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GPIC'S INTEGRATED APPROACH TO SAFETY, HEALTH AND ENVIRONMENT MANAGEMENT¹

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SUMMARY

GPIC's excellent record of safety, health and care for the environment is comparable to the best of the Petrochemical companies in the world. In GPIC's view, harmonizing quality, safety and environment is the real key to its success. The strategies and methodologies are so formulated in GPIC as to ensure safety and environmental compliance, safety and environmental mind-set for the company and minimisation of environmental liability.

Safety and care for the environment in GPIC require considerable investment. But, in GPIC's experience, this is a wise investment with a real good return to its business. GPIC continues to place great emphasis on the development and improvement of systems that effectively manage safety, health and environment. Excellence in the management of safety, health and the environment was achieved through a quality controlled integrated "System Approach" to all aspects of GPIC business.

The paper highlights GPIC management policy and principles and its firm commitment for maintaining and improving safety, health and environmental standards in GPIC. Important factors related to safety, health and environment during all phases of design, construction and operation of GPIC Complex will be addressed in the paper. The paper will highlight GPIC'S experience in the implementation of the quality standard ISO-9002 and its approach towards achieving Total Quality Management (TQM) including Environmental Systems Management ISO-14000 and their impact on company's overall business. The paper also focuses on GPIC safety, culture and effective training of its employees and covers the important provision of health care for all GPIC employees, crucial to effective safety, health and environmental management.

RESUME

Les excellents résultats de GPIC au point de vue sécurité, santé et respect de l'environnement sont comparables à ceux des meilleures sociétés pétrochimiques du monde. GPIC pense que l'harmonisation de la qualité, de la sécurité et de l'environnement est la véritable clé de son succès. Chez GPIC, les stratégies et méthodologies sont formulées pour assurer la conformité au point de vue sécurité et environnement, la conscience de la sécurité et de l'environnement et une responsabilité minime en matière d'environnement.

La sécurité et le respect de l'environnement chez GPIC impliquent des investissements importants. Mais l'expérience de GPIC montre que c'est un investissement sage avec un bon retour pour ses affaires. GPIC continue à accorder beaucoup d'importance au développement et à l'amélioration de systèmes qui gèrent efficacement la sécurité, la santé et l'environnement. L'excellence dans la gestion de la sécurité, de la santé et de l'environnement a été atteinte par une "approche de système" intégrée contrôlée de qualité pour tous les aspects de l'activité de GPIC.

L'exposé insiste sur la politique et les principes de gestion de GPIC et sur son engagement ferme de maintenir et d'améliorer les normes de sécurité, de santé et d'environnement chez GPIC. Des facteurs importants liés à la sécurité, à la santé et à l'environnement durant toutes les phases de conception, de construction et d'opération du complexe GPIC sont présentés dans l'exposé. Celui-ci insistera sur l'expérience de GPIC dans la mise en oeuvre d'une norme de qualité ISO-9002 et son approche en vue de réaliser une Gestion Totale de Qualité (TQM) y compris la gestion de systèmes d'environnement ISO-14000 et leur impact sur l'ensemble de l'activité de la société. L'exposé insiste aussi sur la formation effective des employés de GPIC en matière de sécurité, de santé et d'environnement et couvre les dispositions importantes prises pour les soins de santé des employés de GPIC, cruciaux pour une gestion efficace de la sécurité, de la santé et de l'environnement.



1. BRIEF COMPANY OVERVIEW

¹ Engagement de GPIC en vue d'une approche intégrée de la gestion de la sécurité, de la santé et de l'environnement

Gulf Petrochemical Industries Company, GPIC, formed in December 1979, is a large petrochemical complex jointly and equally owned by the Governments of Bahrain, Saudi Arabia and Kuwait, with the main objective of utilizing Bahrain's natural gas resources for manufacturing ammonia and methanol petrochemical products.

The plants went into commercial production in mid 1985 manufacturing 1000 MT/day each of ammonia and methanol. Subsequently in 1989, both the plants were upgraded to a production level of 1200 MT/day each.

At the present time, GPIC has started up its newly constructed 1700 MT/day granular urea plant. This helps widen GPIC's business spectrum through downstream development.

The requirements of the above plants are met by an extensive utilities plant consisting of various units such as sea water desalination, demineralization, steam generation and effluent treatment. Other ancillary units such as nitrogen generation, instrument and plant air, fire fighting water system and a comprehensive power generation and distribution system are all integrated with the operating units. The offsite facilities include Ammonia and Methanol storage and ship loading facilities, urea silo, cross-water conveyor system for granular urea together with the Marine Terminal Facilities for granular urea export.

