ATEX Hazardous Area Classification Report for Magni Building 3 Expansion

Magh Nala, Mallow Co. Cork

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Revision Changes

The following is a summary of the main changes that have occurred in this document from the last revision and should be used as a guide only.

Revision Changes	
Section	**Remark**
APPENDIX III: Source of Release Report (GASES/VAPOURS)	Updated with release from hydrogen gas tap
APPENDIX IX: risk assessment procedure	Updated with Autoignition Source Review

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1. SUMMARY

This report defines the methodology and reasoning used in the Hazardous Area Classification (HAC) study for the Magni Magh Nala Building 3 Expansion facility.

This report should be read in conjunction with the previous reports DPS have completed on this building:

114101-HZR-001

117179-HZC-001

The classification is based on recommendations within the current standard EN60079-10-1 (Gas) and EN60079-10-2 (Dust): Classification of Hazardous Areas. It should be read and reviewed in conjunction with the ATEX Hazardous Area Classification Drawings.

Hazardous Area Classification is a method of analysing and classifying the environment where explosive atmospheres may occur, so as to facilitate the proper selection, installation and operation of equipment to be used safely in that environment. The classification also takes into account the ignition characteristics of the flammable substance such as ignition energy and ignition temperature. Area classification has three main objectives, the determination of the type of any hazardous zone, the extent of the zone and the selection characteristics for equipment.

The area classification is not intended to deal with catastrophic events within the area such as rupture of drums or vessels, failure of vessels etc. This report is not a fire strategy or fire certificate and the Hazardous Area Classification considers only explosion hazards and does not consider toxic effects or exposure.

This is not an Explosion Protection Document (EPD). This report forms an input to the site EPD, which is the responsibility of the Client. This report does not address worker safety requirements such as training, organisational measures, signage or the requirements of the ATEX Worker Safety Directive. (Key Organizational Measures recommended by DPS are however listed in Section 7.)

Control systems and instrumentation may reduce the potential for a source of release and/or the quantity of a release (e.g. batch sequence controls, inerting systems). Such controls may therefore be considered where critical to the hazardous area classification. Modification or removal of these instruments or systems may extend or alter hazardous zones. Thus, maintenance and calibration of the controls and instrumentation is also critical to the area classification.

This report defines the hazardous zones, thus facilitating the appropriate selection and operation of new apparatus within the facility. This report does not assess the compliance of existing electrical and non-electrical equipment currently within the hazardous zones identified.

Hazardous Area Classification must be revisited if significant changes are made to the processes, materials or operations.

1.1 Facility Classification for Gases and Vapours

Based on the flammable properties of gases and vapours listed in Appendix II, the minimum required apparatus group and temperature classification for the facility are as listed below.

The actual apparatus group or temperature classification may be assigned more conservative values than these minimum requirements. These assigned values are also listed below.

	Minimum Required	Actual Assigned
Apparatus Group (w.r.t. gas/vapour)	IIB	IIB
Temperature Classification (w.r.t. gas/vapour)	T3 (T_{max} = 200°C)	T3 (T_{max} = 200°C)

Notes:

i. Apparatus Group for a given gas/vapour is defined based on how easily ignitable it is (by a flame or spark; not via self-ignition)

Apparatus Group	Test Gas	Common Gases
I (Mining)	Methane	Methane
IIA	Propane	Acetone, Ammonia, Methanol
IIB	Ethylene	Ethylene, Hydrogen Sulphide
IIC	Hydrogen	Hydrogen, Acetylene

ii. Temperature Classification for a given gas/vapour is defined based on its' autoignition temperature (AIT).

Temperature Class	Max Surface Temperature, °C	AIT of Gas/Vapour, °C
T1	450	>450
T2	300	>300
T3	200	>200
T4	135	>135
T5	100	>100
T6	85	>85

iii. Assigned apparatus group meets or exceeds the minimum requirements dictated by the gas/vapours used.

iv. Assigned temperature classification meets or exceeds the minimum requirements dictated by the gas/vapours used.

v. The Production Facility will be assigned a temperature classification of T3, as process temperatures may exceed those allowed for T4 solvents. All equipment will be specified with a T3 temperature classification. T4 solvents may only be introduced to the facility however following a comprehensive risk assessment and revisit of Hazardous Area Classification, with process temperatures limited accordingly.

1.2 Facility Classification for Dusts

Based on the flammable properties of dusts listed in Appendix IV, the minimum required apparatus group and temperature classification for the facility are as listed below.

The actual apparatus group or temperature classification may be assigned more conservative values than these minimum requirements. These assigned values are also listed below.

	Minimum Required	**Actual Assigned**
Apparatus Group (w.r.t. dusts)	*IIIC*	*IIIC*
Temperature Classification (w.r.t. dusts)	*T200℃*	*T200℃*

Notes:

i. Apparatus Group for a dust is defined as follows:

Apparatus Groups (IEC60079-0)	
IIIA	Combustible Flyings
IIIB	Non-Conductive Dusts
IIIC	Conductive Dusts

Common pharmaceutical excipients fall into category IIIB, Non-Conductive Dusts.

ii. Temperature Classification for a dust is defined as the lower of the following two figures:

- 2/3rd of ignition temperature of a dust cloud
- ignition temperature of a dust layer – 75°C

(Ignition temperature of a dust layer is typically lower than the ignition temperature of a dust cloud).

Temperature classification is then listed as T followed by temperature, e.g. T135°C or T85°C.

iii. Assigned apparatus group meets or exceeds the minimum requirements dictated by the dusts present.

iv. Assigned temperature classification meets or exceeds the minimum requirements dictated by the dusts present.

2. FACILITY/PROJECT DESCRIPTION

2.1 Process Description

This document outlines the flammability / explosive properties of materials used during the Mixing and Packaging processes in the expansion of Building 03 Magh Nala, Magni.

2.1.1 Main Process Steps

1. Solids Charge Booth – System 410
2. Existing solids Charge Booth – System 322
3. Paint Mix and Mill – System 404
4. Paint Mix and Mill – System 405
5. SW200 Paint Mill – System 406
6. New Paint Filling Machine – System 408

Refer to the following drawings for details of the process steps and equipment used:

Drawing Number	Title	Revision
A20CK004-KD-41001	P&ID for Solids Charge Booth EB-410	A
A20CK004-KD-40401	P&ID for Paint Mill ML-404 & Paint Mixer MIX-404	A
A20CK004-KD-40501	P&ID for Paint Mill ML-405 & Paint Mixer MIX-405	A
A20CK004-KD-40601	P&ID for SW200 Paint Mill ML-406	A
A20CK004-KD-40801	P&ID for Paint Filling Machine FM0408	A
114101-KD-32201	P&ID for existing Paint Weigh Off Booth EB-322	0

A full list of proposed vapours and gases to be handled in the facility is included in Appendix II.

A full list of dusts to be handled in the facility is included in Appendix IV.

2.1.2 Unit Operations

For the purposes of this report the facility has been subdivided into the following areas:

System No.	Main Equipment	Ancillary Equipment
410	• EB-410, Extraction Booth for powder discharge • FN-41001, Extract fan for EB-410	• FL-41003/FL-41004, Hepa filter for FN-41001
404	• MIX-404, Paint Mixer • ML-404, Paint Mill	
405	• MIX-405, Paint Mixer • ML-405, Paint Mill	
406	• ML-406, SW200 paint mill	• P-40601, charging pump for ML-406
408	• Paint Filling Machine, FM-408	

3. AREA CLASSIFICATIONS

When undertaking Hazardous Area Classifications, DPS will design to ensure that Zone 1 or Zone 21 atmospheres are not present in occupied atmospheres. If assessment indicates that such an area is present, the design parameters shall be reviewed and amended to remove the Zone 1/21 zoning.

This guidance is based on the requirement in Article 3 of the ATEX Worker Protection Directive to prioritise the "prevention of the formation of explosive atmospheres".

Note:

If an area is designated as Zone 2 or 22, in DPS' role as designers we shall advise the client of the hazards and issues associated with this approach, including:

7. Occupational health issues. For example, acetone has an LEL of 2.6% while its OEL is 1500ppm (or approx. 0.15 %), with health effects including central nervous system toxicity and reproductive toxin.

8. Restrictions on presence of non-conducting surfaces, as outlined in EN ISO 80079-36:

Table ZB.1 — Correspondence of equipment groups

EN 60079-0		Directive 2014/34/EU		EN 60079-10-1 and EN 60079-10-2
EPL	**Group**	**Equipment Group**	**Equipment Category**	**Zones**
Ma	I	I	M1	NA
Mb			M2	
Ga	II	II	1G	0
Gb			2G	1
Gc			3G	2
Da	III		1D	20
Db			2D	21
Dc			3D	22

Table 8 – Permitted maximum projected areas for non-conductive parts of equipment liable to become electrostatically charged

EPL	Permitted projected area [c] mm²		
	IIA	IIB	IIC
Ga	5 000	2 500	400
Gb	10 000[a]	10 000[a]	2 000[a]
Gc	no size limit[b]	no size limit[b]	no size limit[b]

[a] where the intended use of the equipment can result in frequent incendive discharges occurring in normal operation, the criteria for EPL Ga equipment shall apply.

[b] where the intended use of the equipment can result in frequent incendive discharges occurring in normal operation, the criteria for EPL Gb equipment shall apply.

[c] Projected area: For sheet materials the area is defined by the exposed (chargeable) area. For curved and projecting objects the area is the projection of the object giving the maximum area i.e. the shadow image. For long narrow materials such as cable, sheaths or pipes the maximum size is defined by the transverse dimension (i.e. the diameter for cable, sheaths or pipes) when it is coiled it should be treated as a sheath.

These values may be multiplied by 4 if the exposed flat areas of plastics are surrounded by and in contact with conductive earthed frames.

3.1 Area Classifications with respect to flammable gases and vapours

With respect to flammable Gases and Vapours each area may fall in to any one of four following area classifications. Hazardous Area Classification is executed in accordance with EN 60079-10-1 (Classification of areas - Explosive gas atmospheres):

Zone 0: An area in which an explosive gas atmosphere is present continuously or for long periods or frequently.

Zone 1: An area in which an explosive gas atmosphere is likely to occur periodically or occasionally in normal operation.

Zone 2: An area in which an explosive gas atmosphere is not likely to occur in normal operation but, if it does occur, it will exist for a short period only.

Non-Hazardous: An area in which an explosive gas atmosphere is not expected to be present in quantities such as to require special precautions for the construction, installation and use of equipment.

3.2 Area Classification with respect to explosive dusts

With respect to explosive dusts each area may fall in to any one of four following area classifications. Hazardous Area Classification is executed in observation of IS-EN-60079-10-2:2015 (Classification of areas – Explosive dust atmospheres):

Zone 20: A place in which an explosive dust atmosphere in the form of a cloud of dust in air is present continuously, or for long periods or frequently.

Zone 21: A place in which an explosive dust atmosphere in the form of a cloud of dust in air is likely to occur in normal operation occasionally.

Zone 22:	A place in which an explosive dust atmosphere in the form of a cloud of combustible dust in air is not likely to occur in normal operation but, if it does occur, will persist for a short period only.
Non-Hazardous:	Area in which combustible dust in the form of a cloud is not expected to be present in quantities such as to require special precautions for the construction, installation and use of equipment.

3.3 Dual / Hybrid Classification

Areas may carry dual area classification with respect to (a) flammable gas & vapour and (b) explosive dust. The two classifications would occur at different times during different operations.

Where there is the possibility of flammable gas/vapour and explosive dust atmospheres occurring simultaneously, classification must consider a hybrid mixture.

A hybrid mixture is a combined mixture of a flammable gas or vapour with a combustible dust or combustible flyings. This hybrid mixture may behave differently than the gas/vapour or dust individually.

Where a hybrid mixture exists, consideration should be given to the assignment of both gas and dust zones to match the worst-case requirements for both the gas and dust hazard. The worst-case consequence should be considered.

