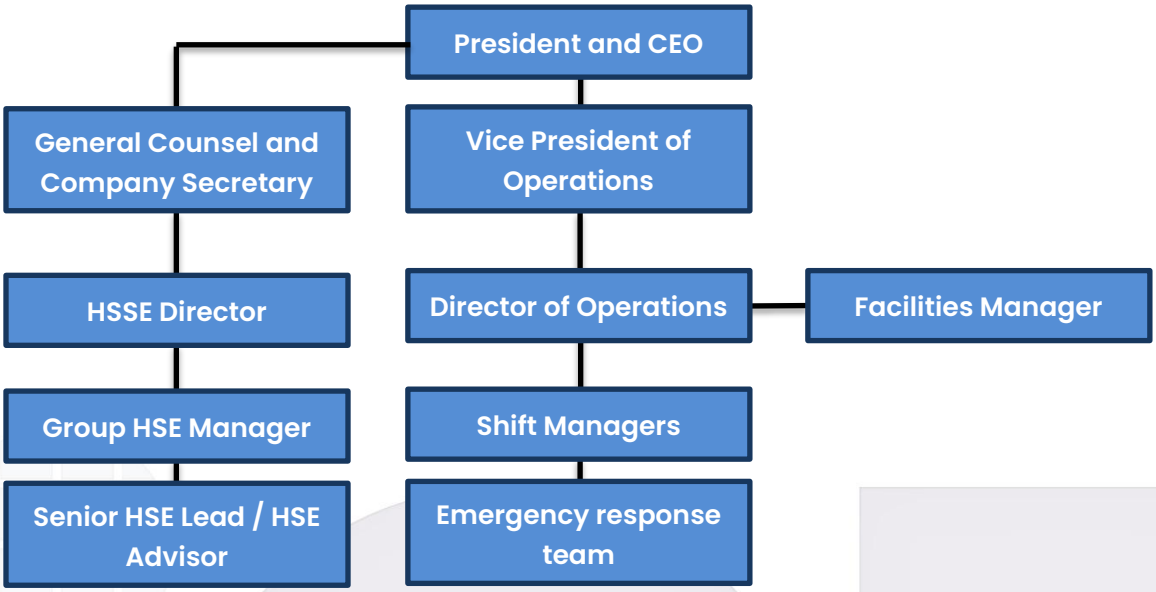
IQE Accident management plan draft

Site Name: Europe	
Department: Health & Safety	**Owner: HSSE Team – South Wales**

Revision History					
Rev.	**Date**	**Author**	**Nature of Changes**	**Change Class**	**ECR Number**
1	1-May-24	Shane McDonald	Initial Release	**Major**	8712
2	13-Aug-26	Shane McDonald	To reflect the addition of new substances to EU site	**Minor**	tbc
	Click to select date.			Choose an item.	

1 ORGANISATIONAL STRUCTURE



2 RESPONSIBILITIES

2.1 Group HSSE

- Ensuring legal compliance at group level and auditing local HSSE functions to ensure local compliance.
- Providing advice and technical support to other group functions concerning new projects, building projects etc.
- Reviewing and updating, where necessary, the MAPP and COMAH policies.

2.2 Local HSSE

- Providing advice and technical support to local functions.
- Ensuring local compliance to group policy and procedure, particularly on legal compliance.
- Reviewing and updating, where necessary, the local emergency preparedness document, emergency response team procedure, chemical spill procedure/training.
- Performing fire/toxic drills for various scenarios.

2.3 Operations

- Ensuring that an emergency response team can be realised at the start of each shift.
- Ensuring that the emergency response team has been sufficiently trained in line with a suitable retraining period
- Overall responsibility for the safety of the site and people conducting production operations.

2.4 Emergency response team

- Determining the course of action for the site should an incident occur.
- Initial spill containment for management spills.

3 SUMMARY OF ACTIVITIES ON SITE

3.1 IQE Europe produces group III-V compound semiconductor materials for a global customer base. The site holds lower tier COMAH quantities of arsine and phosphine gas and bulk quantities of hydrogen gas, liquid nitrogen, sodium hypochlorite solution and sodium hydroxide solution. In addition to these bulk materials the site also holds limited quantities of phosphoric, nitric and hydrochloric acids.

3.2 First responders should be aware that self-contained breathing equipment is also present within the main building including a reserve stock of 20 composite material oxygen cylinders which are located in the main service corridor.

4 OBJECTIVE OF THE ACCIDENT MANAGEMENT PLAN

4.1 This accident management plan has been prepared to provide members of the senior management team, keyholders, emergency response team leaders, and external agencies (Fire & Rescue services, NRW, HSE) with suitable information regarding site hazards, response equipment and service isolation points to enable effective management of an incident at the facility.

5 REVIEW

5.1 This plan will be on an annual review schedule due to the proposed changes to the fabrication facility and construction to support expansion. If significant changes occur between the issuing of this report and the review date, the document will be reviewed before the changes are implemented.

6 DOCUMENT DISTRIBUTION LIST

6.1 Author and:

- Mr. Tom Dale, General Counsel and Company Secretary
- Mr. Scott McKinnon, Health, Safety, Environment Director
- Mr. Andrew Mason, Group HSE Manager
- Mr. Andrew Alder, Group Process Safety Manager
- Mr. Leon Hill, HSE Advisor
- Mr. Leigh Jackson, Facilities Manager
- Mr. Darren Mullen, Director of Operations
- Mr. Brigid Armstead, Regulatory Officer, Natural Resource Wales
- South Wales Fire & Rescue Service - Roath

6.2 An electronic copy is also available on the site intranet for general employee information.

7 EMERGENCY CONTACT LIST

7.1 IQE staff contact numbers

Internal Contact Numbers	
Shift supervisor (site mobile)	07410471810
Leigh Jackson	07817288426
Scott McKinnon	07410 473360
Shane McDonald	[redacted]
Darren Mullen	07531086977
External Contact Numbers	
HSE incident report line	0345 300 9923
HSE Duty Officer	01519229235
Natural Resources Wales incident report line	03000653000
Dwr Cymru	08000520130
Western Power	08006783105
Natural gas leak emergency number	0800111999

8 A PRIMARY MATERIALS INVENTORY

Refer to appendices 1 and 2 for location information

Material	Hazard Statements	CLP/GHS Classification	Max. Inventory	Pictograms
Mixed Acids (Primarily Nitric & Hydrochloric)	**Nitric Acid** H272 - May intensify fire; oxidiser H290 - May be corrosive to metals H314 - Causes severe burns and eye damage EUH071 - Corrosive to the respiratory tract **Hydrochloric Acid** H290 - May be corrosive to metals H314 - Causes severe skin burns and eye damage H335 - May cause respiratory irritation	**Nitric Acid** Oxidising Liq. 3 Skin Corrosive 1A **Hydrochloric Acid** Corrosive to metals 1 Skin Corrosive 1B	1000 litres(per chemical)	**Nitric Acid**  **Hydrochloric Acid** 
Liquid Nitrogen	H281 – Refrigerated gas; may cause cryogenic burns or injury	Not Applicable	2000 litres	
Hydrogen	H220 - Extremely Flammable gas	Flam. Gas 1	0.23 tons	
Helium	H280 – Gas Under pressure	Not Applicable	3.5 tons	
Arsine	H220 - Extremely Flammable gas H330 - Fatal if inhaled H373 - Toxic if inhaled H400 - Very toxic to aquatic life H410 - Very toxic to aquatic life with long lasting effects	Flam. Gas 1 Acute Tox. 1 STOT RE 2 Aquatic Acute 1 Aquatic Acute 1	0.45 tons	

