SAUDI BINLADIN GROUP
OPERATION & MAINTENANCE

HSE PLAN

(SBG O&M)

Project Details

CLIENT	
CONTRACTOR	**SBG O&M**
CONTRACT NO	
DOCUMENT	**HSE PLAN 2017**
DOC. REV. STATUS	**HSE- 01**

DOCUMENT	**SBG O & M HSE PLAN -2007 – 001 Rev 01 – A**
CONTRACT No	
ISSUE	Dated 5th Jan 2013

Sr. No.	Item	Designation	Name	Signature
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Approval	
Date	28th Jan 2013
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Controlled Copy Number	HSE Mukhaizna 0

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INTRODUCTION

This HSE Plan gives guidelines to all levels of personnel regarding their responsibilities in effective HSE Management. It sets high level goals and targets for effective implementation of HSE Policies and procedures. It clearly identifies actions, action party's and target completion dates.

This HSE plan is a tool to improve HSE standards and achieve our ultimate goal of "Zero LTI"

- Managing risk is the summation of all the activities and events associated with the HSE Management System.
- The process for HSE excellence is a business process designed to manage the risk in our daily activities.
- This safety process will be an integral part of our management focus. Safety will be given the same priority as other processes; unless the controls fail then it will be "Safety First".
- We will aim to empower our employees towards proactive performance.

SAFETY POLICY:

To improve the Standard Operating Procedures in all the project sites by following the safety guidelines from the Civil Defense, NFPA & Also according to the international safety regulatory organizations (OSHA, ISO& OHSAS). SBG O&M believes in developing safe working procedures and maintaining a ***0 injury working environment.*** This scope clearly concludes that our main scope is improved performance and the effective utilization of the resources and for the benchmarking with the other departments.

STANDARD OPERATING PROCEDURES:

Protection of Workers:

When construction or repair activity is in progress, for whatever purpose, the employees shall be protected to the same extent as if construction or repair were complete. As per **ILO R-164,** it is the responsibility of the employer to provide safe system of work, safe equipment of work, safe working method and appropriate personal protective equipment.

The activity shall not create any additional danger beyond the normally permissible conditions of the building/site. When these requirements cannot be met, that specific site location or affected portion thereof shall not be occupied.

Protection of Workers during the Maintenance Activities:

Every required exit, way of approach there to, and way of travel from the exit into the corridor or open space shall be continuously maintained free of all obstructions to full instant use in the case of fire or other emergency. Every automatic sprinkler system, fire detection and alarm system, exit lighting, fire door, and other item or equipment, where provided, shall be continuously in proper operating condition. There must be adequate implementation of the HSE policy in each and every activity in accordance to the safe system of work.

Fire Protection Provisions:

Protection – such as automatic sprinklers, and fire retardant paints – are required and/or installed, they shall be regularly inspected, maintained, and renewed as necessary to keep them in good operating condition. The fire retardant doors and the material of construction must be exhibiting appropriate fire retardant properties.

Emergency Action Plan:

The emergency action plan is already in writing & available to all staff & training has already been provided to all about that.

The plan includes, at a minimum, the following important elements:

- ✓ Escape procedures and escape route assignments
- ✓ Critical operations shutdown procedures
- ✓ Procedure to account for all personnel
- ✓ Rescue and medical duties assignment
- ✓ Means of reporting fires and emergencies
- ✓ Identification of responsible persons for further information
- ✓ This emergency action plan addresses all potential emergencies that can be expected.

Alarm System:

Alarms should be audible or seen by all people in the area and should have an auxiliary power supply in the event electricity is affected. The alarm should be distinctive and recognizable as a signal to evacuate the work area or perform actions designated under the emergency action plan

Medical Assistance:

In a major emergency inside the DOKAAE complex (God Forbid), time is a critical factor in minimizing injuries.

Hospital at P11 & Ajyad emergency hospital (Safwa Tower) can be used for the treatment of all injured visitors, employees in case of major accident; SSCL safety staff is adequately trained to render first aid.

Where the eyes or body of any employee may be exposed to injurious corrosive materials, eye washes or suitable equipment for quick drenching and flushing must be provided by the DOKAAE project management.

SSCL safety representatives are trained to use any emergency equipment.

The project management must ensure the ready availability of medical personnel for advice and consultation on matters of employee health. This does not mean that health care must be provided, but rather that, if health problems develop in the workplace, medical help will be available to resolve them.

Fire Prevention Plan:

The following elements, at a minimum, have been included in a fire prevention plan.
A list of all major work place hazards and their proper handling and storage procedures, potential ignition sources, and type of fire equipment or systems to control a fire involving them.
Names or job titles responsible for maintenance of equipment and ignition prevention or control systems.
Job titles or persons responsible for control of fuel source hazards

Housekeeping:

Upon initial assignment, the SSCL safety team shall review those parts of the fire prevention plan which each employee must know to protect them in the event of an emergency. The written plan shall be kept in the work place and available to the all employees.

Electrical Safety:

Eelectrical accidents in the area can, for the most part, be avoided if the

- ✓ Safe electrical equipment is used
- ✓ And safe work practices are adopted

Work At Height Safety:

Areas or Activities Where Fall Protection will be needed:

- ✓ Hoist areas
- ✓ Form work and reinforcing steel
- ✓ Leading edge work, unprotected sides and edges
- ✓ Roofing works, pre-cast concrete erection
- ✓ Construction and other walking/working surfaces

Fall Protection Standard:

- ✓ The rule sets a uniform threshold height of 6 feet (1.8 meters), thereby providing consistent protection.
- ✓ The workplace to determine if the walking or working surfaces have the strength and structural integrity to safely support workers.
- ✓ Selection of proper fall protection system to protect exposed employees at 6 feet (1.8 m) or more.
- ✓ Proper training will be provided related to the work at height safety
- ✓ Protection also will be provided for shops & restaurants workers who are exposed to the hazard of falling into dangerous equipment**.**

Fall Protection Systems:
In case of work at height following fall protection mechanisms will be implemented by the SSCL team;

- ✓ Guardrail Systems.
- ✓ Personal Fall Arrest Systems
- ✓ Safety Monitoring Systems
- ✓ Safety Net Systems
- ✓ Warning Line Systems

Control of Hazardous Energy:

Serious injuries can be caused to the visitors & employees working at DOKAAE complex by the sudden and unexpected start-up of the machinery or equipment, contact with live electrical circuit or the unexpected release of stored energy.
These hazards can be avoided through the use of lockout/tag-out procedures**.**

Lockout:
The placement of a lockout device on energy – isolating device, in accordance with an established procedure, ensuring that the energy – isolating device and the equipment being controlled cannot be operated until the lockout device is removed**.**

Tag-out:
The placement of a tag-out device on an energy-isolating device, in accordance with an established procedure, to indicate that the energy-isolating device and the equipment being controlled may not operate until the tag-out device is removed.

SAFETY MANAGEMENT SYSTEM

Purpose and Objective:

To develop and promote employee awareness with the importance of adhering to Safety Procedures, thereby ensuring protection to the worker, public and environment. SBG O&M accomplishes this objective through effective integration of safety management into all facets of work planning and execution. This systematic approach motivates a culture of personal responsibility by and for each employee which leads to an accident free work environment, safe from diseases and occupational hazards as well as to protect properties from loss and damage.

Occupation Health and Safety:

SBG (O&M) safety management system is intended as a useful tool to achieve the following:
• Protect the human asset against all job related hazards including prevention of injuries, occupational illnesses, fatalities and diseases.
•Eliminate damage to material assets, facilities and related equipment.
•Enhance the feeling of security, belonging and self-worth of the employees while doing their jobs.
•Ensuring commitment to Saudi safety rules, regulations and safe practices.
• Ensuring that all the routine maintenance activities and the corrective maintenance activities are in accordance tot the HSE Policy of the project and the working procedures are according to the OSHA, ILO, IOSH and NFPA Standards.
•Ensuring continual improvement in the company overall safety performance.
• Encouraging active participation of employees to sustaining a safe work environment, free from accidents and diseases.
Elements of Occupation Health and Safety Management System:

The success of SBG (O&M) occupational health and safety program relies upon the Executive Management interest and contribution into planning, implementation and follow up of the strategic safety programs throughout the company. Down the line, the Site Management assumes the role of enforcing safety programs in every detail.
Safety Department:

Is the entity in charge of the planning, directing, implementation and follow-up of Safety Program and of safety related issues? Its role extends to the enforcement of safe working practices within the company different sites, set and define the rules, instructions and guidelines to protect the safety of workers, property and environment. It also draws strategies to guide training, awareness and communication of safety issues in order to improve the employee's safety performance so as to attain the quality standards sought by the company.

Safety Department Functional Responsibilities:

The purpose and scope of safety requirements call for a fully dedicated safety department to establish, implement and execute a practical, sound and effective program for the prevention of incidents that cause or may cause injuries, as well as the assignment of specific responsibilities to site teams and others involved in the enforcement of safety. A well-defined systematic approach will cover the following details:

- Design and approval procedures, technical instructions and guidelines related to proper implementation of safety requirements (safety guidelines - safety manual).
- Assign specific responsibilities to ensure proper implementation of safety requirements in view of the company safety standards.
- Define the criteria for occupational health and safety requirements.
- Enforce the implementation of safety criteria.
- Eliminate the unsafe conditions that may lead to incidents or accidents.
- Establish and maintain a system for early detection and correction of unsafe practices and conditions.
- Follow up and monitoring of adhesion to safety requirements / safety plan.
- Ensure the use of personal protective equipment by all workers.
- Perform safety audit on company sites.
- Design and provide safety induction to company new joiners.
- Design and provide safety training courses in specialist areas.
- Promote and distribute safety information and create updated awareness through flyers, banners and safety notice boards.
- Investigation of incidents that have caused or could cause injuries and potential safety incidents to determine the root cause and the taking of necessary corrective action.
- Keep up to date with reports, research material and other safety information in the field of safety whether international or domestic, aiming at improving and updating the company safety performance.

Defining Missions within the Safety Management System:

Policy: Executive Management
Organization: Safety Department in coordination with operations management & site management.
Implementation: site management in coordination with safety department.
Evaluation: technical department.
Improvement Procedure: safety department in coordination with executive management.

Accident Prevention Strategies:

SBG (O&M) strategy towards accident prevention depends upon eliminating hazards in the form of personal / properly damages through:

- Fire prevention, alarm and fighting.
- Personal injuries prevention through wearing protective through wearing protective equipment
- Emergency evacuation plan in-line and the adequate deployment of all the officers in case of emergency to lead the victims to the assemble points.
- Daily observation, accident, incident and near miss reporting so that all the hazards are being covered and the risk assessment of the deviations on daily basis.

Leadership and Commitment

Managers **lead** by example. They behave safely at all times. They encourage **safe behaviour** and intervene when they identify unsafe behavior

SECTION 1

LEADERSHIP AND COMMITMENT

1.0 Leadership and Commitment

1.1 Leadership and Commitment

HSE matters will be the responsibility of the line management throughout the organization and safety shall not be delegated to HSE staff. It is the duty of all managers to understand that occupational injuries and illnesses are not an acceptable part of our business. SBG O&M has adopted Zero LTI policy. To improve the Standard Operating Procedures in all the project sites by following the safety guidelines from the Civil Defense, NFPA & Also according to the international safety regulatory organizations (OSHA, ISO& OHSAS). **SBG O&M** believes in developing safe working procedures and maintaining a 0 injury working environment. This scope clearly concludes that our main scope is improved performance and the effective utilization of the resources and for the benchmarking with the other departments.

