The Kuwaiti Digest is a quarterly magazine published by the Kuwait Oil Company (K.S.C.) since 1973.

The Kuwaiti Digest invites newspaper, magazine and trade journal editors to reprint or otherwise make use of articles or illustrations appearing in this issue. Material should be credited and a copy mailed to the Kuwait Oil Company.

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As the heat from another Kuwaiti summer begins to cool down, we at KOC are more prepared than ever to tackle the challenges that lie ahead. While much of the hustle and bustle of life in Kuwait seems to slow down a bit during the summer months, all of KOC’s employees and engineers remained dedicated to delivering the same level of commitment to their duties as they do year-round. For this, I commend them, and I would also like to congratulate the Company for a number of very significant milestones we have achieved over the past few months.

Firstly, KOC and our beloved country, Kuwait, showed its resilience and ability to overcome a national crisis after one of our Managers, Esam Al-Houti, was kidnapped in Lebanon. By the Grace of Almighty Allah and through the efforts of Kuwait’s strong leadership, Al-Houti was able to return safely to Kuwait, and for this we are extremely grateful.

In regard to KOC operations and our 2030 Strategy, the Company has taken enormous strides toward meeting production goals and completing major projects, the most important of which was the commissioning of Booster Station-160. The integration of this station within KOC operations will optimize the production and utilization of associated gas while helping to reduce gas flaring tremendously. In addition to the new Booster Station going online, KOC has inked an agreement to purchase 14 new tug boats to help support and replace our current fleet. Their addition to the Company’s assets will greatly help in the contribution to the expansion of KOC’s export operations.

Included in this edition of The Kuwaiti Digest are a number of technical write-ups and submissions which I encourage you to spend some time with. It is only through the collective effort of all KOC employees that the Company can move forward, and I encourage you to learn more about the work your fellow colleagues are doing for the Company.

As always, we are on track to turning the goals of our 2030 Strategy into reality while remaining committed to protecting the health and safety of KOC employees, contractors and the Kuwaiti population as a whole. Our commitment to the community and environment remains strong, and we look forward to working harder to deliver on our obligation of exploring for and producing oil for our beloved country, Kuwait.
Esam Al-Houti, Manager Major Projects I, was greeted to a hero’s welcome recently at the KOC Guest House to celebrate his safe release after being kidnapped on a recent trip to Lebanon. Senior KOC officials, including C&MD Sami Al-Rushaid, DMDs and Managers were present to welcome Al-Houti and congratulate him on his safe return to Kuwait.

Al-Houti’s ordeal began when he was kidnapped in Lebanon’s Bekaa Valley while exiting his car in front of his apartment. As he exited his vehicle, six armed men attacked him, and after a struggle, they managed to blindfold him and restrain him and succeeded in abducting him away in their car. Throughout the duration of his kidnapping, Al-Houti maintained that his captors kept him blindfolded at an undisclosed location. His kidnappers demanded $2 million in ransom money; however, after intense pressure from both the Lebanese government and abroad, Al-Houti was released safely without paying any ransom.

During the welcoming ceremony which took place at the Guest House, Al-Houti appeared in good health and in high spirits. In a statement he made to the Kuwaiti Digest, Al-Houti recounted the entirety of his ordeal and said that he was very happy to see the overwhelming support that he received from the Kuwaiti people upon his release. He said that he was especially surprised to see the outpouring of support, especially considering the fact that he was not even certain if anyone knew about his exact whereabouts during the ordeal, seeing as how he was cut off from the outside world while he was held hostage.

After his release, however, he learned that many segments of Kuwaiti society and the Lebanese authorities were actively working towards his safe release. In that regard, Al-Houti said he was very grateful for the swift action that Kuwait’s diplomatic forces took in their campaign for his release and thanked HH the Amir, senior government officials, various Kuwaiti ministries, the Kuwaiti Embassy in Lebanon, KOC officials and employees and the Kuwaiti people for the support they displayed both during his kidnapping and after his release.
KOC has officially launched the BS-160 Project in a ceremony attended by the Minister of Oil Hani Hussein, the Italian Ambassador to Kuwait and a number of dignitaries and senior oil officials.

On the occasion, KOC C&MD Sami Al-Rushaid affirmed in a speech delivered on his behalf by the Deputy Chairman and DMD (TS), Mazen Al-Sardi, that this project, which has been under construction for the past three years, has been completed within budget and on time in accordance with the contract schedule.

“The booster station utilizes the highest standards of state-of-the-art technology that is available today and is a major step forward towards achieving the overall Kuwait Development Strategic Plan,” the DMD pointed out.

He continued, “In doing so, the facility also sets new standards for environmental stewardship with substantially reduced emissions to the atmosphere over previous generation equipment and with greater efficiency while conserving valuable natural gas and helping to protect the environment.”

Al-Sardi affirmed that the completion is a tribute to the hard work and efforts of the more than 2,500 people who comprised the workforce and made the project possible.

The DMD expressed profound gratitude to all those involved in the massive project, particularly the KOC Management, the Major Projects Group, the Gas Management Group, the main contractor, Saipem, its subcontractors and the Project Management Company (PMC) and WorleyParsons. He then described the safety record of this Project as exceptional. More than 14 million man-hours were worked without a Lost Time injury.

“A comprehensive safety program put in place made sure that the workers went home safe, which is a primary responsibility of all parties,” Al-Sardi pointed out, adding, “The commissioning of this facility means that there is an increased natural gas handling capacity from the Oil Gathering Centers of South East Kuwait which improves oil production handling reliability, operational flexibility and efficiency.”

The DMD explained that less efficient equipment can also now be taken out of service for upgrading while still maintaining the gas handling capability and oil production, which will lead to less flaring of gas and better protection of the atmosphere.

“The installation incorporates equipment sourced from all over the world to attain the highest levels of advanced technical content,” he elaborated.

Al-Sardi informed the gathering that more than 20% of the
materials and equipment utilized in the project, which had a value of approximately KD 32 million, was sourced in Kuwait. The total benefits generated by the local market are estimated at KD 74 million, which is a significant contribution to the economy of the State of Kuwait.

“By the grace of Almighty Allah, this commissioning will not be the last of its kind, given that three other stations are being constructed in various areas of the Company’s operation sites and will be operational accordingly,” he stated.

For his part, the Major Projects II Group Manager, Adnan Al Aradi, stated that the Station sets new standards for environmental stewardship and utilizes the highest levels of state-of-the-art technology that is available today. This, he added, enables the facility to operate at very high levels of energy and environmental efficiency, thereby contributing to a greener environment while saving valuable energy for the State of Kuwait.

