ATTACHMENT F.1

TREATMENT, ABATEMENT AND CONTROL SYSTEMS

FIRE WATER RISK ASSESSMENT – IE0311133-22-RP-0004
F.1 Treatment, Abatement, and Control Systems

Emissions to Water

Process Wastewaters

Process wastewater will go to the on-site waste water balancing system where hydraulic and pH balancing will take place. The process effluent will be combined with the sanitary effluent and pumped via an on-site pump station to a sewer at the L75841 to the north of the site, where it will flow to the Monksland Wastewater Treatment Plant (WWTP).

Foul Sewerage

It is proposed to construct a new separate gravity foul drainage system on the site. The domestic foul effluent will be collected by an underground gravity sewer and carried to a new onsite pump station. The pump station will then pump the effluent to a proposed new gravity sewer adjacent to the L75841 which will then fall by gravity to the existing Monksland WWTP for disposal.

The following mitigation measures will be adopted in order to ensure that the provision of foul sewerage facilities will not adversely affect the water environment;

- Identify site drainage as surface, combined or foul water and suitably colour code and mark on the site plan
- All foul sewers will be pressure tested and surveyed prior to connection to the existing mains foul sewer
- RCC approval will be sought and obtained prior to the connection of sewerage to the Monksland WWTP.
- There are no further remedial or reductive measures as it is expected that sewerage for the development will be adequately designed to cater for the proposed use that there are adequate mains sewer capacities and sewage treatment capacity will be provided.

Storm Water, Firewater and Natural Surface Waters

The increases in volume of storm waters due to rainfall runoff has been identified as a potential impact and therefore the project storm water drainage design proposals need to mitigate sufficiently for these impacts in order to reduce any potential severity. In particular, the detailed design of the project will incorporate the following:

- Surface water drainage design will be carried out in accordance with the following technical design documentation:
  - The Greater Dublin Strategic Drainage Study (GDSDS)
  - EN 752 – Gravity Drainage Systems outside Buildings
  - BRE Digest 365 – Design of Soakaways
- It is proposed to construct a new separate surface water drainage system for the site. This will collect runoff from roofs, roads and paved areas. The surface water collection system carries the surface water to an attenuation pond located south of the proposed buildings.
A shut-off valve will be provided on the outlet of the surface water attenuation pond in order for it to be isolated, if required.

All road and paving gullies will be trapped.

A surface water attenuation pond will be constructed to accommodate up to and including a 1:100 year storm event. This pond will be capable of retaining approximately 850 m$^3$ (note that this is the current volume and may be subject to design change).

A hydrobrake flow control device will limit the flow of surface water to the existing ditch and ultimately to the Cross River.

A class 1 bypass petrol interceptor will be installed downstream of the hydrobrake flow control device prior to connection to the existing ditch.

A firewater risk assessment has been prepared in accordance with EPA Guidance for the purposes of this IEA licence application. Firewater retention requirements have been examined in the PM Group Report No. IE0311133-22-RP-0004 submitted as part of this Section.

**Emissions to Air**

**Boiler System**

There will be 1 No. boiler (1.5MW) located in the Utilities Building to the rear of the site. The boiler will be fuelled only from the natural gas supply to the site. There will be no back-up fuel for the site boiler. Emissions from the gas fired boiler will include the products of combustion, NO$_2$, CO and PM$_{10}$/PM$_{2.5}$. SO$_2$ emissions will be negligible given that the fuel is natural gas. It is noted that a gas fired boiler of this size would not be considered a significant emission point. In general a gas boiler of 5MW or greater would be considered a significant emission point and would warrant detailed assessment.

**Emergency Generator System**

One standby generator (350kVA) will be installed to provide emergency power in the event of a failure of the electricity main supply. The generator will be diesel fuelled and will be capable of supplying power to the site for 12 hours. Emissions from the diesel fired generator when operational will include the products of combustion, NO$_2$, CO and PM$_{10}$/PM$_{2.5}$ and SO$_2$. It will be used for emergency cover only. Under normal circumstances, it will be run for short periods estimated at a maximum of 30 minutes per week, for test and maintenance purposes.

**Process Emissions**

The production processes involves the addition of solids and liquids to purified water in vessels. The vessels are vented to atmosphere with minimal release of nitrogen. Any liquids, other than purified water, used in the process have high boiling points, e.g. >175 degrees Celsius and therefore will not lead to emissions to atmosphere. The Risk Phrases (R-Phrases) for solids and liquids used in the process are R22 (Harmful if swallowed) and R36 (Irritating to eyes) and are not seen as toxic or harmful to the environment. Therefore, emissions from processes are not seen as significant in terms of environmental or human health impact, and as such no specific treatment or abatement controls are required.
Minor fugitive VOC emissions may also arise from some of the QC laboratory activities. The levels of VOC fugitive emissions will very minor. As such, no particular abatement technology will be required.

It is envisaged that there will be no significant effects on air quality during the operational stage of the development. As such, no specific mitigation measures are deemed necessary.

**Noise Emissions**

Noise Modelling was used to assess the contribution of major noise sources at the proposed development to noise levels at noise sensitive locations close to the site during the operational phase.

The majority of the noisy equipment associated with the proposed development will be housed within the building, therefore mitigating that potential source. The facility will also be designed using acoustic enclosures where necessary, so that there will be no clearly audible tonal or impulsive component in the noise from the proposed plant at any noise sensitive locations. These noise criteria have been set by the EPA to avoid disturbance at noise sensitive locations. Therefore by designing the facility to comply with these stringent criteria the noise contribution from the proposed plant during normal operation should not have any significant impact on noise sensitive locations.

In accordance with the EPA Guidance Note NG4, noise attributable solely to onsite activities shall not exceed the values given below:

- Daytime (07:00 to 19:00hrs) – 55dB LAr,T
- Evening time (19:00 to 23:00hrs) – 50dB LAr,T
- Night time (23:00 to 07:00hrs) – 45dB LAeq,T
Fire Water Risk Assessment

Celebrating 40 Years in Business

Jazz Pharmaceuticals Ireland
Project Rock
IE0311133-22-RP-0004, Issue: C

Issue date: 19 December 2013
Document Sign Off

Fire Water Risk Assessment

Jazz Pharmaceuticals Ireland
Project Rock
IE0311133-22-RP-0004, Issue C

File No: IE0311133.22.070

CURRENT ISSUE

<table>
<thead>
<tr>
<th>Issue No</th>
<th>Date</th>
<th>Reason for issue</th>
<th>Sign Off</th>
<th>Originator</th>
<th>Checker</th>
<th>Reviewer</th>
<th>Approver</th>
<th>Customer Approval (if required)</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>19/12/2013</td>
<td>For IEA Licence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Print Name: Ciarán Reay, Pat Swords, Alistair Finlayson

Signature: Authorized Electronically

Date:

PREVIOUS ISSUES

<table>
<thead>
<tr>
<th>Issue No</th>
<th>Date</th>
<th>Originator</th>
<th>Checker</th>
<th>Reviewer</th>
<th>Approver</th>
<th>Customer</th>
<th>Reason for issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>18/10/2013</td>
<td>CR</td>
<td>PS</td>
<td>AF</td>
<td></td>
<td></td>
<td>Client Info</td>
</tr>
<tr>
<td>B</td>
<td>13/11/2013</td>
<td>CR</td>
<td>PS</td>
<td>AF</td>
<td></td>
<td></td>
<td>Client Info</td>
</tr>
</tbody>
</table>
Contents

1 Introduction 5

2 Summary and Conclusion 5

3 Methodology 6
   3.1 Fire Risk 6
   3.2 Environmental Risk 9
   3.3 Fire Water Runoff Risk 14

4 Fire Abatement, Response, Training & Awareness 15
   4.1 Fire Fighting Equipment 15
   4.2 Fire Safety Systems 15
   4.3 Fire Containment 15
   4.4 ATEX Zoning / Hazardous Area Classification 15
   4.5 Emergency Response in the Event of a Fire 16
   4.6 Permits to Work and No Smoking Policy 16
   4.7 Firewater Containment Measures 16

5 Risk Assessment 17
   5.1 Administration & QC Lab 17
   5.2 Warehouse 17
   5.3 Production Suite 18
   5.4 Utilities- Boiler Room 19
   5.5 Plant Area 19
   5.6 Fallow Space 20
   5.7 Conclusion 20

6 Calculation of Required Fire Water Retention Capacity 21
   6.1 Fire Water Retention Pond Sizing 21
   6.2 LÖRÜRL Methodology for the Calculation of Retention Volume 21
   6.3 EPA Methodology for the Calculation of Retention Volume 23
   6.4 LÖRÜRL Calculation 23
   6.5 EPA Calculation 25
   6.6 Legislative Context 25
   6.7 Conclusion 27

Appendix A 28
   Substance Inventory 28

Appendix B 30
   Fire Water Runoff Risk Assessment Summary Table 30
Appendix C
Fuel Source Types and Toxicological Classifications
1 Introduction

PM Group has been requested by Jazz Pharmaceuticals Ireland Limited (JPIL) to carry out a Fire Water Risk Assessment for its proposed new state-of-the-art pharmaceutical development and manufacturing facility which is to be located on a greenfield site at Monksland, Athlone, Co. Roscommon, Ireland.