GPIC employs 479 people including 73 trainees.

2. INTRODUCTION AND OBJECTIVE

2.1 Introduction

GPIC has an excellent record of safety, health and care for the environment, comparable to the best petrochemical companies in the world. The company was awarded its 5th Gold Safety Award by the Royal Society for the Prevention of Accidents, UK in 1996. It has also received the Certificate of Merit from the National Safety Council of the USA for the 5th time, on completing one million no-loss-time accident-free work hours. GPIC recently achieved 2.5 million no-lost-time and accident-free man hours.

It is no small coincidence that our continuous records of production are also excellent and award winning. Our methanol plant has been bench-marked internationally as the best for its performance during 1992 and 1995 by a reputed international consultant Chemsystems, U.K. In 1996, GPIC was presented with the Gulf Enterprise Award as the best manufacturing company in the Arabian Gulf and became the first Gulf venture company to win this prestigious award.

2.2 Objective

The objective of this paper is to briefly share GPIC's experience with the integrated approach to safety, health and environmental management and highlight the benefits achieved from integrating the safety functions into all aspects of GPIC's business. The paper also focuses on GPIC's "System Approach" that effectively manages safety, health and environment.

In keeping with the above objective, the paper will address in greater details the following important aspects:

- GPIC management commitment including policy, philosophy and method used at GPIC to implement safety, health and environmental standards in our organization.
- Actual integrated system strategies used.
- Systems being used to manage safety, health and the environment.
- The "Committee" approach to management of safety, health care and the environment.
- Training in the area of safety and occupational health.

3. MANAGEMENT COMMITMENT

In this section, GPIC management's firm commitment to manage safety, health and the environment will be focused. The philosophies and the methods that GPIC management has found very effective in managing the safety, health and environmental issues are explained in greater details.

3.1 The Importance of the Management Function ("Driving from the Top")

Commitment to safety management must be driven from the highest level of management. GPIC's policies relating to safety, health and environment have been developed and signed by our General Manager and the Managing Director. They give a clear company commitment to these important areas. The 'Safety Policy' developed by the management and the company 'Mission Statement' clearly establish company's commitment at the highest level to ensure the establishment of a safe healthy work environment for all employees.

Petrochemical industry is potentially hazardous in nature. However, these hazards can be properly controlled through good and safe engineering design, safe working practices and safe operational procedures together with commitment of a well trained workforce. In fact, all accidents, in principle, can be prevented. This is achieved through, what is termed "managing safety".

'Managing safety' is an integral and essential responsibility for a successful company. In fact, the accident and fire prevention are the very elements in activities such as production and maintenance that lead to cost effective management for a successful company.

Safety is also a moral and legal obligation. For these reasons, company safety policies should be clear and should specify objectives for the protection of its workers, the external population and the environment. Accountability for safety is included in job training and job descriptions and disciplinary action may be taken for on-the-job safety infringements. Safety of the individual and others cannot be delegated. Everyone has a responsibility towards safety.

In Bahrain, GPIC has safely produced during its 12 years of operation, over 5 million tonnes of ammonia and 5 million tonnes of methanol without accident or fatal injuries and no fires involving more than the use of an extinguisher or steam. In reality, it is the implementation of essential system controls by both management and the workforce that keep people environmentally free from risks and hazards. The involvement of management in safety awareness and training remains a permanent feature of the company's commitment to continued safety improvement.

3.2 GPIC's Operating Management System and the Operating Procedures

3.2.1 Operating Management System

Even before pre-commissioning, commissioning and start-up of the complex, it was felt necessary in GPIC that the safety base for future activities should be established. All the activities of the company were encompassed and issued in GPIC under the title of the Operating Management System (OMS). The OMS is a collection of management procedures which establish actions and inter-relations of the various units depicted in GPIC organization chart. OMS has been conceived as an instrument of management for supplying the Operations, Maintenance, Technical Services Departments and the Fire, Safety and the Plant Security Section with adequate general directions and guidelines. These procedures set out the necessary controls as an integral and essential part of the Management of Safety, together with other primary aspects such as maintenance, production, engineering and inspection activities using safety controls and proper code of practices.

3.2.2 Operating Procedures

The operating procedures in GPIC are the heart of understanding how to operate the plants safely and in environmentally friendly way. These procedures help minimize the risks of accidents by stipulating the correct manner in which the process should be operated consistently. The procedures also advise how to safely start up and shutdown the operation.