“The project forms a part of the continued expansion of the oil production support infrastructure in the state of Kuwait as part of the 2030 Strategy,” Al-Aradi said, adding, “Under this plan, which is central to the continued growth of the State of Kuwait, the objective is to achieve production capability of 4 million barrels of oil per day. This involves ongoing investment to maintain and improve reservoir performance and increased flexibility and capability to handle the production of associated products – natural gas and water. KOC presently has several projects underway to attain these objectives. This project is a critical step forward to assist operations in attaining the Company’s zero flaring target.”

He explained that the project is a two parallel train gas processing and compression facility with a capacity of 500 million standard cubic foot of gas per day. The design allows for the easy addition of a third train to further increase the capacity as and when required in the future.

The Manager revealed that the tender award price was KD 162 million. noting that the project has been completed within the budget and contract schedule, while quoting some relevant statistics:

- The site occupies some 200,000 square meters of land
- 33,000 cubic meters of reinforced concrete were used
- 5,000 tons of structural steel were installed.

Minister of Oil Hani Hussein and Al-Sardi pictured at the event
• Approximately 6,000 tons of pipe and pipelines are used
• 30 major storage tanks and process vessels are used
• 1,200 km of electrical cable was installed

He also pointed out that the addition of the station to the network of gas handling systems and some 3,000 km of pipelines and compression facilities which exist in Kuwait now enables other parts of the network to be upgraded to meet existing and future requirements without affecting daily oil production.

“As mentioned, the installation incorporates equipment sourced from all over the world to attain the highest levels of advanced technical content. However, I would like to mention the significant contribution made to the project by local Kuwaiti industries,” he told the audience.

These, he added, include the manufacture and supply of all electrical switchgear, the fabrication and supply of over 20 pressure vessels, heating and ventilation equipment, large diameter pipes and the main gas treatment facility.

The Manager went on to state that in total, these products amounted to some 20% of the materials and equipment utilized on the Project, with a value of approximately KD 32 million sourced in Kuwait. On a project value of nearly KD 162 million, this is a significant contribution to the economy of the State of Kuwait and confirms that the technical quality and commercial value of goods and products produced by Kuwaiti industries are competitive and of world class quality.

“He also said that the commissioning of this facility means that there is an increased natural gas handling capacity for the Oil Gathering Centers of South East Kuwait which improves oil production reliability, operational flexibility and efficiency.

He seized the opportunity to thank the entire Senior Management of the Company for their unwavering support which collectively has resulted in achieving this milestone project.

Al-Aradi equally expressed gratitude to the KOC Groups and Teams that supported this Project, singling out the Gas Management Group for their input, cooperation and assistance in progressing the project to its successful completion. For his part, a representative from Saipem, the main contractor, noted...
that cooperation and team work were the main factors behind the project’s accomplishment.

At the conclusion of the ceremony, plaques were presented to those who contributed to the success of this vital project for the State of Kuwait.

An Overview of BS-160:

- Construction on BS-160 began on Nov. 15th, 2008.
- BS-160 consists of two trains. Each train has Low Pressure (LP) and High Pressure (HP) units. This facility also has the control flexibility of changing the flow route from Train-I to Train-II and vice versa. The booster overall design capacity is 500 MMSCFD.
- BS-160 offers Gas Operation (S&EK) a greater capacity control over the gas compression amount. The integration of this new constructed facility with Booster Stations 140 & 150 provides significant flexibility which will reduce gas flaring tremendously.

This project provides many factors that will play a key role in achieving the KOC 2030 strategy, such as:

- Satisfying customer needs which include increased demands of operating capacity and technical capability.
- The optimization of production and utilization of associated gas.
- Maximizing the production and utilization of non-associated gas.
- Provide support to the energy requirements for the State of Kuwait.
- Environment-friendly impact by reducing gas flaring.
- Offer many opportunities for recruitment.

The project takes concerns regarding the environment into consideration. BS-160 turbines are of the latest technology and have significantly reduced CO2 emissions. In addition, Flaring Systems have environment-friendly impacts. This facility has met the Company Environment Protection values.

The contribution of this project to Kuwait can be viewed in many ways:

- Reducing gas flaring not only protects the environment but also saves money in terms of gas production cost as well as environmental protection costs.
- Maximizing the production line will grow the economy.
- Provides solutions to the demand of energy requirements.

Factors that distinguish this project from similar projects include:

- The first new booster in S&EK area for 35 years.
- The booster station is designed to handle sour gas. (BS-140 & BS-150 require upgrades)
- The gas turbines use aero-derivative designs which improve overall Booster Station availability. (i.e. Quick to repair)
- The compression units are of the latest design which means that power efficiency is significantly improved. (i.e. Fuel Gas used to provide gas compression power is significantly reduced)
Planning is generally a process which involves the determination of future courses of action. It is a dynamic process which is very essential for every organization to achieve their ultimate goals. Planning bridges the gap from “where we are” to “where we want to go,” and it makes it possible for certain outcomes to occur that would not otherwise come to fruition if there was no planning involved.

In other words, planning in an organization can be defined as the process of creating and maintaining a plan. It is a process of thinking about the activities required to accomplish a desired task or reaching the organizational goal. In short, choosing a destination, evaluating alternative routes, and deciding the specific course of the plan are the major steps involved in the process of planning.

The importance of planning is that it provides directions, reduces the risks of uncertainty, overlap and wasteful activities while facilitating decision-making and establishing standards of control.

The benefits of planning are that it increases an organization’s ability to adapt to future eventualities, helps crystallize objectives, ensures relatedness among decisions, helps the company remain more competitive in its industry, reduces unnecessary pressures of immediacy, reduces mistakes and oversights, ensures a more productive use of the organization’s resources and makes control of certain operations and tasks easier.

Bad planning, on the other hand, can ultimately result in business frustration or, at the very least, prevent the business from operating at its full capacity. The plan, however, provides a vital paradigm against which the performance can be rated and restricts managers from making bad decisions.

What is an Action Plan?
An Action Plan is a process that helps to focus ideas and decide what steps need to be taken to achieve particular goals. It is a statement of what to achieve over a given period of time.

An Action Plan also involves identifying the objectives, setting objectives which are achievable and measurable, prioritizing the tasks effectively, and identifying the steps needed to achieve goals and meet deadlines while taking contingency plans into consideration.

An effective Action Plan should give a concrete timetable and set of clearly defined steps to help reach objectives rather than aimlessly wondering what to do next.

The Action Plan includes the following main steps:
At KOC, the Asset Action Plan is always derived from Business Guidelines and aligned with KPC-KOC strategic objectives. The very purpose of the Asset Action Plan is to formulate the directions, projects, technologies, important initiatives, the quality & quantity of skills required, supports required from the sister directorates, identifying the external & internal risks and activities required to deliver the core business and to achieve the corporate objectives.

