank	210781	Rupture	33	3600	Jet Fire	37.5 kW/m^2	5	21	32	7.44E-07
								4 kW/m^2	88	88	87	
								3% fatality	44	53	53	
							Flash Fire	LFL	17	13	14	1.53E-06
							Explosion	5 psi	NR	NR	NR	2.08E-07
								1 psi	NR	NR	NR	
								0.5 psi	30	25	22	
169	S62_S	Small release from 6" Benzene underground pipeline from ISBL to OSBL storage tank	93705	10	2	3600	Jet Fire	37.5 kW/m^2	2	10	11	3.10E-06
								4 kW/m^2	25	27	27	
								3% fatality	14	16	18	
							Flash Fire	LFL	5	4	4	6.37E-06
							Explosion	5 psi	NR	NR	NR	8.69E-07
								1 psi	NR	NR	NR	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								0.5 psi	NR	NR	NR	
							Toxic	3% fatality	NR	NR	NR	3.35E-04
								IDLH	724	292	224	
170	S62_M	Medium release from 6" Benzene underground pipeline from ISBL to OSBL storage tank	93705	50	12	3600	Jet Fire	37.5 kW/m^2	14	33	35	3.39E-06
								4 kW/m^2	92	95	89	
								3% fatality	52	57	54	
							Flash Fire	LFL	21	20	22	5.53E-06
							Explosion	5 psi	NR	NR	NR	2.37E-06
								1 psi	NR	NR	NR	
								0.5 psi	35	29	25	
							Toxic	3% fatality	NR	NR	NR	1.30E-04
								IDLH	724	292	224	
171	S62_R	Rupture release from 6" Benzene underground pipeline from ISBL to OSBL storage tank	93705	Rupture	12	3600	Jet Fire	37.5 kW/m^2	14	33	35	7.44E-07
								4 kW/m^2	92	95	89	
								3% fatality	52	57	54	
							Flash	LFL	21	20	22	1.53E-06

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Fire					
							Explosion	5 psi	NR	NR	NR	2.08E-07
								1 psi	NR	NR	NR	
								0.5 psi	35	29	25	
							Toxic	3% fatality	NR	NR	NR	8.02E-05
								IDLH	724	292	224	
172	S63_S	Small release from 6" 1-Butene (isopentene) underground pipeline from ISBL to OSBL storage tank	112189	10	2	3600	Jet Fire	37.5 kW/m^2	NR	4	7	3.10E-06
								4 kW/m^2	19	20	20	
								3% fatality	9	12	12	
							Flash Fire	LFL	1	1	1	6.37E-06
							Explosion	5 psi	NR	NR	NR	8.69E-07
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
173	S63_M	Medium release from 6" 1-Butene (isopentene) underground pipeline from ISBL to OSBL	112189	50	12	3600	Jet Fire	37.5 kW/m^2	1	7	15	3.39E-06
								4 kW/m^2	51	48	47	
								3% fatality	25	28	29	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
		storage tank					Flash Fire	LFL	4	4	5	5.53E-06
							Explosion	5 psi	NR	NR	NR	2.37E-06
								1 psi	NR	NR	NR	
								0.5 psi	15	NR	12	
174	S63_R	Rupture of 6" 1-Butene (isopentene) underground pipeline from ISBL to OSBL storage tank	112189	Rupture	12	3600	Jet Fire	37.5 kW/m^2	1	7	15	7.44E-07
								4 kW/m^2	51	48	47	
								3% fatality	25	28	29	
							Flash Fire	LFL	4	4	5	1.53E-06
							Explosion	5 psi	NR	NR	NR	2.08E-07
								1 psi	NR	NR	NR	
								0.5 psi	15	NR	12	
175	S64_S	Small release from 6" Ethylene underground pipeline from ISBL to OSBL storage tank	110042	10	2	3600	Jet Fire	37.5 kW/m^2	NR	2	1	3.10E-06
								4 kW/m^2	20	22	24	
								3% fatality	6	13	7	
							Flash	LFL	3	3	4	6.37E-06

