CONTROL OF ENVIRONMENT AND RISK IN INTEGRATED MANAGEMENT SYSTEMS IN IRON AND STEEL FOUNDRY

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SUMMARY

The contribution discusses the problems of integrated management system with special attention to environment; safety, health and risk in industrial company. The issues of the management systems are applied to hypothetical iron and steel foundry. Four main items of the Integrated Safety, Health and Environment Management System are also presented.

Key words: Safety; Health; Environment; Management system

1. INTRODUCTION

Besides managements of production processes, financial processes and human sources an integrated management system consists of three mutually interlinked parts (1):
- Quality management systems,
- Environmental management systems,
- Safety, health and risk management systems.

Quality management systems will not be discussed in this contribution. ISO 9000 standards for quality management systems, their structure and character, formed a basis for preparation and establishment of environmental and safety, health and risk systems. Actions in the organization leading to high quality of its products and to full satisfaction of its customers must not be in contradiction to environmental policy of the organization. ISO 14000:1998 standards for environmental management systems were prepared and established on the international basis. Quality management systems actions must not be also contradictory to safety and risk regulations of production.

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processes in the organization. It was reason why management systems for work safety and health protection by OHSAS 18000:1999 standards were established.

In this contribution we shall present hypothetical iron and steel foundry, implementation of environmental management system in the foundry, the most important environmental problems in the foundry, the main principles of work safety and health protection management systems.

2. IRON AND STEEL FOUNDRY

Hypothetical iron and steel foundry produces rich sortiment of castings from cast iron and special steels. It uses one cupola furnace for cast iron preparation, one electric arc furnace with 3 t capacity and one induction furnace with 1 t capacity for steel melt preparation. Solid foundry pig iron and steel scrap are used for metallic parts of furnace charges, silica sand with bentonite is used for moulds preparation, silica sand with organic binders for core making. Both mechanical and manual preparation of moulds is used. Fettling of castings is performed by mechanical way in dust – proof space. The castings are heat treated in resistance furnace with controlled regime. Off – gases and flue dust from melting furnaces and casting shop are eliminated by system of sucking hoods. Bag filters are used for cleaning of off – gases and flue dust.

ISO 9000:2000 Quality management system defines whole business in organization as a chain of interlinked processes. The processes are subdivided into three categories: managerial processes, main processes, supporting processes. Customers, their requirements and satisfaction, and suppliers are also linked into organization processes.

3. ENVIRONMENTAL MANAGEMENT SYSTEMS

Realization of quality management system is not sufficient, when production system produces industrial waste, emission to atmosphere and spoils water sources. It was the reason why environmental legislative directed to decrease of environmental burden was established as the family of standards ISO 14000 for environmentaly oriented system.

The standard ISO 14001 relates to those environmental aspects of organization that are under influence of organization and can be operatively managed by the organization. The standard does not determine exact criteria of environmental behaviour. It can be used by the organization that wants:

1. to set up, keep and improve the environmental management systems,
2. become convinced about concord with declared environmental policy,
3. to demonstrate this concord to others,
4. to aim for certification of environmental management system by independent external organization,
5. as a result of its own decision to declare concord with the international standard.
Environmental policy as a general declaration is prepared by top management of the organization. It follows from thorough analysis of initial state and contains the goals from the field of environment, declared by the organization. The policy contains obligation of continuous improvement. It is documented and made accessible to employees of the organization and to public.

Beside management responsibility the standard consists of four main clauses:

- planning
- implementation and operation
- control and corrective actions
- management review

The planning defines environmental objectives and needs for their solution together with legal and other demands. Long-term and short-term actions are defined together with responsibilities. Implementing and operation clause defines structure of EMS and responsibilities. Requirements for communication in the system, documentation and document control are stated. The main point of the clause is identification of shops and activities that are responsible for environmental burden. Very important clause Control and corrective actions deals with the methods of measurements, analysis, monitoring, nonconformities in the field of environmental burden, corrective and preventive actions. Audits of EMS are also covered by this clause. Concerning Survey by management clause contents, top management has to survey in predetermined intervals all aspects of the environmental management system. Problems of continual improvement are also included in the clause.

4. ENVIRONMENTAL PROBLEMS IN FOUNDRY

The main environmental problems in foundry are:

- Generation of harmful and noxious gases: CO, CO₂, SO₂, NOₓ, hydrocarbons,
- Generation of flue dusts,
- Generation of heavy metals vapours: Zn, Pb, Sn, Cd,
- Generation of wastes,
- Contamination of waste water,
- Noise and vibrations.

Pollution control in foundries is treated in Australian Environment Protection Act Guidelines (3). Air pollution is a major environmental problem for foundries. The main sources of pollution are:

- Noxious gases, including partially oxidized hydrocarbons, and odorous substances from mould production, casting, cooling and knocking out,
- Dust and fumes from melting, hot metal transfer and casting,
- Dust and fumes from materials handling and finishing operations.

Three techniques are currently used for elimination of harmful releases:
- supression of emissions at their source,
- local containment,
- remote extraction of emissions.

