

# **HEALTH SAFETY AND ENVIRONMENTAL MANAGEMENT SYSTEMS IN CHINA NATIONAL PETROLEUM CORPORATION**

Yu Sun, PhD Candidate, Department of Construction Management, Tsinghua University  
Beijing 100084 China, Email: sunyu000@mails.tsinghua.edu.cn

Ning Wang, Engineer, China Petroleum Pipeline College, 90, Aimin West Road,  
Langfang, Hebei, 065000, China

## **ABSTRACT**

This paper aims to introduce the health, safety and environmental management systems (HSEMS) being implemented in China National Petroleum Corporation (CNPC). These systems of CNPC are based on the industrial standard for petroleum and natural gas industries. In 2004, the standard was revised. The requirements from the government and other stakeholders were integrated into the new standard so as to make it more applicable. A case study was conducted on a western Libya gas onshore pipeline project to specifically examine the application of the CNPC HSEMS. The results reveal that the HSEMS of CNPC meets the demands of clients, and complies with the local regulations. Good HSE performance has been achieved during the execution of the project.

Keywords: CNPC, HSEMS, Pipeline Project

## **1. INTRODUCTION**

China National Petroleum Corporation (CNPC) is a world-leading integrated energy corporation with businesses covering oil and gas upstream and downstream operations, oilfield services, engineering and construction, petroleum material and equipment manufacturing and supply. CNPC supplies a full range of petroleum materials and equipment and has an excellent global reputation as a contractor and services supplier in seismic exploration, well drilling, well logging, and pipeline and engineering construction. In seeking a greater international role, CNPC strives for expanding overseas business. CNPC owns oil and gas assets and interests in 27 countries, and provides oilfield services, engineering and construction in 49 countries worldwide. Businesses play a key role in society. CNPC is obliged to fulfill the social responsibility to promote the harmonious development of society. "Caring for energy, Caring for you" is CNPC's unwavering commitment. Every employee from CNPC is fully aware of the company's responsibilities to society, which permeates every aspect of everything that has been done.

The company attaches the greatest importance to employees' health and safety in conformity with the "people and health first" and "combination of prevention and

treatment with prevention as the priority" guidelines. CNPC strengthened monitoring of employees' occupational health and safety as well as occupational-disease inductive factors in operations with regard to the environment, high flow rate, intense work and many occupational diseases in the oil production industry. CNPC conducted a comprehensive survey of occupational-disease inductive factors in various operational premises covering oil and gas production, oil processing, well drilling, well logging, downhole operations, pipeline engineering and material & equipment manufacturing. CNPC specially checked hazardous factors, as well as protective facilities and equipment in operational sites, and took active measures according to these conditions. CNPC pays considerable attention to the health of field workers who work in more dangerous and risky environments. Investigations of working sites are conducted beforehand and priority will be given to the health of the staff in emergency rescue planning and residence selection. Meanwhile, the company dispatches health supervision teams, who strive to eliminate hazardous factors and ensure the health of field workers by giving them related information and training, and identifying potential occupational hazards.

Environmental protection is also an important part of CNPC's commitment to society. In strict conformity with environmental laws and regulations, CNPC actively promotes clean operations and does everything it can to build an environmentally friendly company that operates in harmony with the environment. CNPC has adopted the ISO14001 Environmental Management System to continuously improve environmental management performance. By 2006, CNPC's 135 subsidiary companies had achieved ISO14001 certification or obtained Environmental Labeling status. Environmental factor identification and selection programs have been carried out across the whole group, and the Technical Guidelines for the Identification and Selection of Environmental Factors have been issued and environmental management plans and emergency plans have been compiled to control and monitor hidden hazards and handle emergencies. In addition, CNPC has established an environmental protection fulfillment accountability system, including environmental protection indices (e.g. pollution control and rate of standard discharge) into the comprehensive performance assessment for enterprise management and operation.

An annual environmental protection index system was established to ensure the effective monitoring of total pollutant discharge, and responsible people were identified at each level to control standard pollutant discharges and handle emergencies. In terms of ensuring clean operations, CNPC launched a "green operation" demonstration activity and a clean production technology innovation program. In addition, a series of new technologies and new equipment were developed, including clean operation in well drilling, ecological protection during pipeline construction, recycling of refinery sewage and the reduction of greenhouse gas emissions.