**WK Asset Action Plan:**

![AAP Diagram](image)

<table>
<thead>
<tr>
<th>2030 Strategy</th>
<th>Business Guideline</th>
<th>Asset Action Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capex/Opex Allocation</td>
<td>Projects initiation through PGS</td>
<td>5 Year Plan</td>
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<tr>
<td>Balanced Scorecard</td>
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**AAP Preparation Guideline - Chronological Order:**

- **Release of KOC Business Guideline/AAP Template**
  
The most critical purpose of the Business Guideline is to provide KOC Assets and Groups with a high-level direction of where and, to some extent, how we want to move our company forward in the next several years with an eye on WKD and support groups in KOC such as Drilling, Well Surveillance, Major Projects, R&T, etc. This practice eases the communications between Planning (WK) Team and other groups in addition to expediting the availability of information for timely submission of the Plan. The Core Team shall prepare the best plan to fulfill the Assets Goals & Objectives taking into consideration the new challenges in gas flaring, sustaining production targets, water management, sub-surface potential, reservoir management, major & other projects delivery, skilled manpower, etc.

- **Establishment of Core Team in WK Directorate**
  
The Core Team is responsible for the preparation of AAP and is comprised of members from the Planning (WK) Team, all teams in

- **Development of the Plan Document**
  
The Planning (WK) is assigned to develop the different sections of the Plan document – as detailed below - and assure compliance with guidelines and procedures. Generally this milestone is completed by the month of January of the next year, and during that period several interim reviews are taking place with stakeholders.

- **Finalization of the AAP and presentation to WK Management**
  
The final step prior to submission of the AAP document to Planning Group per the due date is to review the whole Plan document and present its outcomes to West Kuwait Management for their final endorsement.

**Main Sections of the AAP document:**

1. **DMD’s Message**
   
The Vision and Mission of WKD, Identifying key goals from now until 2030 that should be achieved by WK groups to support the KOC 2030 Strategy.

2. **Historical Performance**
   
Illustration of current year key performance measures compared to last year’s (Production, wells drilled, reserves, Capex/Opex, workover jobs). This is in addition to indicating successes of each Group and major accomplishments of previous years.
1. **KOC Business Guidelines**
Business Guideline details that are related to West Kuwait Directorate for Metric, Core Business and Strategic Functions & Enablers.

2. **Strategic Initiatives**
- Core Business Initiatives
  List of category-wise initiatives under core business for each Group with description.
- Strategic Functions & Enablers Initiatives
  List of category-wise initiatives under Strategic Functions & Enablers for each Group with description.

3. **High Level Implementation Plan**
- Action Plan Implementation Road Map
  Action Plan Roadmap for each initiative under each strategic function for each Group in the given template for the Development and improvement of the WK operations program.
- Delivery Road Map (Production Profile)
  The annual average WK production capacity up to 2030 for Base/Planned/Potential and Possible cases.
- Water & Gas Management
  The annual average WK gas production capacity up to 2030 and flaring chart with main highlights. In addition to the annual average, WK Water Production and injection up to 2030.
- Financial Outlook
  Capex and Opex requirements up to year 2030 along with major highlights.
- Manpower Outlook
  Manpower forecast of all WK teams up to 2030.
- Technology Road Map
  List of technologies needed to support the activities and projects, stating Business Impact Vs. Ability.

4. **Progression Template and Resources Required**
Summary of the main elements of AAP, i.e. production forecast up to 2030 compared to resources required wells to be drilled, ESPs by field, surface facilities availability and utilities.

5. **Risks and Issues**
Risk Matrix indicating (Impact Vs. Probability) is generated which shows list of associated risks identified by WK teams and support groups that may hinder the delivery of targeted objectives.

6. **Economic Assessments**
Economic assumptions as per the latest KPC Corporate Guidelines are being used to develop economic results for Planned, Potential and Possible production scenarios.

7. **Conclusions and Way Forward**
As a result of the said exercise, summary of main outcomes and potential issues is given along with recommendations for Way Forward.

**Other Appendices of AAP:**
- Appendix I: Production Profile
  - Crude Oil Production Forecast - 20 Year by GC & Field and also by cases (Planned+Potential+Possible)
  - Crude Oil, Water and Gas Production Composite Forecast
Appendix II: 72 Months Production Forecast and Shutdown Plan

Appendix III: Wells Drilling Requirements and Well Inventory

Appendix IV: Workover/Surveillance & Rigless

Appendix V: Capital Projects
- Recent re-phasing of all WKD capital projects listed in KOC Budget Book, taking into consideration the current status for project's implementation and link with other activities in the fields.

Appendix VI: Facility Project Timing
- List the key facility projects and provide the status. These projects are considered key major events to deliver the 2030 Strategy.
- The status is updated by PL (WK).

Appendix VII: Detailed Economic Appraisal
- Using PEEP application and latest KPC guidelines, economic assessment is carried out for the WK Development Plan based on the different scenarios and in comparison with last year indicators.

Appendix VIII: 2030 Power Strategy charts for WK Directorate
- 2030 Power Strategy requirements are coordinated and finalized by PL (WK).

Appendix IX: 2030 WKD Power Plan
- An update of electrical power requirements for WK facilities and wells categorized by WK production fields, Export and Marine business.

Conclusion
The primary objective of the KOC Action Plan is to help the Company concentrate its efforts on areas that require the most attention in order to allow for decisions to be made that will turn particular goals into reality. The Action Plan also seeks to identify and set a range of KOC objectives that are achievable and measurable and present them in a platform that KOC officials can easily understand and benefit from. When Action Plan information is compiled, it allows for the effective prioritization of tasks while also providing channels for KOC to identify steps needed to achieve goals and meet deadlines. The end result is that KOC will be better adapted to anticipate future occurrences. This, in turn, will reduce the total number of mistakes and oversights that may occur in day-to-day operations. As a result, KOC will be more competitive in its field by remaining able to use its resources to be more productive and efficient throughout all areas of operation.
Enterprise Architecture at KOC

Submitted by: Mohammad Haji Al-Sarraf, Business Systems Leader, Information Technology Planning

What is Enterprise Architecture?
Enterprise Architecture (EA) is a guide to an organization’s fitness. It is the dynamic process of managing the enterprise IT change through a planned transformation. The transformation plan provides the process of translating business vision and strategy into effective enterprise change by creating, communicating and improving the key requirements, principles and models that describe the enterprise's future state and enable its evolution. The scope of EA includes the people, processes, information and technology of the enterprise, and their relationships to one another and to the external environment. Enterprise architects compose holistic solutions that address the business challenges of the enterprise and support the governance needed to implement them. Enterprise architects use the EA process to discover the target state that the organization wishes to invest in and then helps the organization understand its progress toward the desired state.

