Risk Assessment for Fossil Fuel Storage and Handling Facilities at Gaili Area, Khartoum North-Sudan
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Abstract

Risk Assessment is a chronic problem specially at Oil Sector in Sudan that is rarely researched. However, it is disputes between competing Companies at Gaili Area and uncertainty. In The current paper introduce its concepts with emphasis on the growing problems of Risk Assessment associated with unsafe acts and should be assessed according to hazard identification and the concept of disaster management. A Case study of the growing problem of Risk Assessment is introduced for workers a Fuel terminals at Gaili Area and analyzed using Environmental Health and Safety Concepts. Khartoum North –Sudan. Hazard recognition requires identification, assessment and control, the problem is to anticipate hazards and then take actions to prevent injury and illness. Risk is associated with Job (driver, electrician, pump attendant,…etc), after hazards to be identified (Natural, Technological, biochemical,…etc) and the job Safety is analyzed (breaking job responsibility in safe stages) according to hazards then risks severity could be assessed, also the No. of Incidents should be recorded to monitor the frequency against damage/lost time hours.

الخلاصة العلمية:
تقييم المخاطر هو معضلة مزمنة في مجال البترول في السودان لقلة البحوث النشورة فيه؛ كما أن شركات توزيع المواد البترولية تخفى معدل وخطورة الحوادث أثناء ساعات العمل للظهور بمظهر لائق أمام المجتمع. حتى لو تغاضي وسائل الإعلام؛ مما يعرقل الحصول على الإحصائيات المطلوبة لمراقبة معدل الحوادث. لعمل تقييم المخاطر لتخزين المواد البترولية تم دراسة حالة لمستودع بترولي بمنطقة الجبلي شمال الخرطوم ومراعاة متطلبات السلامة وحماية البيئة؛ بفرضية التعرف على الاخطار الكامنة (بيئية؛ طبيعية؛ تكنولوجية؛……) تم تحديد المخاطر المرتبطة بالمهنة (كهرباءي؛ سائق؛ عامل تعبئة؛……) وتحديد مسؤولياته الوظيفية فيشك حزمة إحصائية لمعرفة أكثر المهن التي تسبب في معدل حوادث عالي و باهظ التكلفة من حيث ساعات العمل الإنتاجية الضائعة والحوادث المروعة.
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Full Length Research Paper

Risk Assessment for Hydrocarbon Fuel Storage and Handling Facilities at Gaili Area, Khartoum North-Sudan

Introduction
Everyone knows that the concept of risk management is a relatively modern concept, in past the companies and organizations were taking into account only a specific set of risks. Those were limited to operational risks or workers safety. To realize the concept of risk management accurately, the work related goals should be identified as well as analyzing accurately to determine the scope of direct influence on the activities related to work, i.e. if there are no goals zero risks occurs. The managing risks for any projects was previously defined as those significant risks that lead to great losses, but recently many examples for companies which collapsed entirely because they focused only on those gross risks, lack of awareness and ignore the risks of investment, marketing, media etc…. There is a clear example for media risks of what happened to one of the oil companies operating in the north Atlantic Ocean when it decided to get rid of one of its offshore platform. During a meeting to discuss the best solution, it was proposed to dump the platform. This proposal reached to media and lead to a violent attack against the company by the Greenpeace Association, one of the environmental associations. After extensive studies, researches and several negotiations with the company, it was proved that the dumping of the platform is the environmentally perfect solution, to act as an incubator for marine creatures and enhance the quality of the marine life in that zone. (as mentioned by A?Aziz 2013)

Risk Management & Insurance Team: Due to reoccurrence of such examples, the companies and institutions around the world realized the importance of the risk management concept to develop the necessary plans before the risk arises in order to avoid it. The Global model is to join the risk and insurance in one team to provide insurance documents operations, projects and contractors. The team is also responsible of the claim for fair compensation in case of happening of any insured risks. The risk classification is implemented by assessing the procedures to get the final assessment that gives a close ration of the real risk. This system is also used by the International Insurance Companies to estimate the cost of insurance policy, because the insurance value is increased proportionally whenever the risk rating increased and vice versa. The calculation of the worst situation that may occur to the facility or project subject to insurance also considered in the assessment of insurance. The history of risk activities is considered and other factors such as potential suspension of the project by political decision or other factors. The risk has two main aspects, the probability of occurrence and the cost of remediation, those two factors determine the importance of each risk and the necessity to insure it or ignore it. The risk management and Insurance team should compare the loss/damage and the probability of risk occurrence.

The Purpose /Importance of the Research:
The study is covering The Risk base assessment for Gaili Area as the main Investment for Republic of Sudan which costs about (5) Billion Dollars including (Khartoum Refinery Co-KRC, Petrochemicals Plant, Gaili Fuel Terminals, Garri Power Plant) recently Garri free Zone is
attached to the Area. The global issues in Environment couldn’t be contained in a definite area / Geographical Territory or Boundaries i.e. (air pollution or ground water contamination) for the reasons, issues was discussed on Summit Conventions on Leaders level. The Golden Rule in Environmental Science; “ No Competition or Confidentiality in Protecting the World or Community against Damages” it should be the responsibility of everybody enhancing the team spirit, No confidentiality but lessons learned should be shared. The great progress in oil production and refining in Sudan should be met by equivalent studied and researches Environmental Impact Assessment, Risk Assessment, Formulate and Activate the necessary Legislation. The damage occurred at the Fuel Storage areas due to terrorism or Sabotage is not considered as a loss for the Operating Petroleum Companies but it exceeds this to be a Government Strategy, The Gaili Fuel Terminals are considered as the veins to satisfy the whole country with energy and Petroleum Products, The Proactive mode is better than Reactive mode. In case of occurrence of an accident the environmental health & Safety team investigates its reasons, root causes and responsibility while the risk team investigates the major accidents, disasters related to fires, explosion, etc. to determine the appropriate compensation to repair the damage and to identify weaknesses lead to such accident. The Effectiveness of risk management and insurance Team is to reduce and prevent the probability of such accidents to occur, by providing proposals and periodic visits to all high risk sites and to share best practices and learned lessons with international Organization and companies.

