IKO PLC – Alconbury Weald – Manufacturing Process

Proposal by J Pickup, Group Safety Health & Environmental Manager

Background

IKO Insulations UK LTD proposes to construct a state of the art manufacturing facility in Alconbury, Cambridgeshire, the site will manufacture preformed sheets of PIR Insulation Board for use as insulation in the construction industry. IKO PLC has 2 factories of this type already in operation in the Netherlands and in France, in addition to sites in Canada.

The proposed site in Alconbury will utilise the same manufacturing process as the European sites, incorporating best practice techniques to develop on the lessons learned from the European builds.

Due to the type and volume of chemicals stored on site IKO will come qualify as a 'lower tier' site under the Control of Major Accident Hazards (COMAH) Regulations in the UK

Manufacturing Process - Overview

PIR or Polyisocyanurate, is a thermoset plastic. Its chemistry is similar to polyurethane (PUR) except that the proportion of methylene diphenyl diisocyanate (MDI) is higher and a polyester-derived polyol is used in the reaction instead of a polyether polyol. Catalysts and additives used in PIR formulations also differ from those used in PUR.

The reaction of MDI and polyol takes place at high temperatures compared with the reaction temperature for the manufacture of PUR. At these elevated temperatures and in the presence of specific catalysts, MDI will first react with itself, producing a stiff, ring molecule which is a reactive intermediate (a tri-isocyanate isocyanurate compound). Remaining MDI and the tri-isocyanate react with polyol to form a complex poly(urethane-isocyanurate) polymer which is foamed in the presence of a suitable blowing agent.

Raw Material Deliveries

There are several raw materials involved in the production of the PIR insulation foam, initially the cover for the boards is made from foil, this is delivered in the form of foil rolls which are unwound on the production line to form the upper and lower of the insulation board.

The foil is delivered to site by vehicles and stored in one of the main warehouses, once needed on the production machine the foil rolls are transported to the production area by fork lift truck.

The remainder of the raw materials are in the form of chemicals which when mixed at the pouring head section of the machine, react to form rapidly expanding foam.

- Polycat-8 catalyst
- Polycat-5/Toyocat DT/Niax PM20+catalyst
- Struksilon KOCT 14RO
- Dabco K2097
- Mesamoll
- Silicones/surfactants
- Release agent Pura W 6150
- Fyrol PCF
- MDI (Suprasec/Lupranat)
- Stepanpol PS1902
- iso pentane (or n- or cyclo)

Once past the gatehouse, vehicles will be directed around the internal one way system to the designated chemical unloading area.

At the unloading area, substances will then be transferred to the holding tanks via a pipe and pump system.

Strict procedures will be introduced to control deliveries, this will include the interlocking of the valves to the pumping system to prevent pump off without the correct processes in place, this will be computer controlled and integrated into the delivery management system.

Those substances marked as ‘IBC’ will be delivered and unloaded as per normal raw materials via fork lift vehicles.

Drainage at both areas will be fitted with a remote operated valve system, whereby the drainage can be locked closed before delivery commences and purged if necessary before reconnecting to the main draining system.

It is anticipated that deliveries will occur during daytime periods only, although to enhance visibility due to seasonal variations, under canopy lighting will be provided.

Storage of Chemicals

The proposed site will have 2 main storage areas, one for Pentane and one for the main constituent materials (MDI & Polyol).

The Pentane Storage area will consist of 2 underground tanks with overflow in an 1800 mm high paladin fence and secure gated access.

Electrical devices in the area will be subject to 'ATEX' standard. In addition, the area surrounding the Pentane tanks will be fitted with monitors to detect any leakage together with lighting and other safety features as described further in this report.

The other constituent materials will be stored inside the building in a designated 'tank farm'. This will be a bunded area with several tanks for the storage of the main substances, the bund capacity will be not less than 110% of the largest container's storage capacity or 25% of their aggregate storage capacity, whichever is the greater.

Access into this area will be restricted to authorised personnel only.

There will be a smaller 'IBC' storage rack adjacent to the production machine, this will be for the storage of the substances marked as IBC in the table on page 1. This area will be bunded; however it is not anticipated that there will be drainage in this area.

Chemical Usage

All constituent substances are held in colour coded vessels. This colour coding is replicated throughout the site via associated pipework, valves and pumps, to ensure easy identification of the substances that they contain or process.

Pipework is manufactured to 'gas tight' standards, with welded joints to prevent any leakage.

The main pump room will be fitted with tray bunds and also wall vents.

The Pentane pump room will be subject to 'ATEX' (DSEAR) requirements.