The foundation principle of ‘Aligning IT with Business’ for any EA program involves aligning Business Architecture with the other three Architectural components. There are four building blocks for any Enterprise Architecture initiative, namely:
1. Business Architecture
2. Information Architecture
3. Application Architecture
4. Technology Architecture

Business Architecture
Business Architecture defines the structure of the enterprise in terms of its governance structure and key business processes. In defining the structure of the enterprise, business architecture considers customers, finances, and the ever-changing market to align strategic goals and objectives with decisions regarding products and services, partners and suppliers, organization, capabilities, and key initiatives.

Information Architecture
Information Architecture describes the conceptual, logical and physical view of the corporate data asset structures of an organization along with the data management resources.

Solution Architecture
Solution Architecture describes the components and elements required to deliver a solution, how they fit together, and the core technologies required. Therefore, Solution Architecture provides a blueprint of the Application systems deployed enterprise-wide and their interaction and relationship with the core business processes of the organization.

Technology Architecture
Technology Architecture describes the infrastructure that supports the deployment of core, mission-critical applications.

What are the drivers for the Enterprise Architecture (EA) Project?
Let us understand this through the ‘Chain’ metaphor as described in Figures 2, 3 and 4 shown below.
Any company like KOC can operate entirely without enterprise architecture, just as you can build a chain composed entirely of “open” (or incomplete) links (left).

Such a chain will hold some weight, and it may be lighter than a full chain. Potentially, such a chain may be inexpensive to create.

But look at the real world. How many “open link” chains have you actually seen? Why is that?

A chain of open links cannot absorb changes easily. It is weak and frail. A sudden change in the weight bearing load, or a strong push in one direction or another, and the chain fails.

For this reason, chains have closed links (right). Stronger, responsive to change, easier to handle.

Let’s apply this metaphor to the way a business operates. The chain in question is the chain of planning activities that starts with the formulation of strategies and culminates in a series of key changes in the way a business operates. The desired outcome of these changes, all summed up, is the realization of that business strategy.
Enterprise Architecture is in the unique position of addressing these “open” links by creating a quality feedback loop at every step of the way. Using Enterprise Architecture, Business Architecture, and Solution Architecture, the chain becomes stronger, more flexible, and less expensive to own. KOC is currently developing its own customized architecture framework to suit.

**Figure 4: An organization view with Enterprise Architecture**
its needs based on TOGAF (The Open Group Architecture Framework) version 9.0. The customized framework is based upon suiting our organizational needs of Business and IT.

There are innumerable benefits that KOC will obtain as a result of leveraging the usage of the Enterprise Architecture Program. Some of the salient benefits include:

- Capturing facts about KOC’s mission, functions, and business foundation in an understandable manner to promote better planning and decision making
- Aligning IT with business by enabling the use of Technology to drive the facilitation of KOC’s business drivers and help improve consistency, accuracy, timeliness, integrity, quality, availability, access, and sharing of information across the enterprise
- Achieve economies of scale by providing mechanisms for sharing services across KOC thereby reducing or removing complexity and duplication of efforts
- Improve communication among the business organizations and IT organizations within the enterprise through a standardized vocabulary
- Provide architectural views that help communicate the complexity of large systems and facilitate management of extensive, complex environments
- Focus on the strategic use of emerging technologies to better manage the enterprise’s information and consistently insert those technologies into the enterprise
- Support the processes for assessment of benefits, impacts, and capital investment measurements and supporting analyses of alternatives, risks, and tradeoffs
- Highlight opportunities for building greater quality and flexibility into KOC’s core applications without increasing cost
- Expedite integration of legacy, migration, and new systems

Any Enterprise Architecture initiative’s success depends upon the co-operation and support of the Executive Sponsorship, Business User community and ease of use usability of the program in everyday function. In addition to working closely with all the six teams at CITG we are currently are working with the Strategic Planning Team from the Planning Group.

We are also trying to interface with the Information Solutions Team from the Research & Technology (R&T) Group. In addition, individuals can also begin to see the ROI for this project through both the qualitative and quantitative benefits of the of the EA implementation.

In Stage 2 we will be focusing on the “quick wins” or tactical initiatives that will fetch us an immediate return on investment for this project and in Stage 3 we will be focusing on strategic initiatives that will bring value to KOC in the long run.

Improved time to execute, standardized business processes, formal governance and a steering committee to monitor and improve the project execution times and incorporating industry best practices into KOCs daily functions are some of the benefits one will notice within the first year of the project. As the EA program matures by leveraging technology and plugging-in with other groups at KOC, the benefits realized by the EA program will be immense.

Enterprise Architecture is one of the most sophisticated IT initiatives that many large corporations have implemented with great care and caution owing to its complexity due to the involvement of people, processes and various technologies under one umbrella.

The success of any Enterprise Architecture initiative depends upon the support and cooperation of the company’s executive leadership. It also requires strong capability of the execution team and support of all the secondary contributors involved in the project.

Upon successful implementation and ongoing maintenance of any EA program, the benefits will naturally outweigh the implementation complexities, and provide a more organized and easily manageable platform to serve KOC business needs that help contribute to the Company and State of Kuwait.
Over the years, the Corporate Information Technology Group (CITG) at KOC has made significant investments in a strong IT portfolio of innovative and world-class information technology solutions and services that help achieve greater efficiency and productivity which aid the Company’s strategic business objectives. In the current competitive environment, the need for better management of all the organizational resources, especially IT, requires comprehensive assessment of their contribution to the organization performance. While some projects will truly generate a fiscal return on investment, others will only generate goodwill, or in other words, better service and improved customer satisfaction. Whether the value added is fiscal or improved service is something that the Company should recognize at the onset.

Some of the questions that should be asked before making any investment into a possible IT project include: What value does the project bring to the Company? Should the project be undertaken if the cost to create, implement and maintain is greater than the value/savings returned to the Company? Is the project true to the objectives and overall strategy of the organization? Does the service obtained from the project support the organizational mission? How can we use this project to reduce costs and increase effectiveness?

Looking for a way to answer these important questions and be effective in delivering responsible IT solutions and services to KOC users, a conceptual framework has been established by CITG in order to judge the business value outcomes of enterprise (IT) projects. It has been developed by synthesizing the extant literature on IT business value, IT services and process design. The framework provides a set of financial measurements and series of tools for evaluating IT products, services, and support so as to ascertain their business benefits. This framework boosts CITG ability to measure IT initiatives and facilitates decisions on investment that bring the most value to the organization.

The custom-made framework was used as a part of the CITG basic decision-making process to evaluate one of its most critical initiatives called Enterprise Content Management (ECM). The result of applying this framework to the ECM program highlights the expected business value and expected technical value, associated, where possible, with real financial benefits, in addition to the Return on Investment (ROI), financial benefits and cost saving of the ECM initiative. These results could be used by the organization and management to understand and “judge” the value of the ECM program and whether or not it is needed for improving the organization’s performance.