4. ACTUAL INTEGRATED SYSTEM STRATEGIES USED

4.1 Linking Quality System to Enhance Safety

GPIC recognizes that its business will run efficiently, effectively and safely if proper quality and management systems are in place. In 1995, GPIC became an ISO-9002 Quality certified company.

ISO 9002 documented management system ensures that safety instructions and procedures are documented and available for everyone in the organization so that no ambiguity exists. Safety records are kept to prove that the procedures are properly followed and the equipment and instruments are well maintained. Regular audits of the system ensure compliance to these procedures and management instructions. Any deviation is brought to the management's attention for the necessary corrective action and improvements.

The similar approach as for the quality system (ISO-9002) will be applied for environmental management system (ISO-14000). Quality and environment, as an important strategy, will be harmonized in GPIC.

4.2 "Committee" Approach

- One proven method GPIC uses to help manage and make key recommendations and decisions, is through the development of delegated committees. The following are the perceived benefits out of the "Committee" Approach:
 - i Committees develop a positive team spirit.
 - ii They encourage "ownership" of the company workings and active problem solving.
 - iii Decisions made by committees are more likely to be accepted by our departments because they have had valuable input.
 - iv Committee approach encourages healthy discussion about improvements in an open and frank atmosphere that people feel comfortable with.
- Safety, Health and Environment Committee (SHEC)
- The Bahrain Labour Law requires companies with greater than 100 personnel to develop a 'Safety Health and Environment' Committee (SHEC) that meets on a monthly basis. This committee is a major mover in the effective management of our safety, health and environment. GPIC has, in addition to the main SHEC, separate sub-committees for safety, health and environment. The SHEC oversees the effective implementation of the company's safety, health and environment Policies together with any statutory requirements. The committee meets every month to discuss safety, health and environmental practices and issues inside the company. The committee advises the management on appropriate action to be taken whenever necessary.
- Safety Subcommittee (SSC)

The SSC disseminates all safety information passed down from the SHEC to all employees. The Safety issues inside the complex are brought to the attention of the SHEC through this subcommittee. Meetings are held monthly and the minutes are distributed to all concerned including SHEC.

- Health Subcommittee (HSC)

HSC discusses health and hygiene matters in the company and advises management on these aspects when required. It promotes health consciousness amongst employees and monitors food, hygiene and pest control inside the complex. It recommends actions on these issues. HSC also advises potential health hazards inside the complex. Health issues are brought to the attention of the SHEC through this subcommittee. Meetings are held monthly.

- Environmental Subcommittee (ESC)

ESC discusses environmental practices and issues inside the company and advises management on these when required. Meetings are held monthly and minutes are distributed to all members of the SHEC in addition to the ESC members. Many of the substantial achievements that we have made for the care of the environment have been co-ordinated and driven through this sub-committee. ESC co-ordinates closely with the official company spokesman on environment for contact with the Environmental Protection Committee of Bahrain (EPC).

5. SYSTEMS IN USE IN GPIC TO MANAGE SAFETY, HEALTH & ENVIRONMENT

5.1 Plant Safety and Environmental Design Aspects

GPIC recognised from the onset that safety and environmental issues would need be given special consideration. These issues were categorized as 'top priority' during design and construction phases of the existing complex as well as the newly constructed urea project.

The plants have been designed and engineered with high safety and environmental standards and features:

- All plants have been hazoped during the design phase.
- The process is monitored and controlled by the state-of-the-art distributed control systems (DCS).
- To enhance safe shutdown of the process during emergencies, there is a HIMA shutdown control system for the existing complex and the latest technology PLC systems in the urea plant and the package units.
- Necessary isolation, control and pressure relief valves are provided on all equipment.
- The plants are engineered with the best of international codes of practices.
- The main control building and urea control room are blast-proof design.
- All operations and maintenance are carried out using the documented standard operating and maintenance procedures.
- All the effluents are treated and gas releases are controlled, flared/vented safely and in accordance with standards incorporated in the design phases.

5.2 Maintenance Features

A well established maintenance program which covers predictive, preventive and corrective maintenance jobs, is in place. A work-order management procedure is in force which determines the further priorities for each job and which considers safety as a top priority.

The predictive and preventive maintenance covers critical equipment to ensure the integrity of this equipment for safe operation.