CNPC has adopted a strict environmental impact assessment for all construction projects and carried out the "Three-tier HSE Management" system to ensure that environmental protection facilities and major engineering projects are designed, constructed and completed simultaneously. In 2006, CNPC achieved the 100% implementation of the environmental impact assessment and environmental protection checking and approval

system. CNPC continued to carry out the three-level prevention and control program for enterprises operating near rivers, lakes or other public water environments. In 2006, with the continuous growth in oil and gas production, crude runs and the production of major chemicals, discharges of COD (chemical oxygen demand) and major oil-type pollutants were respectively reduced by 4.6% and 5.4% compared to 2005.

## 2. HEALTH SAFETY AND ENVIRONMENT MANAGEMENT SYSTEM IN CNPC

The influence of management must be apparent in the HSE policies it sets, the degree to which those policies are observed, and the concern with which it treats any violation. Managers must leave no doubts in the minds of employees that they are concerned about accident prevention. This concern to prevent injury and damage must be sustained continually, rather than intermittently or only temporarily being presented with an accident report. In the following part, the management on HSE in CNPC is presented in detail, including HSE policy and objectives, and HSE management system.

### HSE policy and objectives

It is the objective of CNPC to provide and maintain a safe and healthy work environment at all times. The goal of CNPC is to prevent occupational accidents, injuries and illnesses. The CNPC management team places accident prevention and the protection of the health and safety of every employee prior to any other consideration of job operation or administration. The Health, Safety and Environment Policy of CNPC is to comply with the applicable laws, codes, standards and regulations in respect for occupational health, safety and environment protection issued by the government. All the staff personnel must strictly comply with the CNPC procedures, regulations, guidelines and rules for health, safety and environment. The HSE policy of CNPC is generally summarized in Table 1.

**Table 1. HSE policy of CNPC**

<b>Policy</b>	<b>Detailed Description</b>
<b>HSE Policy</b>	<ul style="list-style-type: none"> <li>• Being suitable for the activity, product and service of CNPC, and for the risk of health, safety and environment;</li> <li>• Including the commitment for continual improvement, cleaner production and prevention of accidents;</li> <li>• Including the commitment for abiding by the laws;</li> <li>• Forming the documents and implementation;</li> <li>• Informing every employee for understanding respectively;</li> <li>• Periodical audits.</li> </ul>

CNPC strengthens the safety consciousness of the employees through many training sessions so as to keep firmly in their minds that creating a safe and comfortable condition and living environment is each employee's responsibility and duty. All the management and administration departments of CNPC will try their best to implement the HSE Policy into each activity to minimize any HSE risk and mitigate any pollution in order to protect the environment and eliminate the environment impact. It is the responsibility and duty of all the management and administration departments of CNPC to maintain and promote the HSE Policy and keep all the contractors clearly aware of that. Any deviation from the above laws, regulations, rules and CNPC regulations will be considered as violation of the Policy. CNPC is pursuing rigorous and frequent audits to ensure that each partner in the shared responsibilities attains the contractor's goal to prevent injuries and diseases, and to limit losses by exemplary leadership in the prevention of accidents, injuries and illnesses. The HSE objectives of CNPC are generally summarized in Table 2.

**Table 2. HSE objectives of CNPC**

Objective	Detailed Description
<b>Health</b>	<ul style="list-style-type: none"> <li>• The aim of the health plan is to protect personnel from any health hazards that may be associated with the work</li> <li>• Provide and ensure effective medical and first aid facilities (doctor, medical clinic, medicines and registers)</li> <li>• Carry out occupational physical checks to ensure that all personnel are medically fit to work and fitness certificates are available in their files.</li> <li>• Conduct thorough surveillance for poisonous and deleterious working areas.</li> <li>• Develop and encourage preventive medical care attitudes among employees.</li> <li>• Periodic health inspections on messing, catering and accommodation facilities to ensure and maintain good standards of health and hygiene at all times.</li> <li>• Adequate number of first aid boxes shall be available and well maintained in all field locations, including residential and industrial areas.</li> <li>• Records of sickness and absenteeism of personnel will be maintained by the medical personnel on a regular basis. They shall be analyzed for any possible trend towards occupational illness.</li> </ul>