4. HAZARDOUS ZONING – GASES AND VAPOURS

This procedure is taken from EN 60079-10-1 and is used to determine the hazardous zone type and extent.

For each release identified, steps 4.1 to 4.6 should be followed, with results recorded in the Source of Release Report in Appendix III. (Openings between areas should be considered as possible sources of release, as per 4.7.)

4.1 Identify Grade of Release (Continuous / Primary / Secondary)

Continuous	Release which is continuous or is expected to occur frequently or for long periods of time.
Primary	Release which can be expected to occur periodically or occasionally during normal operation.
Secondary	Release which is not expected to occur in normal operation & if it does occur, is likely to do so infrequently and for short periods of time.

The effectiveness of the ventilation in controlling dispersion and persistence of the explosive atmosphere will depend on the degree of dilution, the availability of ventilation and the design of the system.

4.2 Quantify the Release Rate

Having established the grade or grades of release, it is necessary to determine the release rate.

The release rate is the quantity of flammable gas, liquid, vapour or mist emitted per unit time from the source of release. It is the most important factor that affects the extent of a zone. Generally, the higher the release rate the larger the extent of the zone.

The release rate will depend on parameters such as:

a) Nature and type of release

b) Release velocity

c) Concentration

d) Volatility of a flammable liquid

e) Liquid Temperature

4.3 Identify the Degree of Dilution

High Dilution	The concentration near the source of release reduces quickly and there will be virtually no persistence after the release has stopped.
Medium Dilution	The concentration is controlled resulting in a stable zone boundary, whilst the release is in progress and the explosive gas atmosphere does not persist unduly after the release has stopped.
Low Dilution	There is a significant concentration whilst release is in progress and/or significant persistence of a flammable atmosphere after the release has stopped.

4.4 Identify the Availability of the Ventilation System

Good	Ventilation is present virtually continuously. This is applicable to instances where duty / standby fans exist with automatic start up on fan failure.
Fair	Ventilation is expected to be present during normal operation. Discontinuities are permitted provided they occur infrequently and for short periods.
Poor	Ventilation which does not meet the standard for fair or good, but discontinuities are not expected to occur for long periods.

Notes:

i. Ventilation that does not even meet the requirement of poor availability must not be considered to contribute to the ventilation of the area, i.e. low dilution would apply.

4.5 Identify the Type of Hazardous Zone

Based on the effectiveness of ventilation and availability of ventilation, identify the Type of Hazardous Zone:

Grade of Release	Effectiveness of Ventilation						
	High Dilution			Medium Dilution			Low Dilution
	Availability of Ventilation						
	Good	Fair	Poor	Good	Fair	Poor	Good, fair or poor
Continuous	Non-hazardous (Zone 0 NE)[a]	Zone 2 (Zone 0 NE)[a]	Zone 1 (Zone 0 NE)[a]	Zone 0	Zone 0 + Zone 2	Zone 0 + Zone 1	Zone 0
Primary	Non-hazardous (Zone 1 NE)[a]	Zone 2 (Zone 1 NE)[a]	Zone 2 (Zone 1 NE)[a]	Zone 1	Zone 1 + Zone 2	Zone 1 + Zone 2	Zone 1 or Zone 0[c]
Secondary[b]	Non-hazardous (Zone 2 NE)[a]	Non-hazardous (Zone 2 NE)[a]	Zone 2	Zone 2	Zone 2	Zone 2	Zone 1 and even Zone 0[c]

a: *Zone 0 NE, 1 NE or 2 NE indicates a theoretical zone which would be of negligible extent under normal conditions.*

b: *The zone 2 area created by a secondary grade of release may exceed that attributable to a primary or continuous grade of release; in this case, the greater distance should be taken.*

c: *Will be Zone 0 if the ventilation is so weak and the release is such that in practice an explosive gas atmosphere exists virtually continuously (i.e. approaching a 'no ventilation' condition).*

'+' signifies 'surrounded by'

Availability of ventilation in naturally ventilated enclosed spaces shall never be considered as good.

Primary grades of release include:

a) Seals of pumps, compressors or valves if release of flammable substance during normal operation is expected.

b) Water drainage points on vessels which contain flammable gases or liquids, which may release flammable substances into the atmosphere while draining off water during normal operation.

c) Sample points which are expected to release flammable substance into the atmosphere during normal operation.

d) Relief valves, vents and other openings which are expected to release flammable substances into the atmosphere during normal operation.

Secondary grades of release include:

a) Seals of pumps, compressors and valves where release of flammable substance during normal of the equipment is not expected.

b) Flanges, connections and pipe fittings, where release of flammable is not expected during operation.

c) Sample points which are not expected to release flammable substance during normal operation

d) Relief valves, vents and other openings which are not expected to release flammable substances into the atmosphere during normal operation.

4.6 Identify the Extent of the Hazardous Zone

The extent of the hazardous zone or region where flammable gas may occur depends on the release rate and several other factors such as gas properties and release geometry and surrounding geometry. Calculations may be performed reflecting the methodology proposed in EN60079-10-1, Annex D, Figure D.1. Other forms of calculation or assessment based on reputable sources may also be applied.

Results are detailed in the 'Source of Release Report (Gases/ Vapours)'attached in Appendix III and Hazardous Area Classification Drawings attached in Appendix VI.

4.7 Openings

Openings between areas should be considered as possible sources of release. The grade of release will depend upon:

- The zone type of the adjoining area
- The frequency and duration of opening periods
- The effectiveness of seals or joints
- The difference in pressure between the areas involved

As per EN-60079-10-1 openings are classified as follows:

Type A	Openings not conforming to the characteristics specified for types B, C, or D (e.g. open passages for access or utilities, openings which are frequently opened or fixed ventilation outlets in rooms, buildings and similar openings).
Type B	Openings which are normally closed (e.g. automatic closing), infrequently opened and close fitting.
Type C	Openings which are normally closed (e.g. automatic closing), infrequently opened and fitted with sealing devices (e.g. a gasket) along the whole perimeter or two type B openings in series, having independent automatic closing devices.
Type D	Openings which are effectively sealed, such as in utility passages or openings normally closed conforming to type C which can only be opened by special means or in an emergency; or a combination of one opening type C adjacent to a hazardous area and one opening type B in series.

The effect of openings on the grade of release when a hazardous zone has been established upstream of those openings can be seen below:

Zone Upstream of Opening	Opening Type	Grade of Release of Openings considered as Sources of Release
Zone 0	A	Continuous
	B	(Continuous)/primary
	C	Secondary
	D	Secondary/no release
Zone 1	A	Primary
	B	(Primary)/secondary
	C	(Secondary)/no release
	D	No release
Zone 2	A	Secondary
	B	(Secondary)/no release
	C	No release
	D	No release
For grades of release shown in brackets, the frequency of operation of the openings should be considered in the design.		

5. HAZARDOUS ZONING - DUSTS

This procedure is taken from EN 60079-10-2 and is used to determine the hazardous zone type and extent.

For each release identified, steps 5.1 to 5.3 should be followed, with results recorded in the 'Source of Release Report (Dusts)' in Appendix V.

The exercise shall be based on the following assumptions:

- Good housekeeping is maintained throughout the facility

5.1 Identify the Grade of Release (Continuous / Primary / Secondary)

Grade of Release	Description
Continuous	Release which is continuous or is expected to occur frequently or for long periods of time.
Primary	Release which can be expected to occur periodically or occasionally during normal operation.
Secondary	Release which cannot be expected to occur during normal operation & if it does occur, is likely to do so infrequently or for short periods of time.

5.2 Identify the Type of Hazardous Zone

Continuous	Zone 20
Primary	Zone 21
Secondary	Zone 22

5.3 Identify the Extent of the Hazardous Zone

The extent of a zone for explosive dust atmospheres is defined as the distance in any direction from the edge of a source of dust release to the point where the hazard associated with that zone is considered to no longer exist.

Where the classification gives rise to small unclassified areas between classified areas, the classification should be extended to the full area. The boundaries of Zone 21 and Zone 22 areas located outside should allow for the influence of variable weather effects such as wind.

Zone 20

The extent of Zone 20 includes the inside of ducts, producing and handling equipment in which explosive dust atmospheres are present continuously, for long periods, or frequently.

If an explosive dust atmosphere outside dust containment is continuously present, a Zone 20 classification is required.

Zone 21

The extent of Zone 21 is as follows:

- the inside of some dust handling equipment in which an explosive dust atmosphere is likely to occur periodically, for example starting and stopping of filling equipment.
- the Zone 21 formed outside the equipment by a primary grade of release.
- where the spread of dust is limited by mechanical structures (walls etc.), their surfaces can be taken as the boundary of the zone.

A non-confined Zone 21 (not limited by mechanical structures e.g. a vessel with an open man-hole) located inside, will usually be surrounded by a Zone 22.

In many situations, a distance of approximately 1m around the source of release is often sufficient (with a vertical downwards extension to the ground/solid floor).

Zone 22

The extent of Zone 22 is as follows:

- the extent of an area formed by a secondary grade source of release (or surrounding a zone 21).
- where the spread of dust is limited by mechanical structures, e.g. (walls etc.), their surfaces can be taken as the boundary of the zone.

In many situations, a distance of approximately 3m around the source of release is often sufficient (with a vertical downwards extension to the ground/solid floor).

Results are detailed in the Source of Release Report attached in Appendix V and Hazardous Area Classification Drawings attached in Appendix VI.

6. HOUSEKEEPING

6.1 Gases and Vapours

Housekeeping should consider:

- the availability of spill kits
- spill procedures to clean up solvent spills as they occur
- maintenance and the repair of leaks etc.

These will impact on the frequency and duration of the flammable atmosphere.

6.2 Powders and Dusts

It is imperative that 'good' housekeeping is maintained within the production facility in order to prevent the hazardous area zoning for dusts being extended due to the formation of dust layers.

As per EN60079-10-2:2015, the presence and duration of a dust layer depends on:

- the grade of release from the source of the dust
- the rate at which dust is deposited
- the effectiveness of housekeeping

Three levels of housekeeping can be described:

Good	Dust layers are kept to negligible thickness, or are non-existent, irrespective of the grade of release. In this case the risk of occurrence of explosive dust clouds from layers and the risk of fire due to layers has been removed.
Fair	Dust layers are not negligible but are short lived (typically less than one shift). The dust is removed before any fire can start.
Poor	Dust layers are not negligible and persist for a long period of time (typically more than one shift). The fire risk and secondary explosion risk may be significant.

7. KEY ORGANISATIONAL MEASURES

Magh Nala as an organisation is well versed in dealing with hazardous area classification and with operating within a hazardous environment. Organizational measures shall be detailed fully within the Client's Explosion Protection Document, but the following measures are recommended by DPS:

i. All parts of the Installation shall be earthed, including scoops and tools for processing powders, liners for charging/discharging etc. Avoid using materials of low electrical conductivity.

ii. Open handling of powders shall be minimised/eliminated, and operator training put in place to train operators to minimise the generation of dust clouds.

iii. All personnel assigned to carry out works in the Hazardous area shall have suitable safety training associated with the Hazards presented in this area.

iv. A permit system shall be put in place to carry out hot works in the area.

v. All Hazardous areas shall be labelled/ identified accordingly by the Client.

vi. Hazardous Area drawings shall be prepared and maintained identifying the extent of the Hazardous Zones.

vii. All mechanical equipment, motors, electrics, instrumentation, lighting and sockets to be used within the Hazardous areas previously identified shall be suitably rated for use within these areas.

viii. No surface in the Hazardous areas (including pipe surfaces & motor surfaces) shall be permitted to heat to temperatures greater than the temperature classification of any of the flammable powders or flammable liquids to be used in the Area.