Commitment will be made towards the following:

Focus on behavior to help develop the HSE Management System to minimize risk.

1.1.1 Commitment to HSE through Leadership.

Management Commitment

The **SBG O&M** Management will demonstrate their commitment to Health, Safety and Environmental protection by the following means:

- Ensuring that management decisions are consistent with the stated policy and objectives
- Ensuring that there is an effective organisation structure to manage HSE.
- Putting HSE matters high on agenda of meetings
- Participating in the review of performance against all HSE plans and targets
- Taking decisions on HSE matters that will promote a positive HSE culture at all levels within the organization.
- Effective communication, seeking internal & external views on HSE and recognizing achievement.
- Ensuring the sub-contractors meet agreed and acceptable HSE standards
- Visiting sites regularly, discussing and acting on HSE issues

Allocation of Resources

- Making adequate funds and human resources available for HSE
- Ensuring that all levels of line management / supervisors are responsible and accountable for HSE and spend an adequate proportion of their time on HSE
- Allocating adequate time and human resources for HSE training needs

Monitoring and Follow-up

- Visiting all work areas regularly
- Participating in inspections and audits
- Participating in high potential incidents and accident investigation

SECTION 2

POLICY AND STRATEGIC OBJECTIVES

2.0 Policies and Strategic Objective

SBG O&M has an HSE Policy that is signed by the **EBM**. This policy shall be translated into English, Arabic. It shall be communicated to all employees in the appropriate language during HSE induction, a copy of the policy shall be made available to all employees upon request, and it shall be posted prominently on notice boards on sites, in offices and in messes. Copies shall be issued to sub contractors, suppliers and agents involved in the contract. The main scope of SBG O&M is to ensure the effectiveness of the safety standards and the rules and regulations of the regulatory bodies of health and safety. In all the operation and maintenance related issues in the projects, we ensure the implementation of zero accident policy. The main objective is to provide safe system of work, safe equipment of work and safe working methods to ensure the safety of employees, workplace and environment in accordance to the NFPA, OSHA, ILO and national regulatory bodies of Health and Safety

2.1 HSE Policy Statement

SBG O&M acknowledges that:

- We will comply with the Laws and Standards of the Kingdom of Saudi Arabia.
- Health, Safety and Environmental Protection are as important as all other business objectives and HSE shall appear first on the agenda of all business meetings;
- Incidents and injuries are not acceptable and should be eliminated from all company operations, continuous improvements in HSE performance will be implemented to achieve this;
- Health, Safety and Environmental Protection are a line management responsibility and they will set, objectives, targets and appraise HSE performance;
- The Environment shall be protected, pollution minimised, and efficient use shall be made of natural resources;
- Employees shall be trained to work in a healthy, safe and environmentally responsible manner;
- Employees and Sub-Contractors shall be made aware that they are responsible for their own safety and health and for the safety and health of their colleagues and partners at work, in line with this Policy;
- No work shall be started until all measures to assure the health and safety of all persons engaged in the work, and protection of the environment, are in place and where these measures cannot be maintained, work shall be stopped.

- 2.1.1 General Policies:

The company has implemented a Smoking, Drugs and alcohol policy extracts of which are taken from the **SBG O&M** HSE Manual..

SBG O&M EBM is the owner of the HSE Plan; the contracts manager ensures its implementation and the Safety Consultant is the custodian.

2.1.2 Distribution and availability:

The HSE plan is available on request; controlled copies will be distributed as per the distribution list on page 2 of this document. The SBG O&M Contracts manager is responsible for communication and distribution of the document.

2.1.3 Discussion:

The Plan shall be discussed during the safety induction of new or transferred employees.

All employees should know of its existence and they should have a basic knowledge of its function.

This ensures that even the illiterate employees are made aware of the existence and contents of the HSE Plan, HSE policy and the company's expectations with respect to HSE.

SECTION 3

ORGANISATION, RESPONSIBILITIES, RESOURCES, STANDARDS AND DOCUMENTATION

3.0 Organization, Responsibilities, Resources, Standards and Documentation

3.1 HSE Organization:

This section of the document shall contain reference to the responsibilities of all of SBG O&M's key personnel, even those not directly linked to your project. All across reference the org chart to this section of the document to find out the specific responsibilities of the project key personnel. The organization, resources and competence are the key factors of the success of our department in all the current projects as our organization fully exhibits all the standards implementation and the adequate hierarchy. The resources are fully utilized to achieve maximum efficiency and the competence of the staff is enhanced by arranging workshops, training sessions and various courses registration so that we can improve our performance and enhance the benchmarking factor

3.1.1 Key Personnel – HSE Job description

SBG O&M recognizes that HSE responsibilities lie with line management. Subcontractors shall be made fully aware of this fact, and of SBG O&M's obligations to HSE. Specific line responsibilities are detailed below. Please note that some of the positions mentioned below will not be required on all projects, and as such this plan will contain reference to all job descriptions, the individual project HSE plan will be more specific and contain reference to only those individuals who are employed on the project.

3.1.1.1 SBG O&M CHIEF EXECUTIVE

The Chief Executive shall be responsible to:

- Ensure that the SBG O&M HSE policy and SBG O&M's HSEMS are adhered to.

3.1.1.2 Contracts Manager

The Contracts Manager shall be responsible to:

- Ensure that the SBG O&M HSE Plans are correctly developed and implemented
- Periodically appraise the effectiveness of the HSE plan's and ensure that any necessary changes are made
- Ensure that the HSE plan's are understood and are followed by all his contract managers
- Produce HSE objectives, tasks and realistic targets
- Determine at the planning stages, the most appropriate order and method of working, with allocation of responsibilities within company and sub contractor organizations
- Ensure the Permit To Work procedures are complied with and ensure that safe working practices are adhered to

- Maintain working methods in accordance with the safety regulations and those imposed by the Company
- Ensure proper work procedures are in place for the work force
- Provide competent supervision of the work force
- Ensure supervisory staff conducts daily safety related tool box talks
- Conduct audits and inspections as indicated in the HSE Plan & monitoring plan
- Conduct high potential accident or incident investigation and reporting when required, inclusive of Near Miss incidents

Shall be accountable for:

- Primarily ensuring the implementation of the HSE plans.
- Regular review of HSE performance as a proactive measure for adopting ways and means for continual improvement of HSE performance.

3.1.1.3 Safety Mangers

The Safety Managers shall be responsible to:

- Implement the rules and regulations laid down in the HSE Plan
- Ensure that all supervisors under their control fully understand all aspects of this document
- Report to the Contracts Manager any deficiencies in the operation and effectiveness of the objectives laid down in this document
- Determine methods of work execution during the planning stage with due consideration to safe working practices
- Report to the Contracts Manager/Safety Consultant any accident or incident which might occur on site
- Conduct audits and inspections as per the monitoring plan
- Set an exemplary standard of conduct on health, safety and environmental matters at all times
- Ensure that supervisory staff conduct their toolbox talks daily, and attend their TBT at least once a month.
- Ensure all HSE training is carried out as per SBG O&M and client mandatory requirements.
- Ensuring the strict adherence to the client contract document in all his areas of control.
- Ensure that he carry's out near miss, incident and accident investigations as required.
- Participating in HSE Audits and HSE Meetings.

- Monitoring and enforcing safety during execution of jobs.
- Maintaining liaison with Company Site Representative's on HSE Issues.

- Ensuring the implementation of HEMP in the day to day activities and tasks.

Shall be accountable for:

- Primarily for ensuring the implementation of the Health Safety and Environmental plan
- Making subordinates staff accountable for confirming essential systems to be in place before starting worksite activities and suspending the operation if such systems are subsequently found not in place.
- Minimizing waste streams by economical utilization of resources.
- Fulfill the requirement of Tasks and Targets assigned to him and to his subordinate staff.

3.1.1.3 Safety Consultant

- Preparation of the SBG O&M and Contract Specific HSE Plan's.
- Keeping senior management posted, and reviewing latest HSE regulations.
- Preparation of emergency response plans.
- Keeping in touch with relevant Client safety documents and emergency procedures.
- Maintaining liaison with client safety services.
- Participating in high potential incident/accident investigations, inclusive of Near Miss incidents.
- Monitoring implementation of HSE Plan through reports from HSE Advisors
- Conduct audits and inspections as per the monitoring plan

Shall be accountable to

- Fulfill the requirements of the HSE policy and HSE plan's in an advisory capacity.
- Detect deficiencies and weakness in the HSE management system and advise the project line management as required
- To provide support to the project team to strive towards continuous improvement, in order to achieve the set objectives and targets.

3.1.1.5 Safety Coordinator

Shall be responsible for:

- Monitoring implementation of HSE Plans through Monthly reports from Safety Chief
- Keeping in touch with relevant Client safety documents and emergency procedures
- Developing and implementing HSE audit check lists and audit programs.
- Maintaining HSE statistics at project level
- Maintaining liaison with client safety services
- Maintaining project Training Requirements, (Training Matrix)
- Developing material for regular toolbox talks
- Participating in HSE-Meetings
- Advising procurement department on purchase of the right type of safety equipment
- Participating in incident/accident investigations, inclusive of near Miss incidents
- Conduct audits and inspections as per the monitoring plan
- Ensuring the Incident tracker and the training matrix is kept up to date at all times

Shall be accountable for:

- Fulfilling the requirements of the HSE plan in an advisory capacity.

3.1.1.6 Safety Chief:

Shall be responsible for:

- Guiding site management in the effective implementation of the HSE plan
- Arranging & participating the Monthly HSE-Meetings at site management level
- Addressing weekly HSE-Meetings for all employees
- Conduct audits and inspections as per the monitoring plan
- Participating in HSE Inspections & Audits
- Keeping site management informed of the latest HSE requirement
- Maintaining liaison with client safety department
- Maintaining Safety Statistics
- Assisting management in accident investigations
- Arranging for client approved Training Institute and In-House training program for employees.
- Monitoring waste disposal is in accordance with the client / SBG O&M waste management system requirement.
- Participating in incident/accident investigations, inclusive of near miss incidents.
- Conducting & guiding all the emergency exercises, as detailed in the ER procedure
- Keeping monthly records of all activities required to be carried out under the HSE Plan

- Submitting Monthly Records of HSE Plan Activities to the Safety Coordinator at Site
- Daily update of the incident tracker and the HSE training matrix

Shall be accountable for:

- Fulfilling the requirement of the HSE policy and contract HSE plan in the advisory capacity.
- Detect deficiencies and weakness in the HSE management of contract promptly and advise/ correct the project people to make deficiencies and provide support to the project team to improve the performance in order to achieve the set objectives and target.

