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RESOLVE CONSULTING

Resolve Consulting Limited
161A, Labour Avenue, Naxxar Malta EU
Tel/Fax: (+356) 2141 9120
Cell: +356 9911 9911, +356 7982 6530
Email: info@resolveconsulting.com.mt
Web: www.resolveconsulting.com.mt

Loss Adjusting, Claims Management, Accident Investigation
Management Systems - Quality, Health & Safety, ATEX
Risk Management - Health & Safety, Fire Safety, Business Continuity Planning

CLAIMS AND RISK SOLUTIONS

Risk Assessment Report

Operator

UC Limited
Sannat Lane
Marsa, MRS 1310
Malta

Facilities

Cement Bulk Storage Terminal
Laboratory Wharf
Kordin
Malta

Type of Report	Risk Assessment Report
File Reference	H13-0046-AIS-C
Assessment Period	January 2013 – December 2013
Date of Report	20th December 2013
Contact Persons	Mr Ivan Carabott
Risk Assessments conducted by:	Ing. Claude Farrugia B.Eng.(Mech) Hons, Eur.Ing., CMIOSH

Contents

1.0 Introduction

UC Limited requested this office to carry out a risk assessment with a particular focus on dust emissions from the cement handling and storage facility at Laboratory Wharf, Kordin.

2.0 Company Information

UC Limited has constructed a cement silo within the confines of the wharves managed by Valletta Gateway Terminals Limited (refer to appendix 1 – site plan). The bulk cement storage facilities cover an area of approximately 650 square metres excluding offices and un/loading areas.

The system installed consists of rectangular storage silos having a combined storage capacity of 6,000 cubic metres (equivalent to approximately 8,000 metric tonnes of cement). This system consists of the following main sections:

- Ship unloading equipment
- Cement bulk storage silos
- Loading stations for cement road bulk carriers
- Dust bag filtration systems

Cement will be delivered to the site by sea in bulk cement carriers. These are completely sealed. These will berth alongside the quay and unload cement into the bulk cement storage silos. This shall be unloaded and stored in rectangular silos and will be subsequently delivered to cement road bulk carriers by means of enclosed screw conveyors. Unloading into road bulk carriers shall be via telescopic loading bellows.

Refer to photos 1 to 5 for typical and actual representations of the facility.

Photo 1 – Typical cement bulk carrier

Photo 2 – Typical arrangements of cement bulk carrier unloading cement into silo/road bulk carriers

Photo 3 – Actual Installation, Inclined Screw Conveyors and Telescopic Unloading Bellows

Photo 4 – Actual Installation, Telescopic Unloading Bellows

Photo 5 – Actual Installation, Silo Facilities

3.0 Scope

The purpose of this report is to determine the environmental impact of UC Limited's operation on the environment and on third parties operating in the vicinity as a result of cement dust emissions.

The operations covered by this report include:

a. Discharging of cement from ship to storage silos
b. Cement storage
c. Discharging of cement from silos to road bulk tankers

4.0 Approach & Methodology

This office carried out a review of the various risk assessment methodologies available and opted for the FMEA (failure mode and effects analysis) technique. An FMEA is a proactive tool, technique and quality method that enables the identification and prevention of process failures before they occur. Within the scope of this assessment, the goal is to avoid dust emissions that could pollute the areas around the cement silo and potentially effect third party property, processes or products.

FMEA's help identify and eliminate concerns early in the development of a process or new service delivery. It is a systematic way to examine a process prospectively for possible ways in which failure can occur, and then to redesign the processes as necessary, thus minimizing the possibility of failure, i.e. dust emissions.

In general, FMEA requires the identification of the following basic information:

- Items
- Operation
- Part
- Potential Failure Modes
- Potential Failure Effects
- Potential Causes
- Current Controls
- Recommended Actions
- Risk Rating (RPN, i.e. Risk Priority Number)

The steps adopted for performing the FMEA included the following:

Step 1: Assemble the team

The team was composed of

- Ing Claude Farrugia - Resolve Consulting Limited
- Mr Ivan Carabott - UC Limited
- Mr Domenico Perdichizzi (mechanical technician on site) - Euromecc S.r.l.
- Mr Santo Arcidiacono (electrical technician on site) - Euromecc S.r.l.
- Mr Marco Travagliante (electrical technician off site) - Euromecc S.r.l.
- Mr Antonio Adornetto (mechanical technician off site) - Euromecc S.r.l.

Step 2: Gather and review relevant information

The plant and equipment literature was reviewed. The construction and assembly process was monitored to ensure that the equipment designer's and equipment suppliers' installations procedures were followed. This was evidenced photographically.

Step 3: Identify the item(s) or process(es) to be analyzed

The goal of the risk assessment was the identification of sources of dust during normal operations or due to malfunction of the plant and equipment, hence the scope noted under paragraph 2.0.

Step 4: Identify the function(s), failure(s), effect(s), cause(s) and control(s) for each item or process to be analyzed

The assessment team followed a step-by-step approach for identifying all possible failures in design, installation, manufacturing or assembly process that could result in dust emissions to the environment.

Step 5: Evaluate the risk associated with the issues identified by the analysis

Failure modes of plant, components or equipment were assessed and their potential impact on the environment was rated on a scale from 1 to 4, with 1 being the least severe. The significance of each score is given in table 1 noted below:

Table 1 - Severity

Descriptor	Numeric Rating	Definition
Catastrophic	4	Environmental contamination beyond the perimeter of the plant.
Critical	3	Environmental contamination within the perimeter of the plant.
Marginal	2	Localised environmental contamination.
Negligible	1	No potential for environmental contamination by dust release.