7.1 Electrostatic Discharges

Typical electrostatic discharges which may be encountered in industry, and the energy that may be generated by such a discharge are as follows (Ref. Handbook of Batch Process Design – P.N. Sharratt):

Typical Discharge	Energy Generated
Charged Isolated Conductors (Spark discharge)	3-400mJ or more
Unearthed 200L Drum (Spark discharge)	50mJ
Unearthed Operator (Spark discharge)	30-50mJ
Discharge from Bulk Powder to metal container (Cone Discharge)	>10mJ
Insulating plastic, i.e. liner while charging (Brush discharge)	4mJ
Insulator with metal nearby (Propagating brush)	Up to 1-2J
Corona Discharge (Occurs close to Highly charged Electric field)	<0.1mJ

General guidance on electrostatic precautions for powder suspensions in air (Ref. Dust Explosion Prevention and Protection – A Practical Guide – Edited by John Barton):

MIE Minimum Ignition Energy	Precautions
500mJ	Low sensitivity to ignition. Earth plant when ignition energy is at or below this level
50mJ	Earth personnel when ignition energy is at or below this level
25mJ	The majority of ignition incidents occur when ignition energy is below this level
10mJ	High sensitivity to ignition. Particular attention should be paid to the use of high resistivity non-conductors when ignition energy is at or below this level
1mJ	The presence of an explosive dust cloud should be avoided wherever possible. Handling operations should be such that they minimize the possibility of suspending the powder in air. All possible steps should be taken to encourage the dissipation of charge and to discourage charge generation

APPENDIX I: DEFINITIONS

Explosive Gas Atmosphere:	A mixture with air, under atmospheric conditions, of a flammable material in the form of gas or vapour which, after ignition permits self-sustaining flame propagation.
Flammable Gas or Vapour:	Gas or vapour which when mixed with air in certain proportions, will form an explosive gas atmosphere.
Dilution:	The mixing of flammable vapour or gas with air which, over time, will reduce the flammable concentration.
Ventilation:	The movement of air and its replacement with fresh air due to the effects of wind, temperature gradients, or artificial means (for example, fans or extractors).
Hazardous Area:	An area in which an explosive gas atmosphere (or combustible dust in the form of a cloud) is present or may be expected to be present in quantities such as to require special precautions for construction, installation and use of equipment.
Non-Hazardous Area:	An area in which an explosive gas atmosphere (or combustible dust in the form of a cloud) is not expected to be present in quantities such as to require special precautions for the construction, installation and use of equipment.
Release characteristic	$W_g/(\rho_g \times k \times LFL)$ m^3/s Where: W_g = mass release rate of flammable substance (kg/s) ρ_g = density of gas or vapour (kg/m^3) k = safety factor attributed to LFL
Normal operation	When installations are used within their design parameters.
Source of Release:	A point or location from which a flammable gas, vapour or liquid (or combustible dust in the form of a cloud) may be released into the atmosphere such that an explosive atmosphere could be formed.
Flash Point:	The lowest liquid temperature at which under certain standardised conditions the liquid gives off vapours in quantities such as to be capable of forming an ignitable vapour/air mixture.
Lower Flammability Limit (LFL):	The concentration of flammable gas, vapour or mist in air below which an explosive gas atmosphere will not be formed.
Minimum Ignition Energy (MIE)	The smallest amount of energy that will produce ignition in a flammable system. This quantity usually refers to a measurement undertaken in a standard apparatus using a standardised procedure.
Auto-Ignition Temperature:	Lowest temperature at which spontaneous ignition of an explosive gas atmosphere occurs.
Explosive Dust Atmosphere:	A mixture with air, under atmospheric conditions, or flammable substances in the form of dust, which, after ignition, permits self-sustaining propagation.
Combustible Dust:	Finely divided solid particles, 500 µm or less in nominal size, which may form an explosive mixture with air at atmospheric pressure and normal temperatures.
Combustible Flyings:	Solid particles including fibres, greater than 500 µm in nominal size, which may form an explosive mixture with air at atmospheric pressure and normal temperatures NOTE 1 - Examples of flyings include rayon, cotton (including cotton linters and cotton waste) NOTE 2 - Combustible flyings are classified as Group IIIA

Non-Conductive Dust:	Combustible dust with electrical resistivity greater than 10^3 Ωm NOTE 3 - Non-conductive dust is classified as Group IIIB
Conductive Dust:	Combustible dust with electrical resistivity equal to or less than 10^3 Ωm NOTE 4 - Conductive dust is classified as Group IIIC
Ignition Temperature of a Dust Layer:	Lowest temperature of a surface at which ignition occurs in a dust on the surface.
Ignition Temperature of a Dust Cloud:	Lowest temperature of the hot inner wall of a furnace at which ignition occurs in a dust cloud in air contained therein.

APPENDIX II: FLAMMABLE PROPERTIES OF GASES AND VAPOURS

The process liquids and gases expected to be handled in the facility are listed in the table below.

Flammable Gases and Vapours

The proposed process liquids and gases to be handled are listed below.

Flammable Substance					LFL	Ex Characteristics	
Fluid	**Molecular Weight (g/mol)**	**Relative Density (gas/air)**	**Flash Point (°C)**	**AIT (°C)**	**Vol (%)**	**Equipment Group**	**Temp Class**
2-Propanol			12	399	2	IIB	T2
Butan-1-ol			28.9	343		IIA	T2
Isobutanol			28	415.56	1.7		T2
Naphthalene			79	567		IIA	T1
1,2,4-Trimethylbenzene			48	500	0.9	IIA	T1
p-Chlorobenzotrifluoride			42.8	>500			T1
Ethylbenzene			12.8	432	0.8	IIA	T2
2-Ethylhexan-1-ol			75	No Data Note 3	0.88		*** Note 3
Dimethyl succinate			85	365	1		T2
2-Methoxy-1-methylethyl acetate			42	No Data Note 3			*** Note 3

Flammable Substance					LFL	Ex Characteristics	
Fluid	**Molecular Weight (g/mol)**	**Relative Density (gas/air)**	**Flash Point (ºC)**	**AIT (ºC)**	**Vol (%)**	**Equipment Group**	**Temp Class**
Toluene			4.44	480		IIA	T1
Cyclohexanone			43.89	420	1.1	IIA	T1
Diethylene glycol monobutyl ether			77	228	0.9		T3
Dimethyl adipate			107	360	0.8		T2
Dimethyl glutarate			103	365			T2
Xylene			18	432	0.9	IIA	T2
Stoddard solvent			38	210			T3
Hydrocarbons, C10, aromatics, <1% naphthalene			66	No Data Note 3			*** Note 3
PMA	132.2	4.6	45.5	333	1.5	IIA	T2
<1% Naphthalene	126		63	477	0.6		T1
D.E.R. 732 P Epoxy Resin		1.06 – 1.1	194	300			T3
Tytan EHT	130.3	0.93	>70	No Data Note 3			*** Note 3
Tytan PBT		1.12	>45	No Data Note 3	1.4		*** Note 3

Flammable Substance					LFL	Ex Characteristics	
Fluid	**Molecular Weight (g/mol)**	**Relative Density (gas/air)**	**Flash Point (ºC)**	**AIT (ºC)**	**Vol (%)**	**Equipment Group**	**Temp Class**
Dynasylan VTMO		No Data	25	224	0.7		T3
Bykumen		No Data	26	>200	0.6		T3
Cherry Mask 5236		0.88	20	<375 Note 2	No Data		T3 Note 2
Tytan X85		0.945	64	240	No Data		T3

Notes:

1. Values taken from SDS' where available.
2. Cherry Mask is made up of five different acetates of which four have AIT's > 375, therefore it is assumed that the Temp Class of Cherry Mask is at worst, T3.
3. The AIT's and Temp Class of some materials are not known, however, they are used only in small quantities

APPENDIX III: SOURCE OF RELEASE REPORT (GASES/VAPOURS)

The following areas shall be rated based on the likelihood of the formation of explosive gas atmospheres as follows:

No.	Description	Grade of release	Location	Substance	Material State	Release Rate (kg/s)	Release Characteristic (m3/s)	Ventilation			Hazardous area			Reference	Comment
								Type	Degree	Availability	Zone type	Zone extent (m)			
												Vertical	Horizontal		
New Paint Dispersion Machines & Paint Mills (ML-405, ML-406, MIX-405, MIX-406)															
G1 /G2 /G3/G4	Paint Machine Internals	Continuous	Paint Suite	Various	Solvents	N/A	N/A	None	N/A	N/A	Zone 0 (IIB, T3)	Within Paint mixing/ milling Bowl	Within Paint mixing/ milling Bowl	N/A	Vent section to be added to the bellows combined with LEV will allow air from surrounding area to disperse flammable vapours.
G1 /G2 /G3/G4	External to machine – Evaporative leak	Continuous	Paint Suite	Various	Solvents	3.95 E-05 kg/s	0.0005 m3/s (With no LEV) 0.001 m3/s (With LEV)	Artificial	Medium	Good	Non Hazardous (Zone 0 Negligible Extent)	Negligible	Negligible	A20CK004-CALC-001	Failure scenario – Mill/ Mixer left running while failure of chilled water system occurs allowing solvent heat to 50 degC Vent section to be added to the bellows combined with LEV will allow air from surrounding area to disperse flammable vapours.
G1 /G2 /G3/G4	Entire paint suite	Secondary	Entire paint suite	Various	Solvents	N/A	N/A	Artificial	Low	Good	Zone 2 (IIB, T3)	Zone 2 (IIB, T3) Within Entire paint suite	Zone 2 (IIB, T3) Within Entire paint suite	Entire paint suite is rated Zone 2 as unsealed solvent drums and canisters may exist anywhere in this suite	None
SW200 Paint Mill (ML-406)															
G1 /G2 /G3/G4	Paint Mill Internals	Continuous	Paint Suite	Various	Solvents	N/A	N/A	None	N/A	N/A	Zone 0 (IIB, T3)	Within Paint Mill	Within Paint Mill	N/A	Installation of LEV to extract flammable vapours from atmosphere that will be dispersed while product

No.	Description	Grade of release	Location	Substance	Material State	Release Rate (kg/s)	Release Characteristic (m3/s)	Ventilation			Hazardous area			Reference	Comment
								Type	Degree	Availability	Zone type	Zone extent (m)			
												Vertical	Horizontal		
															is pumped into SW200 advised
G1 /G2 /G3/G4	External to machine	Continuous	Paint Suite	Various	Solvents	3.95 E-05 kg/s	0.0005 m3/s (With no LEV) 0.001 m3/s (With LEV)	Artificial	Medium	Good	Non Hazardous (Zone 0 Negligible Extent)	Negligible	Negligible	A20CK004-CALC-001	Failure scenario – Mill left running while failure of chilled water system occurs allowing solvent heat to 50 degC
Raw Material Weigh Up Booth EB-410 (in Paint Suite)															
G14	Within Powder Dispensing Booth in paint Suite	Continuous	Within Booth	Solvent vapours	Liquid	N/A	N/A	Artificial	High	Good	Non Hazardous (Zone 1 Negligible Extent)	Negligible	Negligible	N/A	Solvent processing is not used in this booth unless ventilation is on. In this respect, availability of ventilation may be regarded as good. High ventilation within this booth.
G14	External to Powder Dispensing Booth in paint Suite	Secondary	Paint Suite	Solvent vapours	Liquid	N/A	N/A	Artificial	Poor	Good	Zone 2 (IIB, T3)	Zone 2 (IIB, T3) Within entire paint suite	Zone 2 (IIB, T3) Within entire paint suite	N/A	Entire paint suite is rated Zone 2 as unsealed solvent drums and canisters may exist anywhere in this suite.
G14	Powder Dispensing Booth extract system	Secondary	Paint Suite	Solvent vapours	Liquid	N/A	N/A	Artificial	Poor	Good	Zone 1 (IIB, T3)	Within duct & Within fan	Within duct & Within fan	N/A	Same EEx Environment as that of the Booth
Pail / Drum Filling Machine FM-408															
G5	Pail / Barrel Filling Machine	Primary	Production Area	Various	Liquid	Pail Fill 2.77 E-04 kg/s Barrel Fill 5.54 E-03 kg/s	Pail Fill 0.0038 m3/s Barrel Fill 0.076 m3/s	Artificial	High	Good	Zone 2 (IIB, T3)	2.47m Zone 2 (IIB, T3) Within entire paint suite	2.47m Zone 2 (IIB, T3) Within entire paint suite	A20CK004-CALC-001	Failure Scenario – Leak of pail or barrel contents onto floor Room where Filling Station is to be installed is Zone 2 for whole room space