Research hypothesis:
Are the Psychological factors affecting the performance and the Incidents rate for the workers in Fuel Terminals?
Does the Climatic Factors affect the Fuel Storage and Handling Operations?

Does the waste Disposal Operations affects the Environment & the Severity of Impacts?
Are the Hazard Identifications and Risk Assessments Procedures adequate to mitigate the Impacts of Incidents /Risks?

Research Objectives:
To increase the Safety Measures to comply with Fuel Storage / Handling Requirements and Sudan Legislation.
To manage the Disaster’s according to Preparedness and forecasting Studies.
To assess the Risks at the Gaili Area.
To mitigate the negative impacts due to continuation of Marketing Operations at the Fuel Terminals.

Research Field of Application:
1. Territory Field:

Fuel Terminal at Gaili Area (70 Km) North of Khartoum

Description of Gaili Terminals Area:
(as mentioned in Bashayer Elkhair 2000)
The General Administration for Refining Technical Affairs – Ministry of Energy and Mining elect the Areas / sites for storage facilities (20.000 -50.000)m² and lay down the utilities and infrastructure (Power Supply, Municipal water, Sewage system, telephone lines, Roads, … etc.)

i. The Main Roads and Culverts:
These Roads were constructed with a total height of (90) cm. Including asphalt layer, a total width of (9.00)m. asphalted for (7)m. Road (1,2,3) with a length of (1320)m. for each. Road (4.5) with a length of (800)m. and (750)m. respectively. The total length of the internal road network is (5510) m. The concrete culverts was constructed a cross the road (2) and (3) to facilitate laying of the products pipelines from the control unit to the fuel terminals the total number of culverts is (12).
ii. The Piping System and Support:  
The piping system consist of (6) flow lines extended from Khartoum refinery to the control unit with length of (1120)m for each, so as to facilitate the product handling to the fuel storage terminal, the flow lines are, Mogas (10 dia-inch) Gas oil (12- di-inch), Kerosene (6 dia-inch), LPG (6 dia-inch), fuel oil (6 dia-inch). The piping supports were steel fabricated with concrete basement, erected to fix the piping system of certain level.

iii. Fuel Distribution Network and Measurements:  
The Distribution Network is designed by the British company (TEP Design) to supply one product to three different fuel terminals simultaneously, (39) Bulk meters and (2) master meters for calibration were imported from the British company (Avery Hardol) each product was connected by separate meter, these meters could read the quotation of fuel both in volume and weight according to the temperature during the pumping period which will minimize the volume loss and could be used automatically from the main control center (MCC). A concrete ring read was constructed around the fuel distribution net work with a length of (267)m, width of (6.5)m for security reasons. Asphalted road was constructed form the control unit to the distribution network with length of (50)m, and width of (7) m.

vi. Main Control Center (MCC) Building:  
The control center building constricated on area of (324) m², contains the control room and (3) administration offices, a fence was constructed with (PVC) coated wire and (40) sodium beam lights (250) watts were erected around the fence. A Generator room with dimensions of (3 × 4) m was built.

v. Power Supply:  
The electrical supply for the main control center and the fuel terminals is facilitated from the surplus of the power generation of Khartoum refinery which remains about (30) MW for supplying the electricity demand of the national power network of Khartoum state.

2. Human Field:

By electing a sample of (80) elements represents (8) different jobs for workers and technicians from a total community of (800) persons at the fuel terminal.

Theoretical Framework:


API – American Petroleum Institute Regulation

Research Tools:

- Interviews
- Definite Questionnaire

Research Methodology:

The Case Study method, was elected by choosing Nepta Fuel Terminal as a research Sample. This method lead to more accurate / reliable results could be generalized, also it
could facilitate the awareness / Training in dealing with similar problems.

**Risk Concept:**
*(as mentioned by JO 2013)* Understanding risk is a complex, multidisciplinary endeavor, there are many dimensions, technical, economic, social and political, these dimensions are not universal and are often divergent. Early definitions of risk simply focused on number of deaths associated with a particular hazard. The U.S. Nuclear regulatory commission defines risk as “the combined answers to 1. What can go wrong? 2. How likely is it? 3. What are the consequences?” The U.S. EPA defines risk in the context of human health as” the probability of adverse effects resulting from exposure to an environmental agent or mixture of agents. WHO defines risk as “the probability of an adverse effect in an organism, system or sub-population caused under specified circumstances by exposure to an agent” (WHO 2004). At Clark University in 1985, the founders of one of the earliest science technology and society programs, Chris Hohenemser and Bob Kates with others, broadened the scope of understanding risk beyond its early definitions. They are defined risk as the “quantitative measure of hazard consequences expressed as conditional probabilities of experiencing harm(Kates , Hohenemser and Kasperson 1985). The International Risk Governance Council (IRGC) based in Switzerland defined risk as ”an uncertain consequence of an event or an activity with respect to something that human value. The idea that risk is an inherent properly of the hazard has been criticized by Watson (1981) as the phlogiston theory of risk. **Risk:** The combination of the predicted frequency and severity of the consequences of hazard(s) taking into account all of the potential outcomes. **Risk;** Combination of the likelihood and consequence of a specified hazardous event occurring.”

**Guidelines for Risk Assessment :**
*(Mentioned in QAFCO 2013)* Occupational accident risks are related to hazardous events during "normal" operation and maintenance conditions, like electrical short-circuits / shocks, fall to lower level, trips and fall on same level, dropped objects, machinery movements / malfunctions, vehicle collisions, etc. Detailed Job Safety Analysis (JSA) can be used to identify and evaluate the hazards, to which personnel are exposed when performing work activities, work tasks differ in the level of detail, by which the activities are broken down. For JSA the following factors should be considered: basic layout. Input to technical specifications, Selection of types of equipment including man-machine interfaces. analysis to work activities within a specific area or related to specific machinery. relevant hazards for each activity should be identified, expected consequences should be estimated and the frequencies of each potential hazardous incidents, needs for remedial actions should be evaluated according to Risk assessment.

