

Certifiable Risk Management & Business Continuity Approach in Mining Industry

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Abstract - In mining industry, there is a particular need for a sound approach to the process of risk and business continuity management with ultimate goal the continuity of mining operations in case of unplanned events' materialization. In this context, many functions within large mining companies have a significant risk component to their activities. Emphasis is placed on the type of threats that could cause serious loss of production and even jeopardize the operational continuity. In order to cover a wide spectrum of threats and hazards, an organization could approach their assessment and handling through the implementation of certifiable management system standards, such as ISO 22301, OHSAS 18001 and ISO 14001.

The objective of this paper is to show the gains and the simplicity of development and implementation of a certifiable Integrated Management System in complex and risky activities in order to form a robust and sustainable business continuity and risk management framework which could face a wide range of risks that might prohibit operational continuity, such as production risks, health and safety risks and environmental risks. Through the integration of management systems large companies could achieve economies of scale and avoid duplication of efforts in assessing and handling the vast variety of threats. The integrated management system formulates a platform on which an organization can base a plethora of management systems containing threat assessment and management requirements such as ISO 28000 (Supply Chain Management) and ISO 39001 (Road Traffic Safety). The implementation of an Integrated Management System could help mines and other industries as well, to comply with the regulations and to operate safely and reliably.

Keywords: Risk Management, Business Continuity, Management Systems, Mining Industry.

1. Introduction

In the mining industry – with its inherent potential for major accidents which could cause serious loss of production, injure or kill people, damage the environment and negatively impact company's reputation – there is a particular need for a sound approach to the process of risk management. Risk management is inherently about the management of unplanned events [1].

Operational risk may be considered to be the type of risk that will disrupt normal everyday activities. Operational risk remains a huge threat to companies and one that is significantly affected by the economic downturn because of cost cutting, downsizing and reducing infrastructures investments.

2. Types of Operational Risks

Many functions within large mining companies have a significant risk management component to their activities. Workplace health & safety risks, environmental risks, production risks (production volume, quality, pit failure, major plant or equipment failure) regulatory risks and reputation risks formulate overall company-wide operational risks. Although there are a number of established risk management standards and frameworks which serve as principles, guidelines and codes of practice such as ISO 31000, Institute of Risk Management Standard and COSO ERM framework, there is not any certifiable risk management standard in existence.

Management systems are the pre-eminent tool that the best organizations use to embed processes for ensuring that products, services and daily operations are consistently and reliably delivered. Through the implementation of management systems in key risk areas - such as continuity of operations, health & safety and environment – organizations create an internal control environment where critical functions are constantly monitored and improved [4].

The certifiable management system standards, such as ISO 22301, OHSAS 18001, ISO 14001, ISO 27001, ISO 28000 and ISO 9001 use risk management techniques, tools, methodologies and procedures for risk identification and assessment for:

- risks which prohibit the continuation of operations (ISO 22301)
- health & safety risks (OHSAS 18001)

- environmental risks (ISO 14001)
- quality risks (ISO 9001)
- supply chain risks (ISO 28000)
- information systems & technology risks (ISO 27001)

The integration of these management systems under the guidelines of a risk management system like ISO 31000, could lead towards an efficient and effective operational risk management and provide a comprehensive tool that can help any company establish a robust and sustainable risk management framework and embed it throughout the organization.

Some observers note that, given these individual standards for specific tasks or activities which help organizations to address specific risk issues, the role of risk management is the oversight, coordination and achievement of them, which should help companies meet their organizational objectives [3].

3. Mining Business Unit of Public Power Corporation S.A

3.1. Overview

The Public Power Corporation SA (PPC) is the leading producer and supplier of electricity in Greece, with approximately 7.5 million customers. Its infrastructure extends from lignite mines to power stations. The installed capacity of generating units amounted to 12.445 MW corresponding to approximately 61% of total installed capacity in the country. Its subsidiaries, Hellenic Distribution System Operator SA and PPC Renewables SA own and operate the distribution system and renewable energy installations respectively. Fuel for the Power stations includes lignite and natural gas (for interconnected system).

PPC's Mining Business Unit consists of the Department of Central Support of Mines which is located in Athens, the Lignite Centre of Western Macedonia in Northern Greece - Macedonia and the Lignite Centre of Megalopolis in Southern Greece – Peloponnese. Five open-cast mines are located at the Lignite Centres with an annual lignite production of about 35Mt (2017).