Anhydrous Ammonia	H221 - Flammable gas H314 - Causes severe skin burns and eye damage H331 - Toxic if inhaled H400 - Very toxic to aquatic life H410 - Very toxic to aquatic life with long lasting effects	Flam. Gas 2 Skin Corr. 1B Acute Tox. 3 Aquatic Acute 1 Aquatic Chronic 1	2 tons	

Material	Hazard Statements	CLP/GHS Classification	Max. Inventory	Pictograms
Phosphine	H220 - Extremely Flammable gas H314 - Causes severe skin burns and eye damage H330 - Fatal if inhaled H400 - Very toxic to aquatic life	Flam. Gas 1 Skin Corr. 1B Acute Tox. 2 Aquatic Acute 1	0.36 tonnes	
Metal Alkyl Carbontetrabromide	H302 - Harmful if swallowed H315 - Causes skin irritation H318 - Causes serious eye damage H335 - May cause respiratory sensitisation	Acute Tox. 4 (oral) Skin Irr. 2 Serious eye dam. 1 STOT SE 1	15 kilograms	
Metal Alkyl Carbon tetrachloride	H301 - Toxic if swallowed H311 - Toxic in contact with skin H331 - Toxic if inhaled H351 - Suspected of causing cancer H372 - Causes damage to organs through prolonged or repeated exposure H412 - Harmful to aquatic life with long lasting effects	Acute Tox. 3 (oral) Acute Tox. 3 (dermal) Acute Tox. 3 (inhalation) Carcogenicity 2 STOT RE 1 Aquatic Chronic 3	10 kilograms	
Metal Alkyl Bis(cyclopentadienyl) iron	H228 - Flammable solid H302 - Harmful if swallowed	Flam. Solid 1 Acute Tox. 4 (Oral)	10 kilograms	
Metal Alkyl Bis(cyclopentadienyl) magnesium	H250 - Catches fire spontaneously if exposed to air H314 - Causes severe skin burns and eye damage	Pyr. Sol. 1 Skin Corr. 2	5 kilograms	

Metal Alkyl Diethyltelluride	H226 Flammable liquid and vapour H301 Toxic if swallowed H311 Toxic in contact with skin H331 Toxic if inhaled	Flam. Liq. 3 Acute Tox. 3 (oral) Acute Tox. 3 (dermal) Acute Tox. 3 (inhalation)	5 kilograms	
Metal Alkyl Dimethylzinc	H226 Flammable liquid and vapour. H315 Causes skin irritation. H319 Causes serious eye irritation. H335 May cause respiratory irritation.	Flam. liquids 3 Skin irritation 2 Eye irritation 2 STOT SE 1	5 kilograms	

Material	Hazard Statements	CLP/GHS Classification	Max. Inventory	Pictograms
Metal Alkyl Triethylgallium	H225 - Highly flammable liquid and vapour H250 - Catches fire spontaneously if exposed to air H261 - In contact with water releases flammable gases H314 - Causes severe burns and eye damage	Flam. Liq. 2 Pyr. Liq. 1 Substances, which in contact with water, emit flammable gases. 1 Skin. Corr 1B Serious eye damage 1	5 kilograms	
Metal Alkyl Trimethylaluminium	H250 - Catches fire spontaneously if exposed to air H260 - In contact with water releases flammable gases which may ignite Spontaneously H314 - Causes severe skin burns and eye damage	Pyr. Liq. 1 Substances, which in contact with water, emit flammable gases. 1 Skin. Corr. 1B	75 kilograms	

Metal Alkyl Trimethylgallium	H225 - Highly flammable liquid and vapour H250 - Catches fire spontaneously if exposed to air H261 - In contact with water releases flammable gases H314 - Causes severe burns and eye damage	Flam. Liq. 2 Pyr. Liq. 1 Substances, which in contact with water, emit flammable gases. 1 Skin. Corr 1B Serious eye damage 1	120 kilograms	
Metal Alkyl Trimethyl indium	H250 - Catches fire spontaneously if exposed to air H314 - Causes severs skin burns and eye damage H318 - Causes serious eye damage	Pyr. Sol. 1 Skin Corr. 1B Eye Damage 1	40 kilograms	

Material	Hazard Statements	CLP/GHS Classification	Max. Inventory	Pictograms
Sodium Hypochlorite	EUH 031 - Contact with acids liberates toxic gases H314 - Causes severe skin burns and eye damage H400 - Very toxic to aquatic life	Skin Corrosive 1B Aquatic Acute 1	24,000+5,500 litres	
Phosphoric acid	H314 - Causes severe skin burns and eye damage	Skin Corrosive 1B	800 litres	
Toxic Solids contaminated with gallium arsenide (notes refer to Arsenic)*	H301 - Toxic if swallowed H331 - Toxic if inhaled H400 - Very toxic to aquatic life H410 - Very toxic to aquatic life with long lasting effects	Acute Tox. 3 Acute Tox. 3 Aquatic Acute 1 Aquatic Acute 1	200 kilograms	
Phosphorus under water	H228 - Flammable solid H412 - Harmful to aquatic life with long term effects	Flammable Solid 1 Aquatic Chronic 3	480 kilograms	
Antifreeze	H302 – Harmful if swallowed	Acute Tox. 4	2000 litres	
Isopropyl Alcohol Propan 2-ol	H225 – Highly flammable liquid and vapour H319 – Causes serious eye irritation H336 – May cause drowsiness	Flam. Liq. 2 Eye Irrit. 2 STOT SE 3	100 litres	
Sodium Hydroxide	H290 – May be corrosive to metals H314 - Causes severe skin burns and eye damage	Corrosive to metals 1 Skin Corr. 1A	1500 litres	

LPG (Propane)	H220 – Extremely flammable gas H280 – Contains gas under pressure; may explode if heated	Flam. Gas 1 Press. Gas	108 Kilograms	
Propane	H220 - Flammable gas H280 - Contains gas under pressure; may explode if heated	Flam. Gas 1 Press. Gas	42 Kilograms	
Ethylene	H280 – Contains gas under pressure, may explode if heated. H220 – Extremely flammable gas. H336 – May cause drowsiness or dizziness. H402 – Harmful to aquatic life.	Press. Gas Liquefied gas STOT SE 3 (May cause drowsiness and dizziness.) Aquatic Acute 3 Flam. Gas 1A	30 Kilograms	
Germane (1% in Hydrogen)	H220: Extremely flammable gas. H229: Pressurized container: may burst if heated H280: Contains gas under pressure; may explode if heated. H331: Toxic if inhaled.	Flam. Gas 1 Press. Gas Acute Toxicity, Inhalation 2	0.5 Kilograms	
Tertiary-butyl-Hydrazine	H335 May cause respiratory irritation. H302 Harmful if swallowed. H315 Causes skin irritation. H319 Causes serious eye irritation.	STOT SE (Respitory Irritation) 3 Acute Toxicity (Oral) 4 Skin Corrosion/Irritant 2 Serious eye damage 2	0.6 Kilograms	
Tertiary-butyl-Arsine	H225 Highly flammable liquid and vapour. H301 Toxic if swallowed. H311 Toxic in contact with skin. H314 Causes severe skin burns and eye damage. H331 Toxic if inhaled. H351 Suspected of causing cancer.	Flam. Liq. 2 Acute Tox. 3 (oral) Acute Tox. 3 (dermal) Skin Corr. 1B Acute Tox. 3 (Inhale) Carc. 2	0.65 Kilogrmas	