**Risk Assessment consideration for Design and Engineering :**
Relevant incidents scenarios should be identified, the probabilities and consequences of the accident scenarios should be estimated, the scenarios in order of decreasing consequences should be listed and priories, the cumulative probability of the scenarios, starting at the top of the list should be calculated. The design accidental event/incident is found when the cumulative probability reaches the acceptance criterion and Ergonomics should be considered.

following factors shall be considered in the selection of chemicals:
Toxicity, Degradability, Potential for bio-accumulation / bio-magnification, Carcinogenic, mutagenic properties, Reproduction toxicity, endocrine disrupting properties, Ozone depletion potential, Global warming potential, Risk of release to the environment. Material Safety Data Sheets (MSDS) shall be submitted for all chemicals, for chemicals that may be discharged to the water source, eco-toxico logical data shall be provided.

**Ergonomics:**
*(Mentioned by Khalid 2013)*
The International Labour Organization define Ergonomics as the Application of Humanity and Engineering Science for the labour and its working Environment to sustain labour health satisfaction considering Productivity. Ergonomics is integrated with many Sciences such as Sanitary, Psychology, Sociology, Physics, Measurements, Biomechanical (muscle skeletal) and Engineering Design. A surveillance study for Incidents Root Causes emphasis that the Incidents due to ignorance of Ergonomic in Untied States costs about (50) Billions Dollars annually and (600,000) labour are suffering from abuse of Ergonomics annually. Design Requirements for Prevention of muscle-skeletal injuries: Workplaces shall be designed and arranged such that personnel are not exposed to excessive workloads with risk of muscle-skeletal injury. For determination of maximum workload and force limits, Efforts shall be made to avoid: Monotonous muscular load, Excessive muscular load, Work in fixed or static postures, Work requiring high precision and, at the same time, substantial use of force, Work with joints in extreme position, Work in kneeling, squatting and lying positions, Work of long duration and of repetitive nature with hand above shoulders or below knees, Continuous, asymmetric load on the body, Transportation ways where manual trolleys and carts are used shall not contain steps and thresholds. The opening force of doors in daily use shall not exceed 65N (side hinged) and 50N (sliding door) respectively. No doors shall have an opening force in excess of 130N (side hinged) and 105N (sliding door). Mechanically assisted opening of doors shall be considered in the main walkways. Hinged doors leading to open areas shall be provided with a damping mechanism to prevent crushing injuries. Vertical inspection hatches should be side hinged. Access openings in vertical partitions into tanks, silos, etc. shall be equipped with handgrips on both sides above the opening. Facilities for cleaning of process areas, workshops and offices, etc. shall be provided. Materials and surfaces of buildings and equipment shall be easy to clean and maintain. In toilets, change rooms, and catering areas, equipment and fixtures should be mounted on plinths or fixed to walls. For vertical and horizontal clearances and distances.

**Man-Machine interfaces**
The design of man-machine interfaces shall be based on job / task analyses when the human performance is critical for the safety of the machine. For control rooms and control panels where human errors may cause high risk accidents, the following shall apply: Displays and controls shall be designed in accordance with acknowledged ergonomic / human factor principles, allowing the operator to carry out his tasks in a safe manner and utilising a minimum number of displays. If visual displays are used, information should not be presented in a way which give the operator memory problems or adds to his load of work. System overviews should be available from the displays, giving the operator opportunities to watch process performance. Controls and displays shall be combined and
located in a logical manner with respect to frequency of use and importance for safe operation. Controls and displays shall be clearly marked in English.

Analysis, Control and Verification Activities

Ergonomic job analyses shall be performed and documented for all workplaces, which involve tasks in operations or maintenance with a significant risk of muscle-skeletal injuries. The aim is to identify potential problem areas in design of workplaces in order to ensure that the requirements to maximum workload are possible to meet. The analyses shall include, but not be limited to, evaluations of lay-out, clearances for performance of tasks, location of work functions (displays, control actuators, etc.), needs for stairs and platforms, and lifting and transportation support facilities. Job / task analyses of man-machine interfaces shall be performed and documented for control room tasks, where human errors may cause high risk accidents. The evaluations shall cover normal operations, emergency operations, and maintenance. The analyses shall cover personnel and system safety aspects, and the possibilities to control process disturbances in a safe manner.

Hazard Identification:

Hazard: Source or situation with a potential for harm in terms of injury or ill health, damage to the work place, damage to the work place environment, or a combination of these. Generally understood definition within industry “any practice, behavior, condition, or combination that can cause injury or illness in people or damage to property.” Uncontrolled hazards may cause problems that range from near misses and minor annoyances to very serious consequences, serious disabling injury and even death.

Hazard Identification:

(As mentioned by Ilias 2008) International Civil Aviation Organisation (ICAO) requires organisations to establish Safety Management Systems (SMS) that, as a minimum: identifies safety hazards; assesses risks, ensures that remedial action necessary to maintain an acceptable level of safety is implemented; provides for continuous monitoring and regular assessment of the safety level achieved and aims to make continuous improvement to the overall level of safety. An SMS is a systematic and organised approach to managing safety, including the necessary organisational structures, accountabilities, policies and procedures. The component of SMS within which hazards identification takes place is safety risk assessment and this forms part of an overall safety risk management process.