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Fire					
							Explosion	5 psi	NR	NR	NR	8.69E-07
								1 psi	NR	NR	NR	
								0.5 psi	8	NR	NR	
176	S64_M	Medium release from 6" Ethylene underground pipeline from ISBL to OSBL storage tank	110042	50	5	3600	Jet Fire	37.5 kW/m^2	1	5	15	3.39E-06
								4 kW/m^2	35	38	40	
								3% fatality	13	22	25	
							Flash Fire	LFL	7	6	7	5.53E-06
							Explosion	5 psi	NR	NR	NR	2.37E-06
								1 psi	NR	NR	NR	
								0.5 psi	15	12	11	
177	S64_R	Rupture of 6" Ethylene underground pipeline from ISBL to OSBL storage tank	110042	Rupture	5	3600	Jet Fire	37.5 kW/m^2	1	5	15	7.44E-07
								4 kW/m^2	35	38	40	
								3% fatality	13	22	25	
							Flash Fire	LFL	7	6	7	1.53E-06

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Explosion	5 psi	NR	NR	NR	2.08E-07
								1 psi	NR	NR	NR	
								0.5 psi	15	12	11	
178	S65_S	Small release from 6" Butadiene underground pipeline from ISBL to OSBL storage tank	93705	10	2	3600	Jet Fire	37.5 kW/m^2	1	9	12	3.10E-06
								4 kW/m^2	26	28	29	
								3% fatality	13	17	18	
							Flash Fire	LFL	2	3	3	6.37E-06
							Explosion	5 psi	NR	NR	NR	8.69E-07
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
							Toxic	3% fatality	NR	NR	NR	3.35E-04
								IDLH	36	NR	NR	
179	S65_M	Medium release from 6" Butadiene underground pipeline from ISBL to OSBL storage tank	93705	50	9	3600	Jet Fire	37.5 kW/m^2	4	18	22	3.39E-06
								4 kW/m^2	52	55	55	
								3% fatality	28	33	34	
							Flash	LFL	7	6	6	5.53E-06

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Fire					
							Explosion	5 psi	NR	NR	NR	2.37E-06
								1 psi	NR	NR	NR	
								0.5 psi	16	13	12	
							Toxic	3% fatality	NR	NR	NR	1.30E-04
								IDLH	241	NR	NR	
180	S65_R	Rupture of 6" Butadiene underground pipeline from ISBL to OSBL storage tank	93705	Rupture	9	3600	Jet Fire	37.5 kW/m^2	4	18	22	7.44E-07
								4 kW/m^2	52	55	55	
								3% fatality	28	33	34	
							Flash Fire	LFL	7	6	6	1.53E-06
							Explosion	5 psi	NR	NR	NR	2.08E-07
								1 psi	NR	NR	NR	
								0.5 psi	16	13	12	
							Toxic	3% fatality	NR	NR	NR	8.02E-05
								IDLH	241	NR	NR	
181	S66_S	Small release from 28" Natural Gas	23816	10	0.1	3600	Jet Fire	37.5 kW/m^2	NR	NR	NR	1.03E-06