<b>Objective</b>	<b>Detailed Description</b>
<b>Safety</b>	<ul style="list-style-type: none"> <li>• The prime target shall be for an accident-free environment. The main areas of intervention are the following:</li> <li>• Ensure the HSE plan is a line management responsibility by commitment and implementation.</li> <li>• Addressing critical safety activities and identifying hazards prior to starting the work by induction training, regular safety meetings, refresher training and toolbox talks.</li> <li>• Ensure that all personnel have and use approved work procedures, and that they are fully trained with full understanding of their jobs and equipment.</li> <li>• Establish regular inspections and audit programs for monitoring the implementation of HSE plans and procedures.</li> </ul>
<b>Environment</b>	<ul style="list-style-type: none"> <li>• The prime target is to take all responsible precautions to avoid pollution or contamination of the working locations or water. The main objectives are the following:</li> <li>• Maintain environmental pollution to minimum levels.</li> <li>• Dispose of solid waste and wastewater according to the “ waste management plan”.</li> <li>• Reinstatement of work areas after completion of construction related activities, as per the Construction Environmental Management Plan.</li> </ul>

### **HSE management system**

The HSE management system is a part of the total management system. It helps risk management with health, safety and environment related issues on matters of business for the organization. The system includes the organization structure, HSE plan, HSE responsibility, HSE procedure, process and resources needed for the establishment and implementation of health, safety and environment policy. Generally, this HSE system is summarized in Table 3.

**Table 3. HSE management system of CNPC**

<b>HSE System</b>	<b>Detailed Description</b>
<b>Leadership and Commitment</b>	<ul style="list-style-type: none"> <li>• The president of CNPC provides powerful leadership and explicit commitment for the establishment, implementation and continuous improvement of the health, safety and environment management system.</li> </ul>

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<b>Structure of Organization, Resources and Document</b>	<ul style="list-style-type: none"> <li>• The detailed obligations of the CNPC president on HSE include: a) Informing the organization of the importance to implement the laws; b) Establishing health, safety and environmental policy; c) Insuring the establishment and realization of health, safety and environmental targets; d) Managing the audit; e) Insuring the availability of the necessary resources.</li> <li>• In the HSE management of CNPC, the issues related to structure of organization, resources and documents consist of a) The structure and responsibility of organization; b) The representative of the president; c) Resources; d) Training, consciousness and ability; e) Consultation and communication; f) Documents; g) Document control.</li> </ul>
<b>HSE Plan</b>	<ul style="list-style-type: none"> <li>• The HSE plan of CNPC covers: a) The identification of health , safety and environmental hazards, risk assessment and risk control; b) The laws; c) Targets; d) health , safety and environmental management plans.</li> <li>• In the CNPC HSE management system, the procedures and processes are related to the issues of system implementation, HSE inspection, and HSE improvement.</li> </ul>
<b>HSE Procedure and Process</b>	<ul style="list-style-type: none"> <li>• The system implementation covers: a) The integrity of facilities; b) Contractor and/or supplier; c) Customer and product; d) Community and public relations; e) The control of operations; f) The management of modifications; and g) Emergency response.</li> <li>• The HSE inspections and improvements include: a) The monitoring for performance; b) Non-conformance, modification and prevention; c) Accident, report and investigation; d) The management of records; and e) audits.</li> </ul>

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### **3. CASE STUDY ON WESTERN LIBYA GAS PROJECT ONSHORE PIPELINES**

#### **General introduction of western Libya gas project**

CNPC won the bidding for WESTERN LIBYA GAS PROJECT ONSHORE PIPELINES and become the EPC contractor of the project in 2002. The owner, AGIP GAS BV sought the provision in Libya of a fully-operational oil and gas onshore pipeline between the Wafa Desert Plant and the Wafa Coastal Plant. This pipeline objective was to convey gas and oil products in the capacities and at the pressures specified in the technical

documents. This was to be achieved in a professional manner in accordance with good engineering practice and in an efficient and expert manner, with all due diligence and expedition, and in full conformity in all respects with the contract.

The onshore pipelines system is intended to transport the gas and oil treated at the Wafa Plant from the Central Plant in Wafa to the Mellitah Plant on the Libyan coast. Hydraulic calculations and economic optimizations have suggested the adoption of a ND 32” for the gas pipeline and of a ND 16” for the oil pipeline. The Wafa treatment plant will produce a sales gas; in order to cope with the sales requirements. Gas was to be delivered at Mellitah at 35 bara as a minimum with a maximum temperature of 35 °C. The unstable liquid will be treated at Mellitah with the production of a stable oil and LPG; the unique target during the transport is to avoid the vaporisation of the liquid mixture. For safety reasons, isolating valves have been planned with a maximum spacing of about 32 km according to the ANSI B31.8 code. Furthermore, two intermediate pig trap stations are located along the pipeline route. The isolating valves will be allocated in proper line valve stations (LVS). Each LVS will be used for both pipelines (oil ND 16" and gas ND 32"). At some location, a cathodic protection station may also be provided. Table 4 reveals the environmental parameters and data along the pipeline route from Wafa Central Plant to Mellitah (taken from Ghadamesh meteo-climatic series recorded in the period 1989-1998). These parameters and data should be corrected, when necessary, to take into account the different elevations between Ghadames and the pipeline site.