The purpose of this Firewater Risk Assessment is to assess whether fire water retention is required for the proposed development. It is noted that this risk assessment is being conducted during the detailed design stage of the proposed facility; therefore some details of the design have yet to be confirmed. It is assumed in this report that there is no separate fire water retention pond in the current design.

2 Summary and Conclusion

For the purpose of this assessment the facility has been broken down into areas which were separated from each other by fire rated walls or significant distance, as follows:

- Administration & QC Lab
- Warehouse
- Production Suite
- Utilities
- Plant Area
- Fallow Space

These areas were assessed based on the fire risk associated with them along with the resultant environmental risks to determine the overall site risk in terms of the requirement for fire water retention.

The fire water risk assessment concludes that the proposed development provides an overall site risk of low in terms of the requirement for fire water runoff containment and in addition any fire water generated would not pose any significant environmental risk due the nature of the materials present on site. Therefore it is considered acceptable to conclude that no fire water retention capacity be provided on site according to the philosophy contained in Section 3.3 of this report.

Although the fire water risk assessment concludes that no fire water containment or reduction measures are required, a fire water retention calculation was carried out nonetheless to examine the fire water retention requirements necessary if the site provided a higher risk. Based on the German LÖRÜRL Firewater Retention Calculation Method it is was calculated that in this scenario the site would need 206m$^3$ of firewater retention capacity.

It is concluded that that there is no need for the construction of a retention for fire water run-off alone as even in the higher risk scenario, the required volume of 206m$^3$ would be catered for in the design of the proposed surface water attenuation pond which will be designed to hold 850m$^3$. This pond will be empty during normal plant operation and in the unlikely event of a fire, a shut-off valve on the outlet of the surface water attenuation pond will allow the retention of any fire water generated.
3 Methodology

The methodology for this assessment has been developed by PM Group with reference to the Environmental Protection Agency Draft Guidance Note to Industry on the Requirements for Fire-Water Retention Facilities, 1995. This guidance note requires that a fire water risk assessment be carried out followed by a fire water retention requirement calculation. The following assessment method has formed the basis of numerous submissions by PM Group clients to the EPA with respect to fire water retention.

Prior to commencing the assessment the site is logically divided into separate areas on the basis of significant distance and/or fire containment properties. Each of these areas is then assessed for the following:

1. Fire Risk which includes the likelihood of a fire occurring and the likely consequences of such a fire.

2. Environmental Risk which includes the likelihood of contaminated fire water runoff arising and reaching an environmental receptor and the likely consequences of such an event.

3.1 Fire Risk

The elements of fire risk are assessed, i.e. the likelihood of the event occurring (in this case the likelihood of a fire occurring in the assessment area) and the consequence of the fire.

3.1.1 Likelihood of Fire Occurring

Three conditions are essential for a fire to occur: a fuel source, heat and oxygen. Normally the heat required is initially supplied by an external source, i.e. an ignition source, and then provided by the combustion process. If one of the essential conditions is missing then fire does not occur and, if one of these is removed, then fire is extinguished. Controlling each of these conditions reduces the likelihood of a fire occurring and each condition must be assessed in order to assess the likelihood of a fire occurring.

Therefore the likelihood of a fire occurring depends on a variety of factors including the following:

a) Nature of Materials

Nature of the material which takes into account the presence of fuel sources in the assessment area. Fuel sources include:

- Flammables
- Explosives
- Oxidising Materials
- Other Physio-Chemical Properties
- Combustibles
- Definitions of the above fuel source types are provided in Appendix C.

b) Ignition/Heat Sources

The presence of heat/ignition sources in the assessment area, a contributing factor to which may be system controls. Factors which reduce the likelihood of an ignition source being present include:

- Ex rating/hazardous area classification
- Permit to work system
- Inerting systems
- Earthing of equipment
- No smoking policy
c) Oxygen

Oxygen is generally present under most fuel storage, handling and use conditions. Some processes use gas inerting, e.g. nitrogen, to eliminate oxygen. In most cases the presence of oxygen is assumed.

Once the facility-specific information regarding factors which will affect the likelihood of a fire occurring has been assessed Table 3.1 can be used to determine that likelihood in terms of High, Medium and Low.

**Table 3.1: Likelihood of Fire Occurring**

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Flammable, oxidising or explosive materials present and Potential for ignition source to be present</td>
</tr>
<tr>
<td>Medium</td>
<td>Flammable, oxidising or explosive materials present and Low potential for ignition/heat source to be present <strong>or</strong> Combustible materials only present and Potential for ignition/heat source to be present</td>
</tr>
<tr>
<td>Low</td>
<td>Combustible Materials Only Present And Low Potential For Ignition/Heat Source To Be Present</td>
</tr>
</tbody>
</table>

### 3.1.2 Consequences of a Fire

The potential consequences of a fire can range from being relatively local to being significant. The extent and consequence of a fire will be influenced by the following variables:

- Quantity of flammable/oxidising materials in assessment area
- Fire detection and protection measures
- Emergency response
- Fire containment
- Quantity and nature of fire water runoff generated
a) Quantity of flammable/oxidising materials in assessment area

The quantity of flammable/oxidising materials in the assessment area will be a contributing factor to determining the physical extent of the fire. The nature, thermal radiation levels generated and ability of the fire to spread will all be at least partially determined by the materials present in the assessment area.

b) Fire detection and protection measures

The purpose of fire detection systems is to identify fire as quickly as possible, thereby maximising effectiveness of fire fighting, and ensuring adequate time for evacuation. Elements of a fire detection/alarm system may include:

- Smoke detectors
- Heat detectors
- Manual call points
- Breakable Glass Units (BGUs)

Fire protection provides immediate fire abatement for on-site facilities. The more efficient the fire detection and protection features are, the less severe the consequences are likely to be. Fire protection facilities may include:

- Sprinkler system, consisting of reservoir, pumps and distribution network including deluge systems
- Fire extinguishers
- Hydrants
- Other extinguishing media (foams, etc.)

c) Emergency Response

Efficiency of emergency response procedure can reduce consequences. Crisis management, emergency response training and awareness are preparation tools which improve emergency response.

d) Fire Containment

Fire containment limits the spread of the fire, thereby reducing consequences. Fire containment is achieved by:

- Fire rated walls and structures prevent the spread of fire. These are generally rated to resist fire for a specific time period i.e. 1 & 2 hours.
- Distance between areas. A distance of 15 m should be retained between areas of flammable material storage. This will prevent the spread of fire.

e) Quantity and nature of fire water runoff generated

The consequences due to fire water runoff (predominantly environmental) will be proportional to quantity of runoff generated. If large quantities of flammable liquid are present, there is potential for the fire water to spread the flammable material and escalate the fire.

Once the facility-specific information regarding factors, which will affect the consequence of a fire, has been assessed, Table 3.2 can be used to determine that likelihood in terms of Severe, Moderate and Minor.
Table 3.2: Consequences of a Fire

<table>
<thead>
<tr>
<th>Consequence</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe</td>
<td>Large quantities of fire water runoff generated</td>
</tr>
<tr>
<td></td>
<td>Poor fire detection/protection/emergency response system</td>
</tr>
<tr>
<td></td>
<td>Large storage tank/container damage – release of hazardous materials</td>
</tr>
<tr>
<td></td>
<td>Poor fire containment</td>
</tr>
<tr>
<td>Moderate</td>
<td>Some quantities of fire water runoff generated</td>
</tr>
<tr>
<td></td>
<td>Some fire detection/protection/emergency response system</td>
</tr>
<tr>
<td></td>
<td>Some storage tank/container damage – release of hazardous materials</td>
</tr>
<tr>
<td></td>
<td>Some fire containment</td>
</tr>
<tr>
<td>Minor</td>
<td>Limited Quantities Of Fire Water Runoff Generated</td>
</tr>
<tr>
<td></td>
<td>Good Fire Detection/Protection/Emergency Response System</td>
</tr>
<tr>
<td></td>
<td>Limited Storage Tank/Container Damage – Release Of Hazardous Materials</td>
</tr>
<tr>
<td></td>
<td>Good Fire Containment</td>
</tr>
</tbody>
</table>

3.1.3 Overall Fire Risk

The agreed likelihood and consequence categories determined for the fire hazard are combined, using the matrix in Table 3.3, to qualitatively predict the fire risk associated with each assessment area.