Based on the control measures in place to prevent the failure from occurring, the likelihood of occurrence was rated on a scale 1 to 6 as per table 2:

Table 2 - Occurrence

Descriptor	Numeric Rating	Definition
Frequent	6	Likely to occur frequently.
Probable	5	Likely to occur several times in the plant's usage over one year.
Occasional	4	Likely to occur sometime in the plant's usage over one year.
Remote	3	Unlikely to occur but possible.
Improbable	2	So unlikely that occurrence may not be experienced.
Incredible	1	Virtually impossible.

The response to identify the problem was also assessed on a scale 1 to 5 as described in table 3.

Table 3 - Detection

Descriptor	Numeric Rating	Definition
Very Low	5	Plant operators cannot detect a dust release and informed of a dust release by others.
Low	4	Plant operators are not likely to detect a dust release.
Moderate	3	Plant operators may detect a dust release.
High	2	Plant operators will likely detect a dust release.
Very High	1	Plant operators will almost certainly detect a dust release.

Step 6: Prioritize and assign corrective actions

Prioritisation was carried out by calculating the risk priority number (RPN) by:

Severity x Occurrence x Detection = RPN

Based on the tables noted above, Risk Priority Numbers may range from 1 to 120. The significance of the risk priority number is given in table 4.

Table 4 - Risk Priority Number

RPN Range	Descriptor
1 - 40	Low Risk - Ensure that all control measures installed are subject to a strict maintenance regime and that they are checked prior to operation.
41 - 80	Medium Risk - Ensure that all control measures installed are subject to a strict maintenance regime and that they are checked prior to operation. Seriously consider taking additional measures to lower the risk to low.
81 - 120	High risk - Suspend operations and take remedial action to lower the risk level.

Step 7: Perform corrective actions and re-evaluate risk

Based on the RPN's attained, corrective actions were recommended.

The FMEA is given in appendix 2.

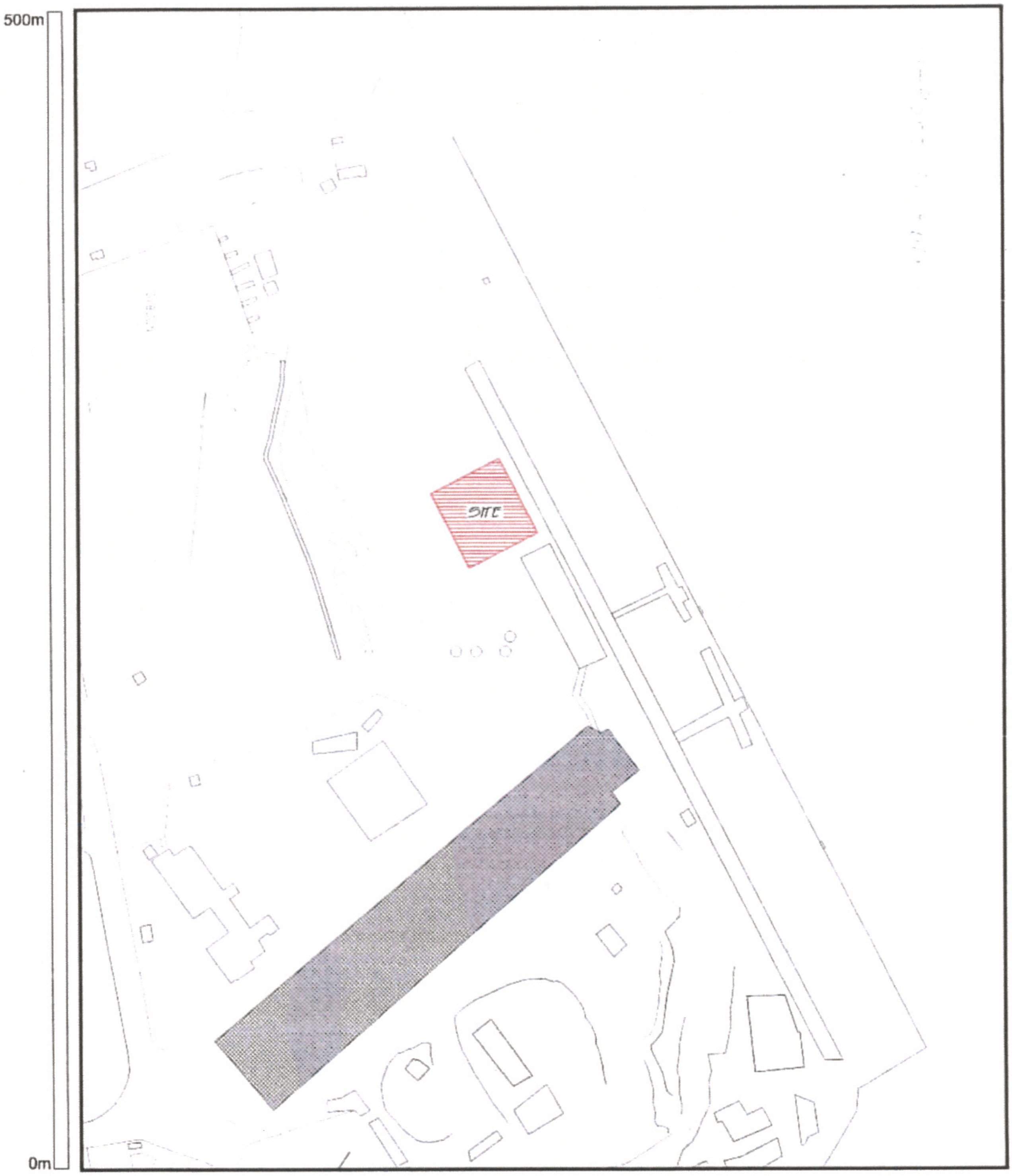
5.0 Conclusions & Recommendations

The highest Risk Priority Number attained was 24. Under normal conditions, the operation is considered to be low risk with regards to dust emissions into the environment. To maintain such a low score, UC Limited shall implement a strict maintenance regime as documented in the plant and equipment manuals.