Techniques for Hazards Identification:

This section provides a summary of a number of tools and techniques that can be used for hazards identification. The various techniques are described below together with a brief overview of their advantages and disadvantages. It should be remembered that any system or operation comprises: people; procedures; equipment; and an environment of operation. All these elements must be considered during hazards identification. Hazards identification techniques require a definition of the System / Operation, its environment of operation and its interactions to have been completed prior to undertaking the task (safety risk assessment: System / Operation / description). This System / Operation definition may take different forms depending on the specific technique and type of system. The definition may be: Functional, Operational, Process & Scenario based

I. Brainstorming
Brainstorming is an unbounded but facilitated discussion within a group of experts. A facilitator prepares prompts or issues ahead of the group session and then encourages imaginative thinking and discussion between group members during the session. The facilitator initiates a thread of discussion and there are no rules as to what is in or out of scope from the subsequent discussion. All contributions are accepted and recorded and no view is challenged or criticised. This provides an environment in which the experts feel comfortable in thinking laterally.

Advantages: Good for identifying new hazards in novel systems. Involves all key personnel, Relatively quick and easy to undertake. Can be applied to a wide range of types of systems.

Disadvantages: Relatively unstructured and therefore not necessarily comprehensive. Depends on the expertise and profile of the participants. May be susceptible to the influence of group dynamics. Can rely heavily on the skills of the facilitator for success.

II. Hazard and Operability (HAZOP) Study
HAZOP is a systematic and structured approach using parameter and deviation guidewords. The technique relies on a very detailed system description being available for study and usually involves breaking down the system into well defined subsystems and functional or process flows between subsystems. Each element of the system is then subjected to discussion within a multidisciplinary group of experts against the various combinations of the guidewords and deviations. The group discussion is facilitated by a Chairman and the results of the discussion recorded by a Secretary together including any hazards identified when a particular guideword and deviation combination is discussed. Where a particular guideword and deviation combination does not produce any hazards, or is not thought credible, this should also be recorded to demonstrate completeness. The guidewords and deviations must be prepared in advance by the HAZOP Chairman and may need to be tailored to the system or operation being studied. In an aviation context, typical guidewords might include: Detection, Coordination, Notification, Transmission, Clearance, Authorisation, Selection, Transcription, Turn, Climb, Descend, Speed, Read-back, Monitoring, Signage, Handover, Supervision

Typical deviations might include: Too soon / early, late, Too much, little, Too high, low Missing, Twice / repeated, Out of sequence, Ambiguous, Reverse / inverted

Advantages: Systematic and rigorous. Involves interaction of views from multidisciplinary experts. Can be applied to a wide range of types of system. Creates a detailed and auditable record of the hazards identification process.

Disadvantages: Requires a considerable amount of preparation. Can rely heavily on the skills of the HAZOP Chairman, Can be time consuming and therefore expensive. Can inhibit imaginative thinking and so certain kinds of hazards.

III. Checklist
Checklists are lists of known hazards or hazard causes that have been derived from past experience. The past experience could be previous risk assessments of similar systems or operations, or from actual incidents that have occurred in the past. This technique involves the systematic use of an appropriate checklist and the consideration
of each item on the checklist for possible applicability to a particular system. Some example checklists are provided in Annex II: Examples of Hazards. Checklists should always be validated for applicability prior to use.

Advantages: They can be used by non-system experts. They capture a wide range of previous knowledge and experience. They ensure that common and more obvious problems are not overlooked.

Disadvantages: They are of limited use when dealing with novel systems. They can inhibit imagination in the hazards identification process. They would miss hazards that have not been previously seen.

IV. Failure Modes and Effects Analysis (FMEA)
FMEA is a ‘bottom up’ technique that is used to consider ways in which the basic components of a system can fail to perform their design intent. This could either be at an equipment level or at a functional level. The technique relies on a detailed system description and considers the ways in which each sub-component of the system could fail to meet its design intent and what the consequences would be on the overall system. For each sub-component of a system an FMEA considers: All the potential ways that the component could fail. The effects that each of these failures would have on the system behaviour. The possible causes of the various failure modes. How the failures might be mitigated within the system or its environment. Behaviours at the system level arising from the sub-component failures which have a safety consequence are thus identified as hazards. The system level at which the analysis is applied can vary and is determined by the level of detail of the system description used to support the analysis. Depending on the nature and complexity of the system, the analysis could be undertaken by an individual system expert or by a team of system experts acting in group session, complexity of the system, the analysis could be undertaken by an individual system expert or by a team of system experts acting in group session.

Advantages: Systematic and rigorous. Creates a detailed and auditable record of the hazards identification process. Can be applied to a wide range of types of system.

Disadvantages: Only really considers hazards arising from single point failure modes rather than combinations of failures. Relies on people with detailed system knowledge. Can be time consuming and expensive.

V. Structured What-if (SWIFT)
The SWIFT technique was originally developed as a simpler and more efficient alternative technique to HAZOP. Like HAZOP, SWIFT involves a multidisciplinary team of experts under the facilitation of a Chairman. It is a facilitated brainstorming group activity but is typically carried out on a higher level system description, having fewer sub elements, than for HAZOP and with a reduced set of prompts. Ahead of the group session the Chairman prepares a suitable list of prompts such as:(What if…?, Could someone…? Has anyone ever…?). The Chairman uses the prompts to initiate discussion within the group.

Advantages: Creates a detailed and auditable record of the hazards identification process. Is less time consuming than other systematic techniques such as HAZOP.

Disadvantages: Careful thought is required in preparation for the application of the technique. Relies heavily on the expertise
and experience of the team members. Relies heavily on the skills of the Chairman.

VI. Dynamic Methods
A number of techniques widely used across the industry such as the FTA and FMEA described above are static techniques which are not very good at capturing hazards related to the dynamic interaction aspects of complex systems and operations involving multiple actors. Some hazards related to timing, sequencing and mutual dependency can be identified using such methods, and also using the various brainstorming approaches described in the previous paragraphs, but other techniques are sometimes needed to ensure an adequate capture of hazards related to the dynamics of complex systems and operations. The complexities involved with employing these techniques, most of which involve some form of simulation, are such however, that their use is beyond the scope of most operational organisations and therefore requires expert assistance. Their description is also beyond the scope of this document. Nevertheless, experience shows that where these dynamic methods are applied, they often identify relevant hazards that were not—or could not be—identified using static approaches. It is therefore wise, when conducting hazard identification for complex and dynamic operations and systems, to give conscious consideration to the possible need to employ dynamic methods in addition to the methods described above.