Table 3.3: Overall fire risk

<table>
<thead>
<tr>
<th>LIKELIHOOD</th>
<th>CONSEQUENCE</th>
<th>SEVERE</th>
<th>MODERATE</th>
<th>MINOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH</td>
<td>HIGH</td>
<td>HIGH</td>
<td>MEDIUM</td>
<td></td>
</tr>
<tr>
<td>MEDIUM</td>
<td>HIGH</td>
<td>MEDIUM</td>
<td>LOW</td>
<td></td>
</tr>
<tr>
<td>LOW</td>
<td>MEDIUM</td>
<td>LOW</td>
<td>LOW</td>
<td></td>
</tr>
</tbody>
</table>

3.2 Environmental Risk

The environmental risk is a combination of the likelihood of the event occurring (in this case the likelihood of contaminated fire water being discharged to the environment) and the consequence of the event on the environment.

3.2.1 Likelihood of an Environmental Release

The two principal factors affecting the likelihood of contaminated fire water being released to the surrounding environment are:

- The level of containment provided for materials in the assessment area
The pathways from the assessment area to environmental receptors

The level of containment provided for spillages and/or releases of a material in the event of a fire situation will affect the extent of contamination of the fire water and the migration potential of any contaminated fire water. A number of measures can contribute to a high level of containment on site including:

- Bunding of tanks and other material storage areas (e.g. drum stores) in accordance with recommended guidelines
- The use of spill containment equipment (e.g. spill pallets) for the storage of smaller quantities of materials
- Proper maintenance of all tanks, bunds and other material containing structures
- Procedural controls, e.g. emergency response procedures to contain and mitigate spillages and/or accidental releases of a material
- Maintaining appropriate equipment (e.g. adsorbent materials, booms) on site to contain any spillages and/or accidental releases of a material

The pathway is defined as the physical route by which released materials (i.e. contaminated fire water) may travel from the source to an environmental receptor, such as a receiving waterway. It is necessary to take into account all of the pathways by which the material may reach the environmental receptor. Potential pathways for contaminated fire water include:

- All water drainage systems on site including sewers, drains and culverts
- Any damage to the site drainage systems, which provide other potential pathways (e.g. cracked pipework which allows fire water to drain to underlying soil and groundwater)
- The surface area of the site if the volume of fire water exceeds the capacity of the site drains
- Areas of the site that do not have a hardsurface or relatively impermeable cover (e.g. concrete), which would allow fire water to drain to the underlying soil and groundwater

Factors which limit the potential pathways for contaminated fire water include:

- Control mechanisms incorporated into the site drainage system (e.g. shut-off valves), which can stop or divert the flow of fire water
- Impermeable surfaces on site to prevent fire water draining to the underlying ground and groundwater

Once the facility-specific information regarding factors, which will affect the likelihood of fire water reaching an environmental receptor, has been assessed, Table 3.4 can be used to determine that likelihood in terms of High, Medium and Low.
Table 3.4: Likelihood of contaminated fire water reaching an environmental receptor

<table>
<thead>
<tr>
<th>Likelihood</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>No containment provided for spillages and/or accidental releases of materials and Numerous pathways to environmental receptors</td>
</tr>
<tr>
<td>Medium</td>
<td>No containment provided for spillages and/or accidental releases of materials and Some pathways to environmental receptors</td>
</tr>
<tr>
<td>Low</td>
<td>Containment Provided For Spillages And/Or Accidental Releases Of Materials And Limited Pathways To Environmental Receptors</td>
</tr>
</tbody>
</table>

3.2.2 Consequences

The factors influencing the consequences of fire water runoff to the environment are:

- The nature and properties of materials on site
- The quantity of materials on site
- The sensitivity of environmental receptors in the surrounding environment

a) Nature and Properties of Materials

The nature and properties of the material on site will to a large extent determine the consequences of a release of the material to the environment. If the material does not possess any hazardous properties, it is unlikely to have any significant adverse impacts if released to the environment.

Toxicological (eco) and associated classifications of a material can be used to assess the consequences of a release of the material to the environment. Details of these classifications are provided in Appendix C.

A number of physical, chemical and biochemical properties of the material influence the likely environmental fate of the material once it is released to the environment including:

- Water Solubility – Water soluble chemicals will more rapidly disperse in the environment and tend to be more biodegradable
- Octanol / Water Partition co-efficient - This indicates the relative solubility of the material in fatty materials. Fat soluble materials are more likely to bioaccumulate in fatty tissues of fauna and are generally less biodegradable.
- Bioaccumulation Factor – This also indicates the bioaccumulation potential of the material
- Biodedegrability –The more biodegradable the material the more rapidly it will be degrade in the environment and the less likely it is to have a long term impact
- Volatility – indicated by Vapour Pressure and Latent Heat of Vaporisation –Volatile materials tend to evaporate and disperse more rapidly
- Oxygen Demand of material (BOD) – Materials with high oxygen demand are likely to deplete the dissolved oxygen levels in an aquatic environment and thus have an adverse impact.

- The potential visual impact of a material (e.g. dyes, detergents, oil) on a receiving water body will be influenced by a number of physical and chemical properties, such as colour, solubility, dispersal characteristics.

b) Quantity of Materials on Site

The other key factor influencing the consequences of a release of a material to the environment is the quantity of material released. The larger the quantity of material released as contaminated fire water, the greater the consequences on the environment will be. Additionally, there may be threshold quantities below which the escape to a watercourse may not have a significant environmental impact.

c) Sensitivity of Environmental Receptors

The sensitivity of the receiving environment / environmental receptors to which the contaminated fire water is discharged will also influence the consequences of the discharge. Therefore it is necessary to identify the receptors and assess the sensitivity of receptors in the surrounding environment.

The presence and nature of the environmental receptor can be thought of as the fixed point in any hazard or risk assessment. Although the site operator is able to modify sources and, to some extent perhaps, on-site pathways, altering the receptor is more difficult. Short of diverting rivers or moving abstraction points, there is usually little that can be done to change the receptors.

The following criteria can be used to assess the sensitivity of environmental receptors in the surrounding environment.

- Characteristics of aquifers in the area:
  - The vulnerability of the aquifer – Extreme (E), High (H), Moderate (M), Low (L) - based on the Geological Survey of Ireland (GSI) classification system
  - The importance of the aquifer – Regionally Important (R), Locally Important (L), Poor (P)
  - Aquifers located within Source Protection Zones
  - Rivers or other watercourses with a high fisheries potential including rivers designated as salmonid waters and as shellfish waters
  - Rivers or other watercourses from which water is abstracted for drinking purposes
  - Waters designated as bathing waters
  - Areas covered by a scientific or conservation designation such as a Special Area of Conservation (SAC), a Natural Heritage Area (NHA), a Special Protection Area (SPA) or other conservation designation
  - Areas covered by special amenity orders or other environmental or recreational designations in the local authority development plan

Once the facility-specific information regarding factors which will affect the consequence of fire water reaching an environmental receptor has been assessed Table 3.5 can be used to determine that consequence in terms of Severe, Moderate and Minor.
**Table 3.5:** Consequences of contaminated fire water discharged to the environment

<table>
<thead>
<tr>
<th>Consequence</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severe</td>
<td>Long term adverse environmental effects</td>
</tr>
<tr>
<td></td>
<td>Large quantity of hazardous materials released</td>
</tr>
<tr>
<td></td>
<td>Materials reach sensitive environmental receptor(s)</td>
</tr>
<tr>
<td>Moderate</td>
<td>Materials have medium term impact</td>
</tr>
<tr>
<td></td>
<td>Medium quantity of hazardous materials released</td>
</tr>
<tr>
<td></td>
<td>Materials have limited impact on environmental receptor(s)</td>
</tr>
<tr>
<td>Minor</td>
<td>Materials Are Rapidly Degraded And Dispersed In The Environment</td>
</tr>
<tr>
<td></td>
<td>Small Quantity Of Hazardous Materials Released</td>
</tr>
<tr>
<td></td>
<td>Materials Do Not Reach Any Sensitive Environmental Receptors</td>
</tr>
</tbody>
</table>

3.2.3 Overall Environmental Risk

The agreed likelihood and consequence categories determined for the environmental hazard are combined, using the following matrix, to qualitatively predict the environmental risk associated with each assessment area.