3.1.1.8 Safety Supervisor

Shall be responsible for:

- Ensuring that all work under their supervision, including Sub-Contractors operations are carried out in accordance with SBG O&M Hazard Analysis sheets and with client procedures as regards Health, Safety and Environment Protection
- Ensuring that Sub-Contractors comply with the HSE plan, through regular review
- Checking that all facilities, tools and equipment used by personnel are safe
- Conducting regular inspections / audits of worksites to eliminate conditions and practices that present a hazard to health, safety and environment
- Checking that personnel are competent to carry out their work safely.
- Ensuring that personnel make correct use of protective clothing and equipment.
- Ensuring that personnel observe traffic safety rules and that vehicles used are safe and fully equipped.
- Checking that safety and emergency equipment are in good operating condition and that personnel are trained in its use.
- Ensuring that follow-up actions from audits and inspections are closed out as soon as possible.
- Advising management promptly of unsafe plant and equipment, of unsafe/unhealthy working conditions and of potential hazardous conditions to environment, taking any immediate remedial action meanwhile.
- Reporting and investigating all unsafe acts, near miss incidents and accidents.
- Holding regular HSE meetings with staff, explaining relevant measures and procedures in relation to their work and responding to their suggestions.
- Preparing job specific hazard checklist before applying for work permit.
- Ensuring all safety controls is in place for the duration of work.
- Planning job activities well in advance to ensure smooth interface with other disciplines avoiding risk.
- Participating in incident/accident investigations, inclusive of near Miss incidents.

Shall be accountable for:

- Primarily accountable for ensuring the implementation of HSE Policy, plan and construction environmental management plan within his portfolio and:
- Does not allow work to start before essential HSE systems are confirmed to be in place.
- Make sure that workers use correct PPE.
- Eliminating unsafe practice that may lead to incidents through unsafe act audits, and the use of SBG O&M's unsafe act reporting system.

3.1.1.14 Sub-Contractors

Shall be Responsible for:

- Implementing the same HSE rules and regulations as SBG O&M, shall be fully integrated into the HSE management system of this contract, and shall comply fully with all requirements of this HSE plan.

3.1.1.15 All Employees

Shall be Responsible for:

- Following supervisor instructions, which are in line with company policies and guidelines.
- Learning and executing operational procedures on Health, Safety and Environmental Protection for the job in hand.
- Using personnel protective clothing and equipment as provided.
- Reporting any hazardous condition to the immediate supervisor and warning colleagues for their safety or health as necessary.
- Maintaining Hand Tools, Plant and Equipment in safe working condition and reporting any defect to the immediate supervisor.
- Obeying road traffic safety rules and procedures and using seat belts, front and rear.
- Reporting any accidents, however small and near misses to the supervisor.
- Participating in HSE Meetings and contributing ideas to promote HSE causes.
- Participating in Safety incentive schemes.
- Participating in Tool Box Talks.
- Own safety and for safety of his colleagues.
- Participating in behaviour based safety and stopping the job if he feels that it is unsafe
- Participating in incident/accident investigations, inclusive of near Miss incidents.

All Employees continued - Shall be accountable:

- Accountable for adhering to the instruction of supervisors.
- Using the personnel protective equipment require for the assigned job.
- Observing traffic safety rules.
- Working safely for self and others.
- Participating in the HSE meeting, activities meant for the safety of work force.

3.1.2 Objectives

- To complete all tasks without an LTI
- To complete all tasks without an RTI
- To complete the all tasks without harming the health of employees.
- To complete all tasks with minimal damage to the environment.

These objectives will be met through:

- Strict compliance with respect to Road Transportation Safety
- Strict compliance with respect to Construction Safety
- Good HSE Communication
- Implementation of all HSE plans
- Reporting all accidents, incidents, (near miss, unsafe acts, etc).
- Training of employees
- Regular site inspections and Audits

3.1.3 Line of Communication:

Regular (weekly / fortnightly / monthly) structured progress meetings between Clients, SBG O&M & various Sub-contractors will form the forum for discussion of all HSE issues.

3.1.3.2 Sub-contract Management:

SBG O&M shall employ only sub-contractors approved by the client and who have established good HSE records. These sub-contractors shall be subjected to the same HSE rules and regulations as SBG O&M.

Sub contractors shall be fully integrated into the HSE Management of the contract, and shall comply fully with all requirements of this HSE plan. SBG O&M shall apply the same management, control and audit of sub-contractor operations as they apply to their own operations. The same safety procedures, with particular emphasis on journey management, shall be applied to both SBG O&M and sub- contractor operations, and special attention shall be paid to the catering contractor transport operations, should these involve other parties. Specialist sub-contracts shall prepare and submit HSE Method Statement.

Audits of these procedures, and of sub-contractor training, meetings, communications and statistics shall be carried out by SBG O&M simultaneously with the audits of their own operations. Where any non-conformance is identified, corrective action shall take place within one week and any learning points shall be passed to the management of both organizations for future reference. All the project sub-contracts will participate in the HSE Meeting and all of the HSE Activities.

SBG O&M will maintain close liaison with sub-contractors and site project management.

- Inspections and scheduled audits shall be carried out periodically of sub-contractors activities at site.
- Monthly meetings with sub-contractors will be conducted on HSE related matters.
- Spot checks and audit shall be carried out on sub-contractor employee movement between site and coast.
- Subcontractors shall be monitored to ensure that they follow SBG O&M's HSE plan and they will be accountable for the meeting the objectives.
- They will actively participate in SBG O&M's HSE activities.

3.1.3.3 Identification & vetting:

All sub-contractors

- Will implement SBG O&M's HSE standards as applicable to contract.
- Will implement journey management procedures.
- Will implement vehicle standards & road transport regulations as applicable to contract.
- Personnel will attend all HSE meetings when at site.

Where the services of specialist sub-contractors have to be utilized to complete a specific job, a HSE method statement will be required to be submitted for approval. This method statement will be approved only if it satisfies all the HSE issues that are foreseen in the scope of work that the sub-contractor is to perform. Sub-contractors will work to the schedules of SBG O&M's HSE Plan.

3.1.3.4 Coverage / Awareness:

All concerned areas of operations and maintenance fields in the Oxy Concession areas are well connected by a telecommunication network. Sufficient telephones and tile-faxes will be provided in the offices, camps and the workshops.

When working in remote locations, away from permanent or temporary phone / radiophone facilities, a standby vehicle will always be available at site to cater to any emergency.

3.1.3.6 Reporting and Follow-up:

A Site HSE Advisor will be available during the mobilization, construction and demobilization phase of all projects.

The Site HSE Advisor, through various meetings keeps the site line management informed of the latest HSE issues of importance. Any discrepancies or observations made are brought to the notice of the concerned department personnel with advice on the action necessary to be taken. A follow up is maintained to ensure that the item is closed out. The Site HSE Advisor also prepares site inspection reports, giving details of unsafe observations and recommendations for corrective actions. These are passed on to the Safety Manager for action. A follow-up is maintained to ensure closeout.

3.2 HSE Meetings

3.2.1 Schedule:

Type	Frequency	Attendance	Responsibility for scheduling, conducting and controlling follow up items	MOM Distribution list
HSE Meeting Client / SBG O&M /Subcontractors	Monthly	Client, Safety Manager, HSE Consultant, Contractor's Site representative.	Safety Manager	All attendees
HSE Meeting General	Weekly	All employees	SBG O&M HSE	Records
HSE Meeting Drivers Forum	Monthly	All drivers & operators	HSE	Record
Tool box meetings	Daily	Crew members	Supervisor Foremen, Permit holder	Attendance / record

3.2.2 Management Participation:

Coast based managers will be invited to attend the Client / SBG O&M / subcontractors monthly HSE meetings.

3.2.3 HSE Meeting structure and Follow-up action:

Ref to the next page of this document for an example of an HSE meeting Agenda, this agenda may be utilized, or alternatively the clients agenda may be followed, dependant upon who is leading the meeting,

HSE Meeting agenda

Section	Topic	Follow-up Action by/date
1.0	**Minutes** of the previous meeting to be reviewed/ accepted/revised	
2.0 2.1 2.2 2.3 2.4	**HSE Information flow** Safety statistics, including NM reported and investigated Incident/accident reporting (Incident Tracker) Permit to work system Client & In-house HSE Alerts/circulars/news letters.	
3.0 3.1	**HSE Training** Institute & In-house training status (Matrix update).	
4.0 4.1	**Client & In-house HSE Inspections** Observations made and action status.	
5.0 5.1	**Client & In-house HSE Audits** Corrective Actions pending & action status.	
6.0	**Emergency Drill status**	
7.0 7.1 7.2 7.3	**Occupational health & hygiene** Exposure to heat, noise, vibration & chemicals - Status. Health risk assessment – status / review Industrial areas and camp - health & hygiene status.	
8.0 8.1 8.2 8.3 8.4 8.5	**Environment** Status of waste disposal approved by CSR Status of chemical waste (if any) disposal. Environment impact General housekeeping status (Camp, industrial areas, sites) Status of permit.	
9.0 9.1 9.2 9.3	**Critical Areas** Road Transport Safety Loading & unloading Competence assessment up date Right of way condition update Sub-contractors Local community issue	
10.0	**Client & SBG O&M HSE Manual, Hazard document (HEMP)status**	
11.0	**Any other business**	

3.2.4 General Information and Learning Points

Arabic, English are the languages known to the majority of the employees, these will be the languages used to disseminate learning points and information to all employees during general safety meetings.

Where persons do not understand, a suitable interpreter will be provided. A separate meeting will be held should the group size exceed 10 persons.

The following list may be used as a guide to generate topics for discussions in the weekly HSE Meetings.

- Incidents highlighted in the minutes of the "HSE Meetings".
- Client and In-house Safety alerts and safety newsletters.
- Near Miss reports and learning points.
- High Potential Unsafe Act / condition observations
- Incident reports and learning points.
- SBG O&M Tool Box Talk database
- Client and SBG O&M HSE Manual Contents.

Meetings, at which all SBG O&M and subcontractor shall be present, shall be conducted in Arabic and English and checks shall be made to ascertain understanding of topics. Minutes shall be taken and posted on the notice board after the meeting. Action points arising from meetings shall be reviewed for completion at the following meetings of the same hierarchy.

3.2.5 Tool Box Meetings:

The Supervisor / Foreman / Permit Holder along with his crew will assemble at the place of work. The scope of work for the day will be discussed. Hazards associated with each Specific job activity and the precautions necessary to prevent incidents will be jointly discussed. The person giving the TBT should refer to, Safe Work Procedures, the HEMP and or the JHA to ensure that all the hazards and controls are addressed.

The Safety Coordinator and Safety Chief shall routinely attend toolbox talks in order to ensure that they describe accurately the work to be undertaken, the likely hazards and the controls and recovery measures to be applied.

3.3.0 HSE promotion and awareness

3.3.1 General

Safety Notice Boards erected at prominent locations will be available and facilities for a television and video / CD player will be made available at site.

3.3.2 HSE Performance Boards

HSE performance boards indicating man hours worked since last LTI; will be posted at the entrance to the camp / residential facility.

3.3.3 Safety Posters

Safety posters in pictorial form as available; will be displayed on the site HSE notice board. (,SBG O&M, Client, Web based sites, etc).

3.3.4 Video Films / DVD's on Safety

Safety films as available will be screened to appropriate employees during regular training programs. A translator shall be provided as required.

3.3.5 Safety Newsletters/Safety Alerts

Safety newsletters and safety alerts will be disseminated to all employees in English, or Arabic, a translator shall be made available as required.

3.3.6 Safety Incentive Scheme

SBG O&M will have a number of HSE milestone achievement awards, the awards will normally be linked to each project, and detailed in the project HSE plan. The following may be used as a guide.

