Growth in the Middle East Cement Industry Triggers Increased Operational Risk

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As published in *World Cement,* November 2016

Demand for cement in the Middle East continues to grow as transport, major construction projects and general development infrastructure projects consume large volumes of cement industry product. The recent 2015-2019 Gulf cement outlook (1) market analysis cites a rise in population, increased numbers of tourists, demand for affordable housing, and the development of new cities as some of the factors that are likely to propel market growth in the next five years. Greater investment in the transportation sector is another major driving force behind growth in this market. Due to the current increase in tourism, governments in this region are investing heavily in public transit systems, such as Qatar which is preparing for the 2022 World Cup. The construction of new railway networks, seaports, and airports is therefore expected to spur demand for cement in the region over the coming years.

Since the cement market is an integral part of the construction sector, growth in this area will lead to growth in the cement industry. Cement production will consequently clearly be key for economies in the Middle East. All the more reason to ensure it grows in a sustainable way. Whilst the imperative to produce is strong and growing, there remains an equally important need to ensure that this growth does not come at the cost of a negative impact on safety, society and reputation. With this in mind, defining and managing risk will be increasingly important to the cement industry, particularly in highly visible locations such as Qatar.

Managing Risk

From boiler blasts to explosions, the risks facing the cement industry are multiple. Just this summer, four contractors were injured in an explosion of a cylinder in the coal crusher plant, probably due to excess pressure, of a cement plant in Sindri, Jharkhand in India. In May this year, a worker died falling from the top of a concrete mixing tower in Texas, and a little over a

Growth in the Middle East Cement Industry Triggers Increased Operational Risk

year ago a hot clinker ash explosion at a cement factory in Kasungu, Malawi led to one death and three injuries. Companies in the sector cannot therefore simply rely on “not doing the wrong thing” to avoid accidents and repeats. They need to put in place proactive measures and systems to prevent recurrences. For many, risk governance generally begins with defining threats, understanding potential consequences and developing some way to measure the probability of risk occurring. After this, organisations need to put in place barriers to risk and appropriate tactics with periodic health-checks as shown in Figure 1. The process is, or should be, no different for the cement industry than for refining, mining to any other manufacturing sector.

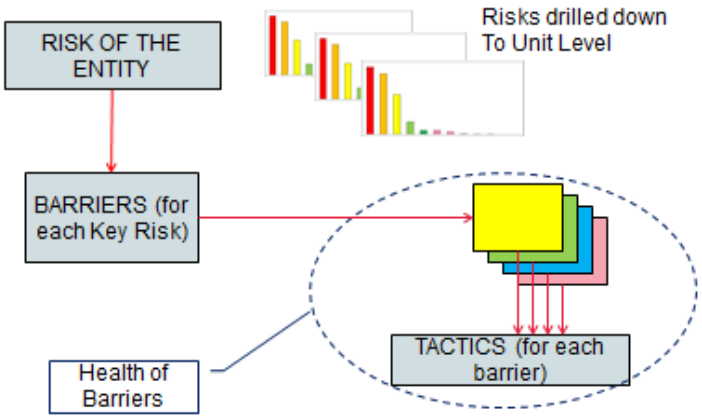

Figure 1 – Managing the risk of an entity.

Growth in the Middle East Cement Industry Triggers Increased Operational Risk

Potential threats fall into fairly typical existential categories such as:

- Earthquake;
- Terrorist Attack;
- Loss of Reputation;
- Falling commodity prices;
- Difficulty sourcing raw materials;
- Supply Constraints.

Once organisations have complied a list of threats, most of which are outside of the control of an organisation, it is necessary to examine each in further detail, drilling down into the specific Unit Level risks, which companies can control or at least mitigate. These usually have three main aspects:

1. Safety (Health and Environment) Risks;
2. Production Risks;
3. Other Risks.

Serious consideration needs to be given to the unmitigated consequences of specific cement-related industry incidents, looking for example at some of the incidents that have already occurred in the industry. Organisations should ask themselves the following question: With no controls or mitigation, what is the worst that can happen? To validate inclusion of the risk on the list, one should also consider if this type of risk has ever triggered an incident elsewhere in the industry? Often there is a history of incidents in the industry from boiler explosions to collapses in civil structures (2), (3).

