# Study, Review, and Implementation of International Standards on Health and Safety Management System (HSE-MS) in Glass Point Solar using OHSAS for Petroleum Development in Oman (PDO)

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*Abstract*— The study have involved reviewing the existing Health and safety management system in the company by keeping the international standard in line to find out the deficiencies, so that the findings could be implemented to improve the areas identified through deep studies. The review of Glass Point HSE-MS was done against OHSAS 18001:2007 and legal requirements of Sultanate of Oman since Glass Point is working for Petroleum Development Oman which is OHSAS 18001:2007 certified and Glass Point are bound to follow the requirements of Petroleum Development Oman's HSE-MS. On the review conducted a few gaps where identified and these gaps were highlighted and provided with recommendations and an action plan for better management of HSE-MS. Out of the eight elements that where reviewed which has been devised by Petroleum Development Oman with reference to OHSAS 18001 the prioritized points for improvement in HSE management system, hazards and risks in the activities with prioritization are brought in this report after deep studies. On the review conducted on the HSE-MS based on the eight elements gaps where identified in the following five elements: - Leadership and Commitment; Policies and Strategic Objectives, Organization, Responsibilities, Resources, Standards and Documents; Monitoring and Audit; Management Review.

***Keywords:*** Hazard Identification & Risk Assessment, Glass point HSE analysis, Petroleum industries, Petroleum development in OMAN (PDO), OHSAS, Health and safety management system (HSE-MS), International standards, NEBOSH, Failure Mode including Effect Analysis, and Consequences Analysis

## I. INTRODUCTION

Petroleum, Gas, oil, and solar products are the type of very dynamic and complex industry, facing numerous challenges. [1] Health and Safety (HS) concept can play a vital role in preventing and mitigating all critical risk factors and this only can be achieved by ensuring the implementation of HS matters in the whole industrial life cycle. [2] The overall risk and safety may be achieved by using some standard methods of performing works and this can be achieved through accurate hazards identification techniques such as Task Risk assessment (TRA), Hazard Identification (HAZID), and Hazard and Operability Study (HAZOP). [3] The work here put some of the important suggestions taken from the previous researchers that all HS matters in the organization can be addressed and implemented effectively if there is a specific system such as Health, Safety and Environmental Management System (HSE-MS).

Fig. 1: Petroleum developments in OMAN (PDO) [4]

Usually in operations sites, a multitude of safety problems occur frequently each year, leading to personal injury and may permanently affect employee's long-term health [5]. In order to improve safety engineering system and reduce accidents as well as personnel injuries, HSE-MS must be constantly improved the concepts and principles that are used in the development and management of an effective HSE program. The HSE-MS plan should be continuously improved with particular emphasis on organizational accident [6].

The Organization of Petroleum Exporting Countries (OPEC) recognizes the United Arab Emirates (UAE) as one of the leading countries in the oil and gas industry in the Middle East and the world where it owns around 10% of the world's total crude oil reserves [7]. According to OPEC's annual statistical report in 2018, the crude oil export rate for UAE is 2.9 million barrels per day (b/d) where the production rate of the onshore oil and gas construction rigs is around 1.8 million (b/d). UAE is ranked as the fourth largest gas reserves country in the world for the gas production after Russia, Iran, and Qatar [8].

The oil and gas industry in UAE witnesses a continuous improvement and development in the production rate as shown in Table 1.

| Year | Production rate Million (b/d) |
|---|---|
| 1984 | 1.0 |
| 1990 | 1.1 |
| 1995 | 1.6 |
| 2000 | 1.8 |
| 2005 | 2.0 |
| 2012 | 2.2 |
| 2018 | 2.9 |

Table 1: Crude Oil production for UAE (OPEC, 2018) [8]

The efficiency of the oil and gas construction projects from 1980 until the present time plays a vital role in enhancing the production rate. The oil and gas construction projects in UAE are divided into three main categories; onshore, offshore and pipelines where around 90% of these construction projects are located in onshore fields. There are

 

several activities that can take place at the materials fabrication, structure installation, etc., which are performed at the required phases (e.g. exploration or production) [9].
All these construction activities are associated with serious hazards such as working at height and dropping objects due to the hydrocarbon materials existence. For instance, fire, explosion, and blow out can be critical hazards that can lead to fatalities.