The maintenance program encompasses the predictive side of the equipment monitoring which includes:-

- Vibration monitoring of all the rotating equipment in the plant.
- Lubrication oil analysis of rotating equipment and insulation oil analysis of electrical transformers to identify any deterioration of the oil constituents.
- Thermographic surveys to identify hot spots on insulated equipment / tanks, reformer tubes, etc. are regularly undertaken.

5.3 Inspection

Routine inspection is done as a preventive maintenance. It also ensures and satisfies the safety of the equipment. Inspection covers the statutory requirement by the government as well as internal quality inspection requirements. Inspection techniques vary from measurement of vessel and pipe thickness, NDT (non-destructive test) of welds and walls, to testing of safety valves.

5.4 Modifications

All modifications raised in GPIC complex undergo detailed study by the engineering team. A Hazop study to ensure the safety of the design of the modification is carried out as per the standard operating procedures (SOP's).

5.5 Emergency Communication Equipment and Hardware

The communication systems form part of the company's established emergency contingency plans.

Means of communication in the event of an emergency are very critical. GPIC has the latest state-of-the-art communication system which include:-

- Intrinsically safe hand-held and vehicle-mounted radios used by Operations, Maintenance and Fire, Safety, Security employees.
- Additionally, public address system via wireless communication have also been installed in each building outside the main process areas.
- "Tannoy" brand electronic communication system is installed in our main process areas to communicate to the main control room and emergency key personnel, in the unlikely event of major emergency. This system is backed up by an emergency telephone system throughout the process area.
- Effective means of communicating swiftly with other industries neighbouring our site is well established.

5.6 Comprehensive Permit-to-Work System

In GPIC complex, any job is carried-out under a comprehensive Permit-to-Work (PTW) system. This covers all aspects of controlling safety related issues to personnel, equipment and the environment.

The hazardous activities are closely controlled by the GPIC Permit system to enhance safety and help avoid accidents. PTW is applicable for the following activities in GPIC Complex:

- Hot and Cold work
- Vessel entry
- Excavation
- Electrical
- Crane Work
- Scaffolding
- Lifting and Rigging
- Working at heights.

5.7 Accident and Incident Reporting System

In GPIC, we have a system in place to record all events that cause, or have the potential to cause, an accident. We also record any violations of our systems. The reporting of all such events, regardless of the scale of severity, is a very important means that GPIC uses to help prevent accidents and learn from previous mistakes.

All employees are actively encouraged to report incidents using a universal report form. We analyse all accidents and ensure that the root causes for system faults are identified and properly rectified.

We develop the data bank of all incidents big or small, near-misses if any, that provide a good focus on our performance.

The important features of the Accident and Incident Reporting system in vogue in GPIC are the following:

- All accidents are preventable.
- Most occur as a result of a 'system' breakdown.
- The 'blame' on the person philosophy is generally avoided to the extent possible so that the approach is always positive and focuses on improvement.
- The 'Caretaking' of the recording and monitoring of these reported events is the responsibility of our Fire, Safety and Security Department (FSS). A database of events called our Register of Accidents & Incidents, is maintained. The responsibility to report, respond and most importantly, investigate and follow-up these events is allocated to the concerned department and the supervisor of the area. FSS assists department concerned in investigating and solving the problems.
- All accidents and incidents are reviewed and discussed at the company Safety, Health and Environment Committee (SHEC) and the committee's recommendations are strictly adhered to.

5.8 Hazard Identification and Risk Assessment

Hazard identification, risk assessment and ultimately the setting of control measures to prevent avoidable accidents are the important part of Risk Management that GPIC recognizes. Systems such as:

- Accident / Incident Reporting
- Audits and Inspection
- Risk Management
- Permit-to-Work System
- Systematic Hazard identification and Hazard analysis are all effective tools to reduce the likelihood of an accident.

5.9 Safety Audits and Regular Inspection

The main objectives of safety audits and inspections are the following:

- Assist in identifying any hazards
- Highlights any weakness in our existing hazard controls
- Raise safety awareness
- Maintain safe and healthy work environments.

These audits and inspections help to identify non-compliance issues that could affect good levels of safety. Outside external auditors are also utilized at GPIC so that specialized knowledge and international experience can help identify the areas for safety improvements.

5.10 Emergency Contingency Planning

GPIC has developed clear plans to respond, evacuate, control and recover from an emergency. These plans allocate responsibilities to all key emergency personnel. An emergency controller is established, command centres are quickly set up and actions mobilized as people are evacuated to predetermined assembly points for accounting and further evacuation from site, if necessary.