What is ECM?
Enterprise Content Management (ECM) as defined by the ECM association AIIM (Association for Information and Image Management) as “The strategies, methods and tools used to capture, manage, store, preserve and deliver content and documents related to organizational processes.”

Looking at KOC Group processes and activities, ECM can be described as the bond that links the contents of the business processes across the organization with the necessary controls and security.
Today, the idea of managing KOC Groups’ business processes and content is not enough. Managing the complete lifecycle of content, from creation to disposal, and managing the complexity of the data and information which results from isolated applications are understood as the two main challenges that the Company should look at in order to achieve its strategic objectives.

**ECM Business Case and BVA Approach**

The preliminary step in this exercise was to identify a suitable business case for further investigation. Among many candidate cases, the “Burgan Development Drilling Wells Process” was the most applicable case for its direct relation to KOC core business.

**Figure 2: High-level flowchart of Burgan Development Drilling Wells Business Process**

The diagram illustrates a "birds-eye view" of the process and portrays the major stages to identify and drill the necessary number of future wells required to meet the Company’s strategic production target, including conducting studies, identifying appropriate well locations and drilling and connecting the wells to the respective GC.

To achieve more accurate and credible results, CITG had to look at business value from the customer’s viewpoint. Therefore, in-depth inquiries into the Burgan Development Drilling Wells Process had to be conducted by an internal task force team which was formed to achieve this objective. Key members of the team included, in addition to ECM BVA domain experts from IBM, selected members from CITG and business owners from different areas, represented by TL Field Development (SK), TL General Projects, TL Production Operations (EK) and TL HSE (S&EK). They were all very committed and supportive and have contributed immensely towards successfully achieving the objectives of this exercise.

Several meetings, interviews, workshops and conference calls were held in order to obtain as much information as possible and gain a deeper understanding of the potential business value that will be realized from the ECM program. Activities included:

- Fully comprehending the information intensive business challenges across the Burgan Development Drilling Wells Process (the current state business problems, the drivers for change and goals and benefits of Future State environment).
• Identifying requirements and making recommendations for improvements and alignment of IT and business, specifically for the Burgan Development Drilling Wells Process in relation to Enterprise Content Management.

• Providing a financial business case for the Enterprise Content Management program by extrapolating the Burgan Development Drilling Wells Process benefits to the enterprise.

1. Information Business Challenges

During the interviews, some information challenges associated with the process, people and system dimensions were identified. The manual process of managing the content and sharing and communicating information resulted in unexpected delays, re-work, and distrust in information. Normally, non-value time exists in any discipline during the communication and integration of various business functions and applications throughout the enterprise. In any business process, there is time where people are being contacted in some way to play a critical part in running/executing a process for a given request by following rules and using systems. The aim was to understand how this time is being used today and whether it can be accelerated through automation, optimization or elimination of time wasted, to return non-value-added time back to the Company by getting the right documents to the right people at the right time.

**Figure 3** summarizes the information challenges observed during the study in relation to ECM:

<table>
<thead>
<tr>
<th>Process</th>
<th>People</th>
<th>System</th>
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<tbody>
<tr>
<td>• Manual processes taking substantially longer than their desired completion</td>
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<td>• 4-5 months of re-work due to inaccuracy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Communication (Time spent sharing information)</td>
<td></td>
<td></td>
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<tr>
<td>• Delays in providing well locations and GC destination (Information is not timely)</td>
<td></td>
<td></td>
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<tr>
<td>• Cultural change issues</td>
<td></td>
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<tr>
<td>• Minimal systems integration</td>
<td></td>
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<tr>
<td>• Different sources of updated information</td>
<td></td>
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<tr>
<td>• Complexity in managing and sharing data due to large amounts of physical storage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• No version control of documents</td>
<td></td>
<td></td>
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<tr>
<td>• Information retention policy defaults to “forever”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Lack of automation of standards and governance</td>
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</tbody>
</table>

**Figure 3: Information Challenges**

2. Defining Requirements

The next stage of this exercise was the definition of what the requirements are and how they can be satisfied. These can be summarized into four main points as follows:

Reduce process latency and increase process adherence by:

• Automating all business processes including HSE processes through different applications and platforms
• Combining information, processes, and people to provide a 360-degree view of information and achieve optimized outcomes
• Enhancing and automating the Company’s information management processes to efficiently manage information throughout its entire lifecycle, from creation to disposal
• Enabling defensible disposal of content whose retention period has expired for a better management of risk and streamline regulatory compliance

Improve Knowledge Worker Productivity by:

• Reducing rework (such as recreating content not found, version control issues, and searching but not finding documents)
• Improving the Content Analytics and Enterprise Search capabilities

Reduce Expense by:

• Reducing or eliminating unproductive tasks such as filing and organizing documents, managing document approvals, and managing document routing
• Enabling systems integration
• Enabling Version Control
• Sharing business information and making it available for reuse
• Delivering Trusted Information that improves fact-based business decisions

The Kuwaiti Digest
Applying standards and governance like retention polices
Managing critical business emails, archiving based on the business value of the content or legal obligations and making them active and accessible whenever and wherever needed
Optimizing storage capacity by creating and enforcing an effective retention policy to enable disposal of expired content or content that has no legal or business value

Increase production capacity by decreasing the time to get wells into production by:
• Getting the right documents to the right people at the right time

3. Define the Business Value and Assessment Results
The financial analysis was done based on the following key metrics and assumptions:

- The estimated budgetary cost: KD 5 million
- Contract duration: 5 years
- Number of knowledge workers (using ECM system): 5,000 users
- Average monthly wage per knowledge worker: KD 1,200
- Average documents generated per year: 4 million
- ECM solutions benefits begin: 9 months after kickoff date
- Adoption business benefit curve during the project period (starting from deployment): 7% for Y1, 15% for Y2, 15% for Y3, 15% for Y4 and 15% for Y5 adoption, which is the assumption of the yearly business benefit
- CITG worked closely with BVA consultants to develop a business value ROI template that incorporates the associated calculations and helps translate the collected data into accurate and objective business-value measurements. This template uses ROI analysis, which includes, in addition to traditional cost and benefit summaries, soft benefits such as employee productivity and time savings.

The calculated benefits include:
• Reduce paper storage and distribution costs with Content Management
• Increase knowledge worker productivity with Case Management
• Reduce storage costs with Information Lifecycle Governance
• Increase production capacity by decreasing the time to get wells into production

The Company will achieve 2.51% as ROI return on investment which is the ratio of the net gain from the ECM program within 5 years based on the above assumptions. The 13 month Payback Period is the time needed to recoup the cost of the ECM investment.