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
		underground pipeline from ISBL to OSBL storage tank						4 kW/m^2	1	3	4	
								3% fatality	NR	NR	NR	
							Flash Fire	LFL	NR	NR	NR	2.32E-06
							Explosion	5 psi	NR	NR	NR	9.66E-08
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
182	S66_M	Medium release from 28" Natural Gas underground pipeline from ISBL to OSBL storage tank	23816	50	2	3600	Jet Fire	37.5 kW/m^2	NR	NR	NR	1.27E-06
								4 kW/m^2	10	15	17	
								3% fatality	NR	NR	5	
							Flash Fire	LFL	1	1	1	2.61E-06
							Explosion	5 psi	NR	NR	NR	3.56E-07
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
183	S66_R	Rupture of 28" Natural Gas underground pipeline	23816	Rupture	10	2523	Jet Fire	37.5 kW/m^2	NR	NR	NR	7.44E-07
								4 kW/m^2	22	29	33	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
		from ISBL to OSBL storage tank						3% fatality	NR	NR	11	
							Flash Fire	LFL	2	2	2	1.53E-06
							Explosion	5 psi	NR	NR	NR	2.08E-07
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
184	S67_S	Small release from Naphtha Storage Tank D5000A/B/C/D	85900100	10	0.2	3600	Pool Fire	37.5 kW/m^2	72	76	81	1.20E-06
								4 kW/m^2	198	188	185	
								3% fatality	29	29	29	
							Flash Fire	LFL	6	2	2	2.69E-06
							Explosion	5 psi	NR	NR	NR	1.12E-07
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
185	S67_R	Rupture of Naptha Storage Tank D5000A/B/C/D	85900100	Rupture	NA	NA	Flash Fire	LFL	190	133	124	1.57E-06
							Pool Fire	37.5 kW/m^2	312	336	356	9.61E-07

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								4 kW/m^2	798	808	813	
								3% fatality	504	520	529	
							Explosion	5 psi	NR	NR	NR	6.73E-07
								1 psi	NR	NR	NR	
								0.5 psi	94	75	77	
186	S68_S	Small release from Propylene Storage Tank D5006	34683200	10	2	3600	Jet Fire	37.5 kW/m^2	30	27	24	9.00E-07
								4 kW/m^2	44	41	38	
								3% fatality	36	32	30	
							Flash Fire	LFL	55	33	27	1.85E-06
							Explosion	5 psi	NR	NR	NR	2.52E-07
								1 psi	NR	NR	NR	
								0.5 psi	22	12	10	
187	S68_R	Rupture of Propylene Storage Tank D5006	34683200	Rupture	NA	NA	Flash Fire	LFL	6337	4431	4406	3.92E-07
							Fireball	37.5 kW/m^2	423	423	423	2.40E-07
								4 kW/m^2	2053	2053	2053	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								3% fatality	#N/A	#N/A	#N/A	
							Explosion	5 psi	NR	NR	NR	1.68E-07
								1 psi	NR	NR	NR	
								0.5 psi	1905	1666	1727	
188	S69_S	Small release from Butadiene Tank D5007A/B	12391300	10	1	3600	Jet Fire	37.5 kW/m^2	18	16	15	6.00E-07
								4 kW/m^2	27	25	23	
								3% fatality	26	25	23	
							Flash Fire	LFL	23	13	8	1.34E-06
							Explosion	5 psi	NR	NR	NR	5.60E-08
								1 psi	NR	NR	NR	
								0.5 psi	15	6	5	
							Toxic	3% fatality	NR	NR	NR	1.98E-04
								IDLH	50	40	37	
189	S69_M	Medium release from Butadiene Tank D5007A/B	12391300	50	14	3600	Jet Fire	37.5 kW/m^2	69	63	58	0.00E+00
								4 kW/m^2	107	98	94	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								3% fatality	83	77	72	
							Flash Fire	LFL	96	66	54	0.00E+00
							Explosion	5 psi	NR	NR	NR	0.00E+00
								1 psi	NR	NR	NR	
								0.5 psi	80	40	30	
							Toxic	3% fatality	NR	NR	NR	0.00E+00
								IDLH	200	148	138	
190	S69_R	Rupture of Butadiene Tank D5007A/B	12391300	Rupture	NA	NA	Flash Fire	LFL	1492	1139	1098	7.85E-07
							Pool Fire	37.5 kW/m^2	138	155	229	4.80E-07
								4 kW/m^2	383	390	454	
								3% fatality	236	247	315	
							Explosion	5 psi	NR	NR	NR	3.36E-07
								1 psi	NR	NR	NR	
								0.5 psi	580	557	543	
							Toxic	3% fatality	NR	NR	NR	1.84E-05
								IDLH	2733	2282	2421	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
191	S70_S	Small release from Benzene Tank D5008 A/B	14475600	10	2	3600	Jet Fire	37.5 kW/m^2	25	22	20	1.80E-06
								4 kW/m^2	38	35	33	
								3% fatality	30	27	25	
							Flash Fire	LFL	41	27	21	3.70E-06
							Explosion	5 psi	NR	NR	NR	5.04E-07
								1 psi	NR	NR	NR	
								0.5 psi	19	10	8	
							Toxic	3% fatality	40	25	18	1.94E-04
								IDLH	126	87	84	
192	S70_R	Rupture of Benzene Tank D5008 A/B	14475600	Rupture	NA	NA	Flash Fire	LFL	1756	1336	1302	7.85E-07
							Pool Fire	37.5 kW/m^2	NR	NR	NR	4.80E-07
								4 kW/m^2	256	185	346	
								3% fatality	182	90	232	
							Explosion	5 psi	NR	NR	NR	7.85E-07
								1 psi	NR	NR	NR	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								0.5 psi	556	579	553	
							Toxic	3% fatality	1681	1286	1249	1.84E-05
								IDLH	4474	3574	3747	
193	S71_S	Small release from 1-Hexene Export Storage Tank D5010	6491410	10	1	3600	Jet Fire	37.5 kW/m^2	23	20	19	9.00E-07
								4 kW/m^2	35	33	31	
								3% fatality	28	25	23	
							Flash Fire	LFL	39	23	17	1.85E-06
							Explosion	5 psi	NR	NR	NR	2.52E-07
								1 psi	NR	NR	NR	
								0.5 psi	19	9	8	
194	S71_R	Rupture of 1-Hexene Export Storage Tank D5010	6491410	Rupture	NA	NA	Flash Fire	LFL	2752	1572	1488	3.92E-07
							Pool Fire	37.5 kW/m^2	831	844	963	2.40E-07
								4 kW/m^2	2094	2071	2152	
								3% fatality	1364	1374	1467	
							Explosion	5 psi	NR	NR	NR	1.68E-07