1. Upon successful completion of one million Km without an RTA

2. Upon successful completion of one million man-hours without an LTI.

3. Upon successful completion of a project, with out an LTI or an RTA, all employees will be issued with a small gift and a safety certificate.

- SBG O&M senior line management in the presence of a client representative will present the awards at site in a special function room.

3.4 HSE Competence requirements

All personnel employed by SBG O&M shall be competent to carry out the duties for which they are employed. Their qualifications, experience in the present job, trainings and attitude shall be used as the bench mark to analyze their competency. Competency shall be deemed as a combination of qualifications; training and experience.

3.4.1 Fitness of personnel

It is the policy of SBG O&M and the health regulations of the Sultanate, that all expat and national employees have to undergo a medical examination and be proved medically fit prior to being employed. Medical record of nationals and expatriates will be available on request.

3.5 Employee Orientation Program

It is the policy of the company to employ personnel who have the necessary knowledge, skills and experience of working in the operations and maintenance field.

3.5.1 New / transferred employees:

All new employees shall undergo a (one time) SBG O&M / Client approved HSE induction program before being assigned any specific work. It is recommended that if a new or transferred employee has attended an HSE induction course more than 3 years ago, they should consider attending the course again.

At the end of the induction program, employees will be able to:

- Define SBG O&M & Clients commitment to HSE.
- Define their own responsibilities with respect to HSE.
- Describe the role of HSE staff.
- State the principle hazards in the oil/gas field construction activities
- State how he would report incidents, accidents and near miss.
- State how he would react in an emergency.
- State the basic road safety rules applicable when working in the interior
- State the occupational health and environmental concerns.

Any employees transferred from another project will undergo a project employee orientation programme to make them familiar with any HSE requirements specific to the project that the employee will be working on.

3.5.2 HSE Training

HSE training will be provided to SBG O&M and Sub-Contractor Employees as follows.
In-house training within SBG O&M will be provided by the HSE department or an approved trainer. HSE Advisors will maintain the training matrix for all project employees, and ensure that the training requirements are met. The following table should be consulted to when planning HSE training. It will define SBG O&M and project training requirements.

COURSE TITLE	TARGET POPULATION	COMPLETION BY	REMARKS
HSE induction	All	Prior to working at site	Compulsory
PTW Signatory	PTW Applicants	Prior to applying for permit	Compulsory
PTW Holder	PTW Holders	Prior to being used as permit holder	Compulsory
Defensive driving light block top.	All LV drivers	Prior to driving in the interior	Recommended
Supervising Safety	As per agreed list of nominated supervisors	During the 1st year of the project	Compulsory
Basic life support	First Aid Team, distributed amongst crews	During the 1st year of the project	Compulsory
Desert driving graded road Light & Heavy vehicle.	LV & Heavy vehicle drivers	Prior to contract start & when permit expires	Compulsory
Defensive driving, black top road Hvy vehicle	HGV drivers	Prior to commencement of site work	Recommended
Defensive desert driving bulk tanker module	All bulk tanker HGV drivers	Prior to driving any HGV in the interior	Compulsory
Defensive driving-annual assessment	All drivers	When permit expires	Compulsory
Fire warden	Designated personnel as fire wardens	During the 1st year of the project	Compulsory
Basic fire extinguisher	Permit holder, designated catering & office personnel, and designated fire wardens	During the 1st year of the project	Compulsory
Permit to work auditing	Nominated auditor	Prior to start audit	Recommended
Chemical hazard awareness	Supervisory personnel involved in receipt, transportation, handling, storage and use of chemicals.	During the 1st year of the project	Compulsory
Scaffolding appreciation	Supervisors who supervise scaffolding activities HSE advisors	During the 1st year of the project	Compulsory Recommended
Incident investigation & reporting	HSE Advisors Const Supervisory personnel required to lead incident investigation & HSE staff	During the 1st year of the project	Recommended
Oxy Safah Journey management	All	During the 1st year of the project	Compulsory
The HSE Management of Contracts	Contracts Manager Construction Manager	Within two months of mobilization	Recommended
Hazard Communications General	All	During the 1st year of the project	Compulsory
Occupational Health	Managers and supervisors	Within 2 month from date of work start	Recommended
Environmental awareness	All supervisory personnel	Two months after mobilization	Recommended
H2S	All	During the 1st year of the project	Compulsory
Tap Root	Personnel nominated as Tap root investigators	As soon as possible	Recommended

3.5.3 In-House

The following course will be conducted internally by SBG O&M'S HSE Department.

COURSE TITLE	TARGET POPULATION	COMPLETION BY	REMARKS
Unsafe Act Auditing / reporting	Safety Manager HSE Consultant HSE Coordinator Supervisors Foreman	During each project execution	
Environmental awareness	Engineers and supervisors	During each project execution	

3.5.4 SAFE / UNSAFE ACT OBSERVATION PROGRAMME

- Observation training will be imparted to selected line managers under the guidance of SBG O&M's HSE department.
- All trained staff will carry out unsafe act audits regularly; they shall be accompanied by an employee selected at random.
- The findings of the audits will be discussed, reviewed, entered onto the incident tracker and tracked until closure.
- An incentive scheme will be put in place by SBG O&M to recognize the best unsafe act observation. A committee will be set up and they will select the best observation amongst the number of observations generated in that quarter. In the case of a safe observation, the incentive will go to the individual who was seen to be behaving safely, and in the case of an unsafe act, the incentive will go to the individual who reported the unsafe act.

3.5.5 HSE Training (Professionals)

3.5.5.1 Selection, training and qualification:

All SBG O&M HSE personnel employed on this task shall be competent to carry out the duties for which they are employed. Their qualifications, experience in the present job, training and attitude shall be used as the bench mark to analyze their competency.

Training received by the site HSE Advisors will be in line with Clients HSEMS requirements.

3.7 HSE standards:

3.7.1 Availability:

SBG O&M have a comprehensive HSE manual specification for the construction activities it undertakes, the generic manual originates from our parent company Willbros; a more specific SBG O&M manual is under review.

The intention of the Manual is to:

- Set company standards
- Publish mandatory HSE requirements
- Address all potential hazards
- Publish work guidelines and codes of practice
- Disseminate and record safety information

All SBG O&M activities shall be controlled through implementation of SBG O&M's HSE Plans and HEMP, with reference to the Willbros manual as required.

3.7.2 Control/Authorization:

The SBG O&M HSE Manual shall be a controlled document.
Current revision status can be obtained from the Safety Consultant.

3.8 Permit to work:

Clients PTW procedures will be followed, in the areas where required.

Permit applicant and holders are identified and certified by the Client.

SECTION 4

HAZARDS AND EFFECTS MANAGEMENT

4.0 Hazards and Effects Management

All Activities are to be assessed for risk

Refer to the Cause and Effects Matrix in the HEMP - Appendix 7.

Each project shall conduct a Cause and Effects study of their operations and insert the relevant scores. This information should help them identify the high risk activities and the most frequent hazards; once identified control measure can be put in place to reduce the risk to ALARP.

Safeguards required that should help control the hazards

- 100% Supervision in high-risk activities.
- Certified Lifting Equipment.
- Tool Box talks before the start of every new activity, and every day.
- Establish method statements for critical activities.
- Make employees aware of the hazards in all activities.
- Compliance with Transport Standards.
- Use of certified drivers.
- Use of approved routes.
- Necessary PPE to be issued and used on site.
- Permit to Work must be obtained before start of works, and all precautions should be in place.
- Develop and implement detailed HEMP for each task and associated hazards identified and ensure the HEMP is implemented to help reduced the risk to ALARP.
- Develop Health Risk Assessments
- First Aider and First Aid Facilities available, cool drinking water made available.

4.1 Methods for Procedures of Hazards and Effect Management:

When all activities have been defined, the hazards involved in those activities shall be identified. Wherever possible the hazards shall be eliminated but where such elimination is not possible then the control and recovery measures necessary for the remaining hazards shall be identified. HEMP prepared for this operation is available in document**.** This shall be utilized as a guidance document. The supervisor after discussion with the crew members can modify the HEMP to suite the job in hand.

In order to ensure that all controls are in place before the commencement of any activity, site supervisor/safety advisor shall conduct site inspections and shall issue safety equipment and all PPE required for the safe operations of the activity.

Site supervisor shall also ensure that all controls and recovery precautions are in place before commencement of any activity, including complying with all systems and procedures, ascertaining that the crew members are competent for their duties, and that all hazard control and recovery measures have been communicated to the work force.

All required items of PPE and safety equipment shall be made available to the crew members before the commencement of the work. A PPE Issue Register shall be used to maintain record of PPE issue on the contract worksite, and a new for old exchange policy should exist. The HSE Advisor shall ensure that the specification of all PPE meets international guidelines, and that all PPE is fit for purpose.

Responsibility for the correct use of PPE shall be with line management but frequent inspections shall be made by the HSE Adviser to ensure that items of PPE are being used correctly.

Any PPE, which is damaged during use, will be exchanged, under approval from the Supervisor or HSE Advisor, a new for old policy shall be used.

4.2 Assessment of exposure of the work force to hazard and effect:

4.2.1 Experience & Awareness

Based on past projects SBG O&M has developed a detailed Hazard Register. This register contains activity specific, simple to use Hazard Analysis sheets, HEMP, which detail the hazards identified, the potential severity, the preventive measures to be taken to minimize/control the hazards and the recovery plan in case the preventive methods fail.

4.3 Handling of Chemicals

The following is a list of chemicals in solid, liquid and gaseous forms being used by SBG O&M regularly or routinely.

Sr. No.	Name of Chemical (SHOC Card No)	Form	Use
1.	Oxygen	Gas	Gas cutting/welding
2.	Acetylene	Gas	Gas cutting/welding
3.	Nitrogen	Gas	Purging
4.	Hypo chlorite	Liquid	Chlorination of potable water
5.	Cement	Powder	Concreting, plastering, etc.
6.	LPG	Gas	Cooking
7.	Diesel	Liquid	Fuel for vehicles/plant equipment
8.	Liquor Ammonia	Liquid	Ammonia printing
9.	Sulphuric Acid	Liquid	Batteries
10.	Lubricants	Viscous	Automobiles
11.	Spirit	Liquid	Medical
12.	Grease	Grease	Vehicles

Personnel involved in the handling of these chemicals and their supervisors must ensure that they are aware of the contents of the SHOC cards, and of what to do in the event of an emergency. The Site Safety Manager and the HSE Coordinator through regular routine checks will ensure adherence to the guidance given on the SHOC cards.

4.4 Hazards and Effect Management and Assessment of Personal Protective Equipment Requirements

4.4.1 Hazard Assessment / PPE Requirements:

- All PPE will be issued free to the employees through the site store.
- The site HSE advisor shall be consulted prior to purchasing PPE to ensure that the specifications meet international standards.
- The site store shall operate a low-stock-warning system for all PPE to be used on the project. This is to ensure that no PPE is ever out of stock.
- All personnel will be issued with basic PPE that includes helmet, safety glasses/goggles, coveralls, gloves, and Safety shoes.
- PPE specific to the job activity will be issued to personnel depending on the requirement.

4.4.2 PPE Instruction / Training:

The Site Safety Manager and HSE Advisor will organize instruction/training on the use, storage and maintenance of PPE.

4.4.3 Renewal / Replacement:

PPE, which is damaged during use, will be exchanged new for old.