**Table 3.6:** Overall Environmental Risk

<table>
<thead>
<tr>
<th>LIKELIHOOD</th>
<th>CONSEQUENCE</th>
<th>SEVERE</th>
<th>MODERATE</th>
<th>MINOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH</td>
<td>HIGH</td>
<td>HIGH</td>
<td>MEDIUM</td>
<td></td>
</tr>
<tr>
<td>MEDIUM</td>
<td>HIGH</td>
<td>MEDIUM</td>
<td>LOW</td>
<td></td>
</tr>
<tr>
<td>LOW</td>
<td>MEDIUM</td>
<td>LOW</td>
<td>LOW</td>
<td></td>
</tr>
</tbody>
</table>
3.3 Fire Water Runoff Risk

The agreed fire and environmental risk are then used to determine the overall site risk in terms of the requirement for fire water runoff risk assessment.

Table 3.7: Risk Associated with Fire Water Run-off

<table>
<thead>
<tr>
<th>ENV RISK</th>
<th>HIGH</th>
<th>MEDIUM</th>
<th>LOW</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH</td>
<td>HIGH</td>
<td>HIGH</td>
<td>MEDIUM</td>
</tr>
<tr>
<td>MEDIUM</td>
<td>HIGH</td>
<td>MEDIUM</td>
<td>LOW</td>
</tr>
<tr>
<td>LOW</td>
<td>MEDIUM</td>
<td>LOW</td>
<td>LOW</td>
</tr>
</tbody>
</table>

Notes:
1. HIGH – Fire water runoff containment will be required if further risk reduction measures are not implemented.
2. MEDIUM – Fire water runoff containment may not be required if further risk reduction measures are implemented.
3. LOW – Fire water runoff containment not required.
4 Fire Abatement, Response, Training & Awareness

4.1 Fire Fighting Equipment
Fixed fire fighting facilities, i.e. sprinklers, fire extinguishers and fire hydrants will be present on site.

4.1.1 Sprinkler System
The facility will be sprinklered to FM Global requirements. The sprinkler system will be fed from a firewater tank located in the service yard.

4.1.2 Fire Water Hydrants
A 150mm diameter hydrant main shall be routed around the perimeter of the facility. The fire main shall consist of six no hydrants. The hydrant main and building sprinkler system shall be fed from a designated fire protection pump house which shall be located adjacent to firewater tank in the services yard.

4.1.3 Fire Extinguishers
There will be a complete inventory of Fire Extinguishers around the site made up of a mixture of types including carbon dioxide, foam, water and powder. The locations and numbers of the appropriate type will be assessed once installation of all equipment is complete. A service and maintenance system will be put in place.

4.2 Fire Safety Systems

4.2.1 Fire Detection and Alarm System
The fire alarm system for the facility will be designed and maintained in accordance with IS3218: 2009 - Fire detection and alarm systems for buildings – System design, installation, servicing and maintenance. The level of system coverage for the facility will be as follows:
Category L1: Systems having detection, manual call points and alarm devices installed throughout the protected premises. The alarm will sound automatically in all locations throughout the site if activated by the smoke detectors and / or heat detectors.

4.3 Fire Containment

4.3.1 Fire Walls, Fire Doors and Cavity Barriers
Fire walls, fire doors and cavity barriers have been designed into the facility to provide for four separate fire compartments, comprising the following areas:
- Administration and QC Lab
- Warehouse
- Production Suite & Main Corridor
- Utilities and Boiler Room

4.4 ATEX Zoning / Hazardous Area Classification
A preliminary ATEX review has been carried and found that a number of potential hazards can be controlled by process control engineering systems and good housekeeping. The above measures will be formally documented before the facility goes operational into a formal Explosion Protection Document.
4.5 Emergency Response in the Event of a Fire

4.5.1 Site Emergency Response Procedure
The site will have a detailed emergency response procedure in place to deal with all likely site emergencies including fire and chemical/process spills. There will be a trained site emergency response team in place with members on all shifts to ensure cover during all hours of operations.

4.5.2 Local Fire Authority Response
Pre-fire planning information including plans of site, location of hydrants, details of active fire fighting systems, and information regarding the types of materials stored on site will be submitted to the local fire authority so that they can determine the appropriate PDA (pre-determined attendance) for the development.

4.5.3 First Aid Cover
First Aid training will be provided for various facility employees to ensure first aid cover is available during all operational hours.

4.6 Permits to Work and No Smoking Policy
Permits to Work will be in place at the site to control the creation of ignition sources especially in areas containing potentially flammable materials. These permits control activities such as welding and any other activities with the potential to produce an ignition source.

Smoking, which is another potential ignition source, will be strictly controlled at the site and will be restricted to designated areas, which are isolated from flammable material storage areas.

4.7 Firewater Containment Measures
The site drainage system consists of three sections – the process effluent drainage system, the domestic foul effluent drainage system and the external surface water drainage system.

During normal facility operations, process effluent is primarily generated during the cleaning of the process equipment. A separate underground piped drainage system will be installed to transport process waste to the onsite waste water balancing system. This system will carry out balancing in terms of hydraulic flow and pH before sending the waste on to the proposed onsite foul water pumping station. The domestic foul drainage system is a closed system which collects the domestic-type wastewater from the hygiene facilities around the site and sends the wastewater to the Monksland WWTP via the onsite foul water pumping station. The external surface water drainage network collects rainwater from all hard-standing and roofed areas of the site and directs it to the surface water attenuation pond. The attenuation pond discharges to the existing drainage ditch which in turn drains to the Cross River which runs along the southern boundary of the site.

In the event of a fire on site any firewater generated will drain into either the internal process or the external surface water drainage systems, depending on where the fire occurs. If the firewater enters the internal process drainage system it will collect in balancing tank. In the event that this tank reaches capacity the water will back up through the internal drainage system which could ultimately overflow, in which case runoff will leave the production area and drain towards the external surface water drainage system.
5 Risk Assessment

For the purpose of this assessment the facility has been broken down into areas which are separated from each other by fire rated walls or significant distance, as follows:

- Administration & QC Lab: An office area with reception, offices, meeting room, kitchen and an adjoining QC laboratory to support finished products.
- Warehouse: A warehouse area with secure vault and sampling/dispensing booth
- Production Area: A manufacturing suite for drug products including formulation, filling and packaging
- Utilities: Plant rooms for clean utilities, boilers, switchgear
- Plant area: Air handling plant, security and comms
- Fallow Space

As detailed in Section 3.3, the overall site risk in terms of the requirement for fire water run-off risk assessment will be classed as HIGH, MEDIUM or LOW.

- Scenarios with a **HIGH** risk **will require** fire water run-off containment if further risk reduction measures are not implemented.
- A **MEDIUM** risk **may not require** fire water run-off containment if further risk reduction measures are implemented.
- A **LOW** risk **does not require** fire water run-off containment.

5.1 Administration & QC Lab

The Administration and QC Lab are considered to represent a very minor overall fire water run-off risk. These areas represent normal office environments with negligible storage of any substances with combustible/flammable or water hazard properties. Therefore it is considered unnecessary to carry out the full risk assessment on this area. The overall fire risk will be considered Low and the overall environmental risk considered as Low also.

5.1.1 Fire Water Run-Off Risk (Low)

The fire water run-off risk is low. No further fire water containment or reduction measures are required.

5.2 Warehouse

This area will provide for storage of raw materials, finished product and packaging. There will also be a deliveries/dispatch area and some associated offices and a workshop. The maximum proposed warehouse inventory is included in Table A1 in Appendix A.

5.2.1 Fire Risk (Low)

Raw material A which will be stored in 200L barrels is considered a class IIIB combustible liquid by OSHA/NFPA meaning its flash point is approximately 99°C. The Warehouse will be kept at ambient temperature i.e. significantly below the flash point. The other raw materials and finished products stored in the Warehouse are rated as non-flammable substances. There will be some storage of combustible material present in relation to packaging which will be stored in a suitable manner. Ignition sources in the area are well controlled through the permit to work system, no smoking policy and staff training. Therefore with reference to Table 3.1 the likelihood of a fire occurring in this area is considered Low.