Manufacturing Process

The foil upper and lower sections of the finished product are unwound onto the pouring table, at this point the constituent chemicals are pumped through several pouring heads onto the bottom foil, this mixture of chemicals creates a reaction which causes the substance to expand rapidly and hence form the middle of the insulation foam 'sandwich'.

The blowing agent used to create the expansion effect is Iso-Pentane, this substance is heavier than air and hence is extracted through slots that run down the side of the pouring table and then extracted to atmosphere.

There are currently no plans to treat this emission before it enters the atmosphere as the extraction system will be designed to dilute the substance with clean surrounding air before emitting out of the factory.

As the site is not yet built it is not possible to estimate at what volumes this extraction will be at this point in time.

As the foaming liquid begins to cure the top layer of the foil sandwich is applied and the block passes through a heated section for curing and setting at its desired height.

The next section of the manufacturing process is to cut the blocks to customer sizes and apply any edges (*ie for tongue and groove profiling*), this is carried out at different sections. As part of the cutting process dust is formed at the moving knife sections, this is extracted away at source through DSEAR rated equipment and then passed through a block briquette machine to form solid blocks of waste foam, it is expected that this will be collected in an external skip before being taken from site by our waste management company and used for refused derived fuel.

After the blocks are cut to an initial size they are sent around a stacked conveyor to allow them to cure fully before a final cutting and palletising section.

Finished product is then stored in one of two warehouses (heated and non-heated) before being loaded onto vehicles at the indoor loading area and then shipped to customers.

Waste

As with all manufacturing processes it is anticipated that some product waste will be produced as mentioned earlier from the cutting process and well as plastic wrappers and general waste.

IKO is currently working with several waste management companies to establish 'zero to landfill' solutions for its current manufacturing sites and the proposed Alconbury development.

Standard waste streams (such as cardboard, paper, plastics and wood) will be source segregated on site and stored for recycling, where product waste cannot be recycled, such as compacted dust from the foam insulation, then it will be processed for Refuse Derived Fuel.

Skip compactor and dust compaction units are identified on relevant plans

'General Waste' such as food waste, office waste and non-recyclables will also be stored for disposal into Refuse Derived Fuel and diverted from landfill.

Environmental Certification

As with other IKO UK sites, it would be company's intention to attain accreditation to the ISO 14001:2015 standard for Environmental Management as well as BES6001 standard for Responsible Sourcing and Sustainable Building Materials.

The site will establish the necessary policies and procedures in order to maintain these certifications and reduce the environmental impact of its activities as far as possible.

Emergency Procedures

IKO will ensure that all employees on site will be trained to cope and react to any emergency eventuality.

External spill management systems will be installed at strategic locations both inside and outside of the factory.

It is planned that the underground drainage systems in the vicinity of the chemical unloading area will be fitted with isolation valves at either end which will be linked to the pump off system so that delivery will only be permitted once the valves are in the closed position and effectively will become an isolated section. In turn this will allow any contamination to be contained and cleared from the drain and the system to be 'purged' before allowing this section to be re-connected to the drain ring main.

The planned Pentane delivery system will be fitted with sensor detection to provide an early warning alarm in the event of any potential leakages. In addition this will also isolate the pump preventing further delivery and the computer controlled delivery system will shut down all associated valves and pumps.