The complicated structure of the lignite deposits, combined with the mining system, is strongly related to the main production risks of the mining stages.

3.2. Certified Management Systems at PPC's Lignite Mines

Currently, at PPC's lignite mines the following management systems standards are implemented which are certified by independent Certification Bodies:

- ISO 22301/2012 (Business Continuity Management System)
- OHSAS 18001/2007 (Health & Safety Management System)
- ISO 14001/2015 (Environmental Management System)
- ISO 9001/2015 (Quality management System)

In order to fulfill the requirements of these management systems, Mining Business Unit has developed:

- Business Impact Analyses
- Risk assessments for production risks, health & safety risks and environmental risks
- Risks Registers
- Emergency Response Contingency Plans
- Business Continuity Plans
- Safety Rules for Main Mine Equipment, Auxiliary Mine Equipment, Conveyor Belts and Maintenance facilities
- Relevant Performance Indicators
- Risk mitigation measures
- Documentation management procedures
- Roles and responsibilities regarding these activities
- Relevant procedures and guidelines regarding incident and near-misses investigation, corrective and preventive actions, internal audits, employees' actions in emergency conditions (earthquakes, severe weather conditions, fire, floods), handling and storage of hazardous materials etc
- Full scale exercises with the participation of external authorities (fire department, police, medical services)

4. Risk Management & Business Continuity Approach through the Integration of Certifiable Management Systems

The systematic approach to business continuity and risk management which is supported by the elements laid out in each of the aforementioned management system standards, is as follows:

Business Continuity Management System

Business Impact Analysis results in the identification of critical activities, the required recovery time in the event of disruption and the impact of disruption of each activity in mines' operation. This identification process establishes the timeframe within which the critical activities must be resumed after the disruption event. The identified critical activities are:

- Lignite delivery in Power Stations (quantity and quality characteristics)
- Lignite Stockyards operation
- Excavation
- Conveyors' Belts Control Room operation
- Lignite and overburden materials transfer through conveyor belts
- Electrical and Mechanical Support
- Dumping of overburden materials

The identification of critical activities and the criticality order were achieved through the use of three parameters "impact", "alternative activity" and "recovery priority". The Rate of Criticality (RoC) is calculated by the formula:

$$RoC = Impact * Alternative activity * Recovery priority$$

where:

Impact: the impact to business continuity in the case that the activity will be interrupted (1: non vital importance – 5: vital importance)

Alternative activity: in the case of activity's interruption, any alternative activity that is available instead (1: 100% substituted – 5: none)

Recovery priority: Priority in recovery in the case of disruption

(1: more than 30 days – 5: within a day)

For each of the critical activities, risks which if materialized, could have negative impact were identified and assessed. The risks assessed through a semi-quantitative method, under ISO 31000 principles and guidelines, by the use of a 5X5 risk matrix. Risk matrix plots the likelihood of an event against the magnitude or impact should the event materialize.

Business Continuity Plans and Emergency Response Plans which contain: a) specific response and recovery actions, b) response and recovery teams and c) resources required, were developed for each identified critical activity and respective risks.

Business Continuity policy and scope, procedures, records, training and exercises complete the Business Continuity Management System, according to ISO 22301 standard requirements.

Health & Safety Management System

Hazards Assessment Studies (HAS) were conducted for all mine sites. HAS addresses the issue of risk assessment and risk classification. Risk assessment and classification is inherently about the management of unplanned events, such as accidents and collapses, which may occur on a mine site. Hazards Assessment Studies include matrices of:

- "seriousness of injury" and "rate of risk"
- severity escalation
- possible damages
- remedy measures
- residual risk

Their purpose is to reduce the risk to acceptable levels.

Within this framework, Central Support of Mines Department, in close cooperation with Lignite Centres, designs Emergency Response Contingency Plans (ERCP) and reviews emergency preparedness and response plans and procedures, in particular after the occurrence of incidents or emergency situations [2].

An ERCP aims to:

- minimize the interruption of operation due to unplanned events
- limit the extent of losses and disasters and prevent their escalation
- implement in advance alternative operation modes
- train mine staff in emergency procedures

- plan for the fast and smooth recovery of operation
- minimize financial implications

The Emergency Response Contingency Plan provides a number of properly trained employees so as to react immediately in an emergency in order to address the effect of it.

Health & Safety manual, procedures, guidelines, records, training and exercises complete the Health & Safety Management System according to OHSAS 18001 standard requirements.