Besides, GPIC regularly tests its emergency plan in the following ways:

- Maintain and check comprehensive early detection warning systems for fire, smoke, heat and gas in vulnerable areas.
- Regularly practice GPIC site emergency procedures to make sure any non-compliance are identified and rectified. GPIC site contingency emergency procedures are reviewed on a regular basis.

- Provide emergency siren coverage and advanced means to communicate danger including visual and audible fixed and portable equipment.
- Maintain a dedicated 24 hour Fire, Safety and Security (FSS) Department. Its primary function is to help assist in preventing a major emergency. The FSS maintains the Fire and Safety response equipment on site in proper working conditions.

5.11 Environmental Considerations in GPIC

GPIC's environmental system is comprehensive and covers all the necessary preventive and control measures. GPIC has committed itself to maintaining a friendly, safe environment on the land, air and sea around the complex.

GPIC's philosophy is to ensure that the manufacturing in all its plants including its newly constructed urea plant in Bahrain is carried out adopting the best possible environmental management. International regulations and specifically the very stringent Bahrain proposed effluent guidelines and the Saudi Royal Commission Environmental guideline are applied as they are one of the most strict guidelines (Table 1)

5.11.1 Environmental Impact Assessment (EIA) for the New Urea Project

An environmental impact assessment was carried out in accordance with GPIC's study plan development following the international guidelines for industrial development, such as those by the World Bank and the United Nations. The objective was to identify and assess the activities that have the potential to result in any significant environmental impact during operation of the new urea project. The study was carried out by an independent renowned organization and the Urea Plant Environmental Impact Assessment Report (EIAR) was produced in December 1995.

Both routine and non-routine operating conditions for the urea production facilities were studied. Because of GPIC's commitment to design the plant using modern, environmentally sound control technology, EIAR revealed that many potential impacts have already been effectively addressed. "Precautionary Principle" had been applied in both engineering and construction of this project and the same was applied in operation. The report was duly accepted by Bahrain's Environmental Affairs.

A very clear strategy concerning control of possible pollution of air, sea water and land has been developed which focuses on control measures that eliminate, isolate or minimize risk. Here are some examples of this strategy:

- The use of natural gas as a fuel rather than fuel oil minimizes significantly the extent of SO_x and NO_x generation by as much as 800 times and 3 times respectively.

6. GPIC'S ENVIRONMENTAL MANAGEMENT

6.1 GPIC'S Commitment for Improvement of its Environment

GPIC recognises that it has an important responsibility for preventing and minimising the adverse impacts of the plant activities, its products and supporting facilities on the human health and environment. It will endeavor to increase process efficiency through continuous improvement of its operational activities and maintain good house-keeping.

GPIC continues to improve its environmental performance taking into account the technical developments, the scientific understanding and the legal regulations applicable on national and international levels. GPIC is committed to meet the local environmental legislations and regulations and to do every effort to meet regional and international standard. The company continues to educate, train and motivate its employees to conduct their activities in an environmentally responsible manner. The company seeks to ensure that throughout all phases of its activities, company personnel and its contractors give proper consideration to the care of the flora, fauna, air, land and water as well as the health of its employees and the community.

6.2 Focus on GPIC's Environmental Control System

- The concept of recycling waste gases and the use of by products is a major step towards controlling pollution in addition to its economical impact.
- Stack height and diameter were designed to ensure that ground level concentration of specified pollutants are within the environmental norms.
- Recycling and treatment of waste water not only conserves water but also, to a large extent, controls the environmental issues associated with waste water.
- Fluid bed granulation process for the manufacture of urea was favoured over the cheaper prilling process, primarily to reduce the impact on air quality.
- A HAZOP study highlighted a significant number of environmental issues which were resolved during the detailed engineering design stage of the urea project.
- Avoiding dredging for construction of the marine terminal facility of the urea project during the fish spawning period protects marine life.
- GPIC aims to further improve its Environmental Management System and plans to achieve the Environmental Management Certification ISO - 14001 by the end of 1998.
- The construction and maintenance of a Charity Fish Farm that helps prove that our approach to bring environmental friendliness to the sea surrounding the complex is a priority.

6.3 Environmental Management System Objectives

The need to incorporate environmental considerations in development policies represent a milestone in protecting the environment and sustaining the development. The presence of a clear, implementable environmental policy that helps to create and maintain a balance between protecting the environment and promoting development in a sustainable way is an absolute necessity.