VII. Future Hazards Identification method
Identification of future hazards often relies on expert judgement and some sort of ‘instrumented’ brainstorming. There are only few methods available for future hazards identification. The method (Ref. 8 - FAST method) is a “prognostic” or “predictive” approach aimed at discovering future hazards arising as a consequence of future changes introduced inside or outside the global aviation system and of their interaction, and subsequently develop and implement mitigating actions.

VIII. The Hazard Log:
The 8th step in the safety risk assessment process is safety assessment documentation. A key element of this process step is the documentation of the hazards. Organisations should wherever possible maintain a centralised log of all identified hazards. The nature and format of such a log may vary from a simple list of hazards to a more sophisticated relational database linking hazards to mitigations, responsibilities and actions (as part of an integrated safety risk management process). As a minimum, it is recommended that the following information be included in the hazard log: Unique hazard reference number against each hazard, Hazard description, Indication of the potential causes of the hazard (safety events), Qualitative assessment of the possible outcomes and severities of consequences arising, from the hazard, Qualitative assessment of the risk associated with the possible consequences of the hazard, Description of the risk controls for the hazard, Indication of the risk controls for the hazard, Indication of responsibilities in relation to the management of the risk controls, In addition, organisations may wish to consider the following information for inclusion in the log. A quantitative assessment of the risk associated with the possible consequences of the hazard, Record of actual incidents or events related to the hazard or its’ causes, Risk tolerability statement, Statement of formal system monitoring requirements, Indication of how the hazard was identified Hazard owner & Assumptions (as mentioned in Michigan Hazard Mitigation Plan - 2011)
I. Natural Hazards

A. Weather Hazards: Storms, Severe Winds, Extreme Temperatures and Fog

B. Hydrological Hazards: Flooding

C. Geological Hazards: Ground Movement, Earthquakes

II. Technological Hazards

Internal Hazard: happened due to failure in design / maintenance or expected aging (i.e. wear of mechanical parts)

External Hazard: happened due to failure or external factor from surrounding environment (i.e. Electrical short circuit, car accident)

Physical: noise, vibration, heat, cold, electrical, mechanical, radiation.

Chemical: dusts, fumes, gases, mists, vapors, liquids, compressed gases, solvents, lead, paints, acids.

Biological: bacteria, viruses, fungi, parasites and insects.

Psychological: stress, occupational violence, fatigue and harassment.

Hazard Identification for Fuel Terminal:

a. Atmospheric Storage Tanks: Spillage due to tank overfill, Leakage from shell or bottom plate corrosion, Catastrophic failure from brittle fracture, Tank nozzle or roof drain leaks, releasing product to dike area, Tank fails from overpressure or vacuum due to blocked or undersized vents, Bottoms water draw off line left open inadvertently, Dike fire following overflow or leak, Light product routed to hot tank or hot product to low flash tank, Floating roof seal fire following electrical storm, Full surface fire (following sunken floating roof, internal explosion of cone roof tank), Internal floating roof tank fire, tank vent fire following lighting strike, flammable atmospheric in cone roof tank explodes full surface fire, floating roof tank landed, vapor space explodes

b. Pumps and Compressors: Seal leakage from misalignment, bearing failure, vibration, Compressor liquid carryover, Compressor surge / over speed, Pump blocked in while running without recycle

c. Road/Rail Loading and Unloading: Spillage due to overfill, Hose or loading arm failure, Spill from hose or loading arm during disconnection, Tank truck drives off while connected, Truck or rail car leaks due to corrosion, leaking fittings, faulty relief valves, etc. Collision or derailment inside or outside fuel terminal, internal explosion, caused by static discharge from splash loading, sampling, gauging, Internal explosion in vapor recovery unit

d. Loading and Unloading: Spillage from hose or loading arm failure hose or loading arm breakaway due to excessive Tanker movement, spillage from hose or loading arm during routine disconnection, overfill from over-pumping, leakage from corrosion or faulty connection, vessel drains inadvertently left open, vessel compartment fails from over-pressure or vacuum, light product inadvertently
routed to heated compartment or tank, splash loading, switch loading, sampling, gauging, line blowing. Displaced vapors ignited by lightning, hot work.

e. Pipe work and Associated Equipment: Leakage from internal or external corrosion (under insulation, underground, submarine) Small bore connections not braced/seal welded, underground piping not protected from heavy loads, No protection against freezing, thermal expansion, hydraulic surge, Inadequate overpressure protection, Safety Valves not sized for all contingencies, or not routinely checked, failure of hoses, non-steel components, expansion, leaks from flanges, valve stems and other connections, failure from brittle fracture, impact from vehicles or other equipment, lifting operations: overhead crane drops loads & improper isolation during removal of equipment for maintenance

Risk Assessment:
Advance assessment of the environmental implications of new projects is increasingly important in view of rising expectations by society reflected in legislation and increasing financial implications. Environmental Risk Assessment as outlined in this Guide is a systematic procedure for considering the potential effects of proposed new projects on the surrounding environment can assist in: identifying cost-effective project designs, ensuring compliance with legislative requirements and international Standards, consultations in-house and with authorities & avoiding long-term liabilities.