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								1 psi	NR	NR	NR	
								0.5 psi	725	682	655	
195	S72_S	Small release from Ethylene Storage Tank D5014	23874900	10	1	3600	Jet Fire	37.5 kW/m^2	26	23	21	9.00E-07
								4 kW/m^2	37	34	32	
								3% fatality	31	27	25	
							Flash Fire	LFL	45	30	23	1.85E-06
							Explosion	5 psi	NR	NR	NR	2.52E-07
								1 psi	NR	NR	NR	
								0.5 psi	21	11	10	
196	S72_R	Rupture of Ethylene Storage Tank D5014	23874900	Rupture	NA	NA	Flash Fire	LFL	2360	1837	1947	3.92E-07
							Pool Fire	37.5 kW/m^2	305	234	385	2.40E-07
								4 kW/m^2	442	364	508	
								3% fatality	652	570	710	
							Explosion	5 psi	NR	NR	NR	1.68E-07
								1 psi	NR	NR	NR	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								0.5 psi	832	733	644	
197	S73_S	Small release from Comonomer FEED To PE Reactor Unit	123313	10	2	3600	Jet Fire	37.5 kW/m^2	25	22	20	8.46E-05
								4 kW/m^2	37	35	33	
								3% fatality	30	27	25	
							Flash Fire	LFL	43	25	19	1.74E-04
							Explosion	5 psi	23	12	10	2.37E-05
								1 psi	74	39	34	
								0.5 psi	136	71	62	
198	S73_R	Rupture of Comonomer FEED To PE Reactor Unit	123313	Rupture	NA	NA	Flash Fire	LFL	578	365	331	1.01E-05
							Fireball	37.5 kW/m^2	152	152	152	6.19E-06
								4 kW/m^2	1225	1225	1225	
								3% fatality	644	644	644	
							Explosion	5 psi	326	202	186	4.34E-06
								1 psi	1121	803	810	
								0.5 psi	2047	1519	1496	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
199	S74_S	Small release from Ethylene Feed to PE reactor	9803	10	1	3600	Jet Fire	37.5 kW/m^2	5	10	5	9.00E-07
								4 kW/m^2	13	13	5	
								3% fatality	5	11	5	
							Flash Fire	LFL	8	7	6	2.02E-06
							Explosion	5 psi	4	4	3	8.40E-08
								1 psi	13	11	11	
								0.5 psi	23	21	20	
200	S74_R	Rupture of Ethylene Feed to PE reactor	9803	Rupture	NA	NA	Flash Fire	LFL	46	49	64	1.18E-06
							Fireball	37.5 kW/m^2	190	190	190	7.21E-07
								4 kW/m^2	827	827	827	
								3% fatality	454	454	454	
							Explosion	5 psi	185	184	187	5.05E-07
								1 psi	602	598	606	
								0.5 psi	1098	1091	1106	
201	S75_M	Medium release from	678	50	5	140	Jet Fire	37.5	30	34	39	1.35E-06