There are good fire detection and suppression measures dispersed throughout the warehouse including break-glass units, fire extinguishers and a sprinkler system. The Warehouse will be a contained in its own fire compartment and the proposed facility will have emergency response procedures in place to limit any incidents that arise. Therefore with reference to Table 3.2 the consequences of a fire have been taken as Minor.
Overall Fire Risk = Low (L) x Minor (C) = Low (Refer to Table 3.3)

5.2.2 Environmental Risk (Low)
The majority of materials in the warehouse will be stored in sealed containers so it is unlikely that more than a few would rupture and spill in the event of a fire. Any fire water used to fight a fire in this area will either remain on the warehouse floor or go via drains to the surface water system onto the surface water attenuation pond. In the event that discharge from the attenuation pond is outside of the licensed parameters for discharge to the Cross River via the existing drainage ditch, an automatic shut-off valve will be provided on the outlet of the surface water attenuation pond in order for it to be isolated. The non-compliant firewater may be held in the attenuation pond for interim storage pending a decision on its fate. Therefore the likelihood of fire water run-off reaching an environmental receptor would be Low with reference to Table 3.4.

The materials present are all non-toxic to the environment. In the event of contaminated fire water reaching environmental receptors, they rapidly degrade and disperse into the environment with no long term effects; therefore the consequence of contaminated fire water discharge to the environment is considered Minor with reference to Table 3.5.

Overall Environmental Risk = Low (L) x Minor (C) = Low (Refer to Table 3.6)

5.2.3 Fire Water Run-Off Risk (Low)
Based on the information detailed in the two preceding sections the overall fire water run-off risk is determined to be Low (refer to Table 3.7). No further fire water containment or reduction measures are required.

5.3 Production Suite
This area will contain the process area, filling room, holding room and packaging. There will also be a manufacturing office and meeting room along with staff changing areas and locker rooms.

5.3.1 Fire Risk (Low)
There will not be any significant fuel sources present in the Production Suite. In addition, the solvent that will be used in the production process for dissolution and mixing of raw materials is water. Raw Material A will be kept well below its flash point in production. The other raw materials present and finished products are all non-flammable. There will combustible packaging material present in the packaging area but this is not considered a high risk risk area. The design has undergone a preliminary ATEX review and a number of potential hazards were identified in respect of raw materials B & C. A list of the advised hazard control measures are listed in section 4.4. Isopropyl alcohol (IPA) is a highly flammable liquid and may be used for cleaning and as a disinfectant. It will be stored in suitable cabinets for flammables and preferably in non-breakable containers (e.g. plastic). When working with IPA, volumes will be restricted to 1 to 2 litres at the most. In addition, procedural controls, staff training, no smoking policy and the permit to work system within the Production Suite ensure that the potential for an ignition source is low. Therefore with reference to Table 3.1 the likelihood of a fire has been taken as Low.

There are good fire detection and suppression measures dispersed throughout the Production Suite and packaging area including break-glass units, fire extinguishers and a sprinkler system. The Production Suite will also be a separate fire compartment. There will also be emergency response procedures in place to limit any incidents that arise, therefore the consequence of a fire with reference to Table 3.2 is considered to be Minor.

Overall Fire Risk = Low (L) x Minor (C) = Low (Refer to Table 3.3)

5.3.2 Environmental Risk (Low)
Fire Water used to fight a fire in this area will either remain on the Production Suite Floor or go via the process area drains to the process effluent balancing tanks or else on to the surface water system onto the surface water attenuation pond where it would be held. Therefore the likelihood of fire water run-off reaching an environmental receptor would be Low with reference to Table 3.4.
The materials that are present are all non-toxic and would rapidly degrade and disperse into the environment with no long term effects, therefore the consequence of contaminated fire water discharge is considered to be Minor with reference to Table 3.5.

**Overall Environmental Risk = Low (L) x Minor (C) = Low (Refer to Table 3.6)**

### 5.3.3 Fire Water Run-Off Risk (Low)

Due to the low fire risk and low environmental risk in the production area, the overall fire water run-off risk is considered low (Refer to Table 3.7). No further fire water containment or reduction measures are required.

### 5.4 Utilities- Boiler Room

The facility will require certain process utilities including Purified Water (PUW), Process & Instrument Air, Nitrogen, Laboratory Gases, Chilled Water, Plant Steam and Natural Gas. All the plant associated with these utilities will be located in the Utilities Room and Boiler Room.

#### 5.4.1 Fire Risk (Medium)

Flammable material (natural gas) will be present in the Boiler Room to fire the boilers. However there will be gas detectors located in the boiler room to shut-off gas supply should concentrations in the room reach a critical level. Some flammable materials and other engineering oils and chemicals will also be present in the Utilities area. Cylinders of flammable compressed gases will be stored outside in cages. Ignition sources in the area are well controlled through the permit to work system, no smoking policy and staff training. Therefore with reference to Table 3.1 the likelihood of a fire in this area is considered Medium.

There will be good fire detection and suppression measures including break glass units, and fire extinguishers and sprinkler system. There will be no significant quantities of chemicals / materials stored in this area and therefore the potential for significant amounts of run-off to be generated is low. Therefore with reference to Table 3.2, the consequence of a fire in the Utilities area is considered Minor.

**Overall Fire Risk = Medium (L) x Minor (C) = Low (Refer to Table 3.3)**

#### 5.4.2 Environmental Risk (Low)

Fire water would drain to the surface water drains outside of the Utilities and Boiler Room onto the surface water attenuation pond where it would be held until testing was carried out to decide its fate. Therefore the likelihood of contaminated firewater reaching an environmental receptor is Low with reference to Table 3.4.

There will be small amounts of potential contaminants stored in these areas mainly for servicing of plant including some chemicals, compressed gases and various engineering oils/lubricants. On this basis and with reference to Table 3.5 the consequence of contaminated fire water discharging to the environment has been taken as Minor.

**Overall Environmental Risk = Low (L) x Minor (C) = Low (Refer to Table 3.6)**

#### 5.4.3 Fire Water Run-Off Risk (Low)

Based on the information detailed in the two preceding sections the overall fire water run-off risk is determined to be Low (refer to Table 3.7).

### 5.5 Plant Area

The plant is located on the first floor level mainly over the utility, spine corridor and production change areas. The main purpose of this area is to accommodate AHUs, electrical panels, comms and security rooms. The plant area is accessed by means of a stairs and lift located within the warehouse. Alternatively this could be accessed from the clean utilities area.
5.5.1 Fire Risk (Low)
There are no flammable materials present in this area although there is some mechanical and electrical equipment present which may provide potential for an ignition/heat source. There is considered to be a Medium likelihood of a fire occurring in plant area with reference to Table 3.1. There will be good fire detection and suppression measures including break glass units, and fire extinguishers and sprinkler system. The comms room will have an FM200 suppression system. With reference to Table 3.2, the consequence of a fire in this area is considered to be minor.

Overall Fire Risk = Medium (L) x Minor (C) = Low (Refer to Table 3.3)

5.5.2 Environmental Risk (Low)
Fire water used in the plant area would most likely drain down into production area or the utilities area where it will either drain to the process drainage system or the surface water system where it would ultimately flow to the surface water attenuation pond where it would be held pending investigation. Therefore the likelihood of fire water run-off reaching an environmental receptor would be Low with reference to Table 3.4.

There are no toxic materials present so water would rapidly disperse into the environment with no long term effects so the consequence of contaminated fire water discharge is considered to be minor with reference to Table 3.5.

Overall Environmental Risk = Low (L) x Minor (C) = Low (Refer to Table 3.6)

5.5.3 Fire Water Run-Off Risk (Low)
Due to the low fire risk and low environmental risk in these areas, the overall fire water run-off risk is low (Refer to Table 3.7). No further fire water containment or reduction measures are required.

5.6 Fallow Space
There is approximately 1250m$^2$ of fallow space mainly on the west side of the facility. These spaces are for possible future expansion in the areas of administration and production. They are not part of the project scope at present. They will be sealed spaces separated from the rest of the building by compartment walls and there are no entry points. The spaces will be covered by the fire detection and alarm system. There will be no fire load present so these areas have not being included in this risk assessment.

5.7 Conclusion
The fire water risk assessment concludes that the proposed development provides an overall site risk of low in terms of the requirement for fire water runoff containment and in addition any fire water generated would not pose any significant environmental risk due the nature of the materials present on site. Therefore it is considered acceptable to conclude that no fire water retention capacity be provided on site.