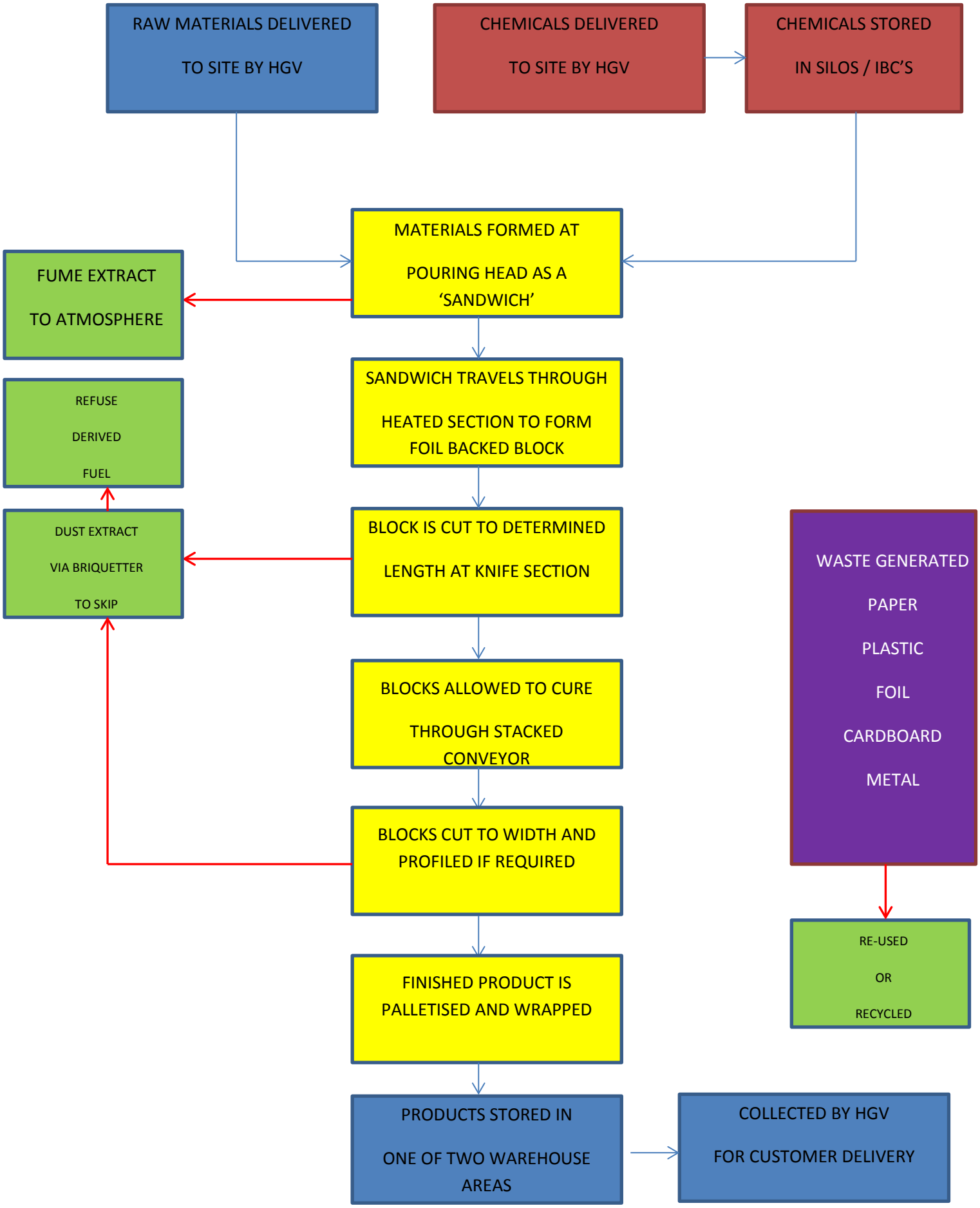
As a back-up to this system, a manual 'emergency stop' button which will also shut down the whole system if manually activated will be installed.

Additional valves will be fitted to the main drain outfeed so that in the event of an emergency the valve may be closed and the site isolated to prevent any pollution.

As part of the sites environmental management system periodic routine audits of all emergency planning and emergency procedures as well as staff training in such eventualities will be undertaken to ensure continual compliance and readiness. This will be strengthened by external audits by accredited bodies.

The site will be covered by a 'FM' rated sprinkler system which will cover the entire site, in addition to a fully operational fire detection system, this will feed back to a constantly monitored location.

Appendix 1 – Flow Diagram



Appendix 2 – Pictorial Representation (from sister sites)

Chemicals are stored in colour coded silo's or in IBC form (bunded) for smaller quantities

Chemicals are pumped to the machine along 'gas safe' colour coded lines and equipment, 'atex' approved equipment for pentane transfer

Substances mix at the pouring head – extraction of pentane fume to atmosphere

'Sandwich' of foil and foam passes through heated section to determine thickness

Solid blocks of insulation foam are cut to size in the knife section

Dust extracted and passed through briquetter machine before storage in skip for RDF

Solid blocks of insulation foam pass through stacked conveyor to cure fully

This is followed by cutting to size and if needed profiled edges

Finished product is palletised and wrapped before storage in the warehouse and eventual shipping to customer on trailers

Dust from the cutting sections is processed through the briquette machine before storage in skips for disposal – it is anticipated that this will be sent for refused derived fuel as opposed to landfill

All sections of the production process will be constantly monitored using CCTV and computer controlled systems with built in safety features to prevent rogue emissions to atmosphere or potential pollution events

Pentane is stored in underground secure tanks – delivery subject to strict conditions

Surrounding area has leak detection and sirens

All drains in the chemical delivery areas will have the capacity to be isolated from the main system

This will be a requirement of the delivery process

Chemical Storage and Emergency Proposal Plan

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The reaction of MDI and polyol takes place at high temperatures compared with the reaction temperature for the manufacture of PUR. At these elevated temperatures and in the presence of specific catalysts, MDI will first react with itself, producing a stiff, ring molecule which is a reactive intermediate (a tri-isocyanate isocyanurate compound). Remaining MDI and the tri-isocyanate react with polyol to form a complex poly(urethane-isocyanurate) polymer which is foamed in the presence of a suitable blowing agent.