Conclusion
The study was conducted including some of the ECM components solutions and shows that ECM will be promising to the objectives and overall strategy of the organization by reducing costs and increasing effectiveness and productivity.
The Benefit of Variable Speed Drives for KOC Operations

Submitted by: Ahmad Jumah Al-Qallaf, Engineer Elec. Maint., Operations Support Group

For centuries, machinery and motors have been the core aspect of the industrial process which symbolizes growth and progress. Semiconductors have played a leading role and have represented the heartbeat of an evolving world that has witnessed improvements in all aspects of industrial life. In addition, machineries and motors have had a fair amount of time to progress and develop over the years to overcome their weaknesses and shortfalls in terms of mechanical and electrical stress during startup and speed control. And thanks to semiconductors, electrical drives known as Variable Frequency/Speed Drives have been introduced to the industrial market as an enhancement to Alternating Current (AC) motors.

Pilot’s Objectives
Description
A variable-frequency drive (VFD), also called “variable-speed drive,” is a type of adjustable-speed drive used in electromechanical drive systems to control AC motor speed and torque by varying motor input frequency and voltage. Fixed-speed operated loads subject the motor to a high starting torque and to current surges that are up to eight times the full-load current. AC drives instead gradually ramp the motor up to operating speed to reduce mechanical and electrical stress, reducing maintenance and repair costs, and extending the life of the motor and the driven equipment.

The following are process control benefits that might be provided by VFDs:
• Smoother operation.
• Acceleration control.
• Different operating speed for each process mode.
• Compensate for changing process variables.
• Adjust the rate of production.

The task of a variable speed electrical drive is to convert the electrical power supplied by the mains into mechanical power with a minimum amount of loss. This is ensured by the low loss control using solid state technology in electronic controllers. The solid state technology is used to achieve an optimum process to drive the motor with varying its speed. The controllers are connected to a mains supply and the electrical machine as shown in Figure 1.

Recently, technology has improved VFD (Variable Frequency Drive) performance through advances in semiconductor switching devises, drive topologies, simulation and control techniques.

Pulse Width Modulation - PWM
Pulse Width Modulation (PWM) is the method of control where variable voltage (AC/DC) is achieved from a fixed DC voltage using switching devices. DC voltage is applied for some time in the cycle and in the remaining period, no voltage is applied to the load. By adjusting the duty ratio, (ratio of on period to cycle time) output voltage is adjusted between zero and rated voltage.

Scalar Control
In scalar control, the relationship between voltage and frequency of the AC voltage applied to the motor terminals is predetermined by the user. This relationship is sometimes marginally altered in scalar drives to improve the performance of the drive. Scalar controlled inverters can only have speed control, and these are ideal for group/multi motor drives.

At Kuwait Oil Company, variable...
speed drive is used widely in production, gas and export facilities to reduce power consumption as well as the high inrush current caused by starting induction motors. Moreover, scalar control is one of the better understood and widely used technologies used, among other technologies, at KOC.

One example of where VSD is being used includes compressors, which are used in a wide variety of applications. Their task is to pump and compress gases to almost any pressure level in addition to fulfilling general requirements regarding efficiency; however, availability and a high power density are also decisive factors in their operation.

Saving energy can be achieved by using VSDs. The following example shows a simple application of where VSD can save energy:

- Fans and pumps are the most common energy saving applications.
- In fixed speed mode, airflow can be regulated by using a damper.
- In VSD, it’s more efficient to regulate the speed of the motor and accordingly airflow will be regulated.
The simulation results of the scalar control – V/F open loop drive, are shown in the following figures:

The above figures show the implementation of open-loop constant V/Hz control of an induction machine. The open-loop constant V/Hz operation is simulated for 1.2s ramping up and down the speed command (as shown in figure No. 2 in 1.5, 3.5 & 4.5 seconds) and applying step load torques (as shown in figure No. 2 in 8 & 10 seconds). Figure No. 3 shows the change in V/F ratio when changing the speed command while maintaining a constant ratio to avoid flux saturation.

Figure No. 4 shows the performance of motor speed when changing the required speed and time required to approach the desired speed. We can notice that there is some delay. However, this delay & performance has been improved by implementing other controller technologies such as Field-Oriented Control (FOC) and Direct Torque Control (DTC).

At Kuwait Oil Company, variable speed drives will continue to be used widely in production, gas and export facilities to reduce power consumption and create better efficiency and control over operations. In addition, as technologies improve, the Company will play a major role in adopting new and improved methods to help better create a more efficient and productive environment.
Significance of Safety Instrumented System

Submitted by: Shemej Kumar Kattikolath, Engineer I Design, Design Team, Engineering Group

Safety and protection of the process plants are one of the highly concerned areas of the plant management and insurance companies. Human safety, asset safety and reputation of the organization are main areas of concerns. Most of the plants are designed with inherent process safety and with additional independent protection layers. After conducting Process Hazard Analysis (PHA), Hazard and Operability Study (HAZOP) and Quantitative Risk Assessments (QRA) to find risks involved, additional protection may be required which shall be achieved through Safety Instrumented System (SIS). By implementing Safety Instrumented System, the reliability and availability of safety/protection system is ensured as and when required.

Risk, Safety and Hazard

Safety can be defined as “freedom from unacceptable risk.” Absolute safety, where risk is completely eliminated, can never be achieved; risk can only be reduced to an acceptable level. Therefore all risks should be dealt with on the ALARP basis, i.e. the target is to ensure that risk is reduced to As Low As Reasonably Practicable (ALARP).

If the hazards are not known, the risk cannot be determined. Process Hazard Analysis (PHA), and Hazard and Operability (HAZOP) study are carried out to identify the risks and risk levels are quantified based on the respective industry standards and legal regulations. Risk is the combination of the probability of an occurrence of harm and the severity of that harm.

Risk reduction can be considerably achieved by the process selection and/or engineering design by:

• Improving mechanical integrity of the system
• Improving the Basic Process Control System (BPCS)
• Providing detailed training and operational procedures
• Increasing the frequency of proof testing of critical system components
• Implementing safety Instrumented System (SIS)
• Implementing mitigating equipment

Risk Reduction Layers

Risk reduction layers or Protective layers can be classified as either Prevention or Mitigation layers. Protective layers such as alarm system, emergency shutdown systems, safety relief systems, etc. are put in place to stop hazardous occurrences and mitigation layers such as fire and gas detection systems, deluge systems, etc. are designed to reduce the consequences after hazardous events have occurred.
Independent Protection Layers (IPL) is a safeguard that works independent of other safeguards like relief valves, BPCS, interlocks, alarms, etc. In case of an independent protection layer, the plant operator gets adequate time to respond to prevent a hazardous event from occurring. However, it is not a good practice to have an operator or human intervention to achieve safety protection layer, as they are not reliable enough during moments of stress and can make systematic failures. It is more advisable to use only as a secondary means of shutdown. Furthermore, any IPL must be totally independent to exclude common cause and common design problems. The effectiveness of IPL is described in terms of the probability that it will fail to perform its required function when called upon to do so (demand) and the scenario continuous towards hazardous consequences despite of the presence of IPL. This is called Probability of Failure on Demand (PFD).