"Environmental Protection" is no longer a corporate image concept and a "buzz word". It has become an economic and business imperative of an organisation. It is very eminent now that application of appropriate and environmentally friendly sound technology boosts development and support economic growth. GPIC recognized that meaningful success of its developments could be realized if the environmental management principles were integrated in the process of its development. Hence, a consistent environmental policy is most needed to complement its developmental policies. GPIC's environmental policy is based on the concept of "prevention" and not a "policy of repair".

The objectives of GPIC's environmental policy can be summarized as follows:

- Harmful effects on personnel, plants and the environment are prevented
Existing potential risks on human and marine lives and the environment (air, water and land) are minimised.
- Globally, the search for innovative, cost effective ways to improve industry's environmental performance has led to the development of a wide pattern of environmental management tools. Environmental Impact Assessment (EIA) and Environmental Management System (EMS) are found to be very effective tools. EIA helps to predict the impact of new industrial plants or infra-structure projects on local environment. However, sound EIA must be backed by efficient Environmental Management system (EMS) with effective tools to support internal decision making within the company, in order to achieve effective compliance with the government regulatory measure. GPIC's EMS objectives are summarised below:

1. To Evaluate and Improve the Processes and Operations

The tools are:

- Environmental Audits
- Cleaner production assessments
- Safety Audits
- Energy Audits
- Risk assessments

2. To communicate with Employee, Shareholders, Government Agencies, etc.

The tools are:

- Clear mission statement
- Environmental reporting

It is proven and is clearly known to GPIC that adoption of systematic approaches to environmental management has both environmental and economic benefits. It has been recognized that better environmental management is coming to be seen as a key source or competitive advantage for GPIC. A whole range of benefits can accrue from improved environmental performance, ranging from reduced effluent discharges to better community relations.

The EMS tools, as indicated above, provide the framework needed for continuous improvement and proactive initiatives to yield real and sustainable improvements in environmental performance.

6.4 GPIC's Environmental Strategy

One of the key responsibilities of today's corporate environmental manager is to anticipate and adapt to emerging issues and trends. Environmental issues are now so numerous and complex that an *ad hoc*, reactive response is no longer adequate or effective. The need is for a systematic, integrated approach to health, safety and environmental concerns.

Preventive Strategies

In the process of industrial development, pollution control has become an increasingly expensive and risk laden response to demands for improving environmental performance. There is really nothing new about the truth that "Prevention is better than cure" which is also frequently recognized to be more cost effective and efficient. No matter what we may call it- cleaner production, eco-efficiency, source reduction, zero emissions, waste minimization or pollution prevention - a strategy of "prevention" is always better and usually cheaper than cure". GPIC applies this preventive strategy (i) to prevent the pollution of air, water and land (ii) to reduce the creation of wastes at source (iii) to minimize risks to its employees and their environment.

GPIC's environmental strategies can be summarised in the following:

- In GPIC, the need exists to systematically integrate environmental issues into business decisions through the use of formal management systems such as ISO 14001.
- Senior management needs to exhibit a commitment to sustainability and incorporate it into their mission and strategic plans. Preventive strategies need to be explicit within these. There needs to be a commitment to improving efficiencies and reducing overall emission, effluents and waste generation and this must be reflected in appropriate policies, programs and resource commitments that implement the strategies.
- A commitment of integrating and improving health, safety and environmental protection in handling hazardous substances requires a program that records significant releases, identifies sources, evaluates their impacts and reduces the impact of spills and accidental releases by early detection and eventual remedies to prevent recurrence.

- Innovate and strive for continual improvement. For GPIC implementing ISO-14001, the commitment to continuous improvement means not only improving the management system itself. It means a gradual improvement of environmental performance.
- Train and build the capacity of staff to think in a pro-active and preventive mode.

7. GPIC'S INDUSTRIAL HEALTH CARE

One of the priorities of GPIC management is the provision of health care for all its employees. The company's medical centre is equipped with a full time chief medical officer and nurses on a shift basis. The medical centre provides the following services to the employees:

1. Primary health care
2. Secondary health care
3. Periodic general medical check-up
4. Pre-employment medical check-up
5. Physiotherapy
6. Emergency service
7. Ambulance service
8. Health education, through
Health sub-committees
Anti-smoking committee
First aid teaching
9. Health club
10. Laboratory service
11. Work place inspection
12. Measurement of noise level
13. Canteen inspection
14. Blood donation (bi annual in April and November)

7.1 Primary Health Care

Medical Centre provides health care for the employees at the work place. The centre is very well equipped to provide the necessary treatment.