A fire water retention calculation was carried out in the next section nonetheless to examine the fire water retention requirements necessary if the site provided a higher risk.
6 Calculation of Required Fire Water Retention Capacity

6.1 Fire Water Retention Pond Sizing

In 1995, the Environmental Protection Agency (EPA) issued a Draft Guidance Note to Industry on the Requirements for Fire Water Retention Facilities. This document does not provide detailed guidance on fire water retention design, including duration of fire event.

However, it does reference a number of other guides including the CIRIA (UK Construction Industry Research Institute) Report 164 on ‘Design of Containment Systems for Prevention of Water Pollution from Industrial Incidents’. This in turn references in Section 9.6 the ‘German Federation of Chemical Industry (VCI) Guide of 1988’ and the European Insurance Commission (CEA) ‘Guide of 1993 for Assessment of Fire water Run-Off Volumes’. These guides were produced as a consequence of the 1986 Sandoz Agrochemical Warehouse fire in Basle which due to contaminated fire water polluted the whole length of the Rhine downstream of Basle.

The VCI formed part of a committee, comprising government bodies, industry representatives, fire services and insurance representatives who in 1991 produced a guide (LÖRÜRL) on fire water retention. This replaced the shorter 1988 text. The LÖRÜRL guide formed the basic principles for the draft guideline produced by the CEA in 1993. However the CEA guide has not been issued since in final form by the CEA.

To ensure a comprehensive and conservative approach to determine the maximum required fire water retention, calculations prescribed in both the LÖRÜRL guide and the EPA Draft Guidance Note were adopted.

6.2 LÖRÜRL Methodology for the Calculation of Retention Volume

With the storage of materials in either block or shelf storage up to various heights and with different fire extinguishing features the permissible storage quantity and permissible area of the storage section are to be determined for ground floor, single storey storage sections according to Table 6.1.

Table 6.1: Permissible storage quantity and permissible storage area of storage sections

<table>
<thead>
<tr>
<th>Safety Category</th>
<th>Permissible storage quantity as well as permissible area of a storage section with a storage density of 0.7 t to 1.2 t/m² for;</th>
<th>Permissible storage quantity as well as permissible area of a storage section with a storage density of 0.7 t to 1.2 t/m² for;</th>
<th>Permissible storage quantity as well as permissible area of a storage section with a storage density of 0.7 t to 1.2 t/m² for;</th>
</tr>
</thead>
<tbody>
<tr>
<td>K 1</td>
<td>200 In t or m²</td>
<td>50 In t or m²</td>
<td>50 In t or m²</td>
</tr>
<tr>
<td>K 2</td>
<td>800 In t or m²</td>
<td>600 In t or m²</td>
<td>200 In t or m²</td>
</tr>
<tr>
<td>K 3</td>
<td>1200 In t or m²</td>
<td>800 In t or m²</td>
<td>600 In t or m²</td>
</tr>
<tr>
<td>K 3 (2 Squads)</td>
<td>1600 In t or m²</td>
<td>1000 In t or m²</td>
<td>800 In t or m²</td>
</tr>
<tr>
<td>K 3 (Engine)</td>
<td>2000 In t or m²</td>
<td>1200 In t or m²</td>
<td>1000 In t or m²</td>
</tr>
<tr>
<td>K 4</td>
<td>4000 In t or m²</td>
<td>3000 In t or m²</td>
<td>2400 In t or m²</td>
</tr>
</tbody>
</table>

Note: With a storage density of under 0.7 t/m² the given values for the area are to be multiplied by a factor of 1.3: With a storage density of more than 1.2 t/m² the given values for the area are to be multiplied by a factor of 0.5.
6.2.1 Safety Categories

Safety categories are classification grades, which are based on the type of fire brigade, the requirements for fire alarm and the provision of automatic fire extinguishing. They are defined as follows:

Safety category K 1
- Public fire brigade
- No particular requirement for fire alarm

Safety category K 2
- Public fire brigade
- Particular requirement for fire alarm

Safety category K 3
- Work’s fire brigade
- Particular requirement for fire alarm

Safety category K 4
- Public fire brigade or work’s fire brigade and
- Automatic fire extinguishing including automatic fire alarm.

The calculation of the required fire water retention facility for stored goods height up to 12 m is to be determined from Table 6.2.
Table 6.2: Determination of the volume of fire water retention facilities for height of stored goods up to 12m

<table>
<thead>
<tr>
<th>Area of stored section in m²</th>
<th>Required volume of retention facility for WGK 1 in the safety category: K1/K2 in m³</th>
<th>Required volume of retention facility for WGK 1 in the safety category: K3/K4 in m³</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>50</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>75</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>100</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>150</td>
<td>45</td>
<td>40</td>
</tr>
<tr>
<td>200</td>
<td>70</td>
<td>55</td>
</tr>
<tr>
<td>250</td>
<td>100</td>
<td>70</td>
</tr>
<tr>
<td>300</td>
<td>125</td>
<td>90</td>
</tr>
<tr>
<td>400</td>
<td>200</td>
<td>125</td>
</tr>
<tr>
<td>500</td>
<td>250</td>
<td>150</td>
</tr>
<tr>
<td>600</td>
<td>300</td>
<td>150</td>
</tr>
<tr>
<td>700</td>
<td>350</td>
<td>150</td>
</tr>
<tr>
<td>800</td>
<td>400</td>
<td>150</td>
</tr>
<tr>
<td>900</td>
<td>450</td>
<td>150</td>
</tr>
<tr>
<td>≥1000</td>
<td>500</td>
<td>150</td>
</tr>
</tbody>
</table>

Note: With storage of material of WGK 2 the given values for the volumes are to be multiplied by a factor of 1.5, with storage of material of WGK 3 by a factor of 2.

6.3 EPA Methodology for the Calculation of Retention Volume

Similar to the LÖRÜRL calculation the EPA calculation method is based on a risk assessment which determines the main areas on site where a fire may occur and be contained (i.e. by distance or fire-rated compartments). The calculation is then based on the following:

- Fire-water likely to be used for the site
- Largest volume of contaminated water to be retained in any of the main areas
- Rainfall Allowance

The larger of 1 & 2 is then added to 3 to determine the overall required fire-water retention capacity for the site.

6.4 LÖRÜRL Calculation

The LÖRÜRL guidelines for the calculation of Fire Water Retention Facilities with the Storage of Materials Hazardous to Water have been developed by the German Nordrhein-Westfalen Ministry for Construction and Housing. It is based on the practical experience of German fire fighting authorities, technical universities, industry federations and the insurance industry. The principle of the guidelines is that measures to ensure that early fire detection and fire fighting occurs, reduce the overall amount of fire water required to fight a fire, and therefore reduce the amount of fire...
water required. The guidelines take into account the type of fire brigade available (public or works or both), the type of fire protection technical infrastructure (fire alarm and extinguishing systems) and the surface area of storage sections (storage heights, densities and quantities of stored goods).

6.4.1 Areas of the Site for Consideration
The following area has been considered for the purposes of a fire water retention calculation;
1. Warehouse
2. Production Suite
3. Utilities & Boiler Room
4. Plant Area

6.4.2 Maximum Permissible Storage for Each Area

Table 6.3: Maximum Permissible Storage for each Area

<table>
<thead>
<tr>
<th>Area of Site</th>
<th>Approx. Storage Density (Tonnes/m²)*</th>
<th>Safety Category</th>
<th>Maximum Permissible Storage Quantities for WGK 1 or WGK 2 substances (t)</th>
<th>Approx. Retained Quantities (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warehouse</td>
<td>0.09</td>
<td>K4</td>
<td>5200 (WGK 1)</td>
<td>62.02</td>
</tr>
<tr>
<td>Production Suite</td>
<td>0.007</td>
<td>K4</td>
<td>5200 (WGK1)</td>
<td>5.2</td>
</tr>
<tr>
<td>Utilities/Boiler Room</td>
<td>0.004</td>
<td>K4</td>
<td>780 (WGK 2)*</td>
<td>4</td>
</tr>
<tr>
<td>Plant Area</td>
<td>0.001</td>
<td>K4</td>
<td>5200 (WGK1)</td>
<td>1</td>
</tr>
</tbody>
</table>

* Maximum permissible storage quantities for WGK 2 used due to uncertainty in substance properties.

As can be seen from Table 6.3, the volume of stored substances is well below the permissible quantities for each area.

Table 6.4 tabulates the calculation of the volume of fire water retention required for the area of the site under consideration.