The low score is due to the fact that the cement un/loading facility is designed to be a closed system. The cement will be delivered to the site in purposely designed ships. These vessels are fitted with fluidization systems in the cargo holds which enables the bulk cargo to flow to a central suction point ensuring maximum efficiency in discharging cement. Since the vessels are totally enclosed, the operation is environmentally friendly with a dust free operation when discharging pneumatically. Pneumatic unloading uses vertical and horizontal screw conveyors to bring the cement from the holds to deck level and into pressure pumps. The pneumatic system uses air pressure to blow the cement through pipelines to the shore terminal located on the quay. Exhaust air is released via filters located on top of the storage silos.

Unloading of cement is performed by dropping cement stored in the silos into closed screw conveyors located underneath the silos. The cement is conveyed to closed inclined screw conveyors. The cement is then dropped into a closed hopper located at height above the road tanker loading hatch. It is subsequently dropped into the road cement tanker via telescopic loading bellows. These are equipped with built-in dust filters to minimise the release of cement dust into the atmosphere. The connecting cones of the road tanker loading bellows are coated with a sealing material such that it provides a dustproof connection with the road tanker hatchway.

Appendix 1: Site Plan



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MEPA - www.mepa.org.mt

St. Francis Ravelin
Floriana FRN 1230, Malta
PO Box 200, Marsa MRS 1000, Malta
Tel: +356 2290 0000 Fax: +356 22902295

Site Plan, Scale 1:2500
Printed on: Thursday, October 04, 2012

Not to be used for interpretation or scaling of scheme alignments

JOE GRECH
Office No.7, 'Coveco Bldgs.', Cospicua Rd., Paola, PLA 07
Tel.: 21 806548 Fax: 21 820837 jg@grechj.com

Appendix 2 – Failure Modes and Effects Analysis

Item No	Operation	Part	Potential Failure Mode	Potential Failure Effect	Potential Causes	Reference Images (App 3)	Severity	Current Control Measures	Occurrence	Detection	Risk Priority Number (RPN)
1 /cont…	Discharging of cement from ship to storage silos	Storage Silos - steel panels, hopper and roof	Failure to contain cement within structures.	Dust emissions	Corrosion of silo material.	1	2	- New plant and protected with paint	3	2	12
					Panel joints pulled apart due to external impact.	2	4	- Silos are constructed on a concrete plinth and away from main traffic routes. - A secure fence is installed around the silo perimeter. - Area is supervised.	2	1	8
					Failure of silo supporting structure due to excessive filling of silos, consequently overloading them.	3, 4	4	- Fifteen level indicators uniformly distributed within the silos which automatically raise an alarm in the event of overfilling during ship unloading. - Filling is carried out in direct communication with the ship. - Storage facility allows for full visibility of silo contents and their distribution. Location of discharge is controlled by plant operatives.	2	1	8
					Failure of sealants between joints due to erosion caused by cement dust sliding over.	5, 6, 7	2	- Three layers of protection 1. Self-adhesive foam sealant placed between joints and compressed by means of bolts holding panels together 2. Sealant placed over edges 3. Brushable body sealing compound placed over 1 and 2 - Daily visual inspection from the outside of the plant by plant operatives.	3	2	12
					Loose bolts due to vibration generated by uneven slippage of material within silo.	-	2	- Visual inspection and periodic tightening to the specified torque.	3	3	18
					Loose bolts due to insufficient tightening by installers.	-	2	- All bolts were tightened as part of the commissioning process.	3	3	18
					Activation of overpressure safety valve due to broken springs.	8	4	- Periodic maintenance as per equipment manual.	3	1	12
					Activation of overpressure safety valve due to poor calibration.	8	4	- Periodic maintenance as per equipment manual.	3	1	12
					Collapse of trench covers due to excessive weight of vehicles travelling over them.	9	4	- Trench covers are to be designed and certified by a structural engineer.	2	1	8