Growth in the Middle East Cement Industry Triggers Increased Operational Risk

The Barriers

Considering these risk aspects can precipitate further questions. For the cement industry these are likely to include:

- Is a boiler explosion possible?
- How likely is a cyclone dust explosion? (4)
- Can the kiln overheat and melt?
- Can tall structures become unstable and collapse?
- At the mines, can the earth collapse/subside?
- Can people be caught in crushers or moving machinery?

Once the right categories of unmitigated risk have been honestly determined, one can start to determine the correct barriers. For example, if we are attempting to contain material, energy or other harm, then a robust Mechanical Integrity and Quality Assurance (MIQA) program would be an appropriate barrier, especially if structure collapse is a potential scenario. Drilling down further, organisations reach the tactical level. In other words, if they put in place a Mechanical Integrity barrier, what sort of tactics could this deploy? Figure 2 shows the tactical level of Mechanical Integrity. If deployed correctly with the appropriate tactics, this can be a strong barrier to risk.

Growth in the Middle East Cement Industry Triggers Increased Operational Risk

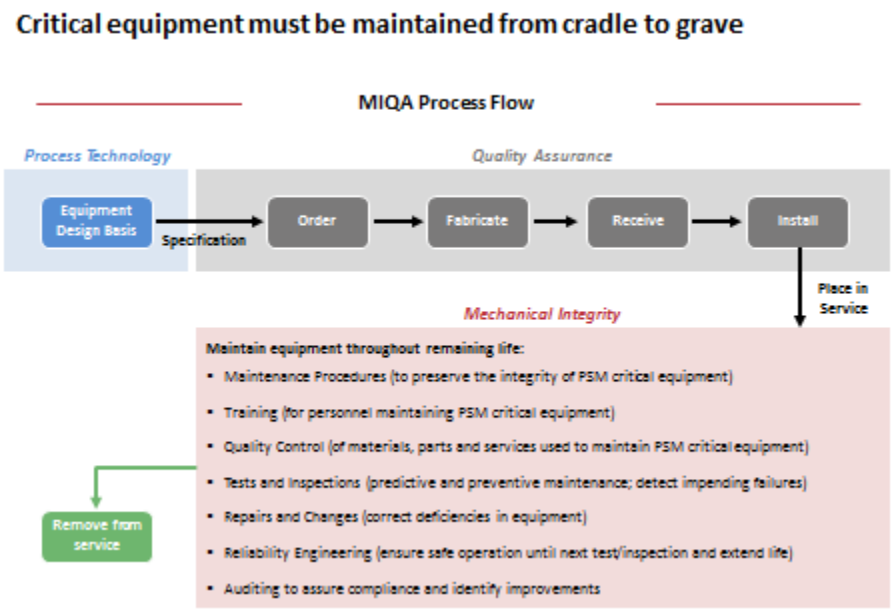

Figure 2 – Tactical aspects of a Mechanical Integrity Barrier

Organisations need to follow the same process for each key, quantified risk: define the barrier, then develop and deploy a menu of appropriate tactics. To give an example of how this can be done, we will develop the Mechanical Integrity barrier a little further.

Risk-Based Tactics

Having barriers in place does not necessarily mean that an organisation has to do everything these barriers entail in terms of tactics. It just means it has to do the right things well, and in some cases do less of something else. Prevention costs are often a lot lower than the cost of failure. For example, recent structural collapses of silos in India and Pakistan suggest issues in design and quality assurance that should have been better addressed at the project stage. Civil inspection regimes could have detected potential failures earlier. There is an optimal point when the right balance between prevention and failure cost forces is achieved. This occurs in

the zone of tolerable and acceptable risk levels defined as ALARP – "As Low As Reasonably Practical" (5). This risk-based approach is illustrated in Figure 3.

The next question organisations need to address is: if they have a mechanical integrity barrier in place and have a number of tactical inspections, how do they know what to do?