Table 6.4: Required Fire Water Retention Calculations

<table>
<thead>
<tr>
<th>Area of Site</th>
<th>Area (m²)</th>
<th>Safety Category</th>
<th>Required Fire Water Retention (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warehouse</td>
<td>680</td>
<td>K4</td>
<td>150</td>
</tr>
<tr>
<td>Production Suite</td>
<td>730</td>
<td>K4</td>
<td>150</td>
</tr>
<tr>
<td>Utilities &amp; Boiler Room</td>
<td>454</td>
<td>K4</td>
<td>206*</td>
</tr>
<tr>
<td>Plant Area</td>
<td>583</td>
<td>K4</td>
<td>150</td>
</tr>
</tbody>
</table>

*Interpolated Value from table 6.2.
From Table 6.4, it can be seen that the maximum potential fire water retention requirement for the site is 206m$^3$.

6.5 EPA Calculation

1. **Fire water likely to be used for the site**

   The calculation of the fire water likely to be used for the site is based on the volume of the fire water tank, where sprinklers are engaged over the particular areas, and where one hydrant is being used in the fighting of the fire.

   Fire water tank volume: 600m$^3$

   For a fire situation at the site it is assumed that the maximum volume of the fire water tank will be discharged to fight the fire.

2. **Largest volume of contaminated water to be retained in any of the main areas**

   This calculation is based on sprinkler and hydrant fire-water and product contribution. The largest possible contributions of fire water volumes during a fire event would occur in the warehouse area where the material storage quantity is approximately 74.4m$^3$, assuming approximately 62 tonnes of storage and an average storage density of 1200 kg/m$^3$. The majority of materials are stored in sealed non-combustible containers and it would be unlikely that a significant number would rupture in the fire so 25% (18.6m$^3$) of the materials stored are assumed as product contribution. Assuming that all of the fire water is discharged during the fire event, 618.6m$^3$ of contaminated fire water could be generated as a result of a fire in the Warehouse area, i.e. the sum of the fire water and the stored material, if one ignores the volume of fire water evaporated in the fire fighting.

3. **Rainfall Allowance**

   Rain that may fall during a fire event is also considered when calculating fire water retention facilities under the EPA methodology. The maximum volume of rainfall to be included is based on 50mm daily rainfall or a 1 in 20 year 24-hour rainfall event, whichever is greater. Data for a 1 in 20 year, 24-hour rainfall event in the Monksland, Athlone area was available from Met Eireann, with a value of 58.1mm. The hardstanding area of the site is estimated as 8259m$^2$. The calculated volume of rainfall over the site is therefore 479 m$^3$.

### Total Calculated Fire Water Retention Volume

For a fire situation at the proposed site the maximum volume to be retained would be:

- Fire water = 618.6 m$^3$
- Rainwater = 479 m$^3$
- Total = 1097.6 m$^3$

6.6 Legislative Context

As can be seen from the previous sections the results from the LÖRÜRL and Irish EPA fire water retention calculation methods differ significantly from each other. The following sections explore European legislative and guideline requirements with respect to implementation of accident prevention and mitigation measures in order to inform the decision on the extent of fire water retention required if it was required.

6.6.1 Principle of Proportionality

The principle of proportionality has been recognised in settled case-law as one of the general principles of European Community law. According to that principle, measures of the Community institutions must not go beyond what is appropriate and necessary for achieving the objectives legitimately pursued by the measure in question, it being understood that, where there is a choice between several appropriate measures, recourse must be had to the least restrictive and that the disadvantages caused must not be disproportionate to the aims pursued.
The above is a legal interpretation of the proportionality principle which specifies that economic considerations apply and that the operator should not be expected to bear excessive costs for relatively small environmental benefits.

6.6.2 Industrial Emissions Directive (2010/75/EU)

According to Article 14 of the IED directive emission limit values, and equivalent parameters and technical measures referred to in the permit shall be based on best available techniques, without prescribing the use of any technique or specific technology, but taking into account local, site-specific factors such as the technical characteristics of the installation concerned, its geographical location and the local environmental conditions. In the case of existing installations, the economic and technical viability of upgrading them also needs to be taken into account.

Under Article 11 of the IED Directive (2010/75/EU) it is stated that it shall be ensured that installations are operated in such a way that the necessary measures are taken to prevent accidents and limit their consequences. Under Annex III of the directive it is also stated that the need to prevent accidents and to minimise the consequences for the environment must be taken into account when determining best available techniques, bearing in mind the likely costs and benefits of a measure and the principles of precaution and prevention. This would infer that one has to design for realistic rather than absolutely catastrophic scenarios.


The principal aims of the Regulations are to prevent and remedy water damage, land damage and damage to protected habitats and species. They reinforce the ‘polluter pays’ principle making an operator that causes environmental damage legally and financially liable for the damage caused and subsequent remediation through the liability regimes.

The general principle is that the operator shall bear the costs for preventive and remedial actions taken pursuant to the Directive, including the costs of the environmental assessments carried out by the competent authority to determine the extent of the damage and the action to be taken to repair it.

It should also be noted that the Directive does not put a financial limit on the amount liable polluters could be required to remedy environmental damage.

The required remediation measures are detailed in the Regulations as follows:

Remedying of environmental damage, in relation to water or protected species or natural habitats, is achieved through the restoration of the environment to its baseline condition by way of primary, complementary and compensatory remediation, where:

(a) ‘Primary’ remediation is any remedial measure which returns the damaged natural resources or impaired services to, or towards, baseline condition;

(b) ‘Complementary’ remediation is any remedial measure taken in relation to natural resources or services to compensate for the fact that primary remediation does not result in fully restoring the damaged natural resources and/or services;

(c) ‘Compensatory’ remediation is any action taken to compensate for interim losses of natural resources or services that occur from the date of damage occurring until primary remediation has achieved its full effect; and

(d) ‘interim losses’ means losses which result from the fact that the damaged natural resources or services are not able to perform their ecological functions or provide services to other natural resources or to the public until the primary or complementary measures have taken effect. It does not consist of financial compensation to members of the public.
Where primary remediation does not result in the restoration of the environment to its baseline condition, then complementary remediation will be undertaken. In addition, compensatory remediation will be undertaken to compensate for the interim losses.

Remedying of environmental damage, in terms of damage to water or protected species or natural habitats, also implies that any significant risk of human health being adversely affected be removed.

The German approach to calculating the fire water retention volume to date provides the most realistic methodology in that it reflects many years of experience of actual fire fighting. Furthermore investment should preferably be channelled into fire precaution measures rather than large volume retention system. This is reflected in the LÖRÜRL calculation method in that the retention volume can be reduced in situations where fire detection and fire fighting systems are more advanced.

In summary the above European legislation and guidelines indicate that measures must be taken to mitigate accidents (including fire) and the IED Directive specifically refers to the principles of precaution and prevention. Similar to most other production plants in Ireland the proposed development has been designed with extensive fire prevention and detection systems in place in line with these principles and more onerously with FM Global Standards. Therefore the probability of an extensive fire occurring at the site is not considered high. The probability of a 1 in 20 year rainfall event is rare, and the probability of the two events occurring simultaneously is almost non-existent. It is therefore not within the principal of proportionality to expect the operator to carry the financial cost of large retention systems for this extreme event. Instead under the principles of BAT and proportionality the costs incurred by the operator for fire water retention should reflect a realistic scenario.

6.7 Conclusion

The fire water risk assessment concludes that the proposed development provides an overall site risk of low in terms of requirements for fire water runoff containment and in addition any fire water generated would not pose any significant environmental risk due the nature of the materials present on site. Therefore it is considered acceptable to conclude that no fire water retention capacity be provided on site according to the philosophy contained in Section 3.3 of this report.

Although the fire water risk assessment concludes that no fire water containment or reduction measures are required, a fire water retention calculation was carried out nonetheless to examine the fire water retention requirements warranted if the site provided a higher risk. Based on the German LÖRÜRL Firewater Retention Calculation Method it is was calculated that in this scenario the site would need 206m$^3$ of firewater retention capacity.