Item No	Operation	Part	Potential Failure Mode	Potential Failure Effect	Potential Causes	Reference Images (App 3)	Severity	Current Control Measures	Occurrence	Detection	Risk Priority Number (RPN)
.../cont 1	Discharging of cement from ship to storage silos	Filter Euro Dry 90	Collapsed filter bags	Dust cloud released into the atmosphere	Broken filter support frame due to wear and tear and physical damage.	10	4	- Replacement filters readily available in the event of replacement. - The air filters installed on the roof of the silos (PS1, PS2) give rise to an audible alarm in the event of failure of the filtration system due to problems with the de-dusting system. - Assurance that the filters are in position and that they are not torn is done through scheduled preventive maintenance. - Procedures are in place to ensure that all the filter bags are in position before commencing cement unloading from the ship. - In the event of a filter bag failure, dust will be discharged from the filter unit into the atmosphere. In such a situation, the system will be shut down from the control room, thus limiting the escape of cement dust. - Unloading shall always be carried out when no grain handling is underway. This is automatically controlled by the size of the quay.	3	2	24
			Broken filter bags	Dust emissions	Worn out bags due to cement dust erosion.	10	4		3	2	24
			Dislodged filter bags	Dust emissions	Excessive air pressure during de-dusting	10	4		3	2	24
			Blocked filters	Low air exhaust which may result in silo overpressure, with the consequence of activating the safety valve and releasing a dust cloud.	Blockage in hoses and pipes.	-	4	- Periodic maintenance carried out by plant operatives. - Replacement filters readily available in the event of replacement.	3	2	24
					Caking of filter bags due to lack of compressed air, air leak, defective solenoid valves and/or electronic cards that control the de-dusting sequence.	-	4	- Periodic maintenance carried out by plant operatives. - Monitoring of pressure and air flows through filter unit.	3	2	24
					Lack of compressed air.	-	4	- Pressure gauges installed on compressed air line.	3	1	12
					Air leak in compressed air system.	-	4	- Pressure gauges installed on compressed air line. - Audible sound of compressed air release.	3	1	12
			Failure of door seals	Dust emissions	Deterioration of seal due to exposure to rain, wind and sun.	-	3	- Visual inspection	3	1	9
			Inefficient filter bags	Dust emissions	Wrong Filters installed	11	4	- Filter bags are defined in filter unit manual. - The filters have an emission value of 0.96 mg/Nm3 (much below 10 mg/Nm3) and the size of these cement particles that come from the filter with size >= 10 μm are equal to 1%, while 99% is <10 μm.	3	1	12
					Insufficient number of filter bags	-	4	- A total of 180 sqm of filters are installed. These have been designed by the manufacturer following their extensive experience in the industry.	1	1	4
		Safety Valve	Early activation	Dust emissions	Wrong calibration of pressure valve.	8	4	- Overpressure and underpressure valves are calibrated by the manufacturer. - Periodic maintenance	3	2	24
					Broken springs	8	4	- Periodic maintenance	3	2	24

Item No	Operation	Part	Potential Failure Mode	Potential Failure Effect	Potential Causes	Reference Images (App 3)	Severity	Current Control Measures	Occurrence	Detection	Risk Priority Number (RPN)
2 /cont...	Discharging of cement from silos to road bulk tankers	Storage Silos - steel panels, hopper and roof	Failure to contain cement within structures.	Dust emissions	Corrosion of silo material.	1	2	- New plant and protected with paint	3	2	12
					Panel joints pulled apart due to external impact.	2	4	- Silos are constructed on a concrete plinth and away from main traffic routes. - A secure fence is installed around the silo perimeter. - Area is supervised.	2	1	8
					Failure of silo supporting structure due to excessive filling of silos, consequently overloading them.	3, 4	4	- Level indicators uniformly distributed within the silos which automatically raise an alarm in the event of overfilling during ship unloading. - Filling is carried out in direct communication with the ship. - Storage facility allows for full visibility of silo contents and their distribution. Location of discharge is controlled by plant operatives.	2	1	8
					Failure of sealants between joints due to erosion caused by cement dust sliding over.	5, 6, 7	2	- Three layers of protection 1. Self-adhesive foam sealant placed between joints and compressed by means of bolts holding panels together 2. Sealant placed over edges 3. Brushable body sealing compound placed over 1 and 2 - Daily visual inspection from the outside of the plant by plant operatives.	3	2	12
					Loose bolts due to vibration generated by uneven slippage of material within silo.	-	2	- Visual inspection and periodic tightening to the specified torque.	3	3	18
					Loose bolts due to insufficient tightening by installers.	-	2	- All bolts were tightened as part of the commissioning process.	3	3	18
					Failure of joints between screw conveyors, silo hoppers, etc.	12, 13	2	- All bolts were tightened as part of the commissioning process. - Gasket installed between flanges. - Self adhesive sealing foam and sealant applied along hopper seams and sliding valves.	3	3	18
					Failure of all (qty 5) safety valves resulting in collapse of silo unit due to under pressure.	8	4	- Five safety installed uniformly distributed. - Overpressure and underpressure valves are calibrated by the manufacturer. - Periodic maintenance	2	1	8