The essential components of Risk are knowledge of the environmentally relevant features of the proposed operation (e.g. emissions, effluents, noise) and understanding of the sensitivity of the receiving environment. These components can be combined to indicate the potential impact. Timely consideration of environmental impact should be a feature of all Group activities. Environmental Risk assessment should begin early in the planning of a project and should develop in conjunction with the evolution of the project design. All aspects of the project should be considered including construction, routine and non-routine operation and abandonment of the site. At various stages in this process, fieldwork and laboratory experiments may be necessary in addition to desk studies. This approach can save costs of a project by avoiding modifications or additions at later stages. The amount of detail required for the environmental impact assessment can vary greatly, depending mainly on the scale of the project, the sensitivity of the environment and the environmental risks related to the type of operation. The scope of the required assessment should be first defined, the impact of various factors (noise, effluents etc.) can then be assessed. Environmental Risk Assessment is an important component of environmental management, particularly in project planning. With increasing public and government environmental awareness throughout the world. Not only current, but also future requirements should be recognized, especially in countries where legislation on these issues is still developing. The importance of handling waste should be stressed since a company might be judged on future standards and held liable for past actions. The purpose of this document is to advise management on the requirement for documented Risks, the benefits which can be obtained and the nature and timing of the assessment required. This should assist in assigning responsibilities for considering environmental impact and producing the necessary documentation. This document is
also intended for use by the environmental adviser or person nominated to organize work associated with the risks. Methods for assessing relevant impacts are therefore outlined in the appendices.

Environmental Risk assessment in this context is the process of considering at the planning stage the potential effects of a proposed new project on the surrounding environment. These effects may be biological, physical or social. Risk assessment requires knowledge of the proposed operation (effluents, emissions, infrastructure requirements etc.) together with an understanding of the sensitivities of the receiving environment which can then be combined to assess the potential impact. While some form of environmental assessment has normally been applied to new projects in the past, the value of site specific and structured impact assessment, which ensures comprehensive and systematic coverage of relevant issues, is increasingly recognized. From this a summary document which outlines the chosen option, supported by environmental arguments, can be prepared and used in discussions internally and with authorities. This is often referred to as an Environmental risk Assessment Studies and this term will be adopted here.

The production of Risk studies includes predictions of environmental effects as well as the assessment of possible hazards are conducted at the feasibility assessment stage. The effort used in preparing an impact assessment should be related to the scale of the project. For small projects, a brief appraisal by a project engineer and environmental advisor may produce the most cost-effective and useful "impact assessment", for use by the project team and as background for consultation with external groups such as government authorities. For large projects, the situation may be more complex and require detailed studies before a well considered Risk is prepared. Where consultants are employed adequate supervision and guidance is important to ensure that the assessments and resulting statements are appropriate for the purposes required and are understood and supported by management.

**Work Psychology**

The Objective for work Psychology is to explore the compatibility conditions between labor associated carrier /Endeavour and contribute in mitigating these conditions after recognized it. Psychology has a wide applications in industry fields such as Vocational Adjustment, it concerns with increasing productivity, to achieve these objectives, Psychology followed different ways such as Job Safety Analysis which defined as the exact known how for work conditions, details and responsibilities for labor to perform his job as mentioned by Mamoud (1985). A/Rhman (1982) mentioned that work incidents is the main problem for labors and business owners, In United States the National Safety Council issued a report indicates that losses due to job incidents costs annually (3) Billion Dollars, most of the studies in this field indicates that the human error (unsafe act) is the main cause for most incidents (P205).

Focusing on work conditions is more useful than looking to job nature such as oil drilling differs in conditions at Africa, offshore, Alaska or Gulf area. Till (1950) the incidents considered as different case from job nature. Work regulatory, social security, insurance motivates, increase the labors loyalty specially incase of high risk or disasters.

**Definition of incident**

Undesired event or series of events that results or could have resulted in death,
injury, loss of process or damage to a system or service; vehicle and/or equipment damage or loss; environmental damage; and/or adversely affecting an activity or function. Also includes events such as a near miss, loss of property through theft, and/or incidental release of a hazardous substance.

**The Hypothesis explaining Incidents:**
Abbas (1985) mentioned that the incidents could occur due many contradicting causes such as external reasons or human reasons, it could be concluded into four hypothesis explain the cause of incidents:

1. Accidental Hypothesis: It depends on accidental occurrence or matter of bad luck, which is rejected by scientific logic.
2. Medical Hypothesis: It explains that regular injured person at work is due to physical or nervous failure causes the incidents.
3. Psychological Analysis: Incidents are un-intended actions, Freud said that most of incidents due to unconscious motivations for internal feeling like self underestimation or bully.

**Incidents Investigation:**
Incident Investigation Objectives is to know the injuries rate, hazard identification and risk assessment, to investigate the root causes, weakness points and recommended corrective actions and new tools to increase safety measures and lessons learned from similar cases. In case of fuel incidents the investigators should be trained for incidents root causes and corrective action rather than blame others. The Four work Environment factors affecting the incidence occurrence:

1. Equipment: Conclude the root causes for equipment in six points: Design failure, false policy, lack of training, periodical inspection, applied Standard or lack of equipment.
2. Site: improper Site selection or site planning, uncertainty of physical/Environmental conditions (illumination, Noise, heat, etc…)
3. People: Failure in Job Safety Analysis, lack of training or unclear responsibility lines.
4. Management: Lack of regulations, Management Systems, unstructured organization chart or lack of supervision and monitoring.

**Causes of Incidents:**
We know that incidents and injuries result in needless pain and suffering as well as financial hardship for the employee, his family and the company. We also know that we have moral, legal and financial obligations to prevent incidents and injuries. To do this we must understand what causes incidents.

Incidents are caused by:
- Unsafe acts
- Unsafe conditions
- Combinations of unsafe acts and conditions

*(As mentioned in ARAMCO 2013)* A study by Bird & Germain (1990) suggested that incidents resulted from unsafe acts 80% of the time, unsafe conditions 16% of the time. Later studies also suggest that most incidents involve both unsafe acts and unsafe conditions. Many people tend to focus their attention on unsafe conditions, often overlooking the unsafe acts. Most safety professionals today agree that we should not ignore unsafe conditions, but a greater focus should be on the actions of people rather than focus on compliance, concentrate on safety fundamentals. Individual behaviors are a key factor after workplace conditions, training and safety standards are addressed.
If we build a safety triangle (pyramid) on the "stone" of excellent fundamentals that modify behaviors and actions, we can limit the base of improper activities that lead to 96 percent of the injuries in this model.