Material	Hazard Statements	CLP/GHS Classification	Max. Inventory	Pictograms
Chlorine	H270: May cause or intensify fire; oxidiser. H280: Contains gas under pressure; may explode if heated. H315: Causes skin irritation. H319: Causes serious eye irritation. H330: Fatal if inhaled. H400: Very toxic to aquatic life.	Oxidising Gas 1 Acute Tox. 2 Skin Irritation 2 Serious Eye Irritation 2 Skin Corrosive 1B Aquatic Acute 1	120 Kilograms	
Tertiary-butyl-phosphine	H250: Catches fire spontaneously if exposed to air. H330: Fatal if inhaled.	Flammable Liquids (Category 1) Pyrophoric Liquids (Category 1) Acute Toxicity (Category 2)	4 Kilograms	

9 SPILL RESPONSE EQUIPMENT

Refer to appendix 4 for locations

Item	Number of / location	Contents
Spill response kits	8 of - see plan	Absorbent Booms - 6 Absorbent mats - 15 Nitrile Gloves - 1 pair Safety Goggles - 1 set TyChem Oversuit - 1 set Vapour mask - 1 Haz. Waste sacks - 2 Ph paper - 1 pk Chemical wellingtons - 1 pair
Spill mops and buckets	Next to spill kits	4
Chemical wellingtons	Main stores	Size 8 - 2 pairs Size 9 - 2 pairs Size 10 - 2 pairs
TyChem "Type F" Oversuits	Main Stores	15
Rubber drain blocker mats	Corridor by scrubber room	2
Clay drain seals	FLT Garage	2
Full face visors	Main Stores	4
SCBA	Refer to site plan	8 sets
SCBA cylinders	Service Corridor	20

10 HAZARD IDENTIFICATION

The following scenarios were identified as part of the Major Accident Hazard (MAH) assessment process required under COMAH or were included after referring to PPG 21: Incident Response Planning as advised by Mr. Toby Griffiths (Environment Agency Regulatory Officer).

i. **Hydrogen Banks** - A delivery vehicle striking the hydrogen maxi-packs causing loss of containment or explosion.

ii. **Fire** - Release of fire water run-off into controlled waters via the site surface water drainage system.

iii. **Toxic Release** - The instantaneous release of 23Kg of arsine to atmosphere following catastrophic cylinder failure during cylinder delivery transfer operations.

iv. **Chemical Spillage** - Delivery vehicle striking the bulk Sodium Hydroxide or Sodium Hypochlorite storage tanks leading to loss of containment and release to controlled waters via surface water drainage system.

v. **Chemical Spillage** - Dropped IBC leading to containment failure and total loss of contents and release to controlled waters via surface water drainage system.

vi. **Chemical Spillage -** Overfilling of bulk Sodium Hydroxide or Sodium Hypochlorite tanks during delivery operations.

vii. **Mixing of Incompatible Substances -** Accidental mixing of chemicals in the waste compound

11 IDENTIFICATION OF SCENARIO SPECIFIC HAZARDS

i. **Hydrogen Banks** - Vehicle impact could result in loss of containment and total loss of contents to atmosphere and /or ignition followed by explosion if an ignition source is available.

ii. **Fire** - Fire resulting from the ignition of combustible materials or gases may lead to fire water run-off entering the surface water drains.

iii. **Toxic Release (Arsine, Phosphine, Ammonia)** - Cylinder failure. If a cylinder fell from the delivery vehicle during transfer operations, the cylinder could catastrophically fail leading to a total loss of contents to atmosphere.

iv. **Chemical Spillage** - Vehicle impact leading to loss of containment integrity of both tanks could lead to a maximum release of up to 1500 litres of Sodium Hydroxide and 5500 litres of Sodium Hypochlorite to the surface water drainage system.

v. **Chemical Spillage -** failure of an IBC during waste transfer operations caused by impact damage could lead to a maximum release of up to 1000 litres of waste Hypochlorite solution contaminated with arsenates and phosphates being released to the surface water drainage system.

vi. **Chemical Spillage -** Overfilling of bulk storage tanks may lead to release into the primary or secondary containment bunds.

vii. **Mixing of Incompatible Substances -** May lead to a runaway chemical reaction within the waste compound.

12 LIKELIHOOD OF OCCURRENCE

i. **Hydrogen Banks** - IQE estimates the probability of such an accident as “highly unlikely”, with an estimated rate of occurrence of 10^{-4} or once in every 10,000 refill operations.

ii. **Fire** - The worst case estimates for likelihood of a fire occurring anywhere on site is a probability rate of 10^{-3} - "unlikely" - or 1 chance in 1000 operations for the ignition of gases within the site wet abatement system.

iii. **Toxic Release** - All cylinders are manufactured and tested to international transport specifications. Detailed study indicates that the probability of catastrophic cylinder failure by any mechanism is considered to be $1x10^{-7}$ / yr.

iv. **Chemical Spillage** - The likelihood of a vehicle strikes of such force that both tanks would be ruptured is estimated at a frequency of 10^{-4}, i.e. potentially once in every 10,000 delivery operations.

v. **Chemical Spillage** - IBC failure after being struck by fork lift truck forks or falling from the forks during waste transfer operations is estimated to be in the range of 10^{-3} - 10^{-2}, i.e. one chance in every 100 - 1000 operations.

vi. **Chemical Spillage** - Probability of overfilling is estimated as 10^{-3} - 10^{-2}, as above, due to frequency of deliveries.

vii. **Mixing of Chemicals** - Potential frequency i.e. chance of accidental mixing is estimated as being in the range of 10^{-3} - 10^{-2}, i.e. one chance in every 100 - 1000 operations.

13 EVALUATION OF EFFECTS (WHAT WOULD ESCAPE AND HOW MUCH)

i. **Hydrogen Banks** - total loss of containment would lead to the release of up to 230kgs of hydrogen over a period of several minutes as all maxi-packs drain off to atmosphere.

ii. **Fire** - In the event of a fire which could not be dealt with by the on-site emergency response team, it is assumed that fire and rescue service responders would use several thousand litres of water to bring such a

fire under control. The fire water run off may contain high levels of particulate matter, including Arsenic.

iii. **Toxic Release -** If a cylinder was not secured in a transport cage, and if the cylinder were not fitted with a protective collar, and if the cylinder was to de dropped from an excessive height then the cylinder could fail releasing its contents over a period of several minutes.

iv. **Chemical Spillage - A**ssuming that both tanks are struck at or just above ground level, this would lead to a release of up to 1500 litres of Sodium Hydroxide and 5000 litres of Sodium Hypochlorite, assuming that the tanks are filled to maximum capacity and that all secondary and tertiary containment systems are destroyed as a result of the impact.

v. **Chemical Spillage -** In the event of an IBC failure, the maximum quantity of contaminated Sodium Hypochlorite solution released would not exceed 1000 litres.

vi. **Chemical Spillage -** Overfilling of tanks would be instantly detectable as all deliveries are supervised. Estimated maximum spill quantity would not be expected to exceed 50 litres and this would be deposited inside the secondary containment area, from which it could be collected for appropriate disposal.

vii. **Mixing of Chemicals –** The maximum waste drum capacity is 205 litres, which is topped up with containers with a max capacity of 25 litres. This could lead to a fume cloud forming which would take several minutes to disperse.