No.	Description	Grade of release	Location	Substance	Material State	Release Rate (kg/s)	Release Characteristic (m3/s)	Ventilation			Hazardous area			Reference	Comment
								Type	Degree	Availability	Zone type	Zone extent (m)			
												Vertical	Horizontal		
G6/ G7/ G8/ G9/ G10	Vapour Release during Pail / Barrel Filling	Primary	Production Area	Various	Gas	Pail Fill 3.53 E-04 kg/s Barrel Fill 1.18 E-03 kg/s	Pail Fill 0.005 m3/s Barrel Fill 0.0016 m3/s	Artificial	High	Good	Non Hazardous (Zone 1 Negligible Extent) With 0.25 m/s LEV installed	Negligible With 0.25 m/s LEV installed	Negligible With 0.25 m/s LEV installed	A20CK004-CALC-001	Failure Scenario – Leak of mineral spirits vapour while filling pail or barrel With no LEV installed, Zone 1 up to 1m from fill point in room. With 0.25 m/s LEV installed Zone reduces to Non Hazardous (Zone 1 NE)
Other Areas															
G11	Warehouse – Pail/ Barrel Spill	Secondary	Warehouse	Various	Liquid	5.54 E-03 kg/s	0.076 m3/s	Artificial	High	Good	Zone 2 (IIB, T3)	2.47m Zone 2 (IIB, T3) Within entire Warehouse	2.47m Zone 2 (IIB, T3) Within entire Warehouse	A20CK004-CALC-001	Failure Scenario – leak of pail/barrel contents onto floor
G12	Goods In/Out – Pail/Barrel Spill	Rare (2)	Goods In/ Out	Various	Liquid	3.34 E-02 kg/s	0.455 m3/s	Natural	High	Fair	No zone,	No zone	No zone	A20CK004-CALC-001	Failure Scenario – leak of pail/barrel contents onto floor
G13	Inter-connecting Pipework	Secondary	Production Area	Various	Liquid	0.225 E-03 kg/s	0.003 m3/s	Artificial	High	Good	Zone 2 (IIB, T3)	2.47m Zone 2 (IIB, T3) Within entire paint suite	2.47m Zone 2 (IIB, T3) Within entire paint suite	A20CK004-CALC-001	Failure scenario – leak from flange on pipe. Production area Zone 2
Instrumentation Lab															
G14	Release from hydrogen gas tap	Secondary	Laboratory	Hydrogen	Gas	Not calculated (see comments)	Not calculated (see comments)	Artificial	High	Good	Zone 2 NE	1. Hydrogen pressure is regulated to mbar levels outside the building 2. All pipework is durably tight technical connections (i.e. fully welded) 3. The lab is not sealed – the ceiling panels will not prevent hydrogen escaping into the main building roof void 4. The main building roof void is not sealed – hydrogen will escape from the building at a high point or with the building HVAC 5. A calculation was deemed unnecessary given the low pressure release rate and large ventilated volume			

Note 1: Hybrid Zones must be listed in both this table and Appendix V.

Note 2: Due to Magni implementing Work Instruction 504, a release in the goods in/out area and the corridor has been classed as a rare release under IEC 60079-10-1:2021 and therefore no ATEX zoning is applicable. This assessment relies on Magni preserving these control measures through the entire life of the facility.
Under WIN504, the movement of partially empty containers to/from the warehouse will be minimised and strict procedures for capping off containers will be followed. Flammable materials will not be stored in the area. Magni have a long history of safe movement of drums of flammable materials on this site.

APPENDIX IV: FLAMMABLE PROPERTIES OF DUSTS

The dusts expected to be handled in the facility are listed in the table below.

Combustible Dusts

The materials to be handled are listed below.

Powder	Flammable Dust (Yes/No)	Minimum Ignition Energy MIE (mJ)	Ignition Temperature of a Dust Cloud (°C)	Ignition Temperature of a Dust Layer (°C)	Temperature Classification of Dust
Zinc Powder	Yes	960 mJ	460°C	540°C	T (307°C)
Aluminium Powder	Yes (only in milling area)	1 mJ	400°C	230°C	T (155°C)
Bentone SD-3	Yes				
Sylysia 256N	No				
Hylar 301F	No	>500 mJ			
Zinc Paste	No				
CAB-O-SIL TS-530 Fumed Silica	No	>10 J (10,000 mJ)		>450°C	

APPENDIX V: SOURCE OF RELEASE REPORT (DUSTS)

The following areas shall be rated based on the likelihood of the formation of an explosive dust atmosphere as follows:

No.	Description	Grade of release	Location	Substance	Dust Layers	Hazardous area			Reference	Comment
						Zone type	Zone extent (m)			
							Vertical	Horizontal		
Raw Material Weigh-Up Booth EB-410 – Paint Suite										
D1	Within new Powder Dispensing Booth	N/A	Paint Mill Suite	Multiple Powders	No	Zone 21 (NE) (IIIC) + Zone 22 (IIIC)	Z21 (NE) Within entire Extract Booth + Z22 3m in all directions from front face of booth	Z21 (NE) Within entire Extract Booth + Z22 3m in all directions from front face of booth	N/A	New booth will be rated Zone 21 internally to match existing equipment, however DPS assessment is that due to the booth ventilation a Zone 21 of negligible extent + a Zone 22 to 3m from the booth, will exist in normal operation.
D2	Within existing Powder Dispensing Booth	N/A	Paint Mill Suite	Multiple Powders	No	Zone 21 (IIIC) + Zone 22 (IIIC)	Z21 Within entire Extract Booth + Z22 3m in all directions from front face of booth	Z21 Within entire Extract Booth + Z22 3m in all directions from front face of booth	N/A	Zone 21 because large powder additions occur in this booth. + Zone 22 3m in all directions from the front face of the booth.
D3	Within Paint dispensing machines MIX-306 & MIX-307 & MIX-405 & MIX-406	N/A	Paint Mill Suite	Multiple Powders	No	Zone 22 (IIIC)	Zone 22 (IIIC) Within the mill/mixer	Zone 22 (IIIC) Within the mill/mixer	N/A	Zone 22 to allow for powder additions to disperse in the Mixer/ mill. Will also allow for minor powder additions.
D4	Within Paint Mills ML-306 & ML-307 & ML-405 & ML-406	N/A	Paint Mill Suite	No powders present	No	Zone 22 (IIIC)	Zone 22 (IIIC) Within the mill/mixer	Zone 22 (IIIC) Within the mill/mixer	N/A	Zone 22 to allow for powder additions to disperse in the Mixer/ mill. Will also allow for minor powder additions.
D5	Within SW200 Paint Mill	N/A	Paint Mill Suite	No powders present	No	Zone 22 (IIIC)	Zone 22 (IIIC) Within the mill/mixer	Zone 22 (IIIC) Within the mill/mixer	N/A	Zone 22 to allow for powder additions to disperse in the Mixer/ mill. Will also allow for minor powder additions.
D6	Paint Filling Machine	N/A	Paint Mill Suite	No powders present	No	Non Hazardous	Non Hazardous - Within entire Paint suite (Excluding above Zone 22 area)	Non Hazardous - Within entire Paint suite (Excluding above Zone 22 area)		
D7	Paint Mill Suite	N/A	Paint Mill Suite	No powders present	No	Non Hazardous	Non Hazardous - Within entire Paint suite (Excluding above Zone 22 area)	Non Hazardous - Within entire Paint suite (Excluding above Zone 22 area)	N/A	Basis of the non hazardous zone is that no large powder transfers are done in the paint suite outside of the dispensing booth.

Note: Hybrid Zones must be listed in both this table and Appendix III.

APPENDIX VI: REFERENCED HAZARDOUS AREA DRAWINGS

Drawing. No.	Title	Rev
A20CK004-HZD-001	Building 3 Hazardous Area Drawing - Dust	A
A20CK004-HZD-002	Building 3 Hazardous Area Drawing – Gas Vapour Mist	A

APPENDIX VII: REFERENCE SPECIFICATIONS AND GUIDELINES

Document Number	Description
NFPA 497	Recommended Practice for the Classification of Flammable Liquids, Gases or Vapours and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas
Draeger Gas List 2011	List of detectable gases and vapours
I.S. EN-60079-10-1	Classification of Areas – Explosive gas atmospheres
I.S. EN-60079-10-2	Classification of Areas – Explosive dust atmospheres
I.S. EN ISO 80079-36:2016	Non-electrical Equipment for Explosive Atmospheres – Basic Method and Requirements
SR CLC/TR 60079-32-1:2015	Explosive atmospheres – Part 32-1: Electrostatic hazards, guidance

APPENDIX VIII: WAIVER

This Hazard Zoning Report represents the combined deliberations of client representatives and DPS Engineering as the study team members. The quality of this study, as for all similar studies, depends on the knowledge, experience, availability and commitment of the team members.

The Hazard Zoning Report forms part of a process of design and review and cannot be considered as a single, all-encompassing design review in and of itself alone. DPS Engineering take the Hazard Zoning process and all safety reviews very seriously and executes them in a diligent and professional manner.

DPS Engineering, the client and their employees, consultants and subcontractors have taken all reasonable efforts to perform this Hazardous Area Classification in an as detailed and as accurate a manner as possible given the available information at the time of the study. The team cannot, however, individually or collectively, predict all future events or scenarios that may arise. It is therefore possible that hazards or unforeseen accident scenarios may remain or have not been addressed by this study.

By following the recommendations and actions highlighted in the report the risk of accidents or their severity is likely to be reduced. Nevertheless, even if all the recommendations are followed, accidents and undesirable events can still occur.

This report records the proceedings of the study and observations made as opposed to independently verified fact. It is assumed for the purpose of the report that statements made during the course of the review by the relevant team members are correct.

This Hazard Zoning Report has been prepared by DPS Engineering solely for the benefit of DPS Engineering and the client. Neither DPS Engineering, nor any persons acting on its behalf, make any warranty (express or implied), or assumes any liability, with respect to the use of any information or methods contained in this report. Any recipient of this report, through use of this report or information contained therein releases DPS Engineering from liability for any direct, indirect, consequential or special loss or damage, whether arising in contract, tort (including negligence) or otherwise.

DPS Engineering can accept no liability for any incidents that might take place in the facility in future. DPS Engineering accepts no liability for any error, neglect or omission in information contained in or excluded from this document or in the review process itself. No responsibility is accepted for non-implementation or non-adherence to the advice given in this report.

APPENDIX IX: RISK ASSESSMENT PROCEDURE

In addition to the Hazardous Zones, this report analyses the flammability risks per area or equipment item to identify if the safeguards adequately mitigate against the risks. This risk assessment procedure is as per that outlined in I.S. EN ISO 80079-36: Non-electrical Equipment for Explosive Atmospheres – Basic Method and Requirements

Ignition Sources

The following 13 potential ignition sources, as described in I.S. EN ISO 80079-36 will be assessed:

- Hot surfaces
- Mechanically generated sparks
- Electrical apparatus
- Stray electric currents
- Static electricity
- Lightning
- Radio frequency (RF) waves
- Flames and hot gases
- Electromagnetic waves
- Ionizing radiation
- Ultrasonics
- Adiabatic Compression and shock waves
- Exothermic reactions including self-ignition of dusts

Risk Category

A risk category is identified using the following information:

Likelihood of an Explosive Incident:

This is determined by considering the likelihood of a flammable atmosphere, with the likelihood of an ignition source.