Oil and gas construction projects have witnessed many historical catastrophes that eventually laid the groundwork for professional practices to the industry [10]. These serious safety failures increased the oil and gas construction world awareness towards safety implementation in the construction activities such as structure installation, foundation pilling, and materials fabrication.

| S. NO | NOTATION | FULL FORM |
|---|---|---|
| 1. | OHSAS | Occupational Health and Safety Management Certification is an international standard |
| 2. | HSE ME | Health and safety management system |
| 3. | HSEIA | Health, Safety and Environment Impact Assessment |
| 4. | EERA | Escape, Evacuation and Rescue Assessment |
| 5. | HAZID | Hazard Identification |
| 6. | HAZOP | Hazard and Operability Study |
| 7. | QLRA | Qualitative Risk Assessment |
| 8. | COMAH | Control of Major Accident Hazards |
| 9. | Bowtie Analysis | Major Accident Hazard Analysis |
| 10. | MOPO | Manual of Permitted Operations |
| 11. | OHRA | Occupational Health Risk Assessment |
| 12. | TRA | Task Risk Assessment |
| 13. | QRA | Quantitative Risk Assessment |

Table 2: Risk assessments that are used in oil and gas in UAE [13]

The main aim here in this research of our work is to carry out a detailed review of the Health and Safety performance of Glass Point Solar Muscat LLC with respect to its compliance with OHSAS 18001:2007 to identify the gaps in the current Health and Safety System of Glass Point. Here in this record we also produce a justified and reasonably practicable Action Plan to improve the current Management Performance of Glass Point and for the proper success of work we adopt a Unit D of NEBOSH IDIP [14]. Here a vast research and review was carried out and we find a Gap Analysis on the existing Health and Safety Management System of Glass Point with reference to OHSAS 18001:2007.

Fig. 2: Glass Point Solar Muscat LLC [15]

### *A. NEBOSH*

The International General Certificate in Occupational Health and Safety is suitable for managers, supervisors and staff based outside the UK from all types of organizations making day-to-day decisions at work that need a broad understanding of health and safety issues and be able to manage risks effectively. Nearly 55,000 people have achieved this qualification since it was introduced in 2004 [18].

The NEBOSH International General Certificate is also suitable for those embarking on a career in health and safety, providing a valuable foundation for further professional study (such as the NEBOSH International Diploma in Occupational Health and Safety). The International General Certificate is modeled on the NEBOSH National General Certificate in Occupational Health and Safety, the most widely recognized health and safety qualification of its kind in the UK. The key difference between the two qualifications is in the applicability of legal requirements. Rather than being guided by a specifically UK framework, the International General Certificate takes a risk management approach based on best practice and international standards, such as International Labor Organization (ILO) codes of practice, with special reference to the model proposed in the ILO's "Guidelines on Occupational Safety and Health Management Systems" (ILO-OSH 2001). Local laws and cultural factors form part of the study program where relevant and appropriate.
Key topics covered

- International standards for health and safety at work
- Implementation of health and safety management systems
- Identification of workplace hazards
- Methods of hazard control
- Practical application of knowledge and understanding

### *B. OHSAS*

This section includes an overview of BS OHSAS 18001 Occupational Health and Safety Management Systems Specification and OHSAS 18002 – Occupational Health and Safety Management Systems – Guidelines for the implementation of BS OHSAS 18001 and how they correspond to other management standards designed to manage quality and environmental issues [19]. BS OHSAS 18001 is a specification giving requirements for an Occupational Health and Safety OH&S Management

 

System, to enable an organization to control its OH&S risks and improve its performance. It does not lay down specific performance criteria or give detailed specifications for the actual structure or form of the management system. It is applicable to any organization that wishes to:

1) Establish an OH&S Management System to eliminate or minimize risk to employees and other interested parties who may be exposed to OH&S risks associated with its activities.
2) Implement, maintain and continually improve an OH&S Management System.
3) Assure itself of its conformance with its stated OH&S policy.
4) Demonstrate such conformance to others.
5) Seek certification/ registration of its OH&S Management System by an external organization.
6) Make a self-determination and declaration of conformance with this OHSAS specification. All the requirements of BS OHSAS 18001 are intended to be incorporated into any OH&S Management System.
7) The extent of the application of the specification will depend on factors such as the policy statement, the nature of the activities of the organization and the risks and complexity of its operations.
8) It is intended to address occupational health and safety rather than product and services safety.
9) OHSAS 18002 is the guidance, providing generic advice on the application of BS OHSAS 18001. It explains the underlying principles of BS OHSAS 18001 and describes the intent, typical inputs, processes and typical outputs, against each requirement of the standard in order to aid the implementation process. It does not contain any additional requirements or prescribe any mandatory approaches to the implementation of BS OHSAS 18001.