14 PREDICTION OF EMISSIONS

i. **Hydrogen Bank Failure** - All emissions under this scenario would be released directly to atmosphere, assuming no ignition source is present.

ii. **Fire** - In the event of a significant fire, it is assumed that most, if not all, of the water will find its way to both surface and foul water drains on site. Water running to surface drains could potentially be deposited into the streams located in the area of the site which flow to a recognised site of special scientific interest (SSSI).

iii. **Toxic Release** - The likely effects of a total loss of contents event have been modelled by a third-party consultant. Such a release presents no life-threatening effects to populations at any of the identified sensitive local receptors, as previously advised, but still presents an environmental hazard until dilution occurs.

iv. **Chemical Spillage** - The maximum release would be 6500 litres of environmentally hazardous materials to surface waters via the main car park drainage system.

v. **Chemical Spillage** – The maximum release would be limited to 1000 litres of environmentally hazardous materials to surface waters via the main car park drainage system.

vi. **Chemical Spillage** - No environmental release would occur as a result of this type of incident as the spillage would be contained within a bunded area.

vii. **Mixing of Chemicals - It** is not possible to determine the total amount of vapour released as a result of this type of incident, as this is dependent upon the amount of chemicals involved, the strength and volatility of the substances involved, and the duration of the reaction.

15 POTENTIAL CONSEQUENCES

i. **Hydrogen Banks** - The environmental impact following release of Hydrogen to atmosphere is considered to be insignificant.

ii. **Fire** - The fire water run off may contain trace levels of arsenic and other toxic solids such as indium or phosphorus. It is predicted that concentrations will be present as trace elements only due to the insolubility of these compounds.

iii. **Toxic Release** - Whilst there could be a significant local environmental impact from such a release, only site near neighbours at a distance of less than 50 metres from the release point would be at immediate risk of harm. Beyond this distance it is believed that the risk is significantly reduced due to the dilution and oxidisation of the gases in air.

iv. **Chemical Spillage** - Total loss of contents to surface water drains may result in major local environmental impact on surrounding controlled waters until dilution occurs. Recovery time for local watercourses may well run to several months.

v. **Chemical Spillage -** Total loss of contents may result in a minor localised environmental impact on surrounding waters until dilution occurs. It is estimated that the recovery time for the local ecosystem may well be several weeks.

vi. **Chemical Release -** No significant environmental impact as a result of overfilling is predicted.

vii. **Mixing of Chemicals -** Any emissions as a result of accidental mixing of chemicals are considered to be insignificant in terms of environmental impact.

16 RISK PREVENTION AND REDUCTION

i. **Hydrogen Banks** - Each individual maxi-pack contains 48 cylinders which are protected by a structural steel cage. These are located within a secure gated compound to prevent acts of vandalism which could potentially lead to loss of containment. The maxi-packs are located 0.50 metres behind a steel safety barrier, which in turn is approximately 1.5 meters behind a 30cm high concrete vehicle bump stop, which is designed to prevent vehicular impact damage.

ii. **Fire** - The controls in place for fire hazards are as follows:

- The site is protected by fire and hydrogen detection equipment, which is linked to an alarm system, which is continuously monitored by a remote service provider to ensure prompt response by the fire service in the event of an emergency.
- An emergency response team is present at all times whilst the site is in production mode. This team is fully trained to respond to any alarm incident which may occur.
- In the event of a fire, all combustible gases and hydride sources will be isolated, power to all operational equipment will by isolated by the safety control system and a general fire alarm will sound, ensuring that the building is evacuated.
- Fire in the facility at the point of use of arsine results in the complete isolation and purging of all toxic and flammable gas lines and the controlled shut down of all equipment. In addition to this, the negative pressure created by the extraction in each individual growth bay will ensure that all gases are exhausted to atmosphere via the wet abatement system.
- All automatic safety control systems are backed up by hard wired systems, thereby creating a double redundancy system

to ensure equipment will shut down to a safe state in the event of a fire.

- Each individual room within the production area is protected by its own dedicated FM200 or Novec 1230 fire suppression system.
- The production area is also protected by an automatic fire sprinkler system, which is activated via heat sensitive head units.
- Clay drain seals are available on site to seal the surface water drains in the event of a fire to contain any fire water run-off.
- All drains are colour coded to aid identification in the event of a fire.
- All hot works (if required) are controlled by means of a permit to work system.
- Smoking is not permitted in any internal area of the building.
- The site is regulated and inspected under the COMAH regime.

iii. **Toxic Release** - The potential for catastrophic cylinder failure or accidental valve damage resulting in a release to air is mitigated through the following:

- All cylinders are manufactured to international specifications.
- All cylinders are fitted with orifice flow restrictors which limit the maximum release rate following accidental valve sheer or damage.
- All toxic gases are carried in stainless steel co-axial pipe work throughout the site.
- All cylinders are changed by a minimum of two persons using SCBA equipment.
- All relevant employees have received training in correct cylinder handling procedures.
- All cylinders are leaked check upon arrival at site so that emergency actions can be taken to mitigate the effects of any detected leak.

- All cylinders are fitted with protective steel caps during transit and whilst in storage to prevent accidental damage to the cylinder valve.
- Cylinders are delivered to site in a secure transport cage to prevent a cylinder falling from the delivery vehicle during unloading operations.
- Cylinders are lifted from the vehicle bed using a fork lift truck (FLT) and are immediately lowered to the minimum safe travelling distance above ground before being transported to the storage bunker.
- ADR trained personnel are employed to transport and deliver the cylinders.
- Delivery frequencies are as low as is reasonably practicable to further reduce the risk associated with unloading operations.
- All FLT operators have been trained to recognised industry standards.
- All cylinders are secured whilst in storage prior to use to eliminate fall over incidents.
- The air within the building and external storage areas is monitored 24/7 for the presence of hydride gases by means of a chemical cassette detection system which is capable of detecting gases at levels as low as 7 ppb.
- The detection system is connected to the general building monitoring system and the GENT alarm panel, which is monitored internally by site employees and externally by a remote alarm monitoring centre.
- All cylinder deliveries are received in line with documented safety procedures.
- All cylinder bank change operations are conducted in line with documented safety procedures.
- IQE uses a gas manifold system for the delivery of hydride gases to the growth bays. Hydride gas is fed to this manifold via two

banks of cylinders. At any time only one bank of cylinders is "live" whilst the other is in "standby". The use of the manifold system reduces the frequency of cylinder change operations, thereby reducing the risk of accidental release during this activity.

- All cylinder connections are vented to the wet abatement system prior to disconnection and tested under inert gas procedures.
- IQE uses go / no go flow indicators to confirm that there is no flow from the cylinders prior to disconnection during change over operations.
- Once new cylinders have been connected, the delivery lines undergo a cycle of vacuum cycle checks to confirm the integrity of all connections prior to the cylinder valves being opened.
- IQE regularly audits cylinder bank change operations to confirm the adequacy of existing procedures and to ensure that the document procedure is adhered to.
- All cylinders supplying the manifold system are retained within extracted hydride gas cabinets fitted with hydride gas detectors.
- The storage areas are fitted with wet sprinkler systems to cool the cylinders in the event of a fire.
- It is important to note that, in a worst-case event, the maximum volume of hydride which could be released would be limited to the contents of one cylinder.
- At no point in the system are cylinders directly interconnected. Indirect downstream connection is achieved through the manifold system.
- In the event of a release from any cylinder in the bank, it is possible to isolate that cylinder by means of an ESO or Key activated switch, both of which actuate multiple isolation valves for that cylinder.