Likelihood of flammable atmosphere	Likelihood of an ignition source		
	Low (L)	Medium (M)	High (H)
N/A (Safe Area)	N/A – No Risk	N/A – No Risk	N/A – No Risk
Low (Zone 2 or Zone 22)	1	2	3
Medium (Zone 1 or Zone 21)	2	3	4
High (Zone 0 or Zone 20)	3	4	5

The resulting scores are defined as follows:

1 Highly Unlikely. Incident might be seen once in total life.

2 Unlikely. Event could occur at some time but would be unusual (Max 1 in 10 years).
3 Possible. Could occur one or more times every 5 years.
4 Likely. Event is foreseeable and is expected. Event could occur one or more times per year
5 Very Likely. Event is certain/near to certain to occur. Event could occur once or more per month. Risk condition almost continuously present

Consequence of Explosive Incident:

The consequence of an explosive incident shall be defined as follows:

Score	Category	Impact to Personnel	Environmental Impact	Business Impact
1	Negligible	Nil or slight injury/illness (possible first aid)	Slight property damage or environmental issue	Minimal Financial Loss
2	Minor	Minor injury/illness (requiring medical treatment/restricted work day case)	Minor property or environmental damage	Medium Financial Loss
3	Moderate	Moderate injury/illness (including Lost Time Injury)	Moderate property damage or environmental issue	High Financial Loss
4	Severe	Major injury/illness (Lost Time Injury and significant time off work)	Major property damage or environmental issue	Large Financial Loss
5	Catastrophic	Fatal or long term disabling injury or illness	Significant property damage or environmental issue	Massive Financial Loss

Overall Risk Matrix:

The likelihood and consequence ratings assigned above, are then multiplied to give a final risk rating:

Likelihood of an Explosive Incident	**Consequence of Explosive Incident**				
	1: Negligible	2: Minor	3: Moderate	4: Severe	5: Catastrophic
1: Highly Unlikely	1	2	3	4	5
2: Unlikely	2	4	6	8	10
3: Possible	3	6	9	12	15
4: Likely	4	8	12	16	20
5: Very Likely	5	10	15	20	25

Overall Risk Rating – Requirement for Further Action:

Further actions can be summarised as follows:

Level of Risk		**ACTION**
Low	1 - 4	Low risk – No further action.
Medium	5 - 12	Medium risk – Risk must be removed or reduced with suitable mitigation.
High	15 - 25	High risk – Action required immediately. If risk cannot be removed or reduced, then a detailed mitigation plan must be prepared.

ATEX RISK ASSESSMENT

Equipment Information : (1) Paint mills ML-404 & ML-405			
Equipment Name:	*2 No. Paint Mills*	Tag No.:	*ML-404/ ML-405*
Processing Flammable Powders	*No*	Processing Flammable Gases & Liquids	*Yes*
Zone Dust Classification:	*Zone 22, IIIC, T135°C (machine Internals)* *Zone 22, IIIC, T135°C (external to machine)*	Zone Solvent/Gas Classification	*Zone 0 (Machine Internals)*

No.	Ignition Source[1]	Activity	Source of Release	Safeguards Against Explosive Atmosphere	Hazardous Zone	Likelihood of Flammable Atmosphere Prevailing	Likelihood of Ignition Source	(A) Likelihood of Explosive Incident	(B) Consequence of Explosive Incident	Risk No. (A) x (B)	Level of Risk	Safeguards Against Ignition Source [Mitigation]	Action No
1	Hot Surface	*Heating vessel*	*Flange*	*None*	*Zone 0*	*High (Zone 0)*	*Low*	*3*	*4*	*12*	*Medium*	*ACTION No. 5 : Temperature monitoring of Mill shaft & interlocks recommended.*	*5*
2	Mechanically generated sparks	*Maintenance activity*	*Flange*	*None*	*Zone 0*	*High (Zone 0)*	*Low*	*3*	*4*	*12*	*Medium*	*ACTION No. 2 : Permit to work in place for any hot works carried out in ATEX Zone.*	*2*
	Mechanically generated sparks	*Dropped tool or other metal*	*Small amount of solvent assumed present on media after CIP*	*None*	*Zone 0*	*High (Zone 0)*	*Low*	3	5	15	Medium	***Action 19: Inlet grating*** *Review Machinery Directive with Netsche– how that impacts on ability to drop something into the vessel.* ***Action 20: Utilise non-sparking tools***	*19*,20
3	Electrical Apparatus	*Maintenance activity*	*Flange*	*None*	*Zone 0*	*High (Zone 0)*	*Low*	*3*	*4*	*12*	*Medium*	*ACTION No. 2 : Permit to work in place for any hot works carried out in ATEX Zone.*	*2*
	Electrical Apparatus	*Mobile phone or similar dropped into mill*	*Small amount of solvent assumed present on media after CIP*	*None*	*Zone 0*	*High (Zone 0)*	*Low*	*3*	*5*	*15*		***Action 19: Inlet grating*** *Review Machinery directive with Netsche – how that impacts on ability to drop something into the vessel.*	*19*
	Electrical Apparatus	*Mill motor*	*Pool of solvent above flashpoint inside mill*	*None*	*Zone 2*	*Low (Zone 2)*	*Unknown*					*Action 7: Confirm ATEX rating of mill vendor temperature sensor, motor and all other electrical equipment*	*7*
4	Stray Electrical currents	*None envisaged*	*Pool of solvent above flashpoint inside mill*	*None*	*Zone 0*	*High (Zone 0)*	*Low*	*3*	*4*	*12*	*Medium*	*ACTION No. 3 : All Equipment is earthed & bonded.*	*3*

No.	Ignition Source[1]	Activity	Source of Release	Safeguards Against Explosive Atmosphere	Hazardous Zone	Likelihood of Flammable Atmosphere Prevailing	Likelihood of Ignition Source	(A) Likelihood of Explosive Incident	(B) Consequence of Explosive Incident	Risk No. (A) x (B)	Level of Risk	Safeguards Against Ignition Source [Mitigation]	Action No
5	Static Electricity	*None envisaged*	*Pool of solvent above flashpoint inside mill*	*None*	*Zone 0*	*High (Zone 0)*	*Low*	*3*	*4*	*12*	*Medium*	*ACTION No. 3 : All Equipment is earthed & bonded.*	*3*
6	Lightning	*None envisaged*	*Pool of solvent above flashpoint inside mill*	*None*	*Zone 0*	*High (Zone 0)*	*Low*	*3*	*4*	*12*	*Medium*	*ACTION 4 : Lightning protection for the facility is required*	*4*
7	Radio Frequency (RF) Waves	*None envisaged - non-ATEX rated RF equipment prohibited from area*	*Pool of solvent above flashpoint inside mill*	*None*	*Zone 0*	*High (Zone 0)*	*None*	*N/A – No risk*	*4*	*None*	*None*	*Action 8: Maintain existing procedural controls*	*8*
8	Flames and Hot Gases	*Maintenance or construction activity*	*Pool of solvent above flashpoint inside mill*	*None*	*Zone 0*	*High (Zone 0)*	*Low*	*3*	*4*	*12*	*Medium*	*ACTION No. 2 : Permit to work in place for any hot works carried out in ATEX Zone.*	*2*
9	Electromagnetic Waves	*None Envisaged-non-ATEX rated RF equipment prohibited from area*	*Pool of solvent above flashpoint inside mill*	*None*	*Zone 0*	*High (Zone 0)*	*None*	*N/A – No risk*	*4*	*None*	*None*	*Action 8: Maintain existing procedural controls*	*8*
10	Ionizing radiation	*None envisaged-non-ATEX rated RF equipment prohibited from area*	*Pool of solvent above flashpoint inside mill*	*None*	*Zone 0*	*High (Zone 0)*	*None*	*N/A – No risk*	*4*	*None*	*None*	*Action 8: Maintain existing procedural controls*	*8*
11	Ultrasonics	*None envisaged-non-ATEX rated RF equipment prohibited from area*	*Pool of solvent above flashpoint inside mill*	*None*	*Zone 0*	*High (Zone 0)*	*None*	*N/A – No risk*	*4*	*None*	*None*	*Action 8: Maintain existing procedural controls*	*8*
12	Adiabatic Compression and shock waves	*None envisaged*	*Pool of solvent above flashpoint inside mill*	*None*	*Zone 0*	*High (Zone 0)*	*None*	*N/A – No risk*	*4*	*None*	*None*	*No sources present*	
13	Exothermic reactions including self-ignition of dusts	*None envisaged*	*Pool of solvent above flashpoint inside mill*	*None*	*Zone 0*	*High (Zone 0)*	*None*	*N/A – No risk*	*4*	*None*	*None*	*Action 18: Magni to confirm that desired chemical reaction within mill is not exothermic and not capable of thermal runaway.*	*18*

Notes:
1. Ref. I.S. EN ISO 80079-36: Non-electrical Equipment for Explosive Atmospheres – Basic Method and Requirements

Equipment Information : (2) Paint dispersion machines MIX-404 & MIX-405			
Equipment Name:	*2 No. Paint Mixers*	Tag No.:	*MIX-404/ MIX-405*
Processing Flammable Powders	*No*	Processing Flammable Gases & Liquids	*Yes*
Zone Dust Classification:	*Zone 22, IIIC, T135°C (machine Internals)* *Zone 22, IIIC, T135°C (external to machine)*	Zone Solvent/Gas Classification	*Zone 0 (Machine Internals)*

No.	Ignition Source[1]	Activity	Source of Release	Safeguards Against Explosive Atmosphere	Hazardous Zone	Likelihood of Flammable Atmosphere Prevailing	Likelihood of Ignition Source	(A) Likelihood of Explosive Incident	(B) Consequence of Explosive Incident	Risk No. (A) x (B)	Level of Risk	Safeguards Against Ignition Source [Mitigation]	Action No
1	Hot Surface	*Heating vessel*	*Flange*	*Operation above flashpoint is infrequent*	*Zone 0*	*High (Zone 0)*	*Low*	*3*	*4*	*12*	*Medium*	*ACTION No. 5 : Temperature monitoring of Mill shaft & interlocks recommended.*	*5*
2	Mechanically generated sparks	*Maintenance activity*	*Flange*	*Operation above flashpoint is infrequent*	*Zone 0*	*High (Zone 0)*	*Low*	*3*	*4*	*12*	*Medium*	*ACTION No. 2 : Permit to work in place for any hot works carried out in ATEX Zone.*	*2*
	Mechanically generated sparks	*Dropped tool or tramp metal*	*Small amount of solvent assumed present on media after CIP*	*Operation above flashpoint is infrequent*	*Zone 0*	*High (Zone 0)*	*Low*	3	5	15	Medium	***Action 19: Inlet grating*** *Review Machinery Directive with Netsche– how that impacts on ability to drop something into the vessel.* ***Action 20: Utilise non-sparking tools***	*19* *20*
3	Electrical Apparatus	*Maintenance activity*	*Flange*	*Operation above flashpoint is infrequent*	*Zone 0*	*High (Zone 0)*	*Low*	*3*	*4*	*12*	*Medium*	*ACTION No. 2 : Permit to work in place for any hot works carried out in ATEX Zone.*	*2*
	Electrical Apparatus	*Mobile phone or similar dropped into mixer*	*Small amount of solvent assumed present on media after CIP*	*Operation above flashpoint is infrequent*	*Zone 0*	*High (Zone 0)*	*Low*	*3*	*5*	*15*	*Medium*	***Action 19: Inlet grating*** *Review Machinery Directive with Netsche– how that impacts on ability to drop something into the vessel.*	*19*