7.2 Secondary Health Care

The centre also provide secondary health care for many employees for the chronic cases of diabetes mellitus, hypertension, heart diseases, etc. Cases are also referred to other consultation at different hospitals and private clinics when necessary. Overseas treatment for specialized medical service to Europe is under active consideration of the company management.

7.3 Periodic General Physical Examination

The Medical Center has implemented the preventive medical treatment. This is very significant for the early detection of diseases, particularly, blood pressure, diabetes mellitus, heart diseases, etc. It is compulsory for the employees to attend these examinations as scheduled.

7.4 Health Sub-Committee

The sub-committee's role is discussed in item 4.2.

Several programs are laid down for health education of the employees, such as:

- Back injury prevention week
- Ideal weight

- Health slogans in the salary slips
- First aid course
- Lectures by specialist on summer diseases, AIDS, dental diseases, on nutrition, hearing preservation program, stress at workplace, etc.
- Blood donations - bi annual

7.5 Anti-Smoking Committee (ASC)

Since the implementation of the no smoking policy in July 1993, about 10% of the employees stopped smoking and a large number has reduced substantially.

ASC's goal is to create a smoke-free environment at GPIC. ASC started its mission of educating employees about the dangers of smoking through various meetings, forums and campaigns.

7.6 Health Club

Company's medical centre provides a fitness centre that contains excellent equipment for physical exercise.

7.7 First Aid Course

All new employees in GPIC undergo first-aid training conducted in the Medical Centre. In addition, refresher courses are repeated every 3-4 years.

8. TRAINING IN SAFETY AND OCCUPATIONAL HEALTH

Safety Induction Courses: All GPIC employees and industrial attachment students attend the courses. Before working within the complex, they are given a two-part safety induction course in which detailed informations about products, raw materials, chemicals used, on-site equipment and emergency procedures are covered. The second part of the course is a practical hands-on fire fighting course including use of extinguishers and breathing apparatus. Regular refresher courses and emergency drills are conducted.

Permit-to-Work Courses: These are conducted to ensure that all work undertaken within the complex is authorized and safe work practices are in place before commencement.

Firefighting Courses: These are of specialized nature and are conducted by the Fire, Safety and Security Department for firemen and plan auxiliary firemen. Fire and Safety personnel are trained at the Bahrain Ministry of Interior, Fire, Training School and Police Driving School. Fire truck, ambulance and fork-lift drivers are licensed as per the government regulations.

Gas Detection Courses: These courses are necessary for operations and maintenance staff in the production area to monitor for gas leakage and atmospheric check before entering process equipment.

Office Safety: This is a basic course to prompt safety awareness among all staff.

Chemical Handling Courses: These courses are conducted for process plant operations working with hazardous materials which require special knowledge and skills to monitor and handle the chemicals in a safe and efficient manner.

Machinery and Lifting Equipment Safety Courses: These are held in-house to ensure that concerned staff 'certified' to recognized international standards in rigging, slinging, lifting equipment inspection and overhead crane driving.

Inspection Courses: These courses are necessary to ensure that inspection personnel have the necessary training and certification to carry out inspection and approve the use of equipment. International standards of inspection and design are adopted within GPIC.

Vocational Qualifications in Health and Safety Management: GPIC safety and training personnel acquire these qualifications to impart the modern knowledge and practice in this field.

9. SUMMARY AND CONCLUSIONS

GPIC's integrated approach to Safety, Health and Environment management can be summarized in the following:

- Management Commitment

1. GPIC believes in the excellent management of safety, health and the environment. GPIC management is totally committed to implement and improve the safety, health and environmental standards in the organization.
2. Integration of safety functions into all aspects of our business is crucial.
3. A "Committee approach" empowers our people and develops a positive team spirit and encourages to improve the 'systems' that maintain safety, healthcare and the environment.
4. A quality controlled 'systems' approach to the management of safety, health and the environment has the ultimate benefits to our operations. All accidents can be prevented with this approach.
5. Money, effort and time allocated to the successful management of safety, health and the environment at GPIC is recognized as an investment.

- Systems Approach

GPIC places great emphasis on the development and continuing improvement of systems that effectively manage safety, health and the environment.

GPIC focuses on all systems that are required to manage safety, health and the environmental issues, such as:

- Safety audits / inspection
- Accidents/Incidents reporting
- Hazard identification & control
- Effective emergency contingency planning
- Quality control standards operating and maintenance procedures
- Predictive and preventive maintenance
- Comprehensive permit to work system
- Environmental audits and compliance with the regulations.