- By employing best available techniques to prevent the accidental release of hydride gases, IQE considers that arsine cylinders either held in storage or in use at its facility are safer and present a lower threat to the environment and local population than when in transit to our premises.
- Arsine is delivered to site approximately once every 2 weeks depending on production output and demand. This delivery frequency is considered to be as low as is reasonably practicable whilst keeping the site operational at all times. Delivery frequency could only be reduced further by increasing the onsite holding capacity for this material.
- To the best of IQE and the Semi-Conductor Safety Association's knowledge, there has not been a single documented case of catastrophic arsine cylinder failure in over 17 million handling operations worldwide.

iv. **Chemical Spillage** - the controls in place are as follows:

- The bulk chemical tanks are located on a raised concrete plinth, surrounded by protective fencing.
- All tanks are double skinned with secondary containment.
- All traffic movements with the delivery area are strictly controlled by IQE.
- IQE imposes a strict speed limit within all traffic areas.
- Clay drain seals are available on site to seal the surface water drains in the event of a spillage to contain any aqueous substances.
- All drains are colour coded to aid identification in the event of an escape to drain.
- All surface water drains are effectively sealed with drain blocker mats during waste transfer operations.
- All IBCs are carried at safe minimum travel height until directly in front of the collection vehicle load bed, whereupon they are lifted and placed on the bed of the collection vehicle.

- Collection frequencies are kept as low as is reasonably practicable to further reduce the risk associated with loading operations.
- All FLT operators have been trained to recognised industry standards.
- All bulk chemical deliveries are directly supervised by an IQE employee.
- Delivery frequencies are kept as low as reasonably practicable to reduce the risks of chemical transfer operations.
- The tank replenishment valves are located within a secure bunded compound in case an overfill event should occur.
- All surface water drains are effectively sealed using drain blocker mats during cross transfer pumping operations in case a transfer pipe should fail on the delivery vehicle.
- A dedicated spill kit is in place, adjacent to the bulk fill transfer valves.
- A documented emergency response procedure is in place for chemical spillages.

v. **Mixing of Chemicals -** the controls in place to reduce the risk of accidental mixing of chemicals are as follows:

- All relevant employees have received documented chemical safety training.
- All waste stored in the secure compound is colour coded and clearly identified to prevent accidental mixing.
- All relevant employees have been trained in line with documented waste control procedures.
- Chemical waste disposal is restricted to Shift Leaders and Designated Deputies only.
- Where practicable, all waste materials are held on site for the minimum period of time prior to disposal.

17 DEVIATION FROM NORMAL OPERATING PRACTICE

In exceptional circumstances, temporary arrangements may be put in place to allow production to continue whilst short term or emergency maintenance issues are addressed. In such circumstances a Temporary Change Notification (TCN) will be raised by the responsible Departmental Manager in line with documented procedure QA-CC-2PC-07 Production, Process and Supplier Change Control.

The TCN will be circulated to all relevant members of the Management Team for comment, appraisal and approval. As part of the approval process, the Operations Director and the HSE Manager are responsible for ensuring that all necessary collective protective measures are in place to eliminate risks to health, safety and the environment.

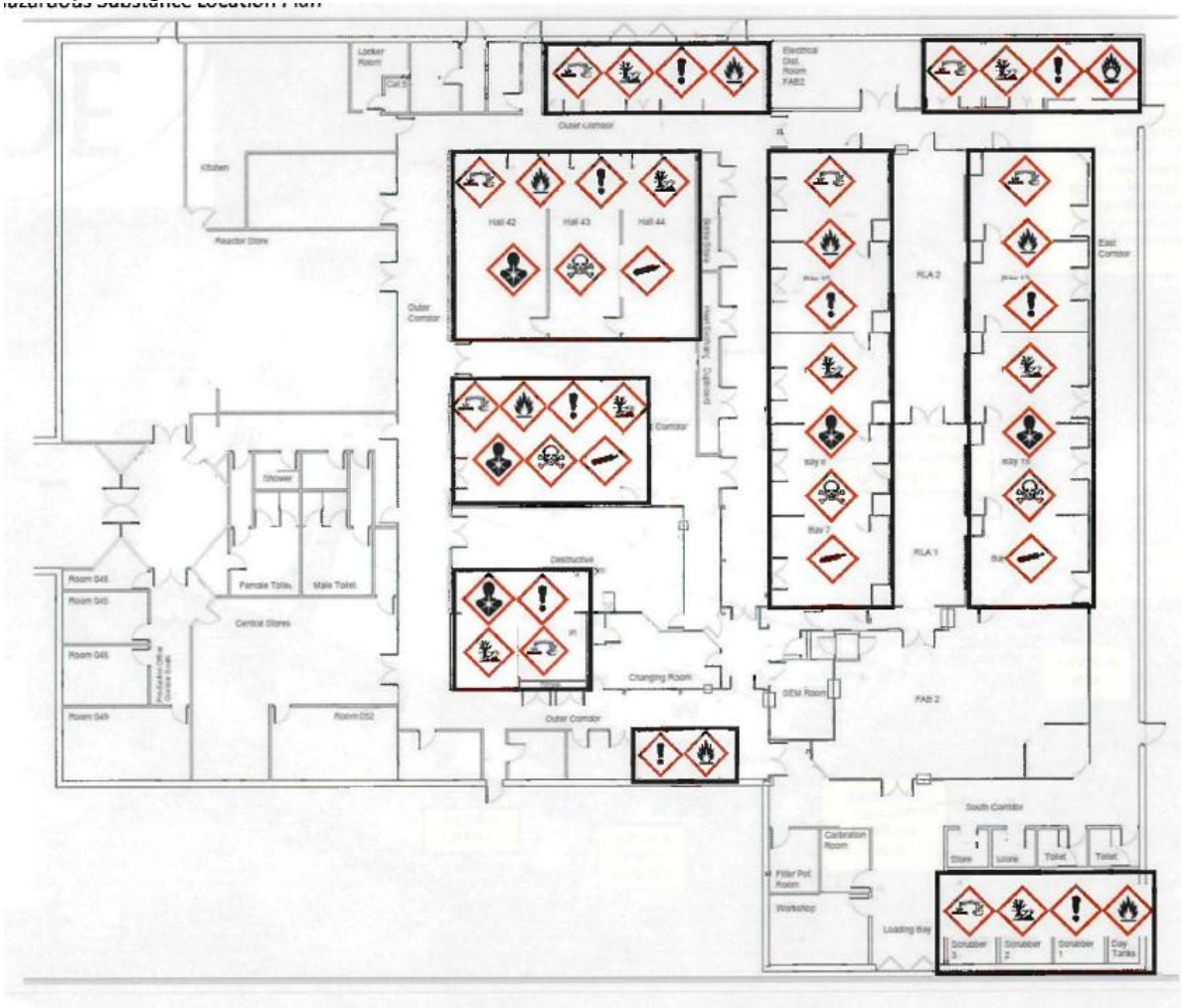
18 EVALUATION OF OVERALL RISK

i. IQE is of the opinion that all necessary and technically possible steps have been taken to avoid the accidental release of hydride gases through valve failure or catastrophic cylinder failure. IQE are acutely aware of the potential effects upon the local environment and local population in the event of such a release, and have many controls in place to prevent such a release.