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
		Hydrogen Feed to PE reactor						kW/m^2				
								4 kW/m^2	56	56	55	
								3% fatality	41	43	45	
							Flash Fire	LFL	50	45	44	2.77E-06
							Explosion	5 psi	34	30	29	3.78E-07
								1 psi	112	98	93	
								0.5 psi	204	179	170	
202	S75_R	Rupture of Hydrogen Feed to PE reactor	678	Rupture	NA	NA	Flash Fire	LFL	34	38	48	1.18E-06
							Fireball	37.5 kW/m^2	96	96	96	7.21E-07
								4 kW/m^2	383	383	383	
								3% fatality	211	211	211	
							Explosion	5 psi	105	95	99	5.05E-07
								1 psi	340	338	341	
								0.5 psi	621	617	622	
203	S76_S	Small release from ICA FEED to PE	123313	10	2	3600	Jet Fire	37.5 kW/m^2	25	22	20	4.14E-05

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
		reactor						4 kW/m^2	37	35	33	
								3% fatality	30	27	25	
							Flash Fire	LFL	43	25	19	8.50E-05
							Explosion	5 psi	23	12	10	1.16E-05
								1 psi	74	39	34	
								0.5 psi	136	71	62	
204	S76_M	Medium release from ICA FEED to PE reactor	123313	50	42	3020	Jet Fire	37.5 kW/m^2	102	91	83	9.00E-05
								4 kW/m^2	157	148	141	
								3% fatality	123	112	105	
							Flash Fire	LFL	219	154	129	1.85E-04
							Explosion	5 psi	175	86	73	2.52E-05
								1 psi	569	279	237	
								0.5 psi	1039	510	433	
205	S76_R	Rupture of ICA FEED to PE reactor	123313	Rupture	NA	NA	Flash Fire	LFL	578	365	331	4.39E-05
							Fireball	37.5	152	152	152	2.69E-05

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								kW/m^2				
								4 kW/m^2	1225	1225	1225	
								3% fatality	644	644	644	
							Explosion	5 psi	326	202	186	1.88E-05
								1 psi	1121	803	810	
								0.5 psi	2047	1519	1496	
206	S77_S	Small release from Alkyl Supply to PE reactor	123313	10	2	3600	Jet Fire	37.5 kW/m^2	25	22	20	8.01E-05
								4 kW/m^2	37	35	33	
								3% fatality	30	27	25	
							Flash Fire	LFL	43	25	19	1.65E-04
							Explosion	5 psi	23	12	10	2.24E-05
								1 psi	74	39	34	
								0.5 psi	136	71	62	
207	S77_R	Rupture of Alkyl Supply to PE reactor	123313	Rupture	NA	NA	Flash Fire	LFL	578	365	331	8.16E-06
							Fireball	37.5 kW/m^2	152	152	152	5.00E-06