In order to manufacture this product, IKO Insulations UK LTD will store and use a variety of substances, in both bulk (tanks or silos) and Intermediate Bulk Containers (IBC's) as follows…

Name	Storage Method	Internal or External storage
Polycat-8 catalyst	IBC	**Internal**
Polycat-5/Toyocat DT/Niax PM20+catalyst	IBC	**Internal**
Struksilon KOCT 14RO	IBC + bulk	**Internal**
Dabco K2097	IBC	**Internal**
Mesamoll	drum	**Internal**
Silicones/surfactants	IBC	**Internal**
Release agent Pura W 6150	IBC	**Internal**
Fyrol PCF	bulk	**Internal**
MDI (Suprasec/Lupranat)	bulk	**Internal**
Stepanpol PS1902	bulk	**Internal**
iso pentane (or n- or cyclo)	bulk	**External - Underground**

Storage of Chemicals

The proposed site will have 2 main storage areas, one for Pentane and one for the main constituent materials (MDI & Polyol).

The Pentane Storage area will consist of 2 underground tanks with overflow in an 1800 mm high paladin fence and secure gated access.

Electrical devices in the area will be subject to 'ATEX' standard. In addition, the area surrounding the Pentane tanks will be fitted with monitors to detect any leakage together with lighting and other safety features as described further in this report.

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Access into this area will be restricted to authorised personnel only.

There will be a smaller 'IBC' storage rack adjacent to the production machine, this will be for the storage of the substances marked as IBC in the table on page 1. This area will be bunded; however it is not anticipated that there will be drainage in this area.

Delivery

Deliveries of chemicals to the site will be by tanker, via the HGV entrance.

Once past the gatehouse vehicles will be directed around the internal one way system to the designated chemical unloading area.

At the unloading area, substances will then be transferred to the holding tanks via a pipe and pump system.

Strict procedures will be introduced to control deliveries, this will include the interlocking of the valves to the pumping system to prevent pump off without the correct processes in place, this will be computer controlled and integrated into the delivery management system.

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It is anticipated that deliveries will occur during daytime periods only, although to enhance visibility due to seasonal variations, under canopy lighting will be provided.

Chemical Usage

The chemicals are transferred by pump from their holding tanks to the 'pouring head' section of the machine, at this point they mix and chemical reactions take place to produce the semi-finished foam in a liquid state, it is a critical part of the manufacturing process that this mix of chemicals does not occur until the pouring head section, so as to prevent blockages and thus wastage.

All constituent substances are held in colour coded vessels. This colour coding is replicated throughout the site via associated pipework, valves and pumps, to ensure easy identification of the substances that they contain or process.

Pipework is manufactured to 'gas tight' standards, with welded joints to prevent any leakage.

The main pump room will be fitted with tray bunds and also wall vents.

The Pentane pump room will be subject to 'ATEX' requirements.

Waste

As with all manufacturing processes it is anticipated that some product waste will be produced. IKO is currently working with several waste management companies to establish 'zero to landfill' solutions for its current manufacturing sites and the proposed Alconbury development.

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It is planned that the underground drainage systems in the vicinity of the chemical unloading area will be fitted with isolation valves at either end which will be linked to the pump off system so that delivery will only be permitted once the valves are in the closed position and effectively will become an isolated section. In turn this will allow any contamination to be contained and cleared from the drain and the system to be 'purged' before allowing this section to be re-connected to the drain ring main.

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As part of the sites environmental management system periodic routine audits of all emergency planning and emergency procedures as well as staff training in such eventualities will be undertaken to ensure continual compliance and readiness. This will be strengthened by external audits by accredited bodies.

The site will be covered by a 'FM' rated sprinkler system which will cover the entire site, in addition to a fully operational fire detection system, this will feed back to a constantly monitored location.

Photo's – Sister site in France, Alconbury will be constructed in a similar fashion.

Showing colour coded pipework and welded joints (Green = Polyol, MDI = Red, Octoate is pink)

Example of bunded storage area for 'IBC' setup

Showing Pentane tank area, secured and tanks underground

Chemical delivery area, note valve cover for drainage and sensors on wall