It is concluded that that there is no need for the construction of a retention for fire water run-off alone as even in the higher risk scenario, the required volume of 206m$^3$ would be catered for in the design of the proposed surface water attenuation pond which will be designed to hold 850m$^3$. This pond will be empty during normal plant operation and in the unlikely event of a fire, a shut-off valve on the outlet of the surface water attenuation pond will allow the retention of any fire water generated.
Appendix A
Substance Inventory
Table A1: Inventory of Materials in Proposed Development

<table>
<thead>
<tr>
<th>Ref. \nCode</th>
<th>Material/Substance (1)</th>
<th>CAS Number</th>
<th>Flammable</th>
<th>Amount Stored (tonnes)</th>
<th>Nature of Use</th>
<th>R(2) - Phrase</th>
<th>S(2) - Phrase</th>
<th>Hazard Statement (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Raw Materials</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>01</td>
<td>Raw Material A*</td>
<td>*</td>
<td>Flash Point 98.3ºC</td>
<td>8</td>
<td>Raw Material</td>
<td>R22, R41, R67</td>
<td>None</td>
<td>H302, H318, H336</td>
</tr>
<tr>
<td>02</td>
<td>Raw Material B*</td>
<td>*</td>
<td>No Data</td>
<td>6.5</td>
<td>Raw Material</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>03</td>
<td>Raw Material C*</td>
<td>*</td>
<td>No</td>
<td>1</td>
<td>Raw Material</td>
<td>R35</td>
<td>S1/2, S26, S37/39, S45</td>
<td>H314</td>
</tr>
<tr>
<td>04</td>
<td>Raw Material D*</td>
<td>*</td>
<td>No</td>
<td>1</td>
<td>Raw Material</td>
<td>R35, R22</td>
<td>S26, S36/37/39, S45</td>
<td>H302, H314</td>
</tr>
<tr>
<td>05</td>
<td>Raw Material E*</td>
<td>*</td>
<td>No</td>
<td>Raw Material</td>
<td>R37/38, R41</td>
<td>S26, S39</td>
<td>H315, H318, H335</td>
<td></td>
</tr>
<tr>
<td>06</td>
<td>Raw Material F*</td>
<td>*</td>
<td>No</td>
<td>1</td>
<td>Raw Material</td>
<td>R36/37/38</td>
<td>S26</td>
<td>H315, H318, H335</td>
</tr>
<tr>
<td>07</td>
<td>Raw Material G*</td>
<td>*</td>
<td>No</td>
<td>0.02</td>
<td>pH Adjustment</td>
<td>R36/37/38</td>
<td>S26</td>
<td>H315, H319, H335</td>
</tr>
<tr>
<td>08</td>
<td>Raw Material H*</td>
<td>N/A</td>
<td>No</td>
<td>Raw Material</td>
<td>Not known</td>
<td>Not known</td>
<td>Not known</td>
<td>Not known</td>
</tr>
<tr>
<td><strong>Products</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>09</td>
<td>Product A*</td>
<td>*</td>
<td>N/A</td>
<td>15.5</td>
<td>Product</td>
<td>Not known</td>
<td>Not known</td>
<td>Not known</td>
</tr>
<tr>
<td>10</td>
<td>Product B*</td>
<td>*</td>
<td>N/A</td>
<td>28</td>
<td>Product</td>
<td>Not known</td>
<td>Not known</td>
<td>Not known</td>
</tr>
<tr>
<td><strong>Lab Chemicals / Cleaners</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Isopropyl Alcohol</td>
<td>67-63-0</td>
<td>Highly Flammable Irritant</td>
<td>5 litres</td>
<td>Cleaning Agent</td>
<td>R11, R36, R67</td>
<td>None</td>
<td>H225, H319, H336</td>
</tr>
<tr>
<td><strong>Packaging</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Packaging</td>
<td>N/A</td>
<td>No</td>
<td>5</td>
<td>Packaging</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
</tbody>
</table>

* Note from Applicant: Details in relation to these substances are available on request
Appendix B
Fire Water Runoff Risk Assessment Summary Table
Table B1: Fire Water Runoff Risk Assessment Summary

<table>
<thead>
<tr>
<th>Area</th>
<th>Fire Risk Assessment</th>
<th>Environmental Risk Assessment</th>
<th>Fire Water Runoff Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Likelihood</td>
<td>Consequence</td>
<td>Likelihood</td>
</tr>
<tr>
<td>Admin &amp; QC Lab</td>
<td>LOW</td>
<td>MINOR</td>
<td>LOW</td>
</tr>
<tr>
<td>Warehouse</td>
<td>LOW</td>
<td>MINOR</td>
<td>LOW</td>
</tr>
<tr>
<td>Production Suite</td>
<td>LOW</td>
<td>MINOR</td>
<td>LOW</td>
</tr>
<tr>
<td>Utilities &amp; Boiler Room</td>
<td>MEDIUM</td>
<td>MINOR</td>
<td>LOW</td>
</tr>
<tr>
<td>Plant Area</td>
<td>MEDIUM</td>
<td>MINOR</td>
<td>LOW</td>
</tr>
<tr>
<td>Fallow Space</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Note: This table summarises the results of the each section of the Fire Water Run-off Risk Assessment. It should be viewed in conjunction with the risk categorisation tables in Section 3 of this report.
Appendix C
Fuel Source Types and Toxicological Classifications
Flammables
- Extremely or highly flammable materials with flash point less than 21°C, i.e. R12 or R11
- Flammable materials with flash point equal to, or below, 55°C, i.e. R10
- Materials which in contact with water liberate extremely flammable gases, i.e. R15
- Materials which are spontaneously flammable in air, i.e. R17

Explosives
- Materials which present a risk of explosion by shock, friction, fire or other sources of ignition, i.e. R2
- Materials which present an extreme risk of explosion by shock, friction, fire or other sources of ignition, i.e. R3

Oxidising Materials
- Oxidising materials which may cause a fire, i.e. R7 risk phrase
- Oxidising materials which in contact or mixed with combustible material may cause fire, i.e. R8 or R9.

Other Physio-Chemical Properties
- Materials which are explosive when dry, i.e. R1
- Materials which form very sensitive explosive metallic compounds, i.e. R4
- Materials which when heated may cause an explosion, i.e. R5
- Materials which are explosive with or without contact with air, i.e. R6
- Reactive materials which may cause a fire, i.e. R7
- Materials which are explosive when mixed with oxidising substances, i.e. R16
- Materials which are spontaneously flammable in air, i.e. R17
- Materials which when processed or used in a process have runaway reaction potential leading to a fire or explosion.

Combustibles
- Combustible liquids, i.e. liquids with a flash point above 55°C
- Combustible solids are those capable of igniting and burning, e.g. wood, cardboard, some plastics and paper
The following (eco) toxicological and associated classifications of a material can be used to assess the consequences of a release of the material to the environment:


- Material is classified under the German WGK system:
  - Non-Hazardous to Waters
  - WGK1 Low Hazard to Waters
  - WGK2 Hazard to Waters
  - WGK3 Severe Hazard to Waters

- Material has one or more of the following ecotoxicological properties:
  - Very Toxic to aquatic organisms (R50),
    - 96 hr LC50 (for fish) \(\leq 1 \text{ mg/l}\)
    - or 48 hr EC50 (for Daphnia) \(\leq 1 \text{ mg/l}\)
    - or 72 hr IC50 (for algae) \(\leq 1 \text{ mg/l}\)
  - Toxic to aquatic organisms (R51),
    - 96 hr LC50 (for fish) \(1 \text{ mg/l} \leq \text{LC50} \leq 10 \text{ mg/l}\)
    - or 48 hr EC50 (for Daphnia) \(1 \text{ mg/l} \leq \text{EC50} \leq 10 \text{ mg/l}\)
    - or 72 hr IC50 (for algae) \(1 \text{ mg/l} \leq \text{IC50} \leq 10 \text{ mg/l}\)
  - Harmful to aquatic organisms (R52),
    - 96 hr LC50 (for fish) \(10 \text{ mg/l} \leq \text{LC50} \leq 100 \text{ mg/l}\)
    - or 48 hr EC50 (for Daphnia) \(10 \text{ mg/l} \leq \text{EC50} \leq 100 \text{ mg/l}\)
    - or 72 hr IC50 (for algae) \(10 \text{ mg/l} \leq \text{IC50} \leq 100 \text{ mg/l}\)
  - May cause long-term adverse effects in the aquatic environment (R53)
    - Toxic to flora (R54)
    - Toxic to fauna (R55)
    - Toxic to soil organisms (R56)
    - May cause long-term adverse effects in the environment (R58)

- Material has one or more of the following toxicological properties:
  - Carcinogenic: May cause cancer (R45)
  - Mutagenic: May cause heritable genetic damage (R46)
  - Teratogenic: May cause harm to the unborn child (R61) or possible risk of harm to the unborn child (R63)