## II. LITERATURE REVIEW

Edward-Odoi et.al [20] investigated the relationship between asset integrity safety and organizational health in the Nigerian Petroleum Industry.

Faith Eyayo et.al [21] Occupational Health Hazard which is different from Occupational Safety Hazard is prevalently on the rise as industrialization increases in the global world.

Panagiotis Marhavilas et.al [22] A significant part of literature has shown that the adoption of Sustainability and Health-Safety management systems from organizations bears some substantial benefits since such systems (i) create a suitable frame for the sustainable development, implementation and review of the plans and/or processes, necessary to manage occupational health-safety (OHS) in their workplaces and (ii) imply innovative thinking and practices in fields of economics, policy-making, legislation, health and education.

Moahamed Younes El Bouti et.al [23] Oil and Gas Industry (OGI) faces a number of evolving and various types of risks and hazards that give rise to serious incidents. To conduct this study 801 incidents reports have been numerically analyzed, evaluated and interpreted.

Sundaram Haridoss et.al [24] deals with the hazards and safety issues and its management practices in Oil and gas industry. In Oil and gas industry, during the well drilling and other service activities involve the use and production of potential hazards. Oil and gas wells can release hydrogen sulfide and expose workers to hydrogen-sulfide gas.

Sunil Jayant Kulkarni et.al [25] Environmental friendly and safe operations and processes are always desired from health perspectives.

## III. SYSTEM AND METHODOLOGY

The American company pioneered an enclosed trough system which is particularly suited to transport the CSP technology from the arid region of southern California to the desert environment of the Arabian Peninsula. Setting up the solar mirrors inside a greenhouse results in three major advantages: reducing costs, achieving high energy density, and protecting sensitive technology [35].

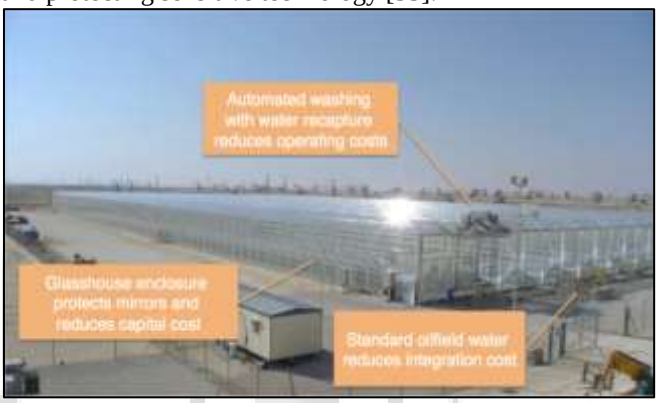


Fig. 3: Operating CSP in Desert Conditions, Glass point [36]

To avoid soaring custom project costs, Glass Point builds its solar fields in glasshouse blocks using a series of standardized steps, where the majority of the system is comprised of prefabricated components that can be easily assembled onsite. Routine constructions steps not only improve the speed of deployment, but by doing so also drive down the costs of construction. This point was validated on November 1st, 2017, when PDO and Glass Point announced that the first out of 36 blocks that constitute the solar plant was completed on time and on budget (PDO 2017).

Standardized construction measures as well as the availability to fall back on lower-cost material thanks to the protection offered by the glasshouse, drastically decreases the production costs. Furthermore, the straight surface of the greenhouse positively affects operating costs as it allows for easy cleaning by a robotic system, compared to a slightly more complicated cleaning process for the curved mirrors.
The second advantage of the enclosed troughs is that the glasshouse blocks provide high energy density as 93 percent of the land area can be covered with mirrors. Since the materials used in an enclosed trough can be low-cost, it is more cost-efficient to pack the collectors tightly together into a smaller space [37].