No.	Ignition Source[1]	Activity	Source of Release	Safeguards Against Explosive Atmosphere	Hazardous Zone	Likelihood of Flammable Atmosphere Prevailing	Likelihood of Ignition Source	(A) Likelihood of Explosive Incident	(B) Consequence of Explosive Incident	Risk No. (A) x (B)	Level of Risk	Safeguards Against Ignition Source [Mitigation]	Action No
	Electrical Apparatus	*Mixer motor*	*Pool of solvent above flashpoint inside mix**er***	*Operation above flashpoint is infrequent*	*Zone 2*	*Low (Zone 2)*	*Low*	*1*	*4*	*4*	*Low*	*Action 7: Confirm ATEX rating of mixer and all other electrical equipment*	*7*
4	Stray Electrical currents	*None envisaged*	*Flange*	*Operation above flashpoint is infrequent*	*Zone 0*	*High (Zone 0)*	*Low*	*3*	*4*	*12*	*Medium*	*ACTION No. 3 : All Equipment is earthed & bonded.*	*3*
5	Static Electricity	*None envisaged*	*Flange*	*Operation above flashpoint is infrequent*	*Zone 0*	*High (Zone 0)*	*Low*	*3*	*4*	*12*	*Medium*	*ACTION No. 3 : All Equipment is earthed & bonded.*	*3*
6	Lightning	*None envisaged*	*Flange*	*Operation above flashpoint is infrequent*	*Zone 0*	*High (Zone 0)*	*Low*	*3*	*4*	*12*	*Medium*	*ACTION 4 : Lightning protection for the facility is required*	*4*
7	Radio Frequency (RF) Waves	*None envisaged - non-ATEX rated RF equipment prohibited from area*	*Flange*	*Operation above flashpoint is infrequent*	*Zone 0*	*High (Zone 0)*	*None*	*N/A – No risk*	*4*	*None*	*None*	*Action 8: Maintain existing procedural controls*	*8*
8	Flames and Hot Gases	*Maintenance or construction activity*	*Flange*	*Operation above flashpoint is infrequent*	*Zone 0*	*High (Zone 0)*	*Low*	*3*	*4*	*12*	*Medium*	*ACTION No. 2 : Permit to work in place for any hot works carried out in ATEX Zone.*	*2*
9	Electromagnetic Waves	*None Envisaged **-** None envisaged – non-ATEX rated equipment prohibited from area*	*Flange*	*Operation above flashpoint is infrequent*	*Zone 0*	*High (Zone 0)*	*None*	*N/A – No risk*	*4*	*None*	*None*	*Action 8: Maintain existing procedural controls*	*8*
10	Ionizing radiation	*None envisaged- None envisaged – non-ATEX rated equipment prohibited from area*	*Flange*	*Operation above flashpoint is infrequent*	*Zone 0*	*High (Zone 0)*	*None*	*N/A – No risk*	*4*	*None*	*None*	*Action 8: Maintain existing procedural controls*	*8*
11	Ultrasonics	*None envisaged- None envisaged – non-ATEX rated equipment prohibited from area*	*Flange*	*Operation above flashpoint is infrequent*	*Zone 0*	*High (Zone 0)*	*None*	*N/A – No risk*	*4*	*None*	*None*	*Action 8: Maintain existing procedural controls*	*8*

No.	Ignition Source[1]	Activity	Source of Release	Safeguards Against Explosive Atmosphere	Hazardous Zone	Likelihood of Flammable Atmosphere Prevailing	Likelihood of Ignition Source	(A) Likelihood of Explosive Incident	(B) Consequence of Explosive Incident	Risk No. (A) x (B)	Level of Risk	Safeguards Against Ignition Source [Mitigation]	Action No
12	Adiabatic Compression and shock waves	*None envisaged*	*Flange*	*Operation above flashpoint is infrequent*	*Zone 0*	*High (Zone 0)*	*None*	*N/A – No risk*	*4*	*None*	*None*	*No sources present*	
13	Exothermic reactions including self-ignition of dusts	*None envisaged*	*Flange*	*Operation above flashpoint is infrequent*	*Zone 0*	*High (Zone 0)*	*None*	*N/A – No risk*	*4*	*None*	*None*	*No Sources Present*	

Notes:
1. Ref. I.S. EN ISO 80079-36: Non-electrical Equipment for Explosive Atmospheres – Basic Method and Requirements

Equipment Information : (3) SW200 Mill ML-406			
Equipment Name:	*1 No. SW200 Paint Mill*	Tag No.:	*ML-406*
Processing Flammable Powders	*No*	Processing Flammable Gases & Liquids	*Yes*
Zone Dust Classification:	*Zone 22, IIIC, T135°C (machine Internals)* *Zone 22, IIIC, T135°C (external to machine)*	Zone Solvent/Gas Classification	*Zone 0 (Machine Internals)*

No.	Ignition Source[1]	Activity	Source of Release	Safeguards Against Explosive Atmosphere	Hazardous Zone	Likelihood of Flammable Atmosphere Prevailing	Likelihood of Ignition Source	(A) Likelihood of Explosive Incident	(B) Consequence of Explosive Incident	Risk No. (A) x (B)	Level of Risk	Safeguards Against Ignition Source [Mitigation]	Action No
1	Hot Surface	*Heating vessel*	*Flange*	*None*	*Zone 0*	*High (Zone 0)*	*Low*	*3*	*4*	*12*	*Medium*	*ACTION No. 5 : Temperature monitoring of Mill shaft & interlocks recommended.*	*5*
	Hot surface	*Bearing*	*Internal Overflow event*	*None*	*Zone 2 due to compressed air supply to bearing*	*Low (Zone 2)*	*Medium (Low with switch)*	2 (1)	5	10 (5)	Medium	*Action no. 6: Add low pressure switch on compressed air, interlocked with mill motor* *Action 7: Consider load cells to mill to detect gross overfill/underfill scenario, interlocked with mill (prevent start, but does not check once mill started?) or actuated inlet valve*	*6, 7*
	Hot surface	*Grinding media during dry running*	*Small amount of solvent assumed present on media after CIP*	*None*	*Zone 0*	*High (Zone 0)*	***Low***	3	5	15	Medium	***Jacket will boil at 100°C*** ***Mill is ATEX rated to not exceed 200°C*** ***Action 17: Add high temperature interlock to jacket return line – interlocking motor***	*17*
2	Mechanically generated sparks	*Maintenance activity*	*Flange*	*None*	*Zone 0*	*High (Zone 0)*	*Low*	*3*	*4*	*12*	*Medium*	*ACTION No. 2 : Permit to work in place for any hot works carried out in ATEX Zone.*	*2*

No.	Ignition Source[1]	Activity	Source of Release	Safeguards Against Explosive Atmosphere	Hazardous Zone	Likelihood of Flammable Atmosphere Prevailing	Likelihood of Ignition Source	(A) Likelihood of Explosive Incident	(B) Consequence of Explosive Incident	Risk No. (A) x (B)	Level of Risk	Safeguards Against Ignition Source [Mitigation]	Action No
	Mechanically generated sparks	*Grinding media during dry running*	*Small amount of solvent assumed present on media after CIP*	*None*	*Zone 0*	*High (Zone 0)*	*High*	5	4	20	High	Action 17: Add high temperature interlock to jacket return line – interlocking motor Action 7: Consider load cells to mill to detect gross overfill/underfill scenario, interlocked with mill Action 9: Maintain use of steel balls, due to concerns about static accumulation on ceramic	*17*
	Mechanically generated sparks	*Dropped tool or tramp metal*	*Small amount of solvent assumed present on media after CIP*	*None*	*Zone 0*	*High (Zone 0)*	*Low*	3	5	15	Medium	Action 19: Inlet grating Action 20: Utilise non-sparking tools Action 7: Consider load cells to mill to detect gross overfill/underfill scenario, interlocked with mill Action 10: Consider proximity switch interlock between access hatch and motor	*19, 20, 7, 10*
3	Electrical Apparatus	Maintenance activity	Flange	None	Zone 0	High (Zone 0)	Low	3	4	12	Medium	ACTION No. 2 : Permit to work in place for any hot works carried out in ATEX Zone.	2
	Electrical Apparatus	*Mobile phone or similar dropped into mill*	*Small amount of solvent assumed present on media after CIP*	*None*	*Zone 0*	*High (Zone 0)*	*Low*	*3*	*5*	*15*		*Action 19: Inlet grating* *Action 10: Consider proximity switch interlock between access hatch and motor*	*19*

No.	Ignition Source[1]	Activity	Source of Release	Safeguards Against Explosive Atmosphere	Hazardous Zone	Likelihood of Flammable Atmosphere Prevailing	Likelihood of Ignition Source	(A) Likelihood of Explosive Incident	(B) Consequence of Explosive Incident	Risk No. (A) x (B)	Level of Risk	Safeguards Against Ignition Source [Mitigation]	Action No
	Electrical Apparatus	*Infra-red sensor*	*Pool of solvent above flashpoint inside mill*	*None*	*Zone 0*	*High (Zone 0)*	*Unknown*					*Action 11: Confirm ATEX rating of mill vendor infra-red sensor, motor and all other electrical equipment*	*11*
	Electrical Apparatus	*Mill motor*	*Pool of solvent above flashpoint inside mill*	*None*	*Zone 2*	*Low (Zone 2)*	*Unknown*					*Action 11: Confirm ATEX rating of mill vendor infra-red sensor, motor and all other electrical equipment*	*11*
4	Stray Electrical currents	*None envisaged*	*Flange*	*None*	*Zone 0*	*High (Zone 0)*	*Low*	*3*	*4*	*12*	*Medium*	*ACTION No. 3 : All Equipment is earthed & bonded.*	*3*
5	Static Electricity	*None envisaged*	*Flange*	*None*	*Zone 0*	*High (Zone 0)*	*Low*	*3*	*4*	*12*	*Medium*	*ACTION No. 3 : All Equipment is earthed & bonded.*	*3*
	Static electricity *(scenario relevant only if ceramic beads are used with non-conductive solvent)*	*Grinding media during dry running*	*Small amount of solvent assumed present on media after CIP*	*None*	*Zone 0*	*High (Zone 0)*	*High*	5	4	20	High	*Action 17: Add high temperature interlock to jacket return line – interlocking motor* *Action 7: Consider load cells to mill to detect gross overfill/underfill scenario, interlocked with mill* *Action 9: Maintain use of steel balls, due to concerns about static accumulation on ceramic* *Action 12: Do not introduce a product that required milling in non-conductive solvents/paint mixtures*	*17, 7, 9, 12*

No.	Ignition Source[1]	Activity	Source of Release	Safeguards Against Explosive Atmosphere	Hazardous Zone	Likelihood of Flammable Atmosphere Prevailing	Likelihood of Ignition Source	(A) Likelihood of Explosive Incident	(B) Consequence of Explosive Incident	Risk No. (A) x (B)	Level of Risk	Safeguards Against Ignition Source [Mitigation]	Action No
	Static electricity	*Mobile equipment (totes and pumps*	*Splash filling of tote from mill, contents above flashpoint.*	*None*	*Zone 1 inside tote*	*Medium (Zone 1)*	*High*	*4*	*5*	*20*	*High*	*Action 13: Establish it if is an operational requirement to discharge above flashpoint and control with procedures if possible* *Action 14: Earthing clamps on discharge tote* *Action 15: Dip tube to prevent splash filling (add to P&ID if SW mill raised)* *Action 16: Install earthing detection clamp with fault interlock to mill discharge actuated valve*	*13,14,15*
6	Lightning	*None envisaged*	*Flange*	*None*	*Zone 0*	*High (Zone 0)*	*Low*	*3*	*4*	*12*	*Medium*	*ACTION 4 : Lightning protection for the facility is required*	*4*
7	Radio Frequency (RF) Waves	*None envisaged – non-ATEX rated RF equipment prohibited from area*	*Flange*	*None*	*Zone 0*	*High (Zone 0)*	*None*	*N/A – No risk*	*4*	*None*	*None*	*Action 8: Maintain existing procedural controls*	*8*
8	Flames and Hot Gases	*Maintenance or construction activity*	*Flange*	*None*	*Zone 0*	*High (Zone 0)*	*Low*	*3*	*4*	*12*	*Medium*	*ACTION No. 2 : Permit to work in place for any hot works carried out in ATEX Zone.*	*2*
9	Electromagnetic Waves	*None envisaged – non-ATEX rated equipment prohibited from area*	*Flange*	*None*	*Zone 0*	*High (Zone 0)*	*None*	*N/A – No risk*	*4*	*None*	*None*	*Action 8: Maintain existing procedural controls*	*8*
10	Ionizing radiation	*None envisaged – non-ATEX rated equipment prohibited from area*	*Flange*	*None*	*Zone 0*	*High (Zone 0)*	*None*	*N/A – No risk*	*4*	*None*	*None*	*Action 8: Maintain existing procedural controls*	*8*
11	Ultrasonics	*None envisaged – non-ATEX rated equipment prohibited from area*	*Flange*	*None*	*Zone 0*	*High (Zone 0)*	*None*	*N/A – No risk*	*4*	*None*	*None*	*Action 8: Maintain existing procedural controls*	*8*