Layers of Protection Analysis (LOPA)

Layers of Protection Analysis (LOPA) is a simplified form of risk assessment. LOPA typically uses order of magnitude categories for initiating event frequency, consequence, severity, and the likelihood of failure of independent protection layers (IPLs) to approximate the risk of scenario. LOPA is limited to evaluating a single cause-consequence pair as a scenario. In LOPA, the initiating events are always described in terms of frequency.

The LOPA method quantifies risk and therefore reduces it subjectively. It is mostly performed after HAZOP and focuses on selected high risk issues. LOPA helps to choose from various alternative safeguards to get the most economically justifiable safeguard. The LOPA analysis includes hazard scenarios described by cause and consequences. All IPLs are analyzed for their effectiveness and the combined effects are compared against the tolerable risk and decide the requirement of additional risk reduction.

To execute a proper LOPA, experienced facilitators, an experienced LPOA team and updated relevant plant documents...
are required. Any irrelevant assumptions or unrealistic hazard event frequency or misjudgment may lead to wrong risk levels as LOPA is a tool which deals with numbers.

**Safety Instrumented System (SIS)**

A SIS is a system comprising sensors, logic solvers and final control element (actuators) for the purposes of taking a process to a safe state when normal predetermined set points are exceeded, or safe operating conditions are violated. It is mandatory that any protection system (including a SIS) be kept functionally separate from the Basic Process Control System (BPCS) in terms of its ability to operate independent of the state of the BPCS. However, these two systems need some integration at certain levels to have effective plant control and monitoring. The classical shutdown system is being eventually replaced by a safety certified protection system due to the stringent safety regulations and insurance requirements.

**Safety Instrumented Function (SIF)**

Safety Instrumented Function (SIF) consists of sensors (e.g. transmitters), final control element (e.g. valves) and a logic solver with safety algorithm. The purpose of the SIF is to increase process safety or reduce risk. SIFs are usually implemented in a safety instrumented system (SIS). Each SIF is designed to meet a specific Safety Integrity Level (SIL), which is called the level of reliability.

A SIF with SIL-1 must at least perform nine times out of 10, which provides a risk reduction factor (RRF) of 10 and Probability of Failure on Demand (PFD) of 0.1. A SIL-2 SIF must perform at least 99 times out of 100 and provides RRF as 100 and PFD as 0.01. Meanwhile, a SIL-3 SIF must perform minimum 999 times out of 1000 providing RRF as 1000 and PFD as 0.001.

The SIL rating of a SIF depends on various factors such as reliability analysis of all loop components, demand frequency, proof test interval, diagnostic coverage, human factors, etc. SIF protects against a single hazard usually on demand, but a SIS implements one or more SIFs, often multiple connectivity between one initiator and several final elements, a final element and several initiators etc. Some SIF’s mitigate after the event consequences, like the Fire and Gas system, which reduce escalation.

The design of SIF is initially based on achieving the required safety integrity levels (SIL). In addition to that, the SIF design must also consider the acceptable levels of spurious (or nuisance) trips, which is the likelihood the safety function will activate unnecessarily. Nuisance trip is not yet completely controlled by any methods in SIF design until now, however methods are available to predict the expected frequency of nuisance tips such as meantime to failure spurious (MTTFS), but not to determine an acceptable level for any particular SIF function.

A practical approach is that the safety function should not cause in more nuisance trips than true trips.

**Probability of Failure on Demand (PFD) and Risk Reduction Factor (RRF)**

PFD probability of failure on demand is the chance that a specific safe guard will not perform its intended function when required. For example, failure of a shutdown valve to close when an abnormal process hazard arises. If that valve fails to close on time of 100 times, then the PFD value is 0.01. Devices with smaller PFD values help to reduce risk more than the devices with higher PFD value. The probability of failure on demand depends on its frequency of testing and repair. The proof test coverage is also a very important factor in maintaining a SIL loop performance compliance. A device which is not proof tested gets larger PFD value as time increases since the failure remains uncorrected.

Using the maximum failure probability is a safe and conservative method in SIL evaluation, but a more realistic method is to use average probability of failure (PFD Avg.) during the entire testing interval. The demand for a safeguard to operate can happen any time during the test interval with equal probability.

**Two fundamental different ways to calculate PFD Avg. are**

1. The unreliability approach in which an unreliability function is calculated as a function of time interval for a specific mission time usually equal to a “proof test” interval. The average of this function is considered over the entire mission time. PFD avg. is the average value of the unreliability function plotted over the testing period.

2. In another approach, PFD avg. is considered as steady state unavailability. The identical approximation in both cases proves that either method unreliability averaged or unavailability averaged may be used to calculate PFD Avg.

The integrity of a SIF is sometimes expressed as the Risk Reduction Factor (RRF).
The risk reduction factor from each independent layer can be combined to obtain the total risk reduction factor. Risk reduction factor (RRF) = 1/PFD Avg.

**Safety Integrity Level (SIL)**

Safety Integrity Level (SIL) is a statistical representation of safety availability of a SIS at the time of process demand. When the hazards identification and risk assessment phase concludes that a SIS is required, the level of risk reduction afforded by the SIS and the target SIL has to be assigned. The effectiveness of a SIS as an independent protective layer is described in terms of the probability it will fail to perform its required function when it is called upon to do so.

The level of risk reduction varies with respect to the amount of risk that has to be reduced and tolerable risk that has to be achieved. Once the level of risk reduction is determined, it is expressed as safety integrity level (SIL). An adequate safety related system (SRS) can then be selected by choosing a system that falls under the appropriate safety integrity level.

The necessity of SIF is termed as demand mode and is classified as Low demand mode and High demand or Continuous mode. If the demand frequency is less than one per year and test frequency is greater than two times demand frequency, then it is called low demand mode. If the demand frequency is greater than one per year and test frequency is less than two times demand frequency, then it is considered high demand mode.

