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# Evaluation Report

# HAZOP Study of the Paint R&D Facility – Jotun Flixborough

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## 1. Introduction

As part of the initiative to continuously improve Health & Safety standards, Jotun has undertaken an evaluation of the proposed new R&D Facility to be built in 2016, with the aim of identify the potential Health, Safety and Operational risks associated with operating the processes and systems with regards to UK legislation and Jotun Policies and Procedures. With reference to, but not confined to, The Control of Substances Hazardous to Health 2002 (COSHH); and the Provision and Use of Work Equipment Regulations 1998 (PUWER). The primary purpose of COSHH is to prevent or limit the exposure to hazardous chemicals and atmospheres for workers and all those who maybe affected. PUWER is to ensure equipment has been installed, operated and is maintained correctly and operated by trained competent persons. The key requirement is to identify the risks and hazards, then assess and eliminate or reduce them, following the Hierarchy of control principles.

This evaluation report contains the methodology used, the action required to mitigate the risks identified and further recommendations and conclusions to enable the changes and improvements to the process line and area. The report details the findings of the study using well documented what, when, how, why philosophy and the use of key words to extract the operating\hazardous scenarios present during start-up and operation.

The report was produced by Robert Preston MBA, BEng(Hons),CEng, FIMechE who has experience gained across a wide spectrum of Engineering and manufacturing environments

The HAZOP team members are listed below

| | |
|---|---|
| Robert Preston | - HAZOP Chair – IRIS Engineering & Technology |
| David Hutchinson | - M&E Design (IRIS) |
| Daniel Kavenagh | - Structural & Architectural Designer ( Head Office3) |
| Richard Mann | - R&D Manager (Jotun) |
| Darren Dawson | - HSE Legal Compliance Specialist (Jotun) |

## 2. Glossary of Terms

| | | |
|---|---|---|
| BS | - | British Standard |
| CE | - | CE marking |
| COSHH | - | Control of Substances Hazardous to Health |
| FSD | - | Functional System Description |
| HAZOP | - | Hazard Operability Study |
| HSE | - | Health and Safety Executive |
| IEC | - | International Electrotechnical Committee |
| MSDS | - | Material Safety Data Sheet |
| URS | - | User Requirement Specification |
| P\T | - | Pressure Test |
| PUWER | - | Provision and Use of Work Equipment Regulations |
| LEV | - | Local Exhaust Ventilation |
| IBC | - | Intermediate Bulk Container |

## 3. The Location

The R&D Facility will be a unique facility enabling Jotun to develop new standard and intumescent paints for industrial applications.

The project continues to strengthen the product development within Jotun and the centre will work with others to further develop antifouling for ships. This will keep Jotun in a leading position in the marine market.

## 4. Scope of Work and Methodology

As part of the commitment to meeting Jotun's minimum standards and legislative compliance, it was identified by the Project Team that a HAZOP study was required to enable the sign off of the new equipment by the Safety Team. The HAZOP undertaken over an intense one day period covering the building and process within

The scope of this study has been broken down into 8 discrete nodes enabling specific analysis of the risk and mode of operation to be undertaken. Appendix 1 identifies The Layout of the area

The nodes are a listed as follows:

Node 1 - Storage & Material Distribution
Node 2 - Mixing Mill Room
Node 3 - Sample Storage Room
Node 4 - Hand Application
Node 5 - Spray Booth 1 & 2
Node 6 - Conditioning Room
Node 7 - Grinding Room
Node 8 - General Area & Furnace Controls

## 5. HAZOP Action & Study Sheets

## Node 1 - Storage & Materials

| Project | Jotun R&D Paint Facility | | | | Table number: 1 | | | Action by | |
|---|---|---|---|---|---|---|---|---|---|
| Line No and Node 1 | Guide word | Deviation | Ref | Cause | Consequence | Comment | Actions required | Person | Risk |
| Storage & Material Distribution | Steel | Movements | 1.01 | Palletised Material | 1m x 75 kg - 4.5m x 240kg | Offloaded from pallet via 5T overhead crane onto transport jig | New Personnel will require in-house training for management of vehicle movements. Training required for crane operations | RM | |
| | Steel | Movements | 1.02 | Palletised Material | | Offloaded from transport via Fork Lift Truck and moved into paint area | New Personnel will require in-house training for management of vehicle movements | RM | |
| | Paint Raw Materials | Storage Liquids | 1.03 | Decanting material | Spillage | No Liquids above 20 litres without a bunded pallet | Spill Kits required within decanting area | DD | |
| | Paint Raw Materials | Storage Liquids | 1.04 | Decanting material | Spillage | 200 litre drum to be stored on bunded pallet | Purchase and located bund pallets | DD | |
| | Paint Raw Materials | Storage Liquids | 1.05 | Decanting material | Spillage | Solvents will be provided in 20ltr drums from the main plant these will be transported via approved movements in sealed containers - no decanting within facility | No action | | |
| | Paint Raw Materials | Powders | 1.06 | Decanting material | Flammable atmosphere | Materials will be moved in 20lts bags and dispensed within ATEX rated Area with appropriate LEV | No action | | |