A record of PPE issue shall be kept and individuals who are unable to exchange old for new may be charged for the replacement of any lost items.

SECTION 5

PLANNING AND PROCEDURE

5.0 Planning and Procedures

5.1 Basic HSE Rules

5.1.1 Availability:

SBG O&M has a Basic Safety Rules Manual published in English.

This manual has been issued to existing staff, and shall be issued to new staff as appropriate: It contains a variety of useful safety information; its contents are listed below.

5.2 Emergency response and preparedness

The following types of emergencies have been identified as having the potential to occur during the course of our construction activities.

- Fire at Camp & Site
- Incident and accident (Fall from height, Road traffic accident, Earth collapse)
- Man lost
- Heat Stress

A separate procedure is available for dealing with emergency response. Refer to SBG O&M Emergency Response Procedure Doc - HSE/05 in **Appendix 4** of this document.

A Flow chart of the emergency response system is given in **Appendix 3** of this document.

5.2.1 EMERGENCY DRILL

Client supervisors will be informed of the date of the drill at least 2 weeks in advance to ensure their participation as observers. SBG O&M will also participate and assist in Clients emergency exercise, whenever these are organized by the client. The Emergency Response; quick response guide is listed on the next page; it shall be issued to key personnel and shall be posted on HSE notice boards.

Emergency Response:

Training in emergency response shall be given to all employees. This training shall include fire drills and evacuation procedures. Meetings shall be held in order to explain clearly too all employees the action which must be taken by them to deal with each type of emergency situation which might occur. In those meetings personnel shall be instructed in the response to be given to the emergency telephone operator. Fire wardens and First Aider's names and duties shall be clearly displayed in offices and on sites. Client Emergency Telephone Numbers shall be prominently displayed at each telephone. Assembly points on sites shall be clearly indicated. Emergency response drills shall take place according to the schedule. Drills shall be closely monitored, and any learning points from them shall be recorded for later reference.

5.3 HSE Equipment and Equipment HSE Inspection:

5.3.1 HSE Equipment:

No specialist HSE equipment will be used on projects, without first notifying the SBG O&M Safety Consultant.

5.4 Occupational Health

5.4.1 Facilities available:

Health risk assessments for project related activities shall be made available at site. The information available therein will be used to educate personnel in occupation health risks and their control.

All personnel working in an activity with a potential risk to health will be made aware of those risks and the actions they must take to reduce/control/eliminate the risk.

The Safety Manager will be responsible for ensuring compliance with Clients Occupational Health Standards. The HSE Advisors and project medical representative will be available to assist / advise as required.

Employees engaged in noise risk areas will be issued with hearing protection and the use of it will be enforced. Further, these employees will be educated on the hazards of noise. They will be suitably rotated in their job work so that exposure to noise is limited.

Employees engaged in dust environment will be issued with necessary dust protection and the use of the same will be enforced.

Employees engaged in working with vibrating tools especially jackhammer operators and pole hole drill operators will be suitably rotated in their job routine so that exposure to vibrating tools is limited.

Employees engaged in grit blasting and painting-operations will use fit for purpose personal protective equipment as provided.

Adequate arrangements will be made to provide sunshades and cool drinking water to personnel engaged in work in the heat.

Waste grit will be collected and disposed of suitably under waste consignment notes to approved facilities, (Refer to SBG O&M's Environmental Management System Plan)

Paints and thinners will be stored and used in line with requirements under specification

5.4.4 Accommodation and Catering Facilities

If required, once ready, the camp and catering facilities will be put forward for Client inspection and approval.

5.4.5 Hygiene and housekeeping:

The Safety Manager through the resources of the camp boss will be responsible for ensuring compliance with the Hygiene Standards.

All accommodation and catering facilities will be provided in accordance with the Health & hygiene requirement of the clients HSE Standards Manual.

All food handlers engaged in the kitchen will be certified medically fit in line with the requirements of the Ministry of Health.

Food prepared for consumption by employees will be regularly checked. The kitchen will be regularly inspected for hygiene.
The catering sub-contractor will be encouraged to put up health & hygiene promotional material on notice boards etc.

Regular health & hygiene news bulletins will be put up for the information of all personnel. The contents will be explained to all employees during the general HSE meeting.

5.5 Environment

5.5.1 Awareness:

SBG O&M shall comply with the Construction Environment Management Plan or the Client requirements of each project.

5.5.2 Control – Waste management

- Waste Management (in accordance with clients Waste Management manual).
- Monitoring and Restoration
- Site waste and rubbish will be removed from site and disposed of at clients designated refuse yards under waste consignment notes.
- Records of quantities and types of waste generated will be maintained.
- Kitchen waste will be disposed of daily to Designated Refuse yard under waste consignment notes. Services of the area environmental contractor may be availed of.
- Waste Kitchen cooking oil will be stored in special drums and disposed along with waste plant/engine oil in designated areas under waste consignment notes.
- Excavation spoils shall be disposed of to designated sites under waste consignment notes or Chemical waste (if any) will be collected separately and disposed of to designated Refuse yard as per waste consignment note.
- Defective batteries will be sent to SBG O&M Head Office for proper disposal.
- Vehicle will be serviced and maintained in a manner such that smoke exhausts are at absolute minimum.
- Aggregate and Sand for concrete will be purchased from a vendor.
- Backfilling material will be collected from borrow pits or sand dunes or will be generated using crusher / screening plants
- Cross-country travel in pickups will be kept to a minimum so as not to disturb the desert.
- Heavy goods vehicle will not travel cross-country but only use proper roads & ROW.

5.5.3 Contract Environmental Management Plan (CEMP):

If required, the environmental management plan shall be made available at site for reference.

5.5.4 Water Management Plan:

If required, the water management plan shall be made available at site for reference

5.6 Road Transport

Managing road transport hazards is one of the critical task on any project. Specific HSE Plans for transportation of multiple port cabins, line pipe, and equipment, shall been made in line with company standard requirement; and a Road Safety Case has been developed to identify and control the threats to this activity.

Road traffic accidents are the most frequently occurring type of accident operations within the Kingdom of Saudi Arabia. SBG O&M, therefore, shall make every effort to minimize such accidents by detailed attention to all contract road transport activities.

Drivers shall be assessed for ability before employment and then after employment they shall be deployed for work based on any special abilities. All drivers shall undergo standard in-house induction training, mandatory HSE training by third party training organisations on courses relevant to their employment. Thereafter, where drivers might become involved in specialized operations they shall receive further in-house training. All new drivers shall undergo a three-month probation period, during which time they shall be required to demonstrate their commitment to safe driving.

All drivers may be subject to an unsafe act audits at anytime during their service. Records of drivers' performance shall be maintained for assessment purposes. All drivers shall meet the requirements of the driver's certification sheet as listed in the Transportation plan. Vehicles to be used shall be selected on the basis of the operations on which they will be used. All shall be equipped, as a minimum, to comply with relevant client and government road safety specifications. Maintenance of vehicles shall be carried out at the intervals specified by the manufacturer.

Rationalization of transport activities shall be attended to at all times in an effort to reduce the number of journey or to reduce the distances to be traveled in order to minimize road traffic exposure. The SBG O&M Journey Management Procedures shall be complied with at all times, and shall apply equally to all SBG O&M and to subcontractor transport activities.

All subcontractors involved in transport operations shall comply with the requirements of SBG O&M's HSE and Transport plans.

SECTION 6

IMPLEMENTATION AND PERFORMANCE MONITORING

6.0 Implementation and Performance Monitoring

6.1 HSE Performance

6.1.1 Targets

Targets / Proactive and Reactive Performance indicators will include:

		Transportation	Construction	Total
1	Fatality	0	0	0
2	Lost Time Injuries (LTI)	0	0	0
3	Total Recordable Incidents	0	0	0
5	High potential incidents	0	0	0
6	Road Traffic Accident Frequency (RTAF)			
7	Total Record-able Incident Freq (TRIF)			
8	Unsafe Act Audits			

1. The LTIF rate will be calculated as

LTIF= (No of Lost time Injury) X 1,000,000 / (Total Man-Hours Worked)

2. The TRIF rate will be calculated as

TRIF=(Total LTI+RWC+MTC) X 200,000 / (Total Man-Hours worked)

3. Road Traffic Accident frequency will be calculated as follows

RTAF= (RTA / Km Driven) X 1,000,000

Additional HSE Performance indicators shall be proactive, and shall include, the number of training courses attended by personnel, the numbers of HSE meetings and emergency drills held, and the numbers of audits and inspections successfully conducted. Monitoring of the performance of the foregoing HSE items shall be carried out by the HSE Adviser. The results shall be advised to Management.

Monthly HSE statistics shall be completed on the HSE Statistics form and forwarded to the client.

6.1.2 Feedback analysis

The target data will be reviewed in HSE meetings and appropriate control measures will be introduced where required to help ensure targets are met.

6.1.3 Comparison of performance

The data will be compared with Industry performance indicators to set a benchmark and assess comparison of trends.

6.2 Incident investigation

For the purpose of incident/accident reporting and investigation SBG O&M will use a document named “Incident notification, investigation, reporting and follow-up Procedures and guidelines”.

Any accident, incident and near-miss involving sickness, injury, asset damage, asset loss, or environmental impact will be immediately reported to Client so as to plan ways and means to prevent recurrence.

- Incidents will be investigated thoroughly (in conjunction with client), by a team comprising of Safety Manager, HSE and concerned construction Engineer/Supervisor with the objective of:

    1. Determining the sequence of events leading to the incident.
    2. Identifying the immediate and root cause of the incident and appropriate controls
    3. Highlighting probability of recurrence, if controls are not implemented.
    4. Recommending remedial measures.
    5. Publishing findings and disseminating important information to all levels of employees through Safety alerts, newsletters, TBT, etc.

SECTION 7

AUDITS

7.0 Audits

Audits will be complied with reference to this HSE plan.

7.1 HSE- Milestone Audit Schedule

Audit schedule will be as detailed in the monitoring plan, and if required milestone audits may be agreed with client, an example of which could be as follows:

No.	SUBJECT	AUDITOR	SCHEDULE
A 22	Camp Inspection & Security	Site HSE Advisor	As per monitoring plan
A 2	HSE Records and Compliance	Safety Consultant / Assistant manager	As per monitoring plan
A 11	Emergency Drill Records	Site HSE Transport / HSE Advisor	As per monitoring plan
A 14	Journey Management System	Site HSE Transport/ HSE Advisor	As per monitoring plan
A 23	ROW Inspection	Site HSE Advisor	As per monitoring plan
A 24	Unsafe Act Auditing	Site HSE Advisor	As per monitoring plan

7.2 Audit Follow-up

Audits to be conducted will be decided as per the Audit Schedule

- The concerned auditor and client company site representative will be informed of the date(s) and scope of audit at least 6 days in advance.
- The audit will be carried out using subject specific audit checklist on the scheduled date by the Site HSE Advisor plus one invitee, usually a department head other than from the department being audited.
- Corrective Action Reports (CAR) if necessary; will be issued for each serious non-compliance.
- Recommendations will be issued for minor non-compliances.
- A Completion date for action will be confirmed with the auditor to close out Corrective action.
- A review date, which will be few days prior to the completion date of the corrective action, will be decided upon to review action progress.
- Once action, has been completed, it will be checked and if the auditors are Satisfied, the CAR will be closed-out

7.3 Lateral Learning

Information issues of common concern arising out of the audit will be disseminated to all concerned departments and employees via Safety meetings and Safety Circular.