**Table 4. Environmental parameters**

<b>Item</b>	<b>Parameter</b>
TEMPERATURE	Minimum winter temperature (December):-2.5 °C; Maximum summer temperature (July): 48.2 °C.
HUMIDITY	Mean relative humidity 37 %; Maximum relative humidity 83 %; Minimum relative humidity 9 %.
BAROMETRIC PRESSURE	Maximum monthly mean at Wafa level 963.4 hPa; Minimum monthly mean at Wafa level 936.7 hPa.
WIND FREQUENCY DISTRIBUTION	From EAST 75%; From NORTH 11%; From WEST 7%; From SOUTH 7%.
WIND SPEED	Max wind speed 95.5 km/h; Wind speed for winter design 25.2 km/h; Wind speed for summer design 9.0 km/h.
RAINFALL	Maximum rainfall recorded in 1 day: 20 mm; Maximum rainfall recorded in 1 month: 76 mm; Maximum rainfall recorded in 1 year: 100 mm

Dust and sandstorms occur often from November to May, and are usually caused by west and south-west winds. Cloudiness is very rare. Fog occurs sometimes during winter mornings. The vegetation is very scanty, consisting of grass and shrubs. The wildlife is scant as well: only reptiles and insects are frequent. The EPC contractor should consider

the peculiar environment reported above to plan all the work phases and to ensure safe work conditions. The construction of both pipelines depends on the EPC contractor equipment and the number of sections to be awarded. Because of the extensive length of the gas and oil pipelines, it is envisaged that installation will be organised in three main sections: Wafa Central Plant to Intermediate Pig Trap No.1; Intermediate Pig Trap No.1 to Intermediate Pig Trap No.2; Intermediate Pig Trap No.2 to Mellitah Plant. There are different conditions along the pipeline route, including: flat sections, sloped sections, wadi cross sections, road crossings, watercourse crossings, loose stone surface soil, mobile dunes of sand, small rural areas and very small populated areas. For each section the following working phases has been foreseen: camping facilities and yards preparation; staking and signalling of the pipeline route; stockpiling yards preparation; handling and storage of materials; doubling joint strings construction; accessing road construction; right of way opening; trenching excavation; stringing 32" pipe; bending 32" pipe; stringing 16" pipe; bending 16" pipe; aligning and welding 16" pipe; non destructive testing 16" pipe; coating repair 16" pipe; lowering 16" pipe; aligning and welding 32" pipe; non destructive testing 32" pipe; coating repair 32" pipe; lowering 32" pipe; backfilling; hydrostatic testing, dewatering and drying; final cleaning-up and restoration of right of way.

### **HSE requirement of the western Libya gas project**

The EPC contractor and all its employees, agents and subcontractors shall comply with all applicable Libya Government safety and environmental regulations and all owner safety, health and environmental Guidelines/Procedures and other related rules and regulations at all times. Specifically, The EPC contractor shall comply with the provisions of the owner, and the owner shall make all other such related requirements, specifications and standards known to EPC contractor. The EPC contractor may request from the owner representative copies of those owner standards, rules and regulations which are applicable to this contract. The EPC contractor shall also take or cause to be taken any additional measures under the direction of the owner's representative to prevent the injury or death of any person, or any damage or loss of property during the EPC contractor's performance of the work. The EPC contractor shall maintain the company HSE documentation at the work site. The owner may monitor and inspect any work site for compliance with the above referenced safety, health and environmental requirements.