No.	Ignition Source[1]	Activity	Source of Release	Safeguards Against Explosive Atmosphere	Hazardous Zone	Likelihood of Flammable Atmosphere Prevailing	Likelihood of Ignition Source	(A) Likelihood of Explosive Incident	(B) Consequence of Explosive Incident	Risk No. (A) x (B)	Level of Risk	Safeguards Against Ignition Source [Mitigation]	Action No
12	Adiabatic Compression and shock waves	*None envisaged*	*Flange*	*None*	*Zone 0*	*High (Zone 0)*	*None*	*N/A – No risk*	*4*	*None*	*None*	*No sources present*	
13	Exothermic reactions including self-ignition of dusts	*Unknown*	*Flange*	*None*	*Zone 0*	*High (Zone 0)*	*None*	*N/A – No risk*	*4*	*None*	*None*	*Action 18: Magni to confirm that desired chemical reaction within mill is not exothermic and not capable of thermal runaway.*	*18*

Notes:
1. Ref. I.S. EN ISO 80079-36: Non-electrical Equipment for Explosive Atmospheres – Basic Method and Requirements

Equipment Information : (4) Solids Charge Booths EB-410			
Equipment Name:	*2 No. Solids Charge Booths*	Tag No.:	*EB-410*
Processing Flammable Powders	*No*	Processing Flammable Gases & Liquids	*Yes*
Zone Dust Classification:	*Zone 21, IIIC, T135°C (machine Internals)* *Zone 22, IIIC, T135°C (external to machine)*	Zone Solvent/Gas Classification	*Zone 2, IIB T3*

No.	Ignition Source[1]	Activity	Source of Release	Safeguards Against Explosive Atmosphere	Hazardous Zone	Likelihood of Flammable Atmosphere Prevailing	Likelihood of Ignition Source	(A) Likelihood of Explosive Incident	(B) Consequence of Explosive Incident	Risk No. (A) x (B)	Level of Risk	Safeguards Against Ignition Source [Mitigation]	Action No
1	Hot Surface	*Forklift truck*	*Open vessel*	*None*	*Zone 2 / 22*	*Low (Zone 2 / 22)*	*Me**dium***	*2*	*5*	*10*	*Me**dium***	Action 21: Ensure ATEX Rating of Forklift Truck Magni to maintain forktrucks and ensure ATEX rating compliant.	*21*
2	Mechanically generated sparks	*Drop tool, forklift mechanical contract*	*Open vessel*	*None*	*Zone 2 / 22*	*Low (Zone 2 / 22)*	*Me**dium***	*2*	*5*	*10*	*Me**dium***	*ACTION No. 2 : Permit to work in place for any hot works carried out in ATEX Zone.* *Action 20: Utilise non-sparking tools* *Action 22: Maintain forklift operator training*	*2, 20, 22*
3	Electrical Apparatus	*Lights and weigh scales in booth*	*Open vessel*	*None*	*Zone 2 / 22*	*Low (Zone 2 / 22)*	*Me**dium***	*2*	*5*	*10*	*Me**dium***	*Action 23: Ensure ATEX rating of electrical equipment*	*23*

No.	Ignition Source[1]	Activity	Source of Release	Safeguards Against Explosive Atmosphere	Hazardous Zone	Likelihood of Flammable Atmosphere Prevailing	Likelihood of Ignition Source	(A) Likelihood of Explosive Incident	(B) Consequence of Explosive Incident	Risk No. (A) x (B)	Level of Risk	Safeguards Against Ignition Source [Mitigation]	Action No
4	Stray Electrical currents	*Lights and weigh scales in booth*	*Open vessel*	*None*	*Zone 2 / 22*	*Low (Zone 2 / 22)*	*Me**dium***	*2*	*5*	*10*	*Me**dium***	*ACTION No. 3 : All Equipment is earthed & bonded.*	*3*
5	Static Electricity	*Splash filling solvents*	*Open vessel*	*None*	*Zone 2 / 22*	*Low (Zone 2 / 22)*	*Me**dium***	*2*	*5*	*10*	*Me**dium***	*ACTION No. 3 : All Equipment is earthed & bonded.* *Action 24: Earthing reels (for tote and forklift) and interlock with weigh scale* *Action 25: Utilise a J tube, or equivalent, to minimise splashing* *Action 26: Consider pneumatic pump to enable liquid transfer* *Action 27: Modify P&ID to illustrate splash filling* *Action 34: Confirm which solvents are static accumulators and the volumes used*	*3,24,25,26, 27, 34*
6	Lightning	*None envisaged*	*Flange*	*None*	*Zone 2 / 22*	*Low (Zone 2 / 22)*	*Low*	*N/A – No risk*	*N/A – No risk*	*N/A – No risk*	*N/A – No risk*	*ACTION 4 : Lightning protection for the facility is required*	*4*
7	Radio Frequency (RF) Waves	*None envisaged - non-ATEX rated RF equipment prohibited from area*	*Flange*	*None*	*Zone 2 / 22*	*Low (Zone 2 / 22)*	*None*	*N/A – No risk*	*3*	*None*	*None*	*Action 8: Maintain existing procedural controls*	*8*
8	Flames and Hot Gases	*Maintenance or construction activity*	*Flange*	*None*	*Zone 2 / 22*	*Low (Zone 2 / 22)*	*Low*	*2*	*3*	*6*	*Medium*	*ACTION No. 2 : Permit to work in place for any hot works carried out in ATEX Zone.*	*2*
9	Electromagnetic Waves	*None Envisaged - non-ATEX rated equipment prohibited from area*	*Flange*	*None*	*Zone 2 / 22*	*Low (Zone 2 / 22)*	*None*	*N/A – No risk*	*3*	*None*	*None*	*Action 8: Maintain existing procedural controls*	*8*
10	Ionizing radiation	*None envisaged - non-ATEX rated equipment prohibited from area*	*Flange*	*None*	*Zone 2 / 22*	*Low (Zone 2 / 22)*	*None*	*N/A – No risk*	*3*	*None*	*None*	*Action 8: Maintain existing procedural controls*	*8*
11	Ultrasonics	*None envisaged- non-ATEX rated equipment prohibited from area*	*Flange*	*None*	*Zone 2 / 22*	*Low (Zone 2 / 22)*	*None*	*N/A – No risk*	*3*	*None*	*None*	*Action 8: Maintain existing procedural controls*	*8*
12	Adiabatic Compression and shock waves	*None envisaged*	*Flange*	*None*	*Zone 2 / 22*	*Low (Zone 2 / 22)*	*None*	*N/A – No risk*	*3*	*None*	*None*	*No sources present*	
13	Exothermic reactions including self-ignition of dusts	*None envisaged*	*Flange*	*None*	*Zone 2 / 22*	*Low (Zone 2 / 22)*	*None*	*N/A – No risk*	*3*	*None*	*None*	*Action 28: Magni to confirm there is no exothermic reaction capable of thermal runaway.*	*28*

Notes:

1. Ref. I.S. EN ISO 80079-36: Non-electrical Equipment for Explosive Atmospheres – Basic Method and Requirements

Equipment Information : (5) New Paint Filling Machine FM-408			
Equipment Name:	*1 No. Filling Machine*	Tag No.:	*FM-408*
Processing Flammable Powders	*No*	Processing Flammable Gases & Liquids	*Yes*
Zone Dust Classification:	*N/A – No dusts present*	Zone Solvent/Gas Classification	*Non Hazardous (Zone 1 NE)* ***– Assuming 0.25 m/s LEV installed***

No.	Ignition Source[1]	Activity	Source of Release	Safeguards Against Explosive Atmosphere	Hazardous Zone	Likelihood of Flammable Atmosphere Prevailing	Likelihood of Ignition Source	(A) Likelihood of Explosive Incident	(B) Consequence of Explosive Incident	Risk No. (A) x (B)	Level of Risk	Safeguards Against Ignition Source [Mitigation]	Action No
1	Hot Surface	*Heating vessel*	*Flange*	*None*	*Non Hazardous (Zone 1 NE)*	*Low (NH, Zone 1 NE)*	*Low*	*2*	*3*	*6*	*Medium*	*ACTION No. 1 : All equipment to be protected from direct sunlight such that filling nozzle contents may not be heated to 36°C.*	*1*
	Hot Surface	***Dead head centrifugal pump***	*Pump*	*No oxygen inside and no vapour space inside pump*	*Zone 2*	*Low*	*Low*	*1*	*4*	*4*	*Low*	*Action 31: Pump should be ATEX rated below 200C,(check the rating of the pump)*	*31*
2	Mechanically generated sparks	*Maintenance activity*	*Flange*	*Routine operation below flashpoint*	*Non Hazardous (Zone 1 NE)*	*Low (NH, Zone 1 NE)*	*Low*	*2*	*3*	*6*	*Medium*	*ACTION 2 : Permit to work in place for any hot works carried out in ATEX Zone.*	*2*
3	Electrical Apparatus	*Maintenance activity*	*Flange*	*Routine operation below flashpoint*	*Non Hazardous (Zone 1 NE)*	*Low (NH, Zone 1 NE)*	*Low*	*2*	*3*	*6*	*Medium*	*ACTION No. 2 : Permit to work in place for any hot works carried out in ATEX Zone.* *Action 32: Ensure equipment is ATEX rated*	*2, 32*
4	Stray Electrical currents	*None envisaged*	*Flange*	*Routine operation below flashpoint*	*Non Hazardous (Zone 1 NE)*	*Low (NH, Zone 1 NE)*	*Low*	*2*	*3*	*6*	*Medium*	*ACTION No. 3 : All Equipment is earthed & bonded.*	*3*
5	Static Electricity	*Mobile equipment accumulating static*	*Flange*	*Routine operation below flashpoint*	*Non Hazardous (Zone 1 NE)*	*Low (NH, Zone 1 NE)*	*Low*	*1*	*3*	*3*	*Low*	*ACTION No. 3 : All Equipment is earthed & bonded.* *Action 33: Include interlock earthing reel for the tote and filling machine with operation of the pump*	*2, 33*
	Static Electricity	*Non conductive paint transfer*	*Flange*	*Routine operation below flashpoint*	*Non Hazardous (Zone 1 NE)*	*Low (NH, Zone 1 NE)*	*Low*	*1*	*3*	*3*	*Low*	*ACTION No. 3 : All Equipment is earthed & bonded.* *Action 29: Consider minimise velocity of filling to less than 1m/s*	*3,29*
6	Lightning	*None envisaged*	*Flange*	*None*	*Non Hazardous (Zone 1 NE)*	*Low (NH, Zone 1 NE)*	*Low*	*2*	*3*	*6*	*Medium*	*ACTION 4 : Lightning protection for the facility is required*	*4*
7	Radio Frequency (RF) Waves	*None envisaged non-ATEX rated RF equipment prohibited from area*	*Flange*	*Routine operation below flashpoint*	*Non Hazardous (Zone 1 NE)*	*Low (NH, Zone 1 NE)*	*Low*	*1*	*3*	*3*	*Low*	*Action 8: Maintain existing procedural controls*	*8*