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								4 kW/m^2	1225	1225	1225	
								3% fatality	644	644	644	
							Explosion	5 psi	326	202	186	3.50E-06
								1 psi	1121	803	810	
								0.5 psi	2047	1519	1496	
208	S78_S	Small release from Reactor	9803	10	1	3600	Jet Fire	37.5 kW/m^2	5	10	5	1.47E-05
								4 kW/m^2	13	13	5	
								3% fatality	5	11	5	
							Flash Fire	LFL	8	7	6	3.29E-05
							Explosion	5 psi	4	4	3	1.37E-06
								1 psi	13	11	11	
								0.5 psi	23	21	20	
209	S78_M	Medium release from Reactor	9803	50	15	638	Jet Fire	37.5 kW/m^2	41	42	44	9.00E-05
								4 kW/m^2	66	66	66	
								3% fatality	51	53	54	
							Flash	LFL	62	56	57	1.85E-04

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Fire					
							Explosion	5 psi	26	23	23	2.52E-05
								1 psi	86	74	74	
								0.5 psi	157	136	136	
210	S78_R	Rupture of Reactor	9803	Rupture	NA	NA	Flash Fire	LFL	46	49	64	4.51E-05
							Fireball	37.5 kW/m^2	190	190	190	2.76E-05
								4 kW/m^2	827	827	827	
								3% fatality	454	454	454	
							Explosion	5 psi	185	184	187	1.93E-05
								1 psi	602	598	606	
								0.5 psi	1098	1091	1106	
211	S79_M	Medium release from Marine Loading Arm	44498	50	33	1356	Jet Fire	37.5 kW/m^2	NR	NR	NR	3.50E-05
								4 kW/m^2	NR	NR	NR	
								3% fatality	NR	NR	NR	
							Flash Fire	LFL	17	13	14	7.19E-05

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Explosion	5 psi	NR	NR	NR	9.81E-06
								1 psi	NR	NR	NR	
								0.5 psi	30	25	22	
212	S79_R	Rupture of Marine Loading Arm	44498	Rupture	33	1356	Flash Fire	LFL	17	13	14	7.21E-06
							Jet Fire	37.5 kW/m^2	NR	NR	NR	3.51E-06
								4 kW/m^2	NR	NR	NR	
								3% fatality	NR	NR	NR	
							Explosion	5 psi	NR	NR	NR	9.83E-07
								1 psi	NR	NR	NR	
								0.5 psi	30	25	22	
213	S80_M	Medium release from Butadiene Marine Loading Arm	93705	50	9	3600	Jet Fire	37.5 kW/m^2	4	18	22	1.24E-05
								4 kW/m^2	52	55	55	
								3% fatality	28	33	34	
							Flash Fire	LFL	7	6	6	2.02E-05
							Explosion	5 psi	NR	NR	NR	8.67E-06

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								1 psi	NR	NR	NR	
								0.5 psi	16	13	12	
							Toxic	3% fatality	NR	NR	NR	4.75E-04
								IDLH	241	NR	NR	
214	S80_R	Rupture of Butadiene Marine Loading Arm	93705	Rupture	9	3600	Flash Fire	LFL	7	6	6	9.64E-07
							Pool Fire	37.5 kW/m^2	NR	NR	NR	4.70E-07
								4 kW/m^2	NR	NR	NR	
								3% fatality	NR	NR	NR	
							Explosion	5 psi	NR	NR	NR	1.31E-07
								1 psi	NR	NR	NR	
								0.5 psi	16	13	12	
							Toxic	3% fatality	NR	NR	NR	5.06E-05
								IDLH	241	NR	NR	
								1 psi	NR	NR	NR	
								0.5 psi	259	165	146	
215	S81_S	Small release from 6" Ethane pipeline	127410	10	2	3600	Jet Fire	37.5 kW/m^2	1	4	10	8.23E-06