**Focus on fundamentals**

The fundamentals of upper management visibility in safety, middle management involvement, focused supervisory performance, employee active involvement and training that both teaches and reinforces these basics of excellence will significantly reduce injuries.

Define the correct behaviors that eliminate unsafe acts and injuries; Train all personnel in these behaviors; Measure that personnel are indeed doing these correct behaviors; Reward their accomplishments of these correct behaviors. By eliminating dangerous behaviors there are never enough dangerous actions to get us to a more serious level of safety injuries in the pyramid. The key is to not focus on compliance, or reward "acceptable injury levels/goals."

Instead, concentrate on the fundamentals that eliminate the activities/behaviors that move us up the triangle.

In 2003, ConocoPhillips Marine conducted a similar study demonstrating a large difference in the ratio of serious incidents and near misses. The study found that for every single fatality there are at least 300,000 at-risk behaviors, defined as activities that are not consistent with safety programs, training or component on machinery. These behaviors may include bypassing safety components on machinery or eliminating a safety step in the production process – in other words “Unsafe Acts”). The responsibility to coworkers and the company to address your own at risk behaviors, recognize and control hazards so we avoid these incidents. Everyone has a part to play in reducing incidents in the workplace.

### 300,000 – At Risk Behaviors

*At Risk Behaviors* are defined as activities that are not consistent with safety programs, training or component on machinery. These behaviors may include bypassing safety components on machinery or eliminating a safety step in the production process – in other words “Unsafe Acts”). The responsibility to coworkers and the company to address your own at risk behaviors, recognize and control hazards so we avoid these incidents. Everyone has a part to play in reducing incidents in the workplace.

#### Progress in Safe Operations

Through the successful implementation of key safety initiatives and the many efforts of all organizations to fully implement our safety management system (SMS), or on-job safety.

#### Materials and Methods - Risks at Gaili Fuel Terminals Study Results:

To Study The Relation Between :
- Incident Rate and Nature of Job
- Work Environment and nature of Job

The Workers/Contractors about (980) at Gaili Area are considered as the Research Community. Controlled Questionnaire was set and distributed to (75) of Workers/Contractors were considered as the Research stratified Sample according to the Nature of job for Eight different jobs including:

- Pump Attendants
- Electricians
- Mechanics
Drivers
Welders
Fitters
Store Keepers
Security Guards

Special Conditions were considered while setting the questionnaire to fulfill the study Objectives such as; using local language and clear instructions to answer the questions, definite and clear questions, Punctual questions, Neutral questions could be answered without biased.

To study the variations between different variables such as the factors related to the health situation for workers, aging, fatigue and the risky jobs, training, job safety analysis, Safety Precautions and the effect of climatic data such as Ambient Temperature, Wind Speed/direction and Humidity for those who works at open or Confined Space and the Local Regulations/Orders, Insurance Coverage Policy and the Intention of the Company to protect the Public health and Environment.

The Descriptive Statistics were used for data analysis and describing the research community by electing Random samples and other subjects could have the same opportunity for election.

The Limiting factors for the questionnaire and interviews, the existing companies at Gaili Area are competitors for Marketing of Fuels and Lubricants, so they wouldn’t like to know about the Storage, handling facilities, findings in operations and the manpower capabilities.

The questionnaire contains Five categories of Questions, the variables are nominated from (X1 – X23) as indicated below :-

1. Health and Personal Particularities
   X1 – Age
   X2 – General Health

   X3 – Vision Test
   X4 – Alcohol/drug Abuse
   X5 – Previous Experience
   X6 – Company Commitment for Safety Regulations

2. Nature of Job
   X7 – Fatigue During working Hours
   X8 – Exposure to Petroleum Vapors
   X9 – Exposure to Petroleum Fires
   X10 – Exposure to Electrical shock during working hours
   X11 – Exposure to Noise pollution during working hours

3. Training
   X12 – Training on Job
   X13 – Safety Training
   X14 – Contingency training and Fire Drills
   X15 – Safety Tools and Personal Protective Equipment (PPE)

4. Work Environment
   X16 – Effect of Temperature Rise on Job Performance
   X17 – Effect of Humidity Rise on Job Performance
   X18 – Effect of Wind and sand storms on Job Performance
   X19 – Effect of Rain Fall on Job Performance

5. Incident Rate
   X20 – First Aid Injuries
   X21- Lost Time Injury(LTI)
   X22- Incidents causing damage more than (50,000) S.D.
   X23 – Job performance showed significant improvement.

This is to show the number of at risk behaviors that are happening in the work place and you all have a part to play in addressing these. You must follow all rules and procedures which are there to help avoid incidents and protect you from harm. You all have a responsibility to look out for
hazards, report these and near misses in the workplace.

**Statistical Package for Social science** [SPSS] version 10.5 – 2000 (SPSS), is a Computer Program for Descriptive Statistics, It was developed by Norman H. Nie, C. Hadlai Hull and Dale Bent at Sanford University at (1968). SPSS Version for Personal Computers (PC) was issued (1984) sponsored by Microsoft Company and updated (1995) for different Programming languages, during the Period (1994 - 1999) it Nine acquire Patent Unions, such as SYSTAT Inc., BMDP Statistical Software, Jandel Scientific Software, Clear Software, Quantime Ltd., In2itive Technologies, Integral Solutions and Vento Software Inc., By (2000) SPSS was developed for different field of applications such as Communications, banking, Insurance, Manufacturing, Consumable Goods, market Survey, ..etc. the Web Site Address is www/http:SPSS.com

**Table (1) indicating the Relation between Incident Rate and Nature of Job according to Study**

<table>
<thead>
<tr>
<th>Incident Rate</th>
<th>Pump Attendants</th>
<th>Electricians</th>
<th>Mechanics</th>
<th>Drivers</th>
<th>Welders</th>
<th>Fitters</th>
<th>Store Keepers</th>
<th>Security Guards</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Subject</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>2nd Subject</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3rd Subject</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>4th Subject</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>5th Subject</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