Environmental Management System

Significant environmental aspects of mining activity determined and evaluated by using established criteria, which results in risks associated with adverse environmental aspects (threats). Risk assessment is performed in order to evaluate these risks and prioritize their treatment.

Through the procedure “Environmental Emergencies Response” scenarios analysis and respectively response measures have been developed for possible environmental threats, such as:

- Land contamination
- Water contamination
- Linkages of hazardous gases
- Linkage / fire on fuels storage place
- Linkage / fire in hazardous chemical materials warehouse
- Explosion on explosives warehouse
- Environmental impact after a natural disaster
- Any possible environmental impact from mine activities

For each scenario, Environmental Emergency Response Plans have been developed. They include preventive measures, actions, required resources, roles and responsibilities.

Environmental manual, procedures, guidelines, records, training and exercises complete the Environmental Management System according to ISO 14001 standard requirements.

4.1. Integration of Management Systems

Common requirements for the development and implementation of those management systems are:

- Risk assessment process
- Emergency preparedness and response
- Corrective and preventive actions
- Exercising and testing
- Monitoring, measurement, analysis and evaluation
- Internal auditing procedures
- Communication
- Management review

These requirements are taken into consideration for risks which could have a disruptive effect on Business Continuity (ISO 22301), for Health & Safety risks (OHSAS 18001), for Environmental risks (ISO 14001) and for Quality risks (ISO 9001).

All the aforementioned risks cover a wide spectrum of operational risks the materialization of which could disrupt business continuity.

By integration of those management systems into an integrated management system, which is certifiable by an independent Certification Body, we could formulate a common risk management platform (Fig.1) on which an organization can also base some other management systems, apart from the aforementioned, containing threat assessment and management requirements such as ISO 28000 (Supply Chain Management) and ISO 39001 (Road Traffic Safety).

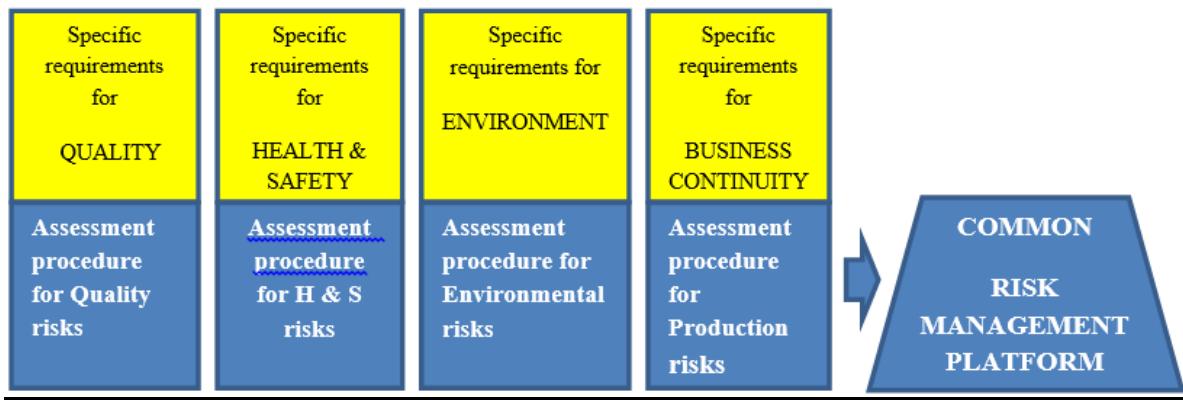


Fig. 1: Integrated QEHSBC Management System.

A single-platform QEHSBC System centralizes tracking to better identify and eliminate systemic risk which is a main goal of operational excellence. Siloing quality and EHS management creates roadblocks to achieving operational excellence, while an integrated QEHSBC System streamlines the path forward. Multiple Risk Registers could be used under the common risk management platform, to cover a wide spectrum of risks and their consequences to People, Assets, Environment, Reputation etc. Qualitative and semi-quantitative risk assessments could be backed by multi-risk rating matrix (Fig.2)

Consequence				Increasing Probability				
Rating	People	Assets	Environment	A	B	C	D	E
0	No injury	No damage	No effects	Low Risk	Low Risk	Low Risk	Low Risk	Low Risk
1	Slight injury	Slight damage	Slight effect	Low Risk	Low Risk	Low Risk	Med/low Risk	Med/low Risk
2	Minor injury	Minor damage	Minor effect	Med/low Risk	Med/low Risk	Med/low Risk	Med/low Risk	Med/low Risk
3	Major injury	Local damage	Localised effect	Med/low Risk	Med/low Risk	Medium Risk	Medium Risk	High Risk
4	Single fatality	Major damage	Major effect	Medium Risk	Medium Risk	Medium Risk	High Risk	High Risk
5	Multiple fatality	Extensive damage	Massive effect	Medium Risk	High Risk	High Risk	High Risk	High Risk

Fig. 2: Multi-risk rating matrix.