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
		from jetty to ISBL						4 kW/m^2	8	14	15	
								3% fatality	21	23	25	
							Flash Fire	LFL	4	3	4	1.69E-05
							Explosion	5 psi	NR	NR	NR	2.30E-06
								1 psi	NR	NR	NR	
								0.5 psi	NR	NR	NR	
216	S81_M	Medium release from from 6" Ethane pipeline from jetty to ISBL	127410	50	38	3357	Jet Fire	37.5 kW/m^2	5	22	38	3.37E-06
								4 kW/m^2	43	59	62	
								3% fatality	93	97	102	
							Flash Fire	LFL	29	23	22	6.91E-06
							Explosion	5 psi	NR	NR	NR	9.43E-07
								1 psi	NR	NR	NR	
								0.5 psi	40	32	27	
217	S81_R	Rupture of from 6" Ethane pipeline from jetty to ISBL	127410	Rupture	70	1804	Jet Fire	37.5 kW/m^2	8	31	49	8.45E-06
								4 kW/m^2	58	78	81	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								3% fatality	123	128	133	
							Flash Fire	LFL	36	32	34	1.38E-05
							Explosion	5 psi	NR	NR	NR	5.92E-06
								1 psi	NR	NR	NR	
								0.5 psi	53	45	38	
218	S82_S	Small release from Ethylene Tank 71-D31	10970000	10	2	3600	Jet Fire	37.5 kW/m^2	26	22	20	1.20E-04
								4 kW/m^2	37	34	32	
								3% fatality	30	27	25	
							Flash Fire	LFL	47	29	22	2.46E-04
							Explosion	5 psi	14	7	6	3.35E-05
								1 psi	39	20	18	
								0.5 psi	65	33	29	
219	S82_R	Rupture of Ethylene Tank 71-D31	10970000	Rupture	NA	NA	Fireball	37.5 kW/m^2	491	491	491	7.37E-06
								4 kW/m^2	2242	2242	2242	
								3% fatality	1227	1227	1227	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Flash Fire	LFL	3953	3020	3188	1.20E-05
							Explosion	5 psi	841	809	731	5.16E-06
								1 psi	2455	2436	2432	
								0.5 psi	4048	4076	4171	
220	S83_S	Small release from Ethane Tank 71-D32	4097000	10	2	3600	Jet Fire	37.5 kW/m^2	26	23	21	9.00E-07
								4 kW/m^2	38	35	33	
								3% fatality	31	28	26	
							Flash Fire	LFL	42	26	20	1.85E-06
							Explosion	5 psi	14	7	6	2.52E-07
								1 psi	38	19	16	
								0.5 psi	63	31	26	
221	S83_R	Rupture of Ethane Tank 71-D32	4097000	Rupture	NA	NA	Fireball	37.5 kW/m^2	605	647	741	2.40E-07
								4 kW/m^2	1722	1732	1781	
								3% fatality	1067	1103	1181	
							Flash	LFL	2044	1464	1261	3.92E-07

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Fire					
							Explosion	5 psi	629	248	343	1.68E-07
								1 psi	1761	949	961	
								0.5 psi	2952	1619	1579	
222	S84_S	Small release from Mixed C4 Tank 59-D31	4711000	10	1	3600	Jet Fire	37.5 kW/m^2	24	21	20	9.24E-05
								4 kW/m^2	36	34	32	
								3% fatality	29	26	24	
							Flash Fire	LFL	27	14	11	1.90E-04
							Explosion	5 psi	6	5	4	2.59E-05
								1 psi	17	13	11	
								0.5 psi	28	21	19	
223	S84_R	Rupture of Mixed C4 Tank 59-D31	4711000	Rupture	NA	NA	Fireball	37.5 kW/m^2	364	364	364	8.92E-06
								4 kW/m^2	1863	1863	1863	
								3% fatality	1005	1005	1005	
							Flash Fire	LFL	2406	1934	2065	1.46E-05