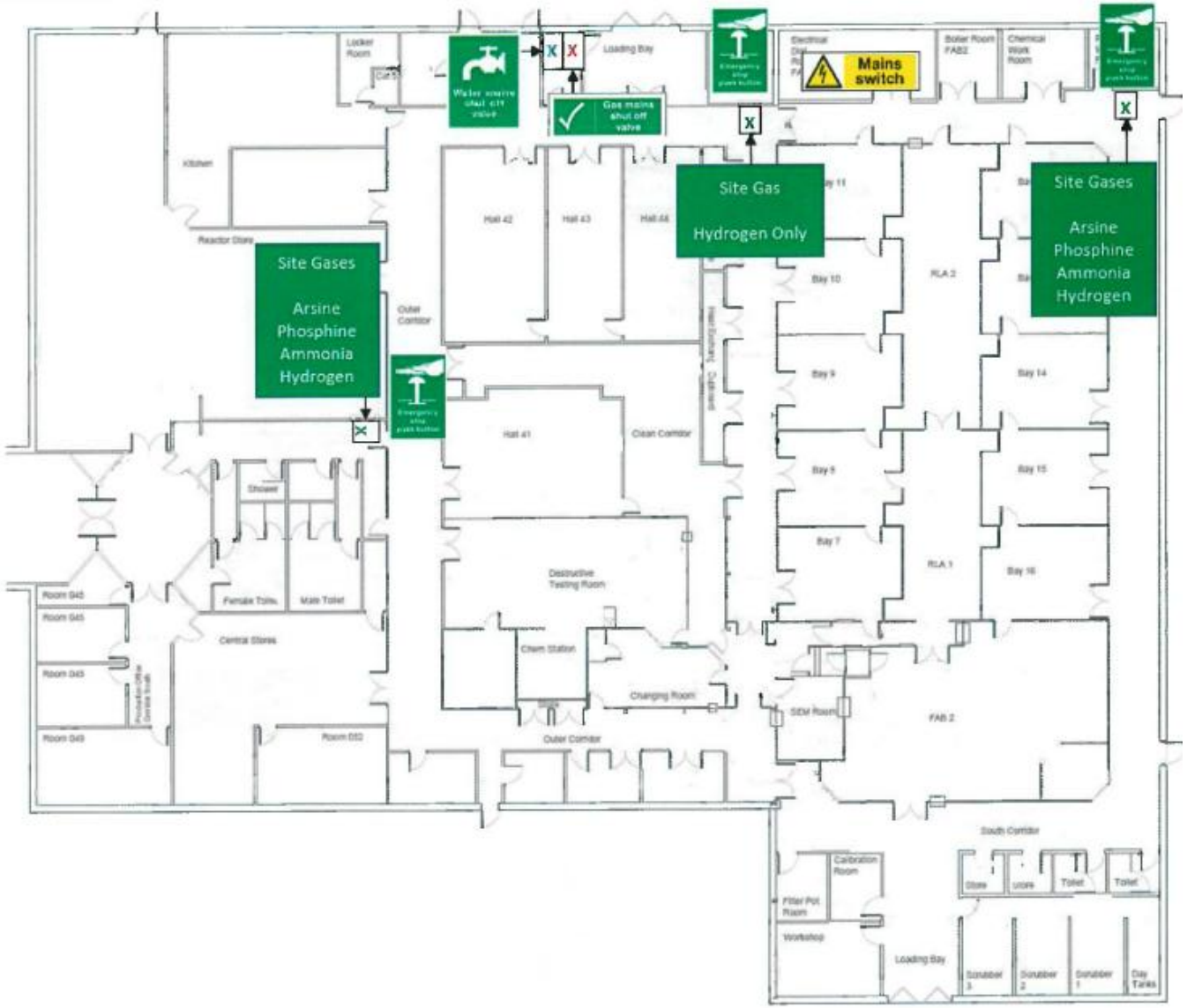
ii. IQE believe that the current controls and safe systems of work in place at the facility reduce the risk of such an event to ALARP standards by using BAT and following industry best practice. No further controls are thought to be necessary.