7.4 HSE inspections

HSE inspection schedule is indicated below.

The site HSE Advisor will visit and inspect the worksite. Unsafe acts and/or unsafe conditions that have the imminent potential of causing harm/injury/asset damage will be immediately corrected through the respective supervisor, and recorded on the incident tracker. A follow-up will be maintained by the HSE Advisor to ensure closeout.

7.4.1 HSE Inspection schedule

HSE inspections shall be carried out as per the monitoring plan, and shall include the following:

TYPE	SCOPE	INSPECTION BY	SCHEDULE
General site inspection	To identify unsafe acts and unsafe conditions including housekeeping.	Site HSE Coordinator jointly with supervisor (Occasionally with Safety Consultant)	Refer to monitoring plan inspection schedule
Occupational health inspection at site	To identify any specific occupational health hazards	Site Coordinator jointly with construction supervisor (occasionally with Safety Consultant)	Refer to monitoring plan inspection schedule
Hygiene and housekeeping inspection at camp	To identify issues of hygiene concern	Site HSE Coordinator jointly with camp boss	Refer to monitoring plan inspection schedule

SECTION 8

MANAGEMENT REVIEW

8.0 Management Review

Chief Executive is responsible for leading the management review of the HSE performance. He shall review SBG O&M HSE performance, along with the Contracts Manager, the Safety Manager's and the Safety Consultant, once a year. A specific agenda shall be followed.

8.1 Objectives

- Assess the effectiveness and adequacy of the HSE management system.
- Identify the weak elements where additional input needs to involve improving the performance.
- To evolve continual and sustainable improvement in HSE performance.

8.2 Scope of Review

The following areas identified as critical activities for review and key result will be documented

- Recommendation made by audit team
- Recommendation made by incident investigation teams.
- Fulfillment of the SBG O&M commitment to HSE
- To identify the effectiveness of HSE policy and objectives.
- To verify adequacy of resources allocated for HSE management
- Achievement of target and need additional input.

8.3 Review committee

The review committee will consist of:

- Chief Executive
- Contracts manager
- Safety Manager's
- Safety Consultant
- Safety Coordinator

8.4 HSE Performance Indicator.

Key elements considered for performance indicators are

- Incident analysis figures such as LTIF, TRIR, RTAF, etc.
- Audit findings
- Inspection results
- HSE Training program

8.5 Review Report

The report will be documented by the Safety Consultant and it will be reviewed annually for further action and continual improvement.

- Document the result of review
- Identify the element that has weakness to initiate concentrated efforts for improvement.
- Propose remedial actions and fix up responsibility for implementation with target dates.
- Recommend suitable incentives for improved performance.
- Identify the need for any revision, modification or change in the HSE plan objectives or procedure
- Required for improved result.

SECTION 9

CHEMICALS SAFETY AT DOKAAE PROJECT

CHEMICAL SAFETY AT DOKAAE PROJECT

Executive Summary:

Chemical products commonly used at our DOKAAE project contain different types of potentially hazardous chemicals, such as acids, alkalis, surfactants, solvents, ammonia compounds and disinfectants. Some of the chemicals are corrosive and can cause chemical burns to the skin and eyes on contact. Other chemicals such as surfactants and solvents may cause skin irritation when used without proper personal protection equipment. Violent chemical reactions may occur with the possibility of generating hazardous reaction products when incompatible chemical substances are mixed. Pest control products, which contain pesticides, may be used in the premises to prevent or kill pests such as rodents and cockroaches. Pesticides are toxic chemicals and are harmful to human. It could be dangerous if contamination of food occurs during the application of pest control products.

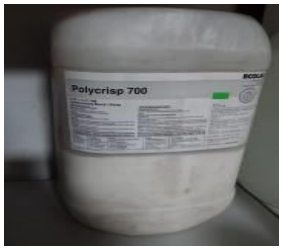
Fire and explosion are the major chemical hazards associated with the use of chemicals. Ethyl alcohol and isopropyl alcohol are flammable chemicals and they could be ignited if used near a flame or any other ignition source in particular when used as spraying mist disinfectants. Some of the chemical disinfectants could also pose fire and explosion hazards. Sodium hypochlorite (chlorine bleach) in aqueous solutions is not explosive but anhydrous sodium hypochlorite is potentially explosive. While storage of the chemicals in pantry rooms, the vapors arisen from these chemicals can also be dangerous. Calcium hypochlorite is not flammable but it acts as an oxidizer with combustible materials and enhances burning. Mixing chemical disinfectants with other chemical substances could be hazardous. Rapidly released from sodium hypochlorite solutions (chlorine bleach) is Chlorine, a toxic gas, if mixed with acids, e.g. acidic cleaning agents. Calcium hypochlorite could react violently with ammonia or amines, the ingredients found in cleansing preparations.

So, keeping in mind the above concerns it is necessarily required to properly assess the risks related to these type of hazardous chemicals stored in Pantry Rooms, Laundry Stores, Paints Stores and Other chemical storage rooms thus ensuring the safety measures regarding to ensure the safe storage and handling of these chemicals.

CLASSIFICATION:

Chemicals in Laundry Detergents (Highly Toxic)

1. Fragrance
2. Cleaning agents (surfactants)
3. Stabilizers
4. Bleach
5. 1, 4-dioxane
6. Brighteners

1. Fragrance	
Ecolab Micro – Quat Detergent, Germicide, Deodorizer	
2. Cleaning agents (surfactants)	
Ecolab Eco-Star Detergent Plus 30 L	
3. Stabilizers	
Ecolab Polycrisp 700	
4. Bleach	
Ecolab Tri star Oxy Brite – Concentrated Liquid Oxygen Bleach	

Ecolab Laundry Destainer- Concentrated Chlorinated Bleach 18.9 L	
Rust Go A.L Wilson Co. 14 oz. x 4 Bottles	
5. 1,4-dioxane	
TarGo Dry A.L Wilson Co. 0.946 L	
6. Brighteners	
Ecolab Eco-Star Sour Control 30 L	

Hazards:

The chemicals found at DOKAAE project laundry stores generally contain highly toxic and more volatile components. They have different applications depending upon their use in the various laundry stages. The cleaning agents are included in the formula to help the product clean better. These chemicals are known to release often formaldehyde, a known carcinogen, diethanolamine (linked with skin and eye irritation and possibly liver problems), nonlphenol ethoxylate or NPE (toxic to nerves, irritating to skin, potential hormone disruptor, toxic to aquatic life), linear alkyl benzene sulfonates or LAS (irritating to skin and eyes and toxic to aquatic life; benzene on its own is a carcinogen), and petroleum distillates (linked to cancer and lung damage). Manufacturers combine a number of chemicals to produce a fragrance, some of those chemicals can be very toxic.

The stabilizers are chemicals help stabilize the formula, so that it lasts longer on the shelf. Examples include polyalkylene oxide or ethylene oxide, which are linked with eye and lung irritation, and even dermatitis.

Bleach may be used separately or may be included in the detergent itself. It's known to irritate skin, eyes, and lungs, and when it mixes with wastewater, it can form toxic organic compounds that have been linked with respiratory issues, liver, and kidney damage.

Brighteners are chemicals that actually remain on the clothes to absorb UV light and help clothes "appear" brighter. Just like naphthotriazolystilbenes (linked with developmental and reproductive effects), benzoxazolyl, diaminostilbene disulfonate, and more. Since these remain on the clothes, they are likely to come into contact with skin.

Recommendations:

Each stock chemical container should have a designated storage place, and should be returned to that same location after each use. Storage locations can be marked on containers.

Do not store stock supplies of chemicals on benchtops where they are unprotected from ignition sources and are more easily knocked over. Only chemicals in use or of low hazard levels (e.g., salts and buffers) are permitted on benchtops.

All chemical containers must be closed, including bottles used for waste chemicals. Waste containers must remain sealed except when a worker is actually filling the container with chemical waste. Also Material Safety Data Sheets (MSDS) must be available accordingly for each of the chemical stored inside.

Storage areas should not be exposed to extremes of heat or high temperature conditions. Do not store any chemicals except bleach and compatible cleaning agents under the sink.

It is a poor practice to dilute chemical concentrates by manually tipping drums. Since it is likely to result in a spill risk, it should not be carried out. Proper dispensing device or equipment should be used to prevent spillage during the transfer of chemical concentrates for dilution.

Chemical products should be stored separately from other incompatible chemical products in a cool and well-ventilated area protected from direct exposure to sunlight. For example, chlorine bleach should not be stored together with cleaning products containing ammonia or acidic cleaners.

Waste chemicals such as unused caustic cleaner, acid cleaner and bleach solution should be properly disposed of. The containers holding the chemicals should be thoroughly flushed with water before discarded.

Typical Chemicals in Store Rooms (Housekeeping, Paints Stores and Pantry Rooms)

Group 1: Flammables
Group 2: Volatile Poisons
Group 3: Oxidizing Acids
Group 4: Organic and Mineral Acids
Group 5: Liquid Bases
Group 6: Liquid Oxidizers
Group 7: Non-Volatile Poisons
Group 8: Metal Hydrides
Group 9: Dry Solids

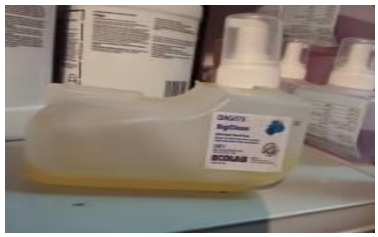
Group 1: Flammables		
1.	Soldier – Lacquer Thinner	
2.	Hundred – Wood Stain Dark Mahogany- 040 1 L	
3.	Kliaton Paints – Top Coat Gloss Enamel	
4.	Emulsion Stainer – For Tinting water based Paints 9 (By Casati) 110 gm	
5.	Ecolab Radiance	
6.	Ecolab Stainless Steel Cleaner and Polish	

7.	AGM 970 Universal Cleaner For Pipes and Fittings 0.946 L	
8.	WD – 40 Multi Use Product	
9.	Hundred Epoxy Full Gloss	
10.	Elephant Brand – Concentrated Wood Lacquer	
11.	Extra Acrylic Jacor Cryl Lacquer Thinner	
Group 2: Volatile Poisons		
12.	Ecolab Neutral All Purpose Cleaner	

13.	Ecolab Glass Force Professional Strength Glass Cleaner	
14.	Ecolab Dip It XP Concentrated Coffee and Tea Destainer	
15.	Ecolab Solid Brilliance	
16.	Ecolab Oasis 146 Multi Quat Sanitizer	 
17.	Ecolab Antibacterial Clean and Smooth	
18.	Ecolab DigiSan Foam Hand Sanitizer	
19.	Ecolab Oasis 13 Orange Force	

20.	Hail Silver Blaze	
21.	Ecolab Mikroklene	
Group 3: Oxidizing Acids		
22.	Meerab – ARM Chemicals Factor	
Group 4: Organic and Mineral Acids		
Group 5: Liquid Bases		
23.	Purovel Awaken Shampoo	
24.	General Purpose Cleaner	 

25.	Super Star Dish Washing Liquid 30 L	
26.	Purovel Invigorate Showergel	
27.	Diversey Tapi Extract Carpet Extraction Cleaner	
28.	Purovel Vitalize Conditioner	
29.	Ecolab Solitaire 2.27 kg Concentrated Solid Detergent	
30.	Ecolab Absorbit Heavy Duty Detergent Degreaser and Fryer Cleaner	
31.	Ecolab Lime A Way	

32.	Ecolab Digi Clean Mild Foam Hand Soap	
33.	Ecolab Digi Clean Antibacterial Foam Hand Soap	
Group 6: Liquid Oxidizers		
34.	Master – 999 White Kerosene	
Group 7: Non-Volatile Poisons		
35.	Sanvix – Pipe Joint Lubricant 1kg – Yakoot Island Modern	
36.	Weldon – Plastic Cement – Flow Guard	
37.	Soudal Universal Silicone U	

38.	Boracit – Brazing Powder Made in Pakistan	
39.	Jotun Easy Coat Exterior	
40.	Jotun Durosan O_2 Exterior Waterborne Paint	
41.	Magic Glue 1 K	
42.	Hardener PB 5	
43.	Orbit Industrial Coating Al Haleef Pain	
44.	Jotun Easy Coat Exterior	

45.	Jotun Fenomastic	
46.	Ecolab Solid Power X	
Group 8: Metal Hydrides		
47.	Ecolab Silver Power	
Group 9: Dry Solids		
48.	Chela Blue Tab 100 tablets Packet	
49.	White Tiger Hi Power Effervescent Chlorine Tablets	

Hazards and Recommendations:

Group 1: Flammable Liquids

Includes liquids with flashpoints < 100°F

Primary Storage Concern: Protect flammable liquids from ignition.