## Node 2 - Mixing\Mill Room

| Project | Jotun R&D Paint Facility | | | | Table number: 2 | | | Action by | |
|---|---|---|---|---|---|---|---|---|---|
| Line No and Node 2 | Guide word | Deviation | Ref | Cause | Consequence | Comment | Actions required | Person | Risk |
| Mixing\Mill Room | Mixing | Ventilation | 2.01 | Loss of Vent | Loss of ATEX zone | Design allows for pressure measurement and doors interlocked with an agreed time delay. Alarm within area to advise operator to stop activities if pressure control is compromised | Training required as part of Operations | RM | |
| | Mixing | Ventilation | 2.02 | Loss of Vent | Loss of ATEX zone | Machine to be interlocked so as activities cannot be undertaken if zone compromised either via pressure loss or doors left open | Set time control as part of commissioning activities | M&E Designers | |
| | Mixing | ATEX | 2.03 | Equipment classification | Ignition source | All equipment to be zone 1 rated | Ensure Zone 1 specified as part of equipment specification\installation order | RM | |
| | Flam Liquids | Storage | 2.04 | Spillage | loss of containment | Purchase bunded flam cabinet for solvents | Purchase bunded flammable cabinet for solvents | RM | |
| | PPE | Anti static | 2.05 | Zoned Area | Ignition source | All clothing within the area to be antistatic with correct signage and personnel earth proving before entry | No action | | |
| | Static\access control | Anti static | 2.06 | Zoned Area | Ignition source | Move Test point from stairs to zone corridor and add additional point to operational corridor, interlock good in\out roller door with Operational corridor roller door | Modify design to comply | M&E Designers | |
| | Product | Spill | 2.09 | Drop of 20 litre tin within area | Potential for flammable atmosphere | Spill kit required to give spill volume protection and correct type of fluids | Provide kit and training for use | RM | |
| | Water Dispense | Spill | 2.10 | Dispense of mains water | Leak onto floor | Spring loaded dispense tap required with mechanical isolation | Install water supply and tap with drip tray below | M&E Designers | |
| | ATEX | Conductivity | 2.11 | Atex compliance | Ignition source | Floor to be conductive construction and certified as built | Ensure full test and certification required | M&E Designers | |
| | | | | | | | | | |
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## Node 3 – Sample Storage

| Project | Jotun R&D Paint Facility | | | | Table number: 3 | | | Action by | |
|---|---|---|---|---|---|---|---|---|---|
| Line No and Node 3 | Guide word | Deviation | Ref | Cause | Consequence | Comment | Actions required | Person | Risk |
| Sample Storage Room | Storage | | 3.01 | | No Hazardous Consequence | Only 25% of product stored in the area will be flammable - No decanting or transport of material in open containers - unless within an ATEX zone | No action required | | |
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## Node 4 - Hand Application

| Project | Jotun R&D Paint Facility | | | | Table number: 4 | | | Action by | |
|---|---|---|---|---|---|---|---|---|---|
| Line No and Node 4 | Guide word | Deviation | Ref | Cause | Consequence | Comment | Actions required | Person | Risk |
| Hand Application | Comment | Other | 4.01 | | | Mainly Solvent free however design as zone 1 to allow flexibility | No action required | | |
| | Ventilation | Loss | 4.02 | Loss of Vent | Loss of ATEX zone | Design allows for pressure measurement and doors interlocked with an agreed time delay with alarm within area to advise operator to stop activities if pressure control or door is compromised | Training required as part of Operations | RM | |
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## Node 5 – Spray Booths 1 & 2

| Project | Jotun R&D Paint Facility | | | | Table number: 5 | | | Action by | |
|---|---|---|---|---|---|---|---|---|---|
| Line No and Node 5 | Guide word | Deviation | Ref | Cause | Consequence | Comment | Actions required | Person | Risk |
| Spray Booth 1 & 2 | | | | | | | | | |
| | Ventilation | Loss | 5.01 | Loss of Vent | Loss of ATEX zone | Design allows for pressure measurement and doors interlocked with an agreed time delay with alarm within area to advise operator to stop activities if pressure control or door is compromised | Training required as part of Operations | RM | |
| | Pressure Control | Room Access | 5.02 | Door locks | Access During Spraying | Doors need to be locked during activity with external manual override | Design to be reviewed at build stage | M&E Designers | |
| | ATEX | Conductivity | 5.03 | Atex compliance | Ignition source | Floor to be conductive construction and certified as built | Ensure full test and certification required | M&E Designers | |
| | PPE | Anti static | 5.04 | Zoned Area | Ignition source | All clothing within the area to be antistatic with correct signage and personnel earth proving before entry | | RM & M&E Designers | |
| | ATEX | Anti static | 5.05 | Zoned Area | Ignition source | If break glass activated then compressed air to room isolated | Design to be reviewed at build stage | M&E Designers | |
| | Booth Design | ATEX | 5.06 | Zoned Area | Ignition source | Booth design to be finalised to confirm air flow design dilution calculation to define ATEX of extracts | Build designer to finalise ATEX report once equipment specification is finalised | M&E Designers | |
| | ATEX | Earthing | 5.07 | Drum & pump units no earthed correctly | ignition source | Add additional earth proving unit to equipment | 4 proving units required per room | M&E Designers | |
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## Node 6 – Conditioning Room