Any deviation by the EPC contractor from the owner's (or other applicable) safety, health and environmental requirements (or rules and regulations) must be approved, in advance in writing by the owner's representative. Should the EPC contractor fail to comply with any of the requirements of this document, the owner shall notify the EPC contractor in writing of this situation. Upon receiving such notification, the EPC contractor shall immediately take all necessary corrective actions. Any corrective action shall, unless provided otherwise in this contract, be taken at the EPC contractor's expense. If the EPC contractor fails to take prompt corrective action, the owner's representative may direct the EPC contractor to suspend all or part of the work until satisfactory corrective action has been taken. Costs incurred by the EPC contractor as a result of such work suspension shall be solely the EPC contractor's responsibility, and any resultant EPC contractor



performance delays shall not be deemed excusable hereunder. The EPC contractor may request assistance from the owner with respect to the implementation of its safety, health and environmental requirements. The owner’s representative (or the owner representative's designated party or parties) shall assist the EPC contractor by explaining good safety and sound environmental practices, pointing out unsafe conditions, and by applying experience and judgment, to assist the EPC contractor in improving safety and to safeguard the environment. Such assistance by the owner shall in no way relieve the EPC contractor of its responsibilities set forth in this document.

HSE practice of CNPC in western Libya gas project

**Project HSE documentation.** The scope of the HSE documentation is to define the safe working procedures and practices that shall be followed by all personnel involved in the Western Libya Gas Project-Onshore pipelines. The project HSE Plan may require updating along with the project construction progress. The program has followed the principles of the laws and regulations on the health, safety, and environment made up by the Libya government. The key elements of the project health, safety and environmental management system shall include documentation listed in Table 5.

**Table 5. HSE documentation of western Libya gas project**

Name	Elements
Basic Documents	1) Project HSE plan; 2) HSE Contractor policy; 3) Hazards identification & risk assessment; 4) Construction environmental management plan.
Supporting Plans	1) Waste management plan; 2) Water management plan; 3) Transport and traffic management plan; 4) Journey management plan; 5)Pre-commissioning, commissioning and operating safety Manual.
Environment Protection	1) Environmental impact assessment (EIA); 2) Environment monitoring and auditing
Monitoring Program	HSE audit report

**HSE hazard assessment.** The HSE procedure has been prepared in accordance with contractual requirements and it addresses specific hazard identification and analysis. It is considered that the project specific hazard identification and analysis provides for all the foreseeable hazards, addressing: the hazard assessment, threats associated with the hazard, controls and mitigations and recovery measures. It is anticipated that once construction activities commence, project management will experience unforeseen and unexpected occurrences, which will require further specific hazard identification and analysis prior to continuing with operations. Therefore this document has to be considered as a “living document” and as such will be continuously monitored and updated when required by circumstances. The HSE coordinator is responsible for such activities.

On the principle of reducing personal injury, environment pollution and property loss, the contractor will be expected to carry out risk assessment for construction activities and pipeline operations and maintenance. According to actual conditions encountered during construction execution, identify and analyze foreseeable hazards and impacts in field operations and key work procedures. Consideration shall be given to the following: flammable and explosive substances, poisonous and harmful gases or chemicals, radioactive substances, confined operation spaces, lifting operations, electrical work, and hot work.. Experience can be helpful for identifying the hazards of construction activities, while the LEC method can be used to assess the relative threat posed by the hazards.

$$D=L \times E \times C \quad (1)$$

Where □

L——likelihood of the accident

E——exposure frequency of the human body in the hazardous environment

C——loss and consequence of the accident

D——the degree of the danger

Assessment method of above factors is given in Table 6 to Table 9:

**Table 6. L-Likelihood of the accident**

<b>Mark</b>	<b>Likelihood of the HSE accident</b>
10	Extremely possible
6	Quite possible
3	Possible but not often
1	Moderately Impossible, out of expect
0.5	Quite impossible
0.2	Extremely impossible
0.1	Unexpected Occurrence

**Table 7. E-Exposure frequency of the human body in the hazardous environment**

<b>Mark</b>	<b>Exposure frequency</b>
10	Continuous exposure
6	Exposure in daily work
3	Once a week, or occasional exposure
2	Once a month
1	Several times every year
0.5	Uncommon exposure

**Table 8. C-Consequences of HSE accident**

Mark	Consequence
100	Big calamity, multiple death
40	Calamity, several death
15	Very severe, single death
7	Severe, badly injured
3	Cause temporary disability
1	No harm expected

**Table 8. D-Degree of danger of HSE accident**

Mark	Hazard degree	Risk grade
>320	Extremely dangerous, work can't be continued	5
160—320	Very danger, need immediate rectifying	4
70—160	Obvious danger, need rectifying	3
20—70	Danger, need attention	2
<20	A little danger, acceptable	1

**Emergency response plan.** The emergency response plan is about the effective and timely emergency response measures taken by the contractor to control or mitigate the spreading and expansion of any emergency accident during the period of the construction, pre-commissioning, and commissioning phases. It applies to the emergency response of accidents in the campsite, construction site, transportation and the pipeline pre-commissioning, etc. All the staff personnel shall know their responsibilities and actions to be taken to keep any emergency case under control and restore conditions to the normal state.