19 APPENDIX

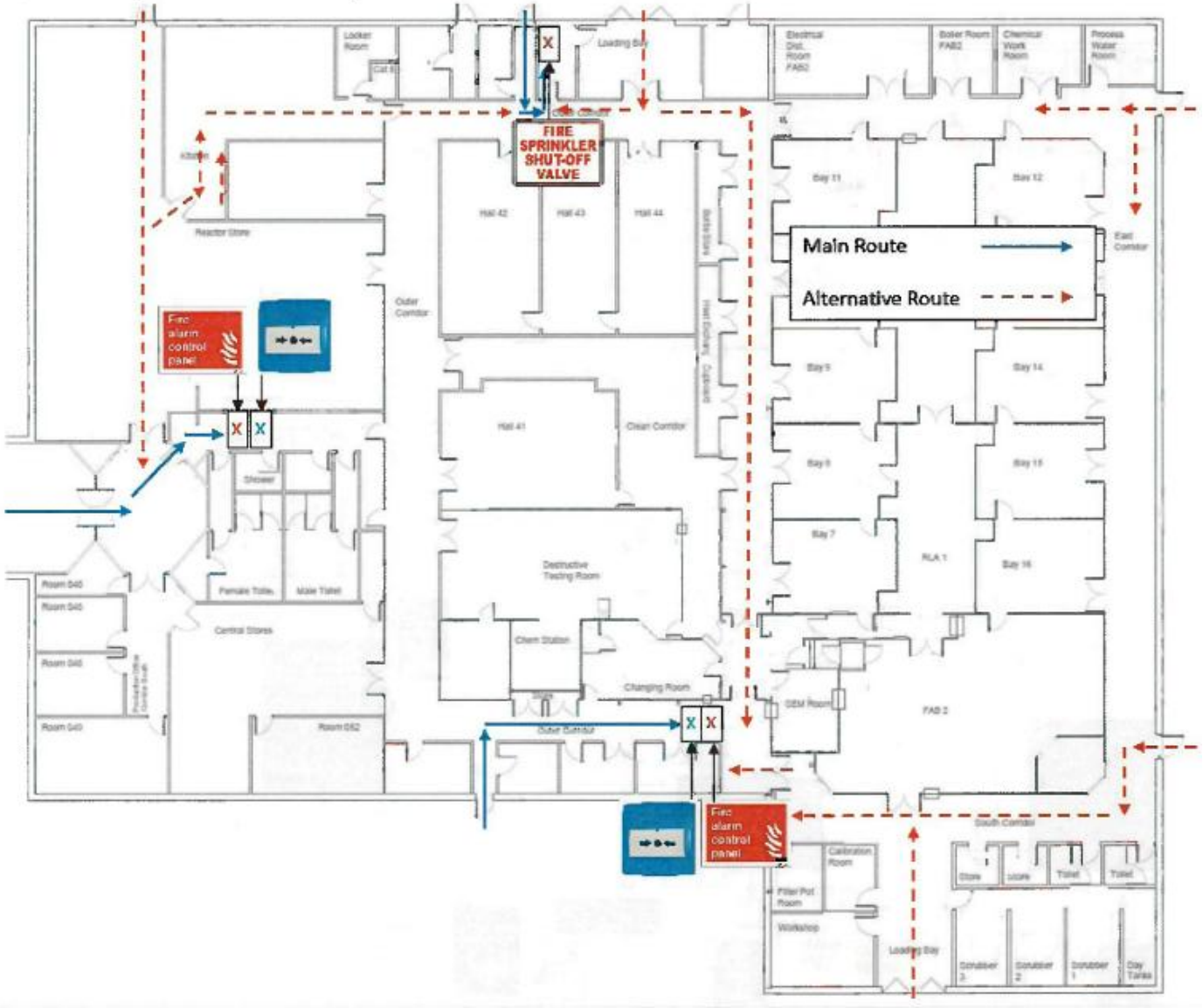
Site plan ground floor



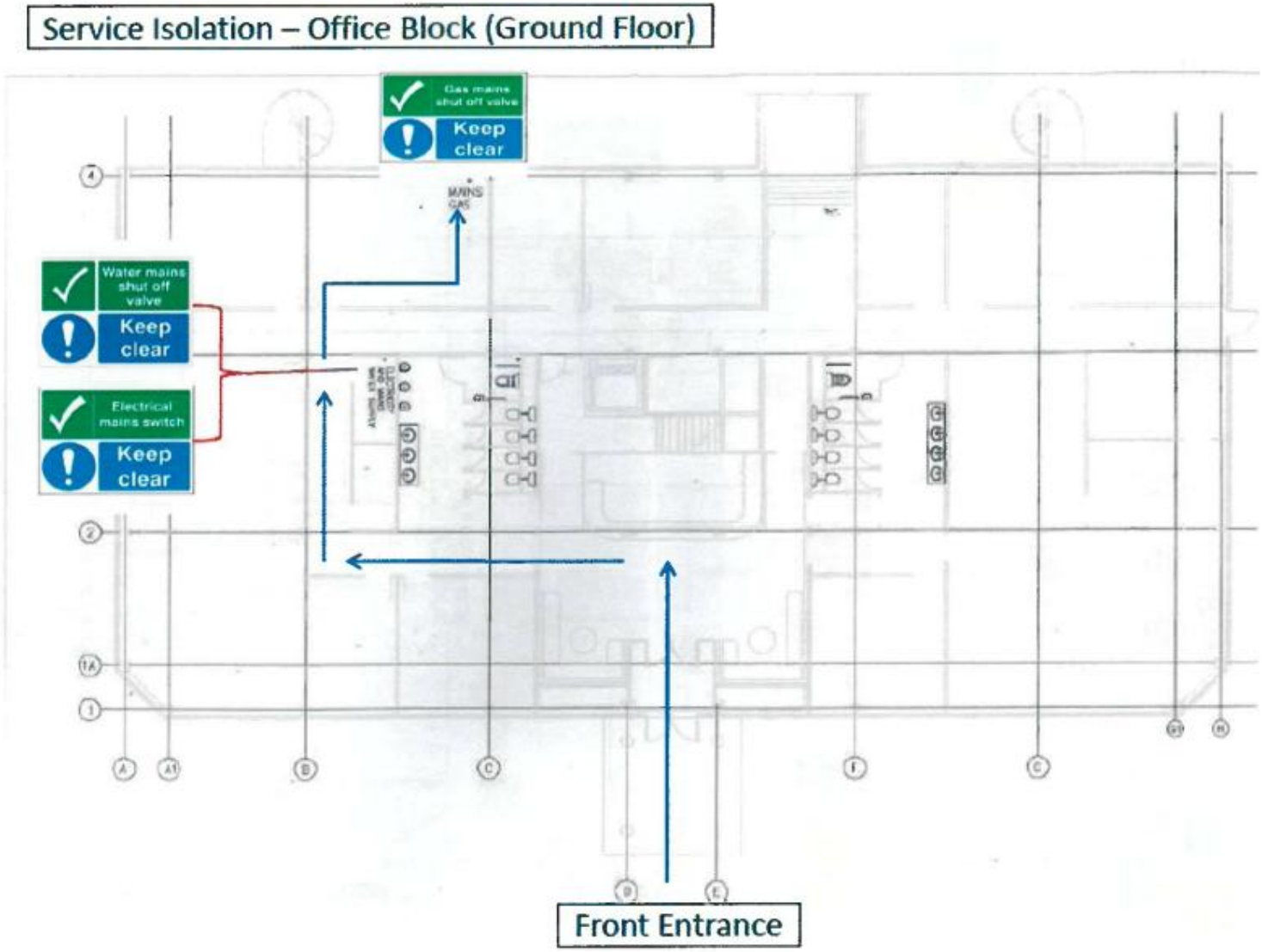
Appendix 3 - Service Isolation Points - FAB



Appendix 4 - Fire Panels, Remote Bay Isolation Switches & Sprinkler Shut Off Valve