| Project | Jotun R&D Paint Facility | | | | Table number: 6 | | | Action by | |
|---|---|---|---|---|---|---|---|---|---|
| Line No and Node 6 | Guide word | Deviation | Ref | Cause | Consequence | Comment | Actions required | Person | Risk |
| Conditioning Room | ATEX | Conductivity | 6.01 | Atex compliance | Ignition source | Floor to be conductive construction and certified as built | Ensure full test and certification required | M&E Designers | |
| | Ventilation | Loss | 6.02 | Loss of Vent | Loss of ATEX zone | Design allows for pressure measurement and doors interlocked with an agreed time delay with alarm within area to advise operator to stop activities if pressure control or door is compromised | Training required as part of Operations | RM | |
| | | | | | | | | | |

## Node 7 – Grinding Room

| Project | Jotun R&D Paint Facility | | | | Table number: 7 | | | Action by | |
|---|---|---|---|---|---|---|---|---|---|
| Line No and Node 7 | Guide word | Deviation | Ref | Cause | Consequence | Comment | Actions required | Person | Risk |
| Grinding Room | | | | | | | | | |
| | Ventilation | Loss | 7.01 | Loss of Vent | Dust Control | Design allows for pressure measurement and doors interlocked with an agreed time delay with alarm within area to advise operator to stop activities if pressure control or door is compromised | Training required as part of Operations | RM | |
| | Dust Control | Door Control | 7.02 | Dust | Dirt within clean areas | Doors to be interlocked with booth operation - doors lock when in use | Implement Design as part of build | M&E Designers | |
| | | | | | | | | | |
| | | | | | | | | | |

## Node 8 – General Area & Furnace Controls

| Project | Jotun R&D Paint Facility | | | | Table number: 8 | | | Action by | |
|---|---|---|---|---|---|---|---|---|---|
| Line No and Node 8 | Guide word | Deviation | Ref | Cause | Consequence | Comment | Actions required | Person | Risk |
| General Area & Furnace Control\ Interfaces | Spillage | Salt Spray Room | 8.01 | Spillage in Large Lab | Contamination of sewer | | Design bund lip to salt spray room to stop liquids entering this room | Head Office | |
| | Working at Height | Furnace and filter System access | 8.02 | Hand Rails removed for potential hard product | Fall | | Review handrails and safety clip on details if rails removed | RM | |
| | Liquid N2 | Spill Test | 8.03 | Normal Activity | asphyxiation | | Asphyxiation risk assessment for test | RM | |
| | Furnace Control | Other | 8.04 | Manage activity & assess during fire test | Pressure Control to area | Minimum of 2 volt free contacts required to manage door control and compressor air flow control | Confirm with Supplier | RM | |
| | Furnace Control | Other | 8.05 | Furnace\Filter Interface | Combustion products within building | The 2 units are from different suppliers and therefore clear controls interface is required | A full and signed off design is required between both parties including interfaces to Facilities systems | All | |
| | | | | | | | | | |

## 6.0 Conclusions & Recommendations

The R&D facilities has been assessed to identify, and propose engineering solutions and operational actions that could be implemented to reduce possible hazard scenarios identified by the team during the HAZOP Study. Individual actions are identified in the study sheets and when implemented should offer both operational safety and process functionality improvements. The control measures must be implemented using robust engineering design and installation procedures documented via the Jotun change control procedures.

## 7. Bibliography


- Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR)
- L136DSEAR Approved Code of Practice and Guidance for Control and Mitigation Measures.
- Control of Substances Hazardous to Health Regulations 2002 (COSHH)
- Provision and Use of Work Equipment Regulations 1998 (PUWER)
- EH40/2005 Workplace exposure limits: Containing the list of workplace exposure limits for use with the Control of Substances Hazardous to Health Regulations 2002 (as amended).
- CISHEC/8906/1000 CIA Guide to Hazard and Operability Studies
- Kietz T.A HAZOP and HAZAN Identifying and Assessing Process Industry Hazards 3rd Edition 1992.


**Appendix 1 – Jotun Drawings**


Node 8
Node 5
Node 6
Node 7
Node 2
Node 3
Node 4
Node Area Drawing