GPIC continues to develop a positive safety, health and environment culture in the following ways:

- Safety induction course
- Quality and environmental awareness seminars
- Anti-smoking campaigns
- Health education programs
- Safety and health suggestions and quizzes
- Safety recognition and communication for safety awareness.

- Training in Safety & Occupational Health

Training in safety and occupation health is an important area of the training function for the workforce in GPIC. Training of the employees is very crucial for maintaining the excellent standards of safety. The following types of safety and occupational health training are included in the total training program:

- Safety induction course
- Permit-to-work course
- Fire fighting course
- Gas detection course
- Chemical handling course
- Machinery and lifting equipment safety courses
- Inspection courses
- Vocational qualification in health and safety management.

GPIC's thrust in the training of the employees is to ensure that the employees are skilled at all levels and that excellent standards are maintained with regard to safety, health and the environmental issues.

9.1 CONCLUSION

Excellence in the management of safety, health and the environment (SHE) is achieved in GPIC through an integrated systems approach to all aspects of its business.

The overall objective of the safety, health and the environment Management System in GPIC is to ensure that our facilities are in compliance with the safety, health and the environment laws and regulations and the system in place ensures that situations are identified before a loss-event takes place. By using an integrated systems approach, losses can be avoided and the safety, health and environment continually improve. GPIC's integrated approach ensures primarily the following:

Reduce the likelihood of undesired environmental, health and safety incidents, such as fires, explosions, chemical exposures, spills, accidents or injuries.

Promote compliance with environmental, health and safety laws and regulations and increase SHE awareness.

The elements of developing a safety culture and the effective training of the employees in safety, health and environmental management are crucial to GPIC's success. GPIC, however, continues to strive for achieving a new standard of excellence in management of safety, health and environment. GPIC knows well that, in the field of environment, health and safety management, there is no word like "satisfaction".

**TABLE 1
COMPARISON OF EFFLUENT STANDARDS**

ITEM	UNIT	BAHRAINI	SAUDI ARABIA *	JAPAN **	GPIC TYPICAL ANALYSIS
PHYSICAL PROPERTIES					
Floating Particles	mg/m2	0.000	0.000	N/A	NIL
pH	mg/L	9.0 (MAX)	6.0 - 9.0	5.0 - 9.0	7.85
Suspended Solids	mg/L	35.000	40.000	200.000	2.5
Turbidity	N.T.U.	75.000	75.000	N/A	3.2
INORGANIC CHEMICAL PROPERTIES					
Ammonia Nitrogen as N	mg/L	3.000	3.000	N/A	1.65
Dissolved Oxygen	mg/L	2.0 (MIN)	2.0 (MIN)	N/A	2.67
Sulfides as H2S	mg/L	1.00	0.10	N/A	N.D.
Chlorine residual	mg/L	2.00	2.00	N/A	0.07
Cynide as CN	mg/L	0.10	0.10	1.00	N.D.
Phosphorous Total	mg/L	2.00	2.00	1.00	N.D.
Fluoride	mg/L	25.0	25.0	N/A	0.8
ORGANIC POLLUTANTS					
BOD	mg/L	50.00	50.00	160.0	25.0
COD	mg/L	350.00	350.00	160.0	50.0
Total Kjeldahl Nitrogen	mg/L	10.00	10.00	N/A	1.7
Oil and Grease	mg/L	15.00	15.00	15.00	0.02
Phenols	mg/L	1.00	1.00	5.00	0.2
TRACE METALS					
Aluminium	mg/L	25.00	25.00	N/A	0.05
Arsenic	mg/L	0.50	0.50	0.50	N.D.
Cadmium	mg/L	0.05	0.05	0.10	N.D.
Chromium	mg/L	1.00	1.00	2.00	N.D.
Copper	mg/L	0.50	0.50	3.00	0.01
Lead	mg/L	1.00	0.50	1.00	N.D.
Mercury	mg/L	0.005	0.005	0.005	N.D.
Nickel	mg/L	0.50	0.50	N/A	N.D.
Zinc	mg/L	5.00	5.00	5.00	N.D.
BIOLOGICAL					
Total Coliforms	No/100 mL	100000	2400 ***	300000	NIL

Notes: N.D. = NOT DETECTABLE

N/A = NOT APPLICABLE

* REFERENCE: ROYAL COMMISSION ENVIRONMENTAL GUIDELINES FOR MADINAT AL JUBAIL AL-BINATYAH, 3rd EDITION, TABLE 3-D

** REFERENCE: QUALITY OF THE ENVIRONMENT IN JAPAN 1984

*** IN MPN/100 mL