(Table 2) : Damage and Property Loss Cases:

<table>
<thead>
<tr>
<th>Incident Rate</th>
<th>Pump Attendants</th>
<th>Electricians</th>
<th>Mechanics</th>
<th>Drivers</th>
<th>Welders</th>
<th>Fitters</th>
<th>Store Keepers</th>
<th>Security Guards</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Subject</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>2nd Subject</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3rd Subject</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>4th Subject</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>5th Subject</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
**Table (3): First Aid Cases:**

<table>
<thead>
<tr>
<th>Job</th>
<th>Not Available</th>
<th>Once</th>
<th>Two Times</th>
<th>Three Times and More</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fitters</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Welders</td>
<td>4</td>
<td>1</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Drivers</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Security Guards</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Electricians</td>
<td>4</td>
<td>1</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Mechanics</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Pump Attendants</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Store Keepers</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>19</td>
<td>14</td>
<td>4</td>
<td>3</td>
<td>40</td>
</tr>
</tbody>
</table>

**Table (4) Fatality and Injury Cases:**

<table>
<thead>
<tr>
<th>Job</th>
<th>Not Available</th>
<th>Once</th>
<th>Two Times</th>
<th>Three Times and More</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fitters</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Welders</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drivers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Security Guards</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricians</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mechanics</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pump Attendants</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Store Keepers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table (5) Jobs Versus Incidents Rate:

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Not Available</th>
<th>Once</th>
<th>Two Times</th>
<th>Three Times and More</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fitters</td>
<td>4</td>
<td>1</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Welders</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Drivers</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Security Guards</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Electricians</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Mechanics</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Pump Attendants</td>
<td>3</td>
<td></td>
<td>2</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Store Keepers</td>
<td>4</td>
<td>1</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>23</strong></td>
<td><strong>6</strong></td>
<td><strong>7</strong></td>
<td><strong>4</strong></td>
<td><strong>40</strong></td>
</tr>
</tbody>
</table>

(Fig. 1) : Results for In ConocoPhillips Marine and ARAMCO Study (2003) :
Table (6) : Comparison of Hazmat Fatality Statistics, Operator Personnel and General public for Road, Rail and Pipeline (2005-2009)

<table>
<thead>
<tr>
<th>Category</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>Total</th>
<th>Average per Year</th>
<th>Fatalities per Billion Ton Miles Shipment per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road</td>
<td>24</td>
<td>6</td>
<td>10</td>
<td>8</td>
<td>3</td>
<td>51</td>
<td>10.2</td>
<td>0.293</td>
</tr>
<tr>
<td>Railway</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td></td>
<td>12</td>
<td>2.4</td>
<td>0.100</td>
<td></td>
</tr>
<tr>
<td>Hazardous onshore Only</td>
<td>2</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>12</td>
<td>2.4</td>
<td>0.004</td>
</tr>
<tr>
<td>Gas Transmission Only</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>1</td>
<td>0.003</td>
</tr>
</tbody>
</table>

Conclusion and Results Comparison:
The result of the Study indicates that the high risk job at Fuel Terminals is the Road divers for fuel Tankers which is follow the direction of Results for In ConocoPhillips Marine and ARAMCO Study (2003) which explains that the incidents are results of unsafe acts, also: the results reproduced from U.S. Department of Transmission, Pipeline and Hazardous Materials safety Administration, Office of pipeline Safety Building Safe Communities: Pipeline Risk and its Application to local Development Decisions, October 2010, indicates that the HZMAT (Hazard Material) road drivers are the highly risk job among the other divers.

Recommendations:
The Conclusion and Recommendations for this study could be summarized as: Formulation of HSE Steering Committee from governmental and non-governmental bodies to be responsible for:
   I. Incident Reporting
   II. Public Media
   III. Constitutional / Legal
   IV. Training and Awareness

The preventive measures stipulated in section 37(1) and (2) of the Road Traffic Act 1983 are also useful, if applied rigorously by the concerned authorities, in eliminating air pollution resulted from automobiles exhaust. However, in the absence of other complimentary trade enactments and regulations that prohibit the importation of, for example, automobiles which do not meet the safety standards, it is unlikely to secure the implementation of these measures. Moreover, in light of the prevailing economic and social problems facing the country, it is extremely difficult, if not impossible, to implement the type of measures stipulated in the Road Traffic Act 1983. This difficulty shows why most regulations and measures set out by various relevant institutions. So Stringent regulation and Laws should be stated and implemented regarding the transporting of fuel or other Hazardous Materials.

Bibliography:
Abbas Mahmoud Awad (1985) : “Psycology of Incidents”, University Knowledge Press, Alexandaria, Egypt
Abdul Aziz Datshi (2013):”Realization of Risk Management Concept Saves a lot for Companies, Gulf Oil, a monthly Newspaper published by Kuwait Gulf Oil, issue 104
Elaine L. Chao, Secretary (2002) : Occupational Safety and Health Administration (OSHA) - U.S. Department of Labor, OSHA 3075 - (Revised)
ExxonMobil Crisis Response Plan (2003) Environmental Health & Safety Department Exxon Mobil Corporation, USA


Lincoln Chao et al (1990):” Statistics in Management”, Dar Elmeraikh Press, Doha, Qatar


Michigan Hazard Mitigation Plan (2011) : Emergency Management and Homeland Security Division, Michigan Department of State Police, USA


Occupational Safety and Health Administration – OSHA (2011):” Hazard Recognition” version 5.24.11 – Department of Labor - USA

Qatar Fertilizers Company- QAFCO (2009): “Environmental Awareness”, Doha, Qatar

Qatar General Petroleum Corporation (1998): Environmental Guidelines & Environmental Protection for Ras Laffan Industrial City, - Doha – Qatar

Qatar Petrochemicals Co-QAPCO (1998): “Safety Training and Fire Drill”, Maisaeed, Qatar