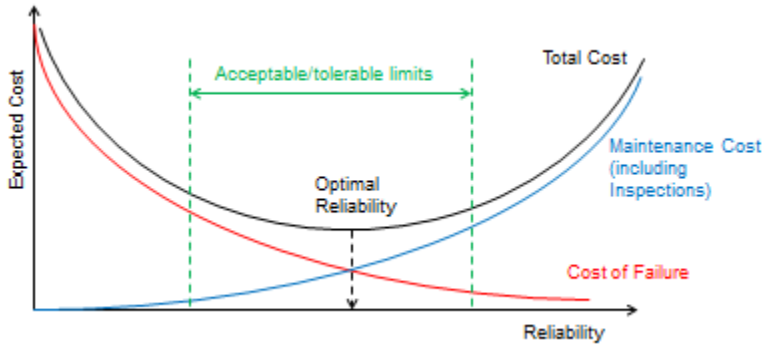

Figure 3 – The Cost Optimised Risk Based approach to tactical inspections in a Mechanical Integrity Program.

Let us take the Testing and Inspection "tactic" as an example. Generally, testing and inspection falls into three broad categories based on the function of the equipment. The three categories are:

1. Risk Based Inspections, RBI that are normally developed for static physical equipment whose primary function is to contain something. In the cement industry, this could apply to inspection of concrete or metal civil structures or aspects of utilities boiler operation.
2. Safety Integrity Level, SIL (6). This tactic should be used for programmable instrumentation systems whose primary function is to contain harm in some way. The SIL Level should determine the performance expected of the Safety Instrumented Function, or interlock. In the cement industry, owners often defer SIL to OEMs and ask

them to supply control strategies at installation of new equipment and DCS (Distributed Control System which poses an important challenge.

3. Reliability Centred Maintenance, RCM/FMEA. The challenge here is to improve the reliability of equipment, prevent failure and transient conditions which can precipitate mechanical interventions and exposure to harm. It is therefore also good for safety. A reliable plant is a safe plant.

Of course, as well as taking a risk-based approach, it is necessary to carry out statutory compliance inspections to a high standard. Best in-class practice in testing and inspecting takes each failure under test as a recordable, leading indicator with subsequent RCFA (Root Cause Failure Analysis) to understand the cause and, over time, build up a pattern of failure. This is particularly significant, as a failure under test implies the device may not work in service if required to do so.

For the cement Industry, the quality assurance process entails a number of additional key tactics (see Figure 3) which can have catastrophic outcomes in building and operating a cement plant, if not carried out correctly. There have been many examples of failure in this regard globally and in India and Pakistan specifically. Poor qualification processes, poor governance, welding, fabrication and installation are often triggers for failure. All of these are often activated before the plant is started, or when there is a new project to install a new plant or civil structure.

We have seen that the barriers of Mechanical Integrity and Quality Assurance have specific tactics that can be used to reduce risk, to safely operate a plant, to run it more productively and to save lives.

Growth in the Middle East Cement Industry Triggers Increased Operational Risk

Barrier health

The health of barriers is important. Organisation should therefore have a dynamic health-checking process as risk is always dynamic. Barriers can still fail if they are not checked regularly against dynamic change, and continually improved. In fact, the Demings Cycle advocates just this: Plan, Do, Check, Adjust (PDCA). As a result, the Health Check generally addresses three key questions:

- Do we have the right barriers that can prevent the defined risk from happening?
- How good are the barriers?
- How do we know they are as good as we hope they are?

Considering Mechanical Integrity specifically – as shown in Figure 3 – there is an "Audit" tactic, which addresses these questions. This is a periodic system check, led by senior management together with subject matter experts. It verifies the validity of current tactics and barriers against the performance expectation and is absolutely vital for sustainable success.

Conclusion

With the fast growth of the cement industry in the Middle East, correct risk assessment and preventive measures will become increasingly important. In some regions, state regulation is weak, if not completely absent. In this context, the onus of responsible care lies with the operator. Appropriate risk management (within tolerable and acceptable limits) is a business imperative, not an optional extra, if the cement industry is to grow and meet demand in a sustainable manner.

Tactics, standards and protocols can be designed for the most appropriate risk-based approach

and lessons in that regard can be adapted from other industries. Managing risk is not a nice-to-have luxury that gets in the way of productivity, it is the foundation upon which productivity and quality are built.

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