The additional energy generated during peak sun hours, when the sun is high in the sky, far exceed any losses from shading caused by neighboring mirrors during the low

 

sun hours. Achieving high energy density is crucial for EOR applications because steam needs to be produced close to the oil field so that it travels the shortest distance. Without the protection offered by the glasshouse, sand and dust storms, common phenomena in the deserts of the Middle East, would decrease the efficiency of the mirrors through soiling. Because the glasshouse has a height of 6 meters above the ground, soiling rates are 50 percent less compared to objects that are merely 1 meter above the ground. The glasshouse also prevents damages to the mirrors and other delicate components of the system caused by sand, wind, and humidity.

Legal environment of company

- RD 35/2003 - Labor Law
- MD 286/2008 Regulation of Occupational Safety and Health
- MD 18/93 - Regulations for Management of Hazardous Waste
- MD 80/94 – Regulations for Control of Noise Pollution in a Work Environment
- PR 1172 of PDO – Permit to Work System
- SP 1257 of PDO – Work at Height and Access
- SP 1157 of PDO – HSE Training Specifications
- CP 122 of PDO – Health Safety and Environment Management System


Fig. 4: Elements Flow Chart

| HSE MS EIGHT ELEMENTS | OHSAS 18001:2007 |
|---|---|
| Leadership and Commitment | Resources, Roles, Responsibility, Accountability and Authority. |
| Policy and Strategic Objectives | General Requirements, OH&S Policy, Legal and Other Requirements |
| Organization, Responsibilities, Resources, Standards and Documents. | Resources, Roles, Responsibility, Accountability and Authority, Competence, Training and Awareness. Communication, Participation and Consultation. Documentation, Control of Documents. |
| Hazards and Effects Management | Hazard Identification, Risk Assessment and Determining Controls, Emergency Preparedness and Response. |
| Planning and Procedures | Objectives and Program, Operational control, Emergency Preparedness and Response. |
| Implementation and Operations | Operational control, Control of Documents. |
| Assurance: Monitoring and Audit | Performance Measurement and Monitoring, Evaluation of Compliance, Incident Investigation, Non Conformity, Corrective Action Preventive and Action, Internal Audit. |
| Review | Management Review. |

Table 3: Tabular Form for Description of Elements

## IV. TECHNICAL ASPECTS

PDO activities have the potential to harm people and the environment, to cause damage or loss to assets, to defer oil product ion, to cause financial loss, and to adversely impact the Company's reputation. A Hazards and Effects Management Process (HEMP) provides a structured approach to managing the hazards and potential effects of PDO"s activities. There are numerous techniques to carry out HEMP, and the technique chosen should be aligned to the scope of work, risk scenarios in that work, etc. Once this is known, an appropriate technique can be chosen, such as Hazard Identification (HAZID), Hazards Analysis (HAZAN), Hazards & Operability (HAZOP), Task Risk Assessment (TRA), Quantitative Risk Assessment (QRA), Job Safety Plan (JSP), etc.

1) Gap Analysis layout Leadership and Commitment
2) Gap Analysis layout Policy and Strategic objectives
3) Gap Analysis layout Organization, Responsibilities, Resources, Standards and Documents
4) Gap Analysis layout Hazards and Effects Management
5) Gap Analysis layout Planning and Procedures
6) Gap Analysis layout Implementation and Operations
7) Gap Analysis layouts Assurance: - Monitoring and Audit
8) Gap Analysis layouts Assurance: - Monitoring and Audit

| | |
|---|---|
| 0 | No injury or damage to health |
| 1 | Slight injury or health effects (including first aid case and medical treatment case and Occupational Illness) – Not affecting work performance or causing disability. |
| 2 | Minor injury or health effects (Lost Time Injury) – Affecting work performance, such as restriction to activities (Restricted Work Case or Occupational Illness) or a need to take a few days to fully recover (Lost Workday Case). Minor health effects, which are reversible, e.g. skin irritation, food poisoning. |
| 3 | Major injury or health effects (including Permanent Partial Disability and Occupational Illness) – Affecting work performance in the longer term, such as a prolonged absence from work. Irreversible health damage without loss of life, e.g. Noise induced hearing loss, chronic back injuries, sensitization, hand/arm vibration syndrome, and repetitive strain injury. |
| 4 | Permanent Total Disability or one to three fatalities – From an accident or occupational illness. Irreversible |