Qualitative risk assessment techniques use descriptive terms to define the likelihoods and consequences of risk events. Semi-quantitative risk assessment methods clearly identify consequences and likelihoods by assigned numbered levels that have been multiplied to generate a numeric description of risk ratings. The colours give the region of risk that require different levels of control to ensure that such an event does not occur [5].

4.2. Benefits from the Integration of Management Systems

Through the use of a common risk management platform a mining company can develop:

- an enterprise-wide risk framework which can enhance the basis for decision making through a clearer articulation of business objectives and more focused management information
- an effective risk management process, which provides the assurance that risks are being identified and controlled.

Although not any certifiable management system for risk management exists, through the integration of certifiable management systems an organization can now implement a single solution (the certifiable risk management platform) that controls a wide spectrum of operational risks. Common processes typically involve some form of hazard identification and risk assessment and choosing controls that may have technical, behavioral, organizational and procedural elements. With this integrated approach, much of what is needed from the management team can now be done

under one umbrella, and top management can now take a broader view of their organization whilst undertaking the activities of risk assessment, planning, internal audits, management review and corrective actions. Organizations with an effective integrated management system can perform optimally when challenged by disparate risks and multiple uncertainties like the peculiarities of mining industry.

Holistic risk management supports decision making and resource allocation at both strategic and operational levels and aims to eradicate or minimize the adverse effects of pure and speculative risks that organizations are exposed to. An independently certificated integrated management system can help to demonstrate to stakeholders that an effective, holistic risk management system is in place [6].

The integration of management systems drives mining company from the Calculative stage to the Generative stage according to the evolutionary model of Safety Culture [5] (Fig.2).

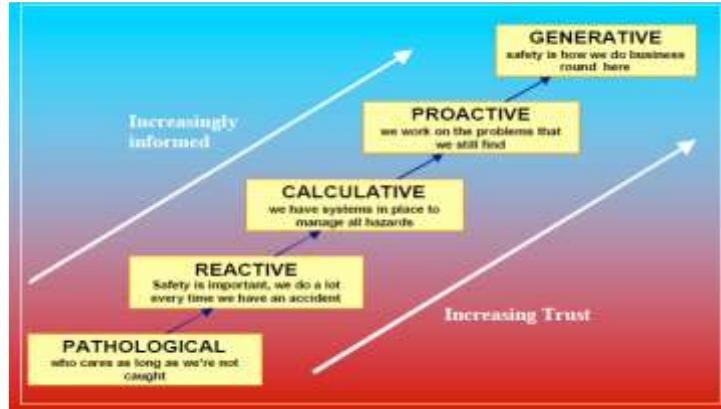


Fig. 2: The evolutionary model of Safety Culture.

Through the integration of management systems:

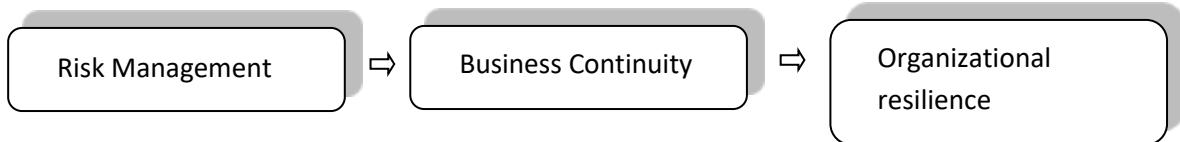
- The organisation can now be managed using joined-up thinking
- Auditing models can be revised to provide a much broader remit, but with fewer audits.
- Key Performance Indicators and objectives can now become more aligned.
- Elimination of duplication of effort is achieved
- Expertise could be shared between specialisms
- Improved QEHSBC performance is achieved

The drivers behind improving QEHSBC performance are:

- Operational performance improvement
- Sustained regulatory compliance
- Corporate culture improvement
- Overall sustainability performance improvement