Item No	Operation	Part	Potential Failure Mode	Potential Failure Effect	Potential Causes	Reference Images (App 3)	Severity	Current Control Measures	Occurrence	Detection	Risk Priority Number (RPN)
2 /cont...	Discharging of cement from silos to road bulk tankers	Telescopic loading bellows	Failure to extract dust during dropping of cement into bulk carrier.	Dust emissions	Excessive air being exhausted due to cement dust caking.	14	3	- Filter differential monitored to be within 50-150 mm H_2O. - Periodic visual inspection of filter cartridges to confirm that they are not damaged or being caked up with cement dust.	3	2	18
					Failure of filter cartidges due to feeding of oil or humidity laden air, thus damaging the filters or causing filters to clogg.	15	4	- Rotary screw compressors fitted with pre and final high efficiency filtration capable of removing particles, oil and water droplets from air in compressed air system. - Periodic maintenance of compressor. - Periodic visual inspection of filter cartridges by plant operatives to confirm that they are not damaged.	3	1	12
					Torn external bellow	14	4	- Bellows are made of flexible neoprene coated with Hypalon which offers high resistance to atmospheric agents, abrasion and high temperature, thus making the loader highly durable. - Visual inspection carried out by plant operatives. - Emergency stop available on control panel. - Activity is attended at all times.	3	1	12
					Worn polymer SINT® coating of the outlet cone that connects to tanks of cement bulk carrier.	16	3	- Daily visual inspection from the outside of the cone by plant operatives. - Emergency stop available on control panel.	3	1	9
					Overfilling	17	3	- A level probe consisting of a rotary blade that interrupts flow when the level of material already deposited touches the blade. - Emergency stop available on control panel. - Activity is attended at all times.	3	1	9
					Premature bellow disengagement from cement bulk carrier.	18	3	- Disengaging of bellow from road tanker is carried out manually by the plant operatives. - Activity is carried out within direct line of sight. - Once bellow is retracted, the bottom closure cone (i.e. anti-spill device) prevents dust from leaking out of the loading bellows to avoid dust dispersal around the loading bellows. - Emergency stop available on control panel.	3	1	9
					Cement dust residue left in external bellow when the bellow is in the raised position.	-	3	- Contraction of the bellow back to stand-by position starts after a delay of approximately ten seconds in order to allow the filter to evacuate the remaining dust. - The preset after shut-down cleaning cycle provides for additional pulse jet cleaning of the filter cartridges for another ten minutes. - Emergency stop available on control panel.	3	1	9
					Failure of fan motor	-	3	- Power indicator lamp, lack of sound emitted by motor, visual inspection and periodic maintenance.	3	1	9
					Inefficient filtration system	-	4	- Eight cartridge filters have a combined filtering area of 10 sqm are integrated within the design. - Proven design by TOREX.	1	1	4
		Hopper fluidisation system	Malfunction of fluidisation system	No production	-	-	1	-	1	1	1
		Screw conveyors	Failure to convey cement dust	No production	-	-	1	-	1	1	1
		Air compressors	Poor air pressure	No production	-	-	1	-	1	1	1

Appendix 3 – Schedule of Photographs & Images

Photo 1: Minimum steel panel thickness 5 mm

Photo 2: Bolted and torque wrench tightened steel panels

Photo 3: Purposely designed silo supporting structure

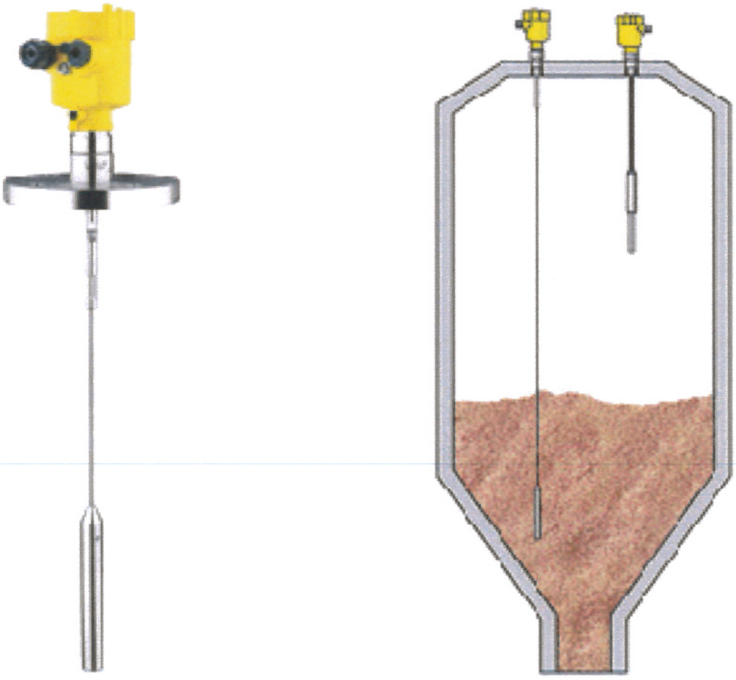


Photo 4: Cement dust level indicator, typical installation

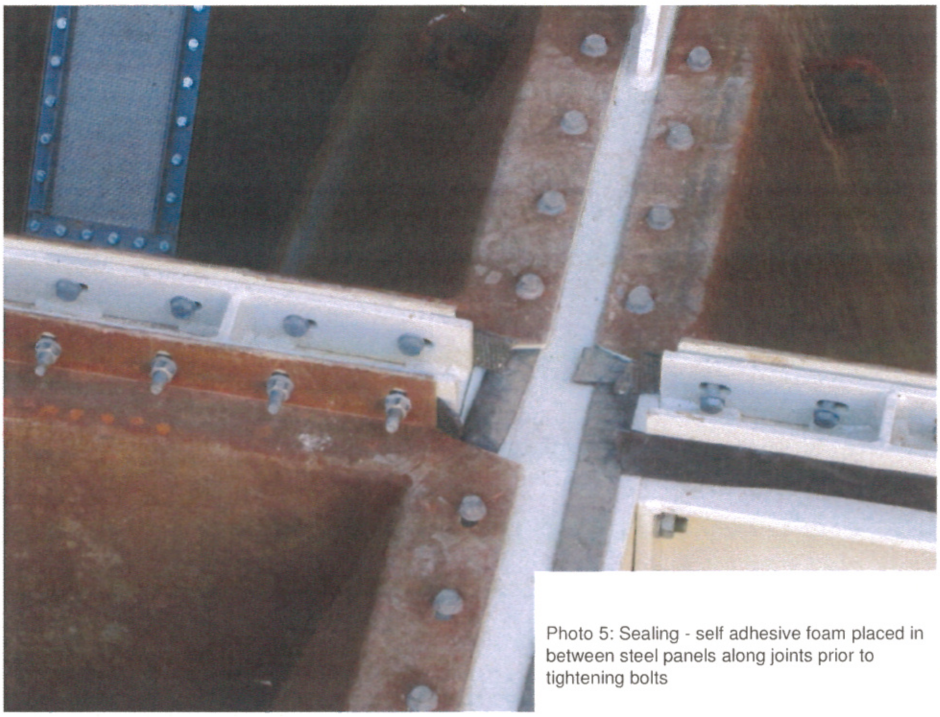


Photo 5: Sealing - self adhesive foam placed in between steel panels along joints prior to tightening bolts