 

| | |
|---|---|
| | health damage with serious disability or death, e.g. Corrosive burns, heat stroke, cancer (small exposed population). |
| 5 | Multiple fatalities – From an accident or occupational illness e.g. Chemical asphyxiation or cancer (large exposed population). |

Table 4: Severity Levels in RAM (PEOPLE)

| | |
|---|---|
| 0 | Zero damage |
| 1 | Slight damage – No disruption to operation (costs less than USD 10,000) |
| 2 | Minor damage – Brief disruption (costs less than USD 100,000) |
| 3 | Local damage – Partial shutdown (can be restarted but costs up to USD 1,000,000) |
| 4 | Major damage – Partial operation loss (2 weeks shutdown costs up to USD 10,000,000) |
| 5 | Extensive damage – Substantial or total loss of operation (costs in excess of USD 10,000,000) |

Table 5: Severity Levels in RAM (ASSET)

| | |
|---|---|
| 0 | No impact – No public awareness |
| 1 | Slight impact – Public awareness may exist, but there is no public concern |
| 2 | Limited impact – Some local public concern. Some local media and/or local political attention with potentially adverse aspects for company operations. |
| 3 | Considerable impact – Regional public concern. Extensive adverse attention in local media. Slight national media and/or local/regional political attention. Adverse stance of local government and/or action groups. |
| 4 | National impact – National public concern. Extensive adverse attention in local media. Effect on Regional/national policies with potentially restrictive measures and/or impact on grant of licenses. Mobilization of action groups. |
| 5 | International impact – International public attention. Extensive adverse attention in international media. National/international policies with potentially severe impact on access to new areas, grants of licenses and/or tax legislation. |

Table 6: Severity Levels in RAM (ENVIRONMENTAL IMPACT)

| | |
|---|---|
| 0 | No impact – No public awareness |
| 1 | Slight impact – Public awareness may exist, but there is no public concern. |
| 2 | Limited impact – Some local public concern. Some local media and/or local political attention with potentially adverse aspects for company operations |
| 3 | Considerable impact – Regional public concern. Extensive adverse attention in local media. Slight national media and/or local/regional political attention. Adverse stance of local government and/or action groups. |
| 4 | National impact – National public concern. Extensive adverse attention in the national media. Effect on Regional/national policies with potentially restrictive measures and/or impact on grant of licenses. Mobilization of action groups. |
| 5 | International impact – International public attention. Extensive adverse attention in international media. National/international policies with potentially severe impact on access to new areas, grants of licenses and/or tax legislation. |

Table 7: Severity Levels in RAM (REPUTATION)

## V. CONCLUSION

Out of the eight elements of the HSE MS reviewed the organization has a full compliance on the elements such as Hazard and Effect Management, Implementation and Operations and Planning and Procedures. Non compliances where observed in the below mentioned elements such as:-

1) Leadership and Commitment
   Neither the line supervisors nor their team leads are conducting regular inspections and audits as per HSE MS. Mandatory HSE trainings pending for few employees.
2) Policy and Strategic Objectives
3) Organization, Responsibilities, Resources, Standards and Documents
4) Monitoring And Audit:
5) Management Review

### *A. Conclusion from the Hazard Identification and Risk Assessment Conducted*

From the Hazard identification conducted, working at height activities were found frequent and considering the potential risk with the hazards involved in the activities, two hazards one physical and health hazard have been given high priorities;

1) Scaffolding and Working at Height - Physical Hazard.
2) Working in High Temperatures - Health Hazard.

On reviewing the existing risk assessments on the above mentioned two hazards it was concluded that a few additional control measures can be implemented for better and safer management on the mentioned activities.

### *B. Conclusions from the Risk Assessment on Physical Hazard*

1) Periodic Inspection and certification of the mobile maintenance cart platform by competent person.
2) Provision of Safety Straps to prevent suspension trauma and acquire more time for emergency response.
3) Awareness program on Suspension Trauma for all personnel working at height.
4) Periodic Inspection of ladders and maintaining a register for the ladders and its inspection schedules.
5) Preparation of an emergency rescue plan for fall from height.

### *C. Conclusions from the Risk Assessment on Health Hazard*

1) Provision of electrolyte (Oral Rehydration Solution) for workers during summer season.
2) Provision of cooling (ice) jackets for personnel working inside the Glass House.

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