5. Results of the Implementation

The combination of the certifiable risk management platform with the business continuity management system results in a resilient organization



Some indicative results from the implementation of the integrated management system includes:

• 30%-70% reduction of Incidence Frequency Rate (Health & Safety) among different mines (8,5 for 2012 - 4,66 for 2014 – 2,35 for 2015 – 1,8 for 2017, for the Lignite Centre of Megalopolis. 2014 is the first year of implementation) (*improved H & S performance*)

- 30% reduction of fines and penalties (*improved regulatory compliance*)
- 25 % increase of per employee training hours and execution of awareness campaigns for QEHS issues among employees (*corporate culture improvement*)

- Annually testing of Contingency Plans and Business Continuity Plans through full scales drills
- Action Plans for risk treatment have been developed and executed annually
- Investments in required equipment for operational preparedness in production facilities as well as in environmental and health & safety issues
- Integrated performance management system monitors the results and the formulated indices

The prevailing misconception of the past, that working safely and simultaneously taking care of environmental aspects is to the detriment of production, has no place today. The results of modern industries demonstrate that efficiency, productivity and quality are inextricably linked to high standards of safety at work and environmental protection. Figure 3 shows the correlation between the Incidence Frequency Rate for PPC's lignite mines and the lignite production. The trend shows that, despite the increase of production, the Incident Frequency Rate is reduced, confirming the effectiveness of measures taken by the MBU, so that the high level of safety to keep pace with the increase of production [2].

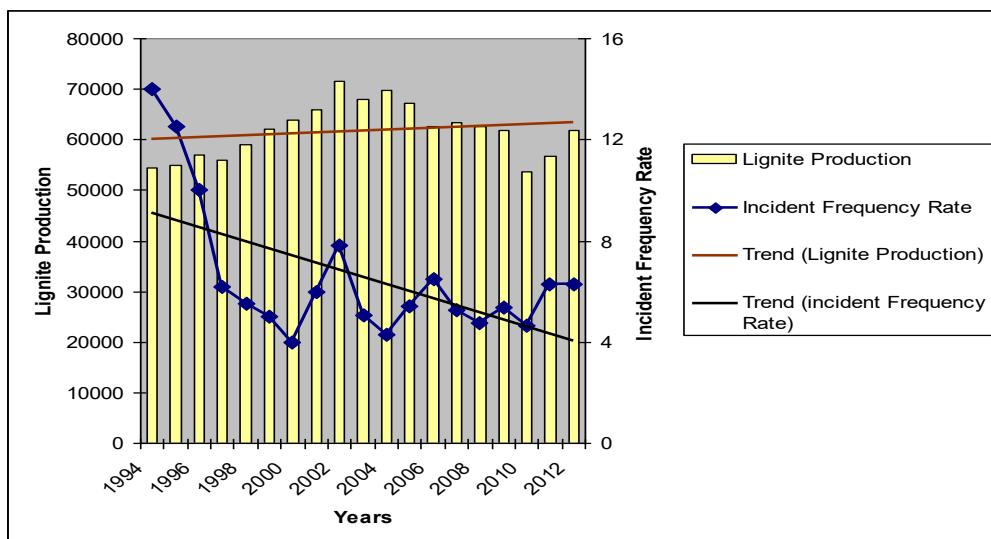


Fig. 3: Correlation between the Incidence Frequency Rate and Lignite Production.

6. Conclusions

Risk management and Business Continuity management are important aspects of mining business success. Implementation of certifiable management systems standards which includes elements that support a systematic approach to risk management, provides the structure and framework that could be adopted as long as they allow for interpretation in a manner that best suits the organization. Certifiable standards recommend regular reviews and audits of risks, risk assessment procedures and risk mitigation measures, thus avoiding complacency or a framework that becomes out of date after organizational or industry changes.

From the analysis of the present work, it is concluded that the integration of the four management systems (ISO 22301, OHSAS 18001, ISO 14001 and ISO 9001), which are certified at PPC's lignite mines is related to a lot of benefits that are summarized to the following:

- Systematic approach and certified methodology for operational risks treatment
- Reliability to stakeholders
- Alignment of policies, strategies and objectives
- Reduced implementation cost and economies of scale
- Avoidance of overlapped procedures / files and contradictions between them
- Coordinated activities for risk treatment

which ultimately assures business continuity and a resilient organization.

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