Photo 6: Sealing - self adhesive foam placed in between steel panels along joints prior to tightening bolts

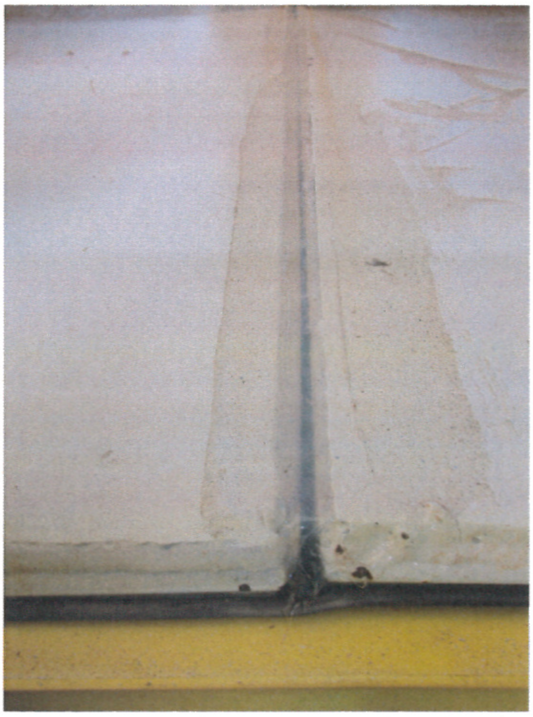


Photo 7: Sealer applied along internal seams to protect self adhesive foam placed in between steel panels along joints prior to tightening bolts