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
							Explosion	5 psi	502	453	503	6.24E-06
								1 psi	1546	1522	1655	
								0.5 psi	2549	2735	2780	
224	S85_S	Small release from Naphtha Feed Buffer Tank 24-D31	6578000	10	1	3600	Jet Fire	37.5 kW/m^2	22	19	18	9.00E-07
								4 kW/m^2	33	31	29	
								3% fatality	26	24	22	
							Flash Fire	LFL	34	22	16	1.85E-06
							Explosion	5 psi	11	6	5	2.52E-07
								1 psi	30	17	14	
								0.5 psi	49	28	24	
225	S85_R	Rupture of Naphtha Feed Buffer Tank 24-D31	6578000	Rupture	NA	NA	Pool Fire	37.5 kW/m^2	NR	NR	NR	2.40E-07
								4 kW/m^2	969	1017	1136	
								3% fatality	648	632	683	
							Flash Fire	LFL	1366	927	913	3.92E-07
							Explosion	5 psi	181	282	239	1.68E-07

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								1 psi	734	877	876	
								0.5 psi	1371	1530	1569	
226	S86_S	Small release from Mixed C6 Tank 66-D31	6395000	10	1	3600	Pool Fire	37.5 kW/m^2	13	11	10	1.35E-05
								4 kW/m^2	19	18	17	
								3% fatality	15	14	13	
							Flash Fire	LFL	19	10	6	3.02E-05
							Explosion	5 psi	3	2	2	1.26E-06
								1 psi	8	5	5	
								0.5 psi	13	9	9	
227	S86_R	Rupture of Mixed C6 Tank 66-D31	6395000	Rupture	NA	NA	Pool Fire	37.5 kW/m^2	NR	NR	NR	2.62E-06
								4 kW/m^2	70	81	89	
								3% fatality	29	30	31	
							Flash Fire	LFL	166	125	119	4.27E-06
							Explosion	5 psi	64	39	35	1.83E-06
								1 psi	178	164	152	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
								0.5 psi	309	282	277	
228	S87_S	Small release from PGO/PFO Tank 77-D31	1366000	10	1	3600	Jet Fire	37.5 kW/m^2	7	6	6	9.00E-07
								4 kW/m^2	11	11	11	
								3% fatality	8	8	8	
							Flash Fire	LFL	13	15	15	1.85E-06
							Explosion	5 psi	3	2	2	2.52E-07
								1 psi	7	7	7	
								0.5 psi	12	11	11	
229	S87_R	Rupture of PGO/PFO Tank 77-D31	1366000	Rupture	NA	NA	Pool Fire	37.5 kW/m^2	NR	NR	NR	2.40E-07
								4 kW/m^2	1216	1232	1286	
								3% fatality	799	826	889	
							Flash Fire	LFL	243	243	287	3.92E-07
							Explosion	5 psi	142	149	143	1.68E-07
								1 psi	399	418	401	
								0.5 psi	655	686	659	

No	Scenario ID	Scenario Description	Mass Released (kg)	Release Size (mm)	Initial Release Rate (kg/s)	Release Duration (s)	Potential Outcomes		Consequence Downwind Distance (m)			Event Frequency (per year)
									1.5F	3C	5D	
230	S88_S	Small release from Hexene-1 Tank 75-D31	5033000	10	2	3600	Jet Fire	37.5 kW/m^2	24	21	19	4.05E-05
								4 kW/m^2	37	34	33	
								3% fatality	29	26	24	
							Flash Fire	LFL	39	23	17	8.32E-05
							Explosion	5 psi	13	6	5	1.13E-05
								1 psi	37	18	15	
								0.5 psi	61	29	25	
231	S88_R	Rupture of Hexene-1 Tank 75-D31	5033000	Rupture	NA	NA	Pool Fire	37.5 kW/m^2	NR	NR	NR	2.62E-06
								4 kW/m^2	890	934	1053	
								3% fatality	590	574	629	
							Flash Fire	LFL	1291	924	910	4.27E-06
							Explosion	5 psi	216	281	261	1.83E-06
								1 psi	826	877	913	
								0.5 psi	1476	1542	1590	