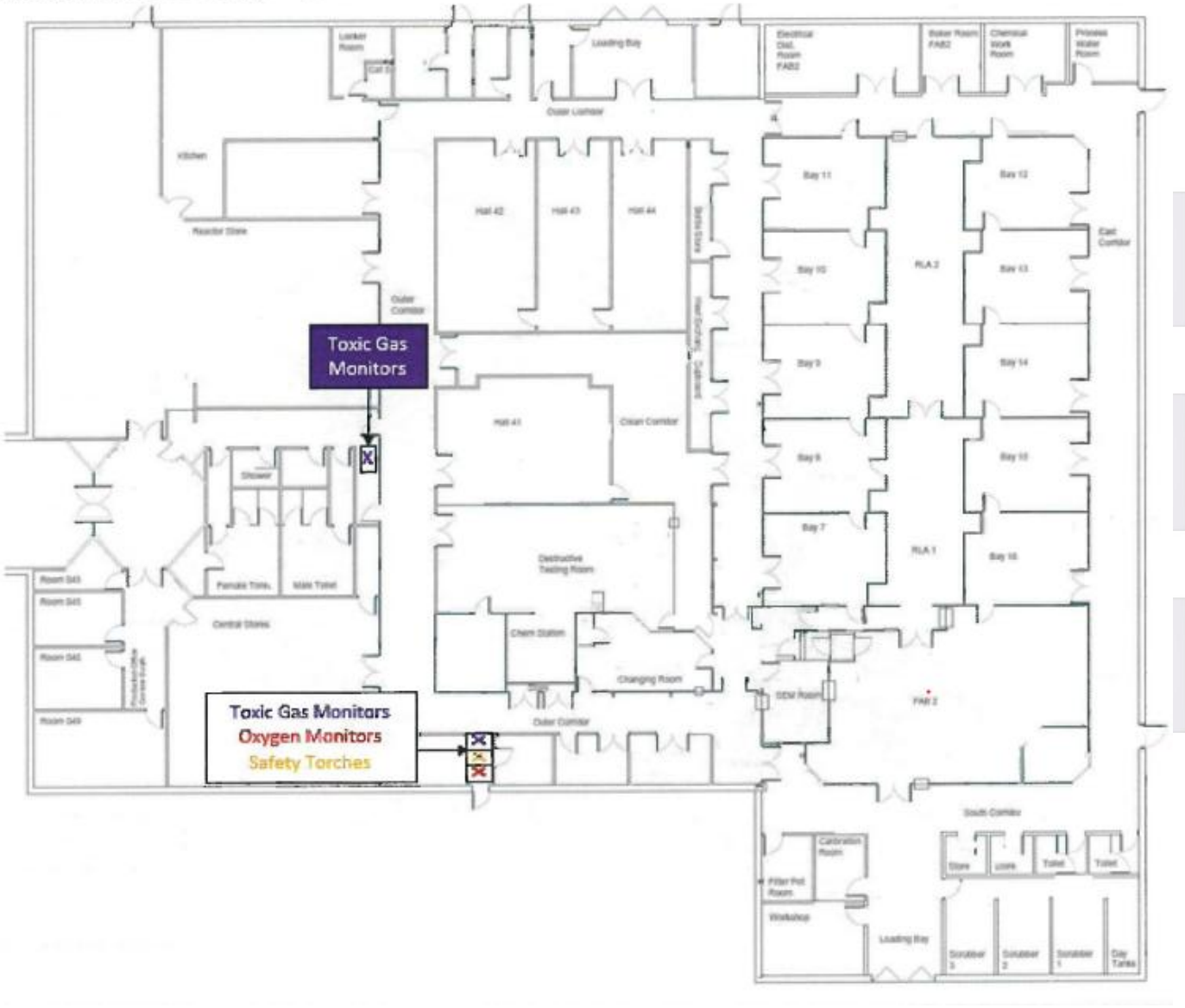


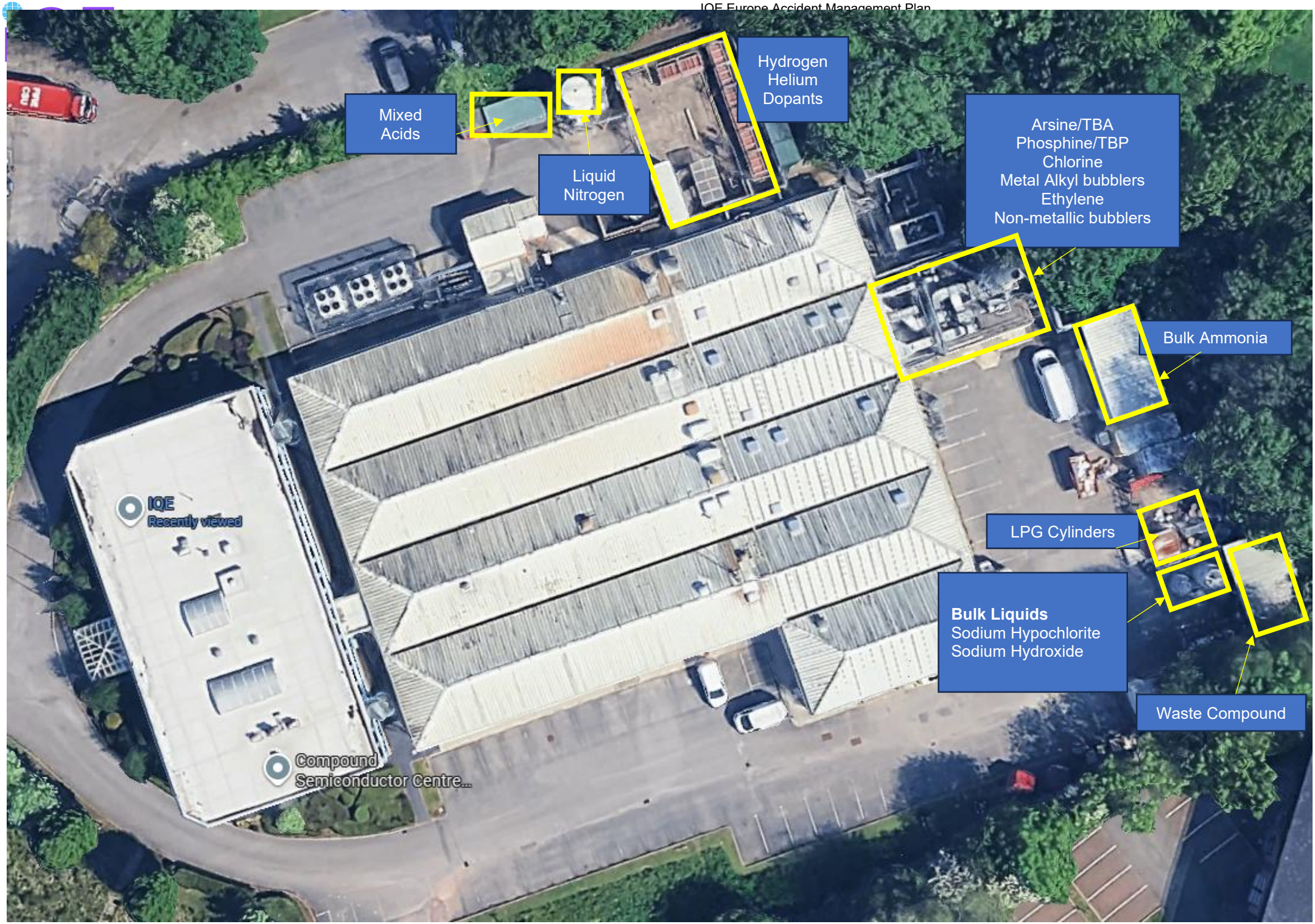
Appendix 5 - Service Isolation - Office Block



Appendix 6 - Emergency Response Equipment

Location of Safety Torches, Toxic Gas & Oxygen Monitors




Mixed Acids
Hydrogen
Helium
Dopants
Liquid Nitrogen
Arsine/TBA
Phosphine/TBP
Chlorine
Metal Alkyl bubblers
Ethylene
Non-metallic bubblers
Bulk Ammonia
LPG Cylinders
Bulk Liquids
Sodium Hypochlorite
Sodium Hydroxide
Waste Compound
IQE
Recently viewed
Compound Semiconductor Centre...

20 MAINTENANCE CONTRACTOR CONTACT LIST

Service	Current Contact details	Likely Manufacturer Contact details – following site handover
Safety Control Systems	**CMB Engineering** 1 Alexandra Gate, Ffordd Pengam, Tremorfa, Cardiff, CF24 2SA. Bertie Borley Mob: 07967 653226 Email: bborley@cmbeng.co.uk	J.W. Bowkett 01633 254 222
Fire System	**CMB Engineering** 1 Alexandra Gate, Ffordd Pengam, Tremorfa, Cardiff, CF24 2SA. Bertie Borley Mob: 07967 653226 Email: bborley@cmbeng.co.uk	AFS (Southwest)Ltd A. C. Barnard 01594 543 066
Fire Extinguishers	**CMB Engineering** 1 Alexandra Gate, Ffordd Pengam, Tremorfa, Cardiff, CF24 2SA. Bertie Borley Mob: 07967 653226 Email: bborley@cmbeng.co.uk	TBC
Mechanical Services	**CMB Engineering** 1 Alexandra Gate, Ffordd Pengam, Tremorfa, Cardiff, CF24 2SA. Bertie Borley Mob: 07967 653226 Email: bborley@cmbeng.co.uk	TBC
Electrical Services	**CMB Engineering** 1 Alexandra Gate, Ffordd Pengam, Tremorfa, Cardiff, CF24 2SA. Bertie Borley Mob: 07967 653226 Email: bborley@cmbeng.co.uk	J.W. Bowkett 01633 254 222
Chiller & Refrigeration System	**CMB Engineering** 1 Alexandra Gate, Ffordd Pengam, Tremorfa, Cardiff, CF24 2SA. Bertie Borley Mob: 07967 653226 Email: bborley@cmbeng.co.uk	Airedale Ltd 01132 391 000 Carrier Air Conditioning 0870 068 8551
Hydrogen Gas Detection	**CMB Engineering** 1 Alexandra Gate, Ffordd Pengam, Tremorfa, Cardiff, CF24 2SA. Bertie Borley Mob: 07967 653226 Email: bborley@cmbeng.co.uk	Honeywell Analytics 01202 676 161
Toxic Gas Detection	**CMB Engineering** 1 Alexandra Gate, Ffordd Pengam, Tremorfa, Cardiff, CF24 2SA. Bertie Borley Mob: 07967 653226 Email: bborley@cmbeng.co.uk	Honeywell Analytics 01202 676 161
Scrubber system	**CMB Engineering** 1 Alexandra Gate, Ffordd Pengam, Tremorfa, Cardiff, CF24 2SA. Bertie Borley Mob: 07967 653226 Email: bborley@cmbeng.co.uk	CS Clean Systems UK Ltd. 024 7671 2555