Emissions can be suppressed at source by sucking of generated emissions from covered smelting units (4th hole in electric arc furnace cover), runners etc. Local containment is realized by local sucking hoods placed over possible sources of emissions. Such measures are not effective for secondary fumes. Remote, high level extraction is used in this case.

Amount of contaminated water from foundries is usually small, comprising:
- discharge from wet scrubbers,
- cooling water, often containing biocides and anti-oxidants,
- leachate from slag.

Process water is not suitable for discharge to water sources.

Foundries generate wastes (4) such as waste sand, slag, waste chemicals and binders. Amount of waste sand is 150 to 200 kg.t⁻¹ of castings. Amount of slag from EAF steel smelting is about 100 kg.t⁻¹ of castings.

5. SAFETY, HEALTH AND RISK MANAGEMENT SYSTEMS

Based on principles of quality management systems and environmental management systems many national and institutional standards for work safety and risk prevention were developed and established. Needs for united criteria resulted in fact, that the British standard BS 8800 became accepted as a standard in many countries. This development led to preparation and acceptance of international document OHSAS 18001 – Systems of work safety and health protection. This document has not a statute of official international standard.

The document is compatible with QMS standards ISO 9000 and with EMS standards ISO 14000. It has following characteristic features:
1. Top management of the organization has full responsibility for work safety and health protection system (WSHPS). He prepares WSHP institutional policy, compatible with the other organization’s conceptions. The policy is general document destined for both employees and public. It contains commitment of the organization in this field.
2. The management has to secure WSHPS conception is understood and applied by all employees of the organization.
3. Prevention of the problems and defects is the main goal of the system.
4. The system must be applied in all processes in the organization.
5. Responsibilities and relations of all people in the organization related to the system must be exactly defined.
6. Information flow and actual feedback form substantial support of the system.
7. Documentation in the system has high priority. All principles and procedures related to the system must be documented. Also all activities that are sensitive to work safety and health protection must be documented. Regular control of documents must be established.

8. Working plans of the processes have to be prepared with attention to WSHPS demands.

9. All materials, technique and technology used in the organization’s processes must be checked to comply with the system demands.

10. Programmes for education and training of the employees must be prepared with attention to WSHPS principles.

11. Identification of all possible risks in processes and continual improvement of the processes from work safety and health protection point of view is the main aim of the system.

6. INTEGRATED SAFETY, HEALTH AND ENVIRONMENT MANAGEMENT SYSTEM

Four subject disciplines, that are applied to Integrated Management System, were described by Industrial Accident Prevention Association, Canada (6). They are:

- Safety management,
- Health management,
- Environmental management,
- Process safety management.

Safety Management. The principles of safety management are applied to activities that identify and quantify the risk of personal injuries in the workplace. This application involves understanding and anticipating the legal, technical, economic, social, cultural and physical environmental factors affecting the organization. The safety management consists of the following elements: General rules; Behaviour based performance; Work permits; Product safety; Off the job safety; Workplace violence; Security.

Health Management. The aim of a health management system is to anticipate, recognize, evaluate and control all health hazards in the work environment and to provide appropriate resources for the overall health and wellness of all workplace parties. Elements within this discipline include: Occupational hygiene; Medical; Ergonomics; Wellness; Psychosocial risk.

Environmental Management. An environmental management system provides the framework for an organization to achieve and sustain performance in accordance with established goals and in response to constantly changing regulations, social, financial, economic and competitive pressures related to environmental risk. It contains the elements of: Waste management for both hazardous and non-hazardous waste; Pollution prevention for air, water, soil, and ground water; Community involvement as for fauna, flora and humans.
Process Safety Management. Process safety management is the application of management principles and systems for the identification, understanding and control of process hazards to prevent process related injuries, illnesses, fire explosions and releases of toxic chemicals or flammable liquids and gases into the environment. The process safety identifies, assesses and controls process safety hazards throughout the life cycle of a process: from conception and design, through construction, to start up and operation of the facility. Elements of the Process Safety Management include: Process hazard information and knowledge; Process hazard identification and analysis; Process design considerations and facility location; Process equipment integrity; Pre start up safety / health and environment reviews and compliance audits; Sharing of process safety information / incident learning.

7. CONCLUSIONS

The contribution deals with three elements of an integrated management system: quality; environment; safety, health and risk. Special attention is paid to the second and the third part. Main features of Environmental Management System are presented together with their application in iron and steel foundry. Three main hazards to environment in the foundry are discussed: emissions to air; contamination of water; generation of wastes. Principal information on Safety, Health and Risk Management System are also given. The contribution is finished by presentation of four main items of Integrated Safety, Health and Environment Management System.

REFERENCES

STRESZCZENIE

Przedyskutowano problemy związane z zarządzaniem ryzykiem, środowiskiem oraz bezpieczeństwem pracy w ramach zintegrowanego systemu w odlewni żeliwa i staliwa. Omówiono trzy główne zagrożenia środowiska w odlewni: emisję do powietrza, zanieczyszczenie wody i wytwarzanie odpadów.

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