Compatible Storage Groups: Flammables may be with either Group 2: Volatile Poisons, or Group 5: Liquid Bases, but not with both.

Group 2: Volatile Poisons

Includes poisons, toxics, and select and suspected carcinogens with strong odor or an evaporation rate greater than 1

Primary Storage Concern: Prevent volatile poison inhalation exposures.

Compatible Storage Groups: Volatile poisons may be stored with flammables if bases are not present.

Group 3: Oxidizing Acids

All oxidizing acids are highly reactive with most substances and each other.

Primary Storage Concern: Prevent contact and reaction between oxidizing acids and other substances and prevent corrosive action on surfaces.

Acceptable Storage Facilities/Methods: Store in a safety cabinet.

Compatible Storage Groups: Store oxidizing acids on the bottom shelf, below Group 4.

Group 4: Organic and Mineral Acids

Primary Storage Concern: Prevent contact and reaction with bases and oxidizing acids and prevent corrosive action on surfaces.

Acceptable Storage Facilities/Methods: Store in a safety cabinet.

Group 5: Liquid Bases

Liquid bases. Examples include sodium hydroxide, ammonium hydroxide, calcium hydroxide, and gluteraldehyde.

Primary Storage Concern: Prevent contact and reaction with acids.

Acceptable Storage Facilities/Methods: In a safety cabinet; or In tubs or trays in normal cabinet.

Compatible Storage Groups: Liquid bases may be stored with flammables in the flammable cabinet if volatile poisons are not stored there.

Group 6: Liquid Oxidizers

Oxidizing liquids react with everything, potentially causing explosions or corrosion of surfaces.

Primary Storage Concern: Isolate liquid oxidizers from other substances.

Compatible Storage Groups: There are no compatible storage groups for liquid oxidizers; store liquid oxidizers separately from other chemicals.

Group 7: Non-Volatile Liquid Poisons

Includes highly toxic (LD oral rat < 50 mg/kg) and toxic chemicals (LD oral rat < 500 mg/kg), select carcinogens, suspected carcinogens, and mutagens.

Primary Storage Concern: Prevent contact and reaction between non-volatile liquid poisons and other substances.

Acceptable Storage Facilities/Methods: Store in a cabinet or refrigerator (i.e., non-volatile liquid poisons must be enclosed). Do not store on open shelves in the store room. Liquid poisons in containers larger than one liter must be stored below bench level on shelves closest to the floor. Smaller containers of liquid poison can be stored above bench level only if behind sliding (non-swinging) doors.

Compatible Storage Group: Store non-volatile liquid poisons with non-hazardous liquids

Group 8: Metal Hydrides

Most metal hydrides react violently with water, some ignite spontaneously in air (pyrophoric).

Primary Storage Concern: Prevent contact and reaction with liquids and, in some cases, air.

Acceptable Storage Facilities/Methods: Store using secure, waterproof double-containment according to label instructions. Isolate from other storage groups.

Group 9: Dry Solids

Includes all powders, hazardous and non-hazardous. Examples include benzidine, cyanogen bromide, ethylmaleimide, oxalic acid, potassium cyanide, and sodium cyanide.

Primary Storage Concern: Prevent contact and potential reaction with liquids.

Acceptable Storage Facilities/Methods: Cabinets are recommended, but if not available, open shelves are acceptable. Store above liquids. Warning labels on highly toxic powders should be inspected and highlighted or amended to stand out against less toxic substances in this group.

It is recommended that the most hazardous substances in this group be segregated.

A spill of aqueous liquid onto cyanide-containing or sulfide-containing poisons would cause a reaction that would release poisonous gas.

Compatible Storage Groups: Metal hydrides, if properly double-contained, may be stored in the same area as dry solids.

Chemical Safety Plan:

I am recommending a chemical safety plan which is essential for ensuring the health and safety of SSCL and hotels employees for Safe Storages and Utilization of Chemicals in Almuqam Hotel. I will develop this plan suitable for the multi aspects of various establishments to minimize the risk of chemical hazards in the store rooms and workplace sites in Almuqam Hotel. The chemical safety plan shall be properly organized and integrated into the management system of the store rooms and workplaces. Safety Wardens should be adequately trained specifically and resources must be optimistically utilized for the development, implementation and maintenance of the above mentioned chemical safety plan, if necessary.

The major components of my chemical safety plan for Hotels at DOKAAE project include.

1. **Risk Assessment** – An evaluation process to assess the likely hazards to hotel employees of the chemical or operations involving chemicals and the severity of such hazard like the pantry rooms, laundry stores, paint stores and other housekeeping stores. The process provides the necessary information for establishing the appropriate safety measures and procedures.

2. **Safety Measures** – measures established and maintained on the basis of the specific risk assessment to eliminate or reduce the hazards associated with chemicals or operations involving chemicals to ensure the safety and
Health of the employees.

3. **Emergency Preparedness** – quick and effective response in the event of emergencies such as fire, explosion and chemical spill to minimize injuries and damage.

4. **Hazard Communication** – the means for disseminating to hotels employees and workers safety and health information about the chemicals and processes.

5. **Information, Instruction and Training** – providing information, instruction and training to help Safety Wardens acquiring the skills, knowledge and attitude to protect their safety and health at work

6. **Review** – safety measures should be reviewed periodically to monitor their effectiveness particularly when there are new requirements or significant changes in the chemical materials or processes. Safety measures shall be revised, where necessary, taking into account the review findings.

SECTION 10

ESCALATORS SAFETY

ESCALATOR SAFETY

Escalators are used in Abraj Albayt where elevators would be impractical. Escalators have the capacity to move a large number of employees, pilgrims and visitors; and they can be placed in the same physical space as a staircase. Advantage is that they have no waiting interval (except during peak crowd events like Ramadan and Hajj), they can be used to guide people toward main exits or special exhibits. This proposal report is about "**Updating the Safety levels of Escalators in Abraj Albayt**". First of all the introduction of escalators safe design is given, which highlights the importance of them. Different kind of safety devices and innovations are also described. Detailed description of escalators safety with respect to research and development is also presented. Afterwards engineering based calculations for each innovation are presented.

Health and Safety Aspects, Instrumentation & Control, and Heat Transfer for these innovations are also included in this report.

3. Technical Background

3.1 Identification of the Problem:-

Hijab has different legal and cultural status in Saudi Arabia. During peak crowd events like Ramadan and Hajj, a very remarkable number of Hijab wearing women arrive at haram. Abraaj Albayt is considered as an important place for shopping and commercial purposes along with residential capabilities. Being a modern, quicker and smooth transportation device mostly people prefer escalators for moving among the floors of building. While moving through, the abaya can stuck between the steps of escalator and can lead to fatal accidents. Currently safety devices are installed on the escalators to reduce the chances of accidents. But it is observed that it is still needed to review and update them innovatively, considering the abaya factor as constant factor of requirement.

3.2 Justification for Proposed Work:-

3.2.1 Theory:

The Makkah Royal Clock tower is the third largest building and fourth tallest freestanding structure in world. These are mixed use postmodern type of towers including Hotel and Residential located in Mecca Saudi Arabia having coordinates 21’25’08N 39’49’35’E on a typical hot line area by globe, costing $15 billion. Its podium commercial area consists of 6 floors with more than 700 shops and restaurants comprising 13 escalators among the floors.

“Nearly three million worshipers, including foreign umrah pilgrims and local visitors, performed isha (evening prayers) and taraweeh (special Ramadan prayers) prayers in Grand Mosque in Makkah.” Alarbia English reported. Considering the men/women ratio if we calculate it is found that

Calculation Basis: One month of Ramadan

No. of total Muslims = 3 million

Ratio of Men/Women = 0.79/1 (by taking average of 50 Muslim majority countries)

No. of Muslim Women = 1.89 million

Considering the fact that Abraj Albayt is located just in front of King Abdul Aziz Gate (from where Kaba is nearest) along with that of gate No. 79 (Hilton Side) which is also mostly crowd filled. An estimated figure of 30% crowd is presented to enter through these towers.

No. of Muslim Women entering in Abraj Albayt = 1.89 million x 30 /100 = 0.567 million women

As a number of women enter through basement one entry gate so keeping the ratio 0.7/1,

No. of women entered through basement 1 gate = 0.171 million

Remaining women 0.396 million enter from ground 0 gate. As most probably the passengers chose nearest escalator so keeping 0.8/1 ratio for both ground 0 escalators,

Number of women going through Ground 0 main escalator = 0.198 million

Number of women going through Ground 0 Zain escalator = 0.3168 million

If we divide these figures into daily basis and so on we get:

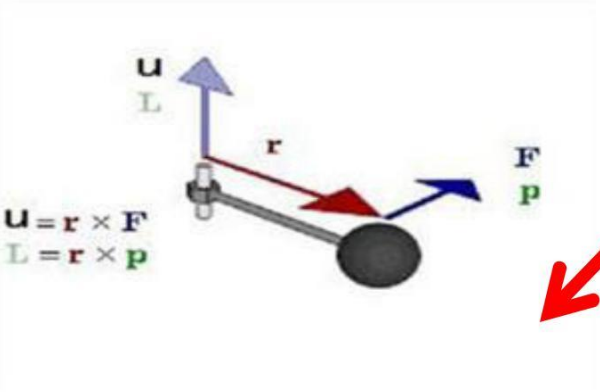
No. of women entered through basement 1 gate = 0.171 m per month => 5700 per day =>237.5 per hour

Number of women going through Ground 0 main escalator = 0.198 m per month => 6600 per day => 275 per hour

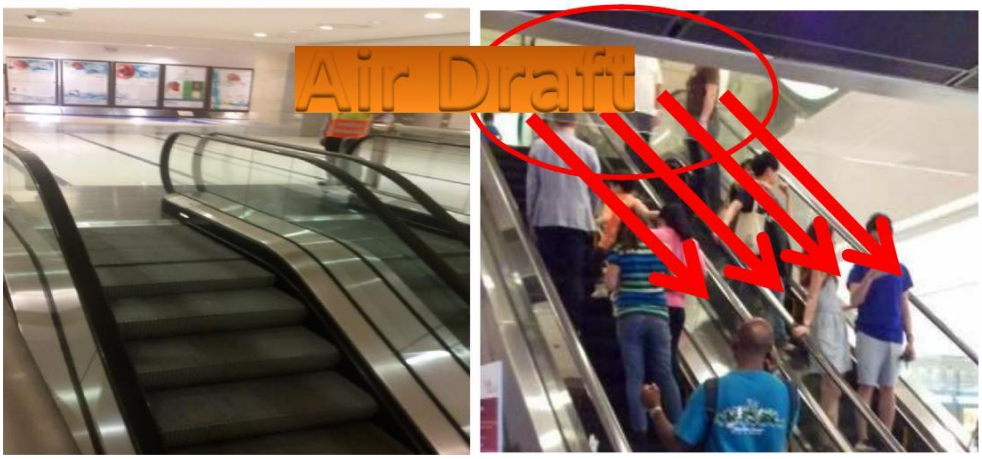
Number of women going through Ground 0 Zain escalator = 0.3168 million => 10560 per day => 440 per hour

3.2.2 Previous Experimental Results (OBSERVATIONS & CHALLENGES):-

- **Torque Effect:** Most probably it is found that the escalators where the number of women traffic was high there was increased chances of trapping their abaya in the escalators. This is due to the fact that created torque effect essential for the movement of abaya while rushing together of women on escalators.