Target failure measures for SIF at low demand mode of operation is given in Table 1:

<table>
<thead>
<tr>
<th>Safety Integrity Level</th>
<th>PFDavg.</th>
<th>Risk Reduction Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>≥ 10-5 to &lt;10-4</td>
<td>100,000 to 10,000 times</td>
</tr>
<tr>
<td>3</td>
<td>≥ 10-4 to &lt;10-3</td>
<td>10,000 to 1000 times</td>
</tr>
<tr>
<td>2</td>
<td>≥ 10-3 to &lt;10-2</td>
<td>1000 to 100 times≥ 10-2</td>
</tr>
<tr>
<td>1</td>
<td>≥ 10-2 to &lt;10-1</td>
<td>100 to 10 times</td>
</tr>
</tbody>
</table>

Table 1 – SIL and Related Measures (For Low Demand Mode Operation)

In addition to assessing the likelihood of hardware failure, SIL is assessed against the severity of design processes used to prevent systematic failures and the hardware architecture used to provide safety function. Probability of hardware failure alone is not sufficient to be compatible with the particular SIL but the hardware fault tolerance and safe failure fraction also to be satisfied for the target SIL.

The SIL is the key design parameter specifying the amount of risk reduction that the safety equipment is required to achieve for a particular function in question. The safety integrity level indicates the minimum probability that the equipment will successfully do what it is designed to do when it is need to do so.

**Safety Life Cycle**

Safety Life Cycle (SLC) defines the methods or process that provides a global content for specifying, designing implementing and maintaining Safety Instrumented System so as to achieve overall functional safety in a documented and verified way.
SLC analysis phase focuses on the SIL selection process and starts from the basic conceptual design of the process and safety system through to the release of the safety requirements specifications. This includes collecting supporting information on process and tolerable risk levels of the organization through PHA, HAZOP and potential safety instrumented functions are identified. By LPOA, the amount of risk present without SIS is characterized. If the risk is within a tolerable level, SIS is not required to be implemented and can rely on existing layers of protections. If risk is intolerable, appropriate SIL to reduce the risk to an acceptable level is determined and the same shall be documented with relevant information as safety specification.

SLC realization phase highlights on designing and fabricating the SIS to meet the specifications yielded by the analysis phase. SLC operation phase starts from startup to decommissioning through the entire safety system. The highlights of this phase is maintaining function, testing and proof testing the system to ensure the system is functionally safe. The operation phase ends when the system is fully decommissioned and taken out of service or when modified with respect to a specific MOC which will start the safety lifecycle from beginning. The SLC can be summarized in three steps which include analyzing the hazardous risk, designing the suitable solution and verifying that the solution effectively solves the hazard risk.

Proof Testing
In order to maintain the SIL level of a SIS loop, proof testing is an important factor. Dangerous failures are identified by proof testing. For the proof test executed online, all the proof testing devices shall be an integral part of SIS loop. In most cases, full proof testing is not practical in a running plant. In this case partial stroke testing is adopted as a method to execute proof testing.

Periodic proof testing shall be carried out by well written procedures and methodologies, and proof testing shall have proper records with details such as description of tests, dates, name of person, serial number, tag numbers, results of tests and inspection, etc.

Personnel competency certification
A major issue faced by companies that implement SIS is the verification of personnel competency. Personnel who design, implement, maintain and operate SIS are required to be competent in the process they are assigned.

As per IEC 61508, “All personnel involved in any overall E/E/ PES or software safety life cycle activity including management activities should have the appropriate training, technical knowledge, experience, and qualifications relevant to the specific duties they have to perform.” Personnel competency is therefore now a “Normative” requirement in the IEC 61508 edition 2.0. Many companies are concerned that there has been no guidance on how this assessment shall be carried out. There are agencies such as TUV, ISA, Exida, Risknowlogy and more which provide certification programs to overcome these issues.

What may go wrong in SIS design?
There is a general tendency to keep adding safeguards in the belief that the more safeguards added, the safer the process. In fact it is a false concept. Eventually the more and more safeguards that are added that are unnecessary for the SIF, the effect shall be less focus on the safeguards that are critical to achieve tolerable risk. Unnecessary safeguards also become complex which may result in new unidentified hazard situations. Selection of a competitive team for the SIS design is an important criterion to achieve an optimum and economical design. Gathering relevant plant data and history is another major factor to be considered during SIS design.
Since its earliest days, Corporate Social Responsibility (CSR) has played a major role in Kuwait Oil Company’s day-to-day activities. Stretching as far back as the 1930s, when the Company was still run by a mostly British workforce, employees were provided with housing, health care and food. Of course, these earliest accommodations and services were very basic; however, over time, KOC went on to build one of the strongest support structures that directly benefited not only employees, but residents throughout Kuwait as a whole.

**Happiness and Health**

During the 1940s, the first major steps were taken to create a vibrant community within Ahmadi that would turn the small desert town into a self-sustaining hub where KOC employees could live comfortably and enjoy various activities for entertainment after work hours. It was around this time that major construction began which saw the building of more homes, swimming pools, playing fields and parks, a golf course and a number of different clubs for entertainment, such as the Kuwait Little Theater, which is one of the oldest theaters in the region.

Ensuring the health and safety of its employees has also been a longstanding tradition of KOC. Before 1960, most employees received their medical care at the medical center in Magwa, which was used as the Company hospital until Ahmadi Hospital was built. Today, the hospital provides a range of medical services to not only KOC employees and their families, but all oil sector employees.

**The Environment**

Part of KOC’s CSR initiative is to do everything in its power...
to ensure the Company’s oil operations have as little negative impact as possible on the country’s environment. Examples of these initiatives include the water re-injection program, where polluted and unusable water resulting from production is re-injected into the reservoir instead of being dumped on the soil on the surface in evaporation pits.

KOC’s extremely successful effort to reduce gas flaring must also be mentioned, as this campaign has resulted in positive results thanks to the cooperation that exists among employees throughout KOC. Recently, KOC has been able to reduce gas flaring from 17% to 1.75%, and in many cases, that figure is even lower, with some extremely successful cases attaining figures of less than 1% flaring. The environmental and economic ramifications of this extremely significant achievement will leave a positive impact on Kuwait for years to come.

Ahmadi is considered by many to be one of Kuwait’s greener areas, and this is definitely not the result of chance or accident. KOC has spent decades planting and maintaining the many trees that line Ahmadi’s streets and boulevards, and this practice has turned out to be a very good investment. Many studies indicate a greener environment leads to happier people, and happy people are generally more satisfied and productive at their jobs, which leads to an arrangement that is mutually beneficial to the Company and its employees.

The One Million Trees Project was also an undertaking that witnessed the Company make efforts to beautify Kuwait by planting trees throughout the country. In addition, concerns about the impact of oil production on the local landscape resulted in KOC initiating two projects. These included Spirit of the Desert and the Kuwait Oasis, whose goal was to bring areas of the desert back to their natural state. Both projects involved the transformation of polluted land into green areas that are available for use by company employees. In addition to being leisure areas, the parks are also sanctuaries for local and migrating wildlife. In addition, the Company’s concern for the environment affected its