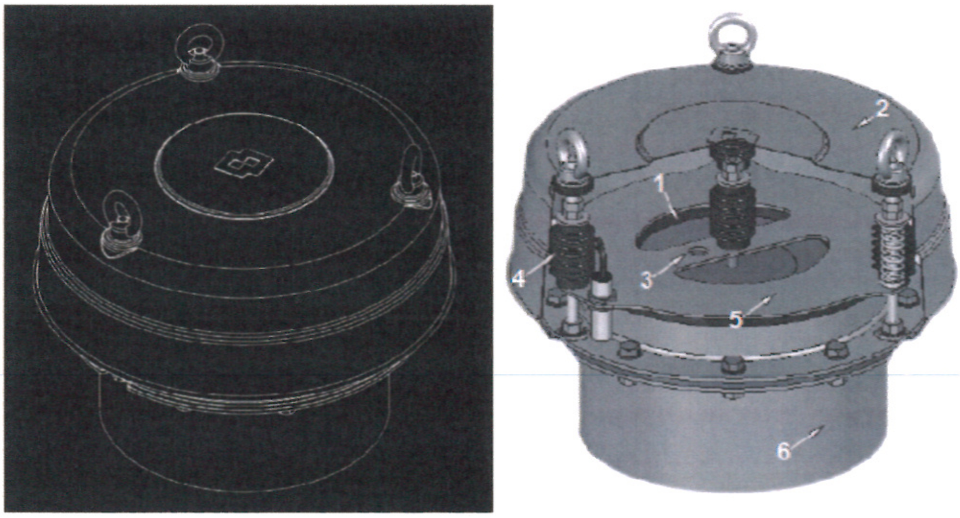


Photo 8: Over-pressure/under-pressure valve placed above silos

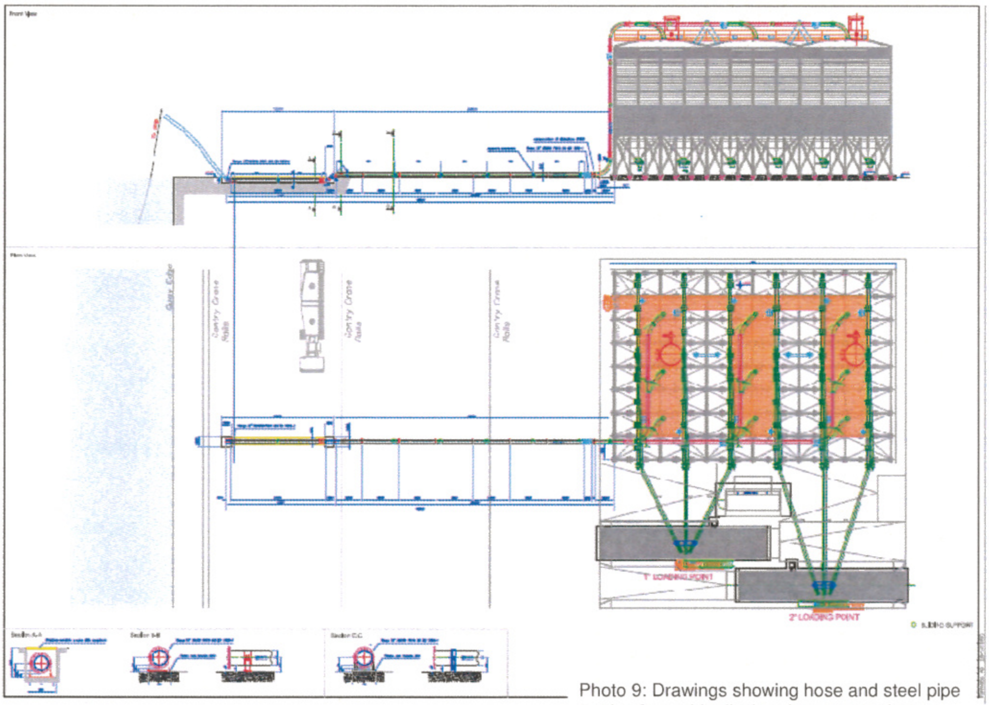
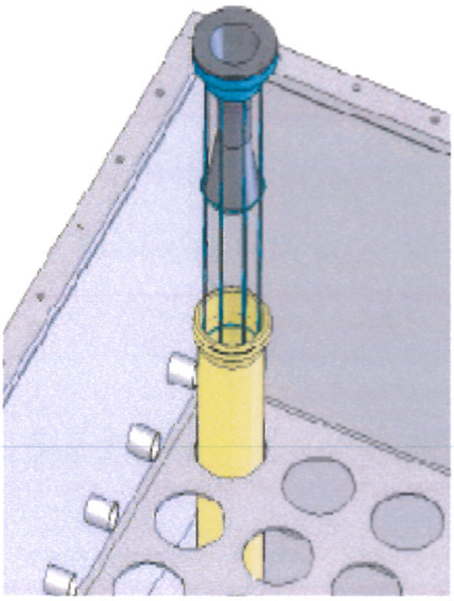
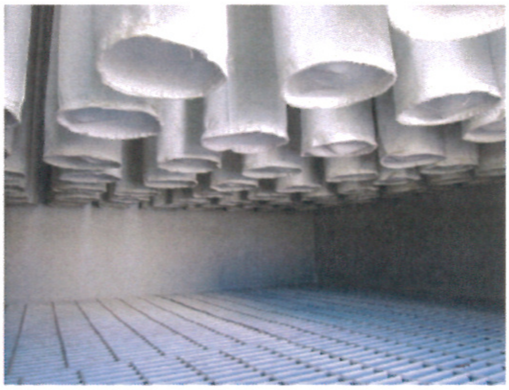


Photo 9: Drawings showing hose and steel pipe routing from ship discharging cement dust to silos.





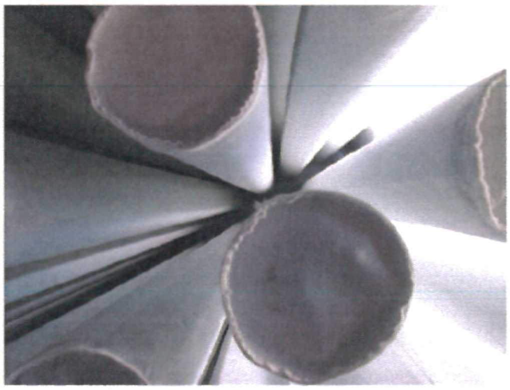


Photo10: Bag filters mounted over support frames and as shown in filter units installed above silos

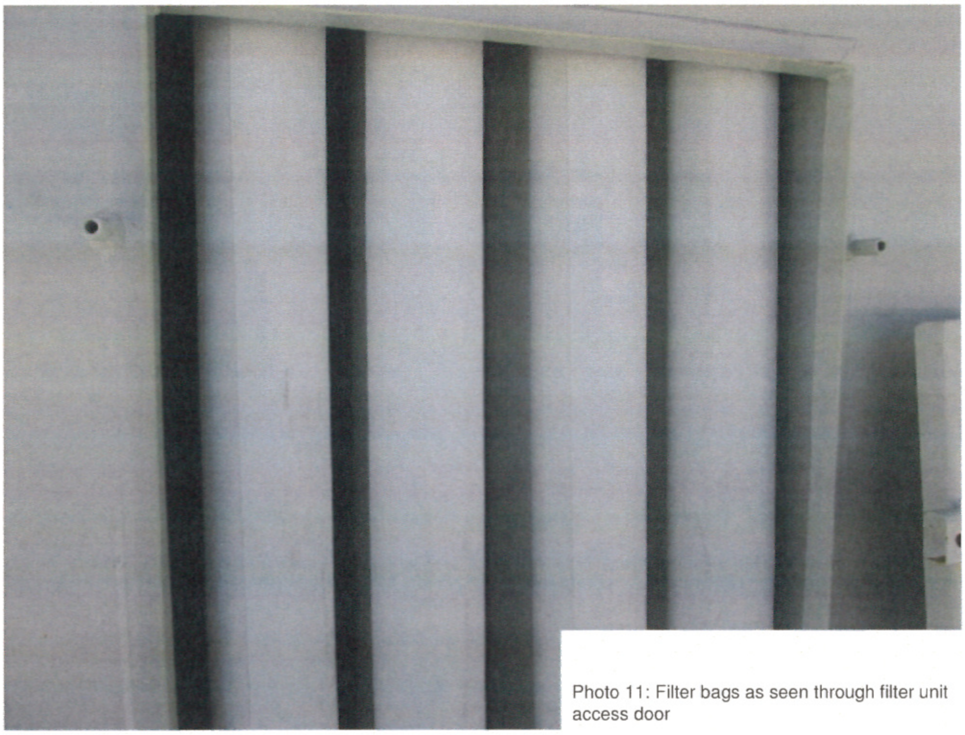


Photo 11: Filter bags as seen through filter unit access door

Photo 12: Underside of hopper, screw conveyors transporting cement to road tankers.