Air Draft: It was found that the escalator which was between the covered top roofs was mostly involved to capture the abaya just like PMDC escalator between basement 1 & ground 0. This



This is due to the fact that induced air suction draft is created on these escalators passage between floors. And the air draft was involved in the movement of abaya helping in stuck process in escalators.

Prandtl's Equation

$$v = \sqrt{\frac{2 \times \Delta P}{\rho}} \qquad \text{Or rearranged to show.....} \qquad \Delta P = \frac{v\,\text{^}2 \times \rho}{2}$$

Where:

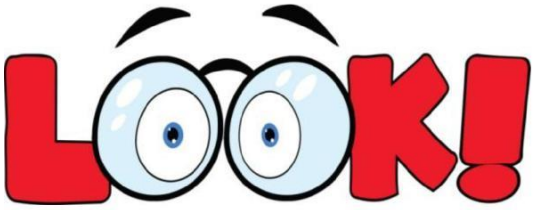
v .....is air velocity in m/s
ΔP .....is the differential pressure in Pascals measured by the DP instrument/pitot tube combination
ρ .....is the density in kg/m3 (commonly normalised to 1.2041 at normal ambient conditions of 101.325KPA and 20°C)

Landing/Rising Platforms Fear: It was found that women often afraid of landing riding on escalators while they feel difficult to put their feet on the platforms. This is due to the fact that the steps become straight at the landing and rising parts of the escalators and they keep on moving ahead while their lines of joint seem to be invisible or not so clear.

Looking Aside: It was found that passengers while moving through escalators sometimes put their heads outwards to look aside and this may lead to collapse of their head with the

Upper ceiling or walls. This is due to the design structure of the ceiling and roof side walls to consider compact structural components and improved look as a whole.

Multiparallel Escalators: It is found that people rush toward the multi-parallel type (both moving in same direction) of escalators and this can be very dangerous because they are unable to see the escalator direction most often and try to go upwards on the downward coming escalators. This is due to the fact that it is a common perception thought by people that one escalator would be going upwards and one would surely be downwards just like basement 1 escalators PMDC office.



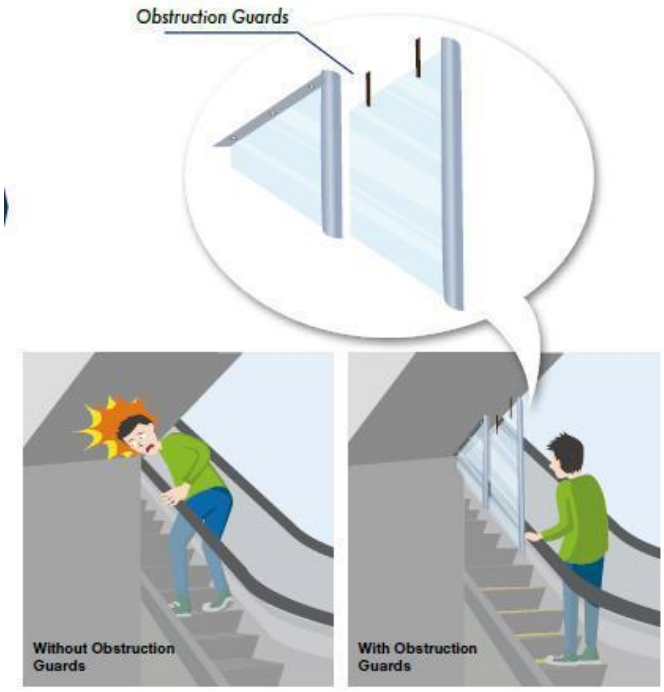
Sliding/Climbing on Escalators: It is observed that some naughty elements like children try to climb up from outer slider or try to slide on the escalators. Their action is too quick and it is many times very difficult to stop them by manually speaking loudly.

4. Recommendations (Technical Solution Approach):-

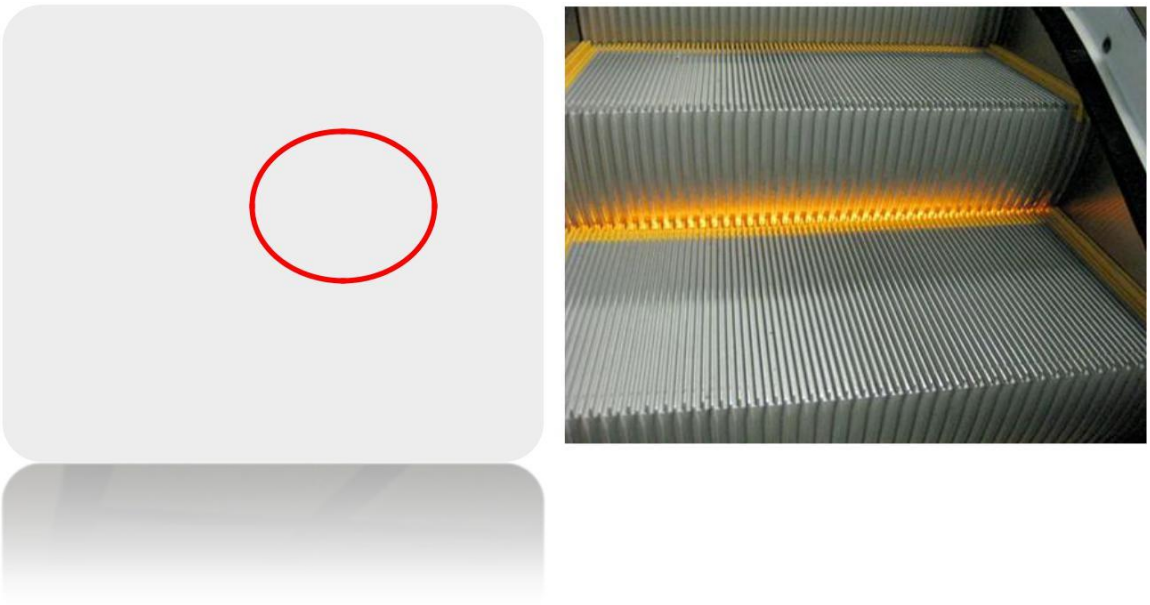
Abaya Panel Safety Device: To prevent serious injury due to trapping between skirting (abaya stuck) and steps, abaya panel safety devices can be installed to detect any objects being trapped between skirting and steps and stop the escalator automatically. Apart from installing abaya panel safety devices at the points of upper and lower transition

from incline to horizontal, additional abaya panel safety devices shall also be installed along the inclined section.

Obstruction Guards: To reduce the risk of trapping passenger's head or upper limb, obstruction guards can be installed at floor intersections, criss-cross escalators and building obstacles. In particular, at floor intersections and on criss-cross escalators, a set of fixed guard and suspended guard shall be placed. For vertical building obstacles, fixed guards shall be installed. The position of the obstruction guards shall effectively prevent injuries to the passengers.



Step demarcation lighting/ Marking: This under step lighting helps passengers notice the break between steps, encouraging them to stand solidly and firmly on single step; especially below the landing and upper platforms straight conveying ahead steps. Yellow colour is best for this lighting as it is most visible in this scenario with a predominant wavelength of 570-590 nanometres because human eyes are built to be most sensitive to that particular wavelength of light (~ 550 nanometres).



Safety Signage: There must be a stop sign (red and white) on the hand rail edge of multi parallel type (both escalators moving in same direction) with a hand showing to prohibit the passengers while they are trying to rush in opposite direction to that of the escalators just like basement 1 escalators PMDC location.

The average height of a normal human is 6 feet. So the sign must be visible from 5.8 feet and not too far angle of depression falling of eyesight making sure that it is visible by the person just standing on the edge line of landing platform in the first sight.

Or, alternatively a flash siren light can also be used while on multi-parallel escalators.

Anti-Climb Devices: Anti-climb devices and anti-slide cones can be used for stopping the sliding and climbing of notorious elements (children) on the escalators side rails and sliding portion.

As it was observed that just after the Eid prayer finished, a supervisor stopped immediately the p1 and ground floor escalators trying to manipulate the crowd, which is not a good practical approach and a safety violation to stop the escalators for manipulating the crowd during over crowd.

Other Factors: Some factors are involved in Abaya Stuck in escalators steps. These factors involved in abaya capturing on steps:

1. **Elastic Modulus, Shear Modulus**: As the abaya strikes with something just like other lady abaya, then the variations in elastic modulus are generated. This ultimately results in a chain momentum transfer eventually and the abaya strikes between the steps of the escalator along sidewalls which can lead into a fatal accident. This can be stopped by providing gaps between crowd such like the traffic signals, which allows a group of arranged traffic to move ahead. Specially the areas like basement 1 entry gate, the security can do that by using the barricades and allowing some limited group of people to move ahead. This technique can be helpful by integrating some other resources also.

$$E = \frac{stress}{strain} = \frac{F/A}{\Delta l / l_o}$$

2. **Temperature Gradient, Static Charge:** It is observed that static charge is present on

The handrails and other metallic parts of the escalators. Which can lead to electric shock and when in contact with low ignition point material (light clothing material etc.), it may initiate fire triangle also.

Also there is a temperature gradient formed on the escalator steps which has the form that temperature is higher at the joining sections of the steps and then it gradually decreases towards the front & top side of the steps.

Temperature gradient along with static charge can cause sufficient force to attract abaya towards the step gaps area between the escalator sides. This can be avoided by proper grounding of the metallic parts of the escalator to stop the generation of static charge. Temperature gradient can be minimized by proper maintenance of the internal mechanical parts of the escalators and periodic replacement of the lubricating oils. It is also observed that the escalators which have the moving mechanical sound (relatively higher) are more probably to possess this temperature gradient; this is due to the fact that heat is generated by friction of the mechanical parts and also by the decomposition of the lubricating oils.