Prior to starting construction work, the contractor shall organize an emergency response team (ERT) including HSE supervisor, site manager, medical personnel and other relevant personnel. The HSE supervisor shall determine the measures to be taken according to the actual conditions. The site manager shall arrange the required equipment and personnel and direct the emergency response activities on site. The emergency response direction center will be located in the main campsite near Mellitah, where the person is assigned to be on duty all the time, so that a distress message can be received when the emergency occurs. The member of ERT shall have been trained on HSE knowledge, experienced in construction, know what to do when an emergency occurs and address the consequent hazard. The training of the personnel aims to make the personnel aware of what shall be done when the accident occurs and the duty of each person (e.g. during “tool box” talks foreseen by the Project HSE plan).

The contractor will train its personnel at least twice a year. By doing so, the personnel will be skilled in taking timely and effective measures to respond to the accident and reduce personnel damage and property loss. The content of training and drilling shall cover: using of fire prevention equipment and fire extinguishers; emergency response methods in case there is a poisonous gas leakage; safe withdrawal; rescue of sick persons. Sufficient contingency equipment and devices shall be equipped, so that quick actions can be made and effective measures can be taken when the accident occurs. There shall be sufficient and effective fire fighting equipment such as fire extinguishers. There shall be an ambulance and first-aid kits when the sick or injured person needs treatment.

When there is oil leakage, the upstream and downstream block valves shall be turned off and the rescue shall be organized. There shall be breathing apparatus in case there is leakage of natural gas or other poisonous gases. Proper communication facilities will be equipped in the emergency team, such as radiotelephone and walkie-talkie to ensure smooth contact with the outside when an accident occurs. Prior to construction activities beginning, the contractor shall establish a set of emergency response signals, being updated constantly, which will be introduced to the staff and subcontractors, and shown on the bulletin board in the campsite and on the construction site. The information shall include but not be limited to: safe withdrawal route and gathering place; location of fire extinguishers; location of the clinic; location of the ambulance; and the phone number and fax number of the local hospital and firehouse.

Different emergency response measures shall be taken for different situations involving accidents. When it is dangerous, the followings shall be considered: stopping all activities at once except rescue activities; evacuating the scene and having all personnel gather at a designated safe place; and checking whether there are any injured persons; and saving property and equipment after it is verified that the personnel has been evacuated to a safe place. According to the HSE Plan the following shall be treated: radioactive materials; explosives; fire and explosions (different from oil/gas leakage); hydrocarbon spillage and fire; chemicals; traffic; and health emergency at the work site.

**Investigation and report.** After the response to the accident and after the injured worker(s) has been taken to be treated by a medical professional, the investigation and analysis shall be carried out. The investigation will cover the cause and course of the accident, casualties, property damage and measures to prevent recurrence of the accident. The investigation report shall confirm whether the measures taken are correct and if the emergency response plan needs to be updated. At first, the report will be oral or a prompt report of the accident (see attachment 1) shall be produced and delivered to the contractor HSE department, safety manager and someone in top management. When the investigation is completed, a monthly HSE report will be submitted to the contractor's project manager and the company's HSE manager. The investigation and analysis report shall contain the measures to prevent recurrence of the accident, be distributed to every foreman and site HSE supervisor. A copy shall be kept in the archives for the investigation report.

#### **4. CONCLUSIONS**

Health, safety and environmental management systems (HSEMS) play an important role in the operation of China National Petroleum Corporation (CNPC). The crux of the problem on HSE should be controlled on every part of every project. The HSE performance is continuously improving with the execution of HSEMS. Meanwhile, a set of procedures should be made to support HSEMS. Some means by which a manager of CNPC can be responsible for an effective program in any operation are to:

- Establish in writing and disseminate specific and firm safety policies for the organization, and then ensure they are carried out;
- Provide a coordinated effort, integrating the safety efforts of all organizations concerned;
- Direct the participation of all subordinate organization heads in the safety effort, with specific responsibilities assigned to each. Ensure that each manager passes on suitable guidance to personnel under his or her jurisdiction.

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