Photo 13: Assembly showing sliding gate (normally open during operation, closed during maintenance operations) and connection to discharging screw conveyors

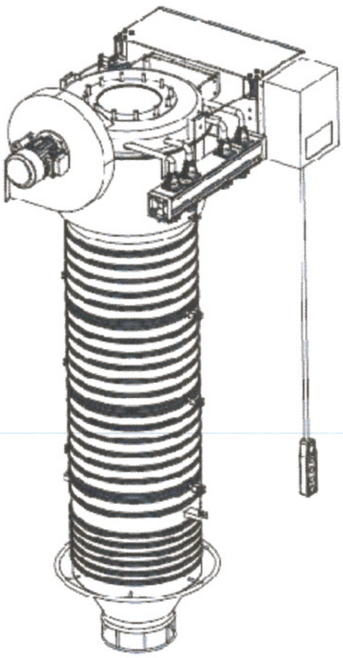
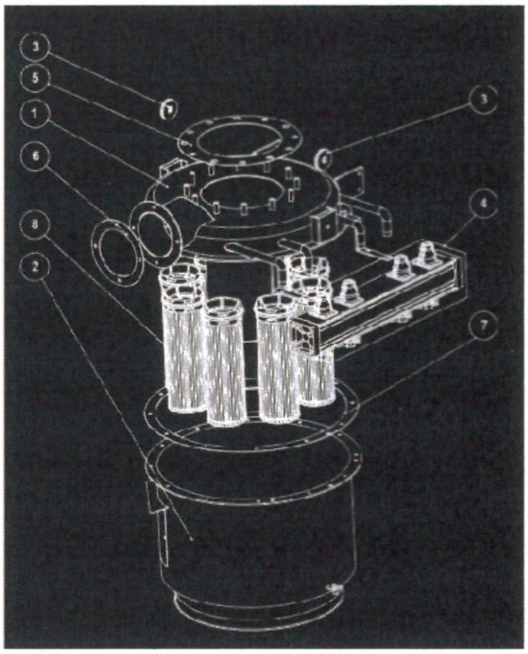


Photo 14: Unloading bellows connected to road tanker creating a dust seal during loading



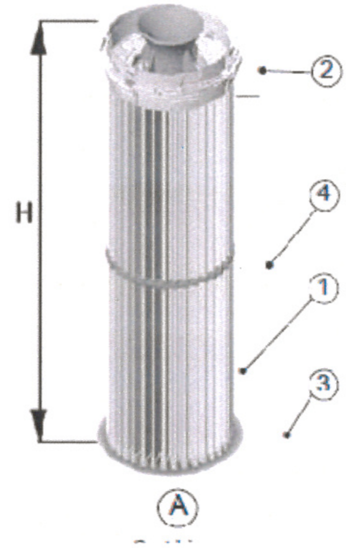


Photo 15: Discharging bellows cartridge filters

Photo 16

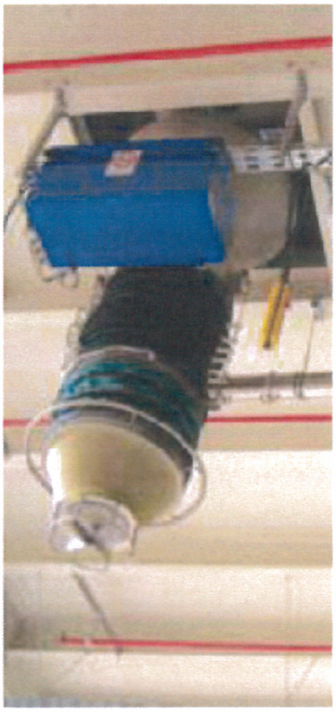


Photo 17: Level probe consisting of a rotary blade that interrupts flow when the level of material already deposited touches the blade

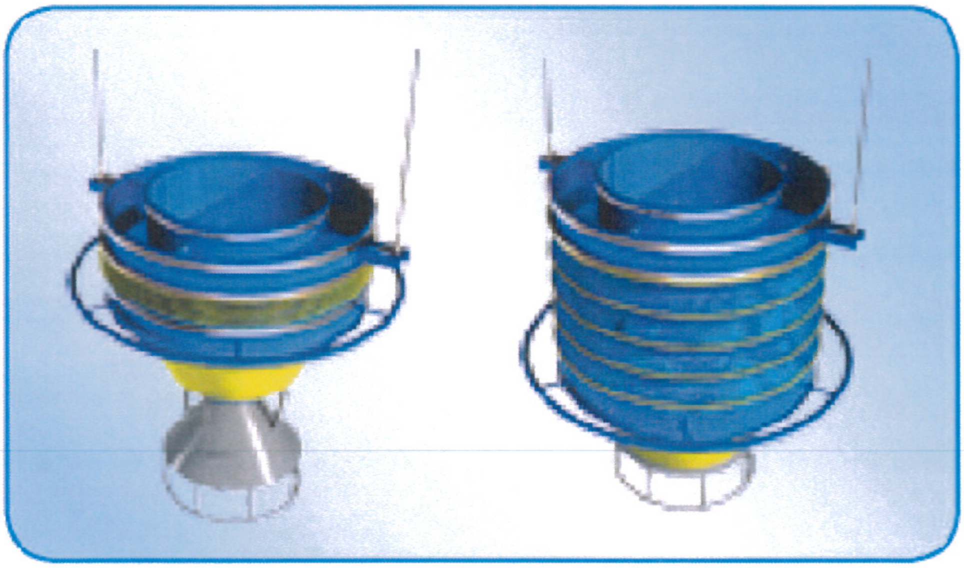


Photo 18: Bottom closure cone to prevent any spillage of dust as the loading bellows is being raised