No.	Ignition Source[1]	Activity	Source of Release	Safeguards Against Explosive Atmosphere	Hazardous Zone	Likelihood of Flammable Atmosphere Prevailing	Likelihood of Ignition Source	(A) Likelihood of Explosive Incident	(B) Consequence of Explosive Incident	Risk No. (A) x (B)	Level of Risk	Safeguards Against Ignition Source [Mitigation]	Action No
8	Flames and Hot Gases	*Maintenance or construction activity*	*Flange*	*Routine operation below flashpoint*	*Non Hazardous (Zone 1 NE)*	*Low (NH, Zone 1 NE)*	*Low*	*2*	*3*	*6*	*Medium*	*ACTION No. 2 : Permit to work in place for any hot works carried out in ATEX Zone.*	*2*
9	Electromagnetic Waves	*None Envisaged non-ATEX rated equipment prohibited from area*	*Flange*	*Routine operation below flashpoint*	*Non Hazardous (Zone 1 NE)*	*Low (NH, Zone 1 NE)*	*Low*	*1*	*3*	*3*	*Low*	*Action 8: Maintain existing procedural controls*	*8*
10	Ionizing radiation	*None envisaged - non-ATEX rated equipment prohibited from area*	*Flange*	*Routine operation below flashpoint*	*Non Hazardous (Zone 1 NE)*	*Low (NH, Zone 1 NE)*	*Low*	*1*	*3*	*3*	*Low*	*Action 8: Maintain existing procedural controls*	*8*
11	Ultrasonics	*None envisaged - non-ATEX rated equipment prohibited from area*	*Flange*	*Routine operation below flashpoint*	*Non Hazardous (Zone 1 NE)*	*Low (NH, Zone 1 NE)*	*None*	*N/A – No risk*	*3*	*None*	*None*	*Action 8: Maintain existing procedural controls*	*8*
12	Adiabatic Compression and shock waves	*None envisaged*	*Flange*	*Routine operation below flashpoint*	*Non Hazardous (Zone 1 NE)*	*Low (NH, Zone 1 NE)*	*None*	*N/A – No risk*	*3*	*None*	*None*	*No sources present*	
13	Exothermic reactions including self-ignition of dusts	*None envisaged*	*Flange*	*Routine operation below flashpoint*	*Non Hazardous (Zone 1 NE)*	*Low (NH, Zone 1 NE)*	*None*	*N/A – No risk*	*3*	*None*	*None*	*Action 30: Magni to confirm there is no exothermic chemical reaction or runaway within the filling machine*	*30*

Notes:

1. Ref. I.S. EN ISO 80079-36: Non-electrical Equipment for Explosive Atmospheres – Basic Method and Requirements

Equipment Information : (6) Paint Suite Production Area, Warehouse and Goods In/ Out			
Equipment Name:	*External to all Equipment*	Tag No.:	*N/A*
Processing Flammable Powders	*No*	Processing Flammable Gases & Liquids	*Yes*
Zone Dust Classification:	*N/A – No dusts present*	Zone Solvent/Gas Classification	*Zone 2*

No.	Ignition Source[1]	Activity	Source of Release	Safeguards Against Explosive Atmosphere	Hazardous Zone	Likelihood of Flammable Atmosphere Prevailing	Likelihood of Ignition Source	(A) Likelihood of Explosive Incident	(B) Consequence of Explosive Incident	Risk No. (A) x (B)	Level of Risk	Safeguards Against Ignition Source [Mitigation]	Action No
1	Hot Surface	*Heating vessel, Forklift Truck*	*Flange*	*None*	*Zone 2*	*Low (Zone 2)*	*Low*	*2*	*4*	*8*	*Medium*	*ACTION 1: All equipment to be protected from direct sunlight such that filling nozzle contents may not be heated to 36°C.* *Action 21: Ensure ATEX Rating of Forklift Truck*	*1, 21*
2	Mechanically generated sparks	*Maintenance activity, Drop tool. Forklift*	*Flange*	*None*	*Zone 2*	*Low (Zone 2)*	*Low*	*2*	*4*	*8*	*Medium*	*ACTION No. 2 : Permit to work in place for any hot works carried out in ATEX Zone.* *Action 20: Utilise non-sparking tools* *Action 22: Maintain forklift operator training*	*2, 20, 22*
3	Electrical Apparatus	*Maintenance activity*	*Flange*	*None*	*Zone 2*	*Low (Zone 2)*	*Low*	*2*	*4*	*8*	*Medium*	*ACTION No. 2 : Permit to work in place for any hot works carried out in ATEX Zone.* *Action 23: Ensure ATEX rating of electrical equipment*	*2, 23*
4	Stray Electrical currents	*None envisaged*	*Flange*	*None*	*Zone 2*	*Low (Zone 2)*	*Low*	*2*	*4*	*8*	*Medium*	*ACTION No. 3 : All Equipment is earthed & bonded.*	*3*
5	Static Electricity	*None envisaged*	*Flange/open vessel*	*None*	*Zone 2*	*Low (Zone 2)*	*Low*	*2*	*4*	*8*	*Medium*	*ACTION No. 3 : All Equipment is earthed & bonded.* *Action 26: Consider pneumatic pump to enable liquid transfer* *Action 34: Confirm which solvents are static accumulators and the volumes used*	*3, 26, 34*
6	Lightning	*None envisaged*	*Flange*	*None*	*Zone 2*	*Low (Zone 2)*	*Low*	*2*	*4*	*8*	*Medium*	*ACTION 4 : Lightning protection for the facility is required*	*4*
7	Radio Frequency (RF) Waves	*None envisaged – non ATEX rated equipment prohibited from area*	*Flange*	*None*	*Zone 2*	*Low (Zone 2)*	*None*	*N/A – No risk*	*3*	*None*	*None*	*Action 8: Maintain existing procedural controls*	*8*
8	Flames and Hot Gases	*Maintenance or construction activity*	*Flange*	*None*	*Zone 2*	*Low (Zone 2)*	*Low*	*2*	*3*	*6*	*Medium*	*ACTION No. 2 : Permit to work in place for any hot works carried out in ATEX Zone.*	*2*

No.	Ignition Source[1]	Activity	Source of Release	Safeguards Against Explosive Atmosphere	Hazardous Zone	Likelihood of Flammable Atmosphere Prevailing	Likelihood of Ignition Source	(A) Likelihood of Explosive Incident	(B) Consequence of Explosive Incident	Risk No. (A) x (B)	Level of Risk	Safeguards Against Ignition Source [Mitigation]	Action No
9	Electromagnetic Waves	*None Envisaged - non ATEX rated equipment prohibited from area*	*Flange*	*None*	*Zone 2*	*Low (Zone 2)*	*None*	*N/A – No risk*	*3*	*None*	*None*	*Action 8: Maintain existing procedural controls*	*8*
10	Ionizing radiation	*None envisaged - Action 8: Maintain existing procedural controls*	*Flange*	*None*	*Zone 2*	*Low (Zone 2)*	*None*	*N/A – No risk*	*3*	*None*	*None*	*Action 8: Maintain existing procedural controls*	*8*
11	Ultrasonics	*None envisaged*	*Flange*	*None*	*Zone 2*	*Low (Zone 2)*	*None*	*N/A – No risk*	*3*	*None*	*None*	*No sources present*	
12	Adiabatic Compression and shock waves	*None envisaged*	*Flange*	*None*	*Zone 2*	*Low (Zone 2)*	*None*	*N/A – No risk*	*3*	*None*	*None*	*No sources present*	
13	Exothermic reactions including self-ignition of dusts	*None envisaged*	*Flange*	*None*	*Zone 2*	*Low (Zone 2)*	*None*	*N/A – No risk*	*3*	*None*	*None*	*Action 28: Magni to confirm there is no exothermic reaction capable of thermal runaway.*	*28*

Notes:
1. Ref. I.S. EN ISO 80079-36: Non-electrical Equipment for Explosive Atmospheres – Basic Method and Requirements

Client Reponses to Action Numbers (ASITE Meeting ID: MOM034)

Action No	Safeguards Against Ignition Source [Mitigation]	Client Response
1	All equipment to be protected from direct sunlight such that filling nozzle contents may not be heated to 36°C.	*Confirmed. No direct sunlight*
2	Permit to work in place for any hot works carried out in ATEX Zone.	*Confirmed. Permit system in place*
3	All Equipment is earthed & bonded.	*Confirmed*
4	Lightning protection for the facility is required	*Lightening protection is outside of the project budget*
5	Temperature monitoring of Mill shaft & interlocks recommended	*Temperature instrument in place and interlocks at 54C*
6	Add low pressure switch on compressed air, interlocked with mill motor	*Confirmed. Pressure switch to be included in design.*
7	Consider load cells to mill to detect gross overfill/underfill scenario, interlocked with mill	*A level transmitter, with high and low level is recommended to the client. Client will confirm with US colleagues the suitability of a level instrument.*
8	Maintain existing procedural controls	*Confirmed*
9	Maintain use of steel balls, due to concerns about static accumulation on ceramic	*Confirmed*
10	Consider proximity switch interlock between access hatch and motor	*Do not use a proximity switch as it may be necessary to look into the mill during production.*
11	Confirm ATEX rating of mill vendor infra-red sensor, motor and all other electrical equipment	*Advanced products to provide data sheet and ATEX certification, so DPS can make the appropriate assessment. If the infrared sensor is suitable, Interlock will be setup on-site by DPS and the TSH on the Chilled water return removed*
12	Do not introduce a product that required milling in non-conductive solvents/paint mixtures	*Client cannot t confirm that all solvents will be conductive*
13	Establish it if is an operational requirement to discharge above flashpoint and control with procedures if possible	*It is not an operational requirement, but client can't reduce temperature before discharging due to inefficiency in cycle time.*
14	Earthing clamps on discharge tote	*Confirmed*
15	Dip tube to prevent splash filling (add to P&ID if SW mill raised)	*No. Client preference is to pour liquid directly onto surface of liquid/rotors in SW mill*
16	Install earthing detection clamp with fault interlock to mill discharge actuated valve	*No. Earthing clamps, without an interlock facility will be used. This in turn negates the use of an actuated valve, as the valve cannot be interlocked.*
17	Add high temperature interlock to jacket return line – interlocking motor	*If the infrared sensors, supplied by Advanced products, cannot be interlocked, then a TSH on the cold water return line will be included.*
18	Magni to confirm that desired chemical reaction within mill is not exothermic and not capable of thermal runaway.	*Confirmed.*
19	Inlet grating	*CE certification for the mill will be provided by Advanced Products*
20	Utilise non-sparking tools	*Confirmed*
21	Ensure ATEX Rating of Forklift Truck	*Confirmed IIB 3G T4*
22	Maintain forklift operator training	*Confirmed*

Action No	Safeguards Against Ignition Source [Mitigation]	Client Response
23	Ensure ATEX rating of electrical equipment	*Confirmed*
24	Earthing reels (for tote and forklift) and interlock with weigh scale	*No. Earthing clamps, without an interlock facility will be used. The tote will be earthed with a mechanical earthing reel. The forklift is already earthed.*
25	Utilise a J tube, or equivalent, to minimise splashing	*No. Dip tube impractical as too many types of drums/ IBCs/ and cleaning dip tube would be time consuming.*
26	Consider pneumatic pump to enable liquid transfer	*No. Pump transfer impractical as there are too many types of drums/ IBCs / and cleaning dip tube would be time consuming.*
27	Modify P&ID to illustrate splash filling	*Confirmed*
28	Magni to confirm there is no exothermic reaction capable of thermal runaway.	*Confirmed*
29	Consider minimise velocity of filling to less than 1m/s	*Confirmed*
30	Magni to confirm there is no exothermic chemical reaction or runaway within the filling machine	*Confirmed. Magni currently fill at a rate of 800lt/min (or approx. 4.8 m3/hr)*
31	Pump should be ATEX rated below 200C,(check the rating of the pump)	*Confirmed. T4 (135C)*
32	Ensure equipment is ATEX rated	*Confirmed*
33	Include interlock earthing reel for the tote and filling machine with operation of the pump	*No. Earthing clamps, without an interlock facility will be used. The tote will be earthed with a mechanical earthing reel. The filling machine will be fixed in place and earthed.*
34	Confirm which solvents are static accumulators and the volumes used	*Client cannot t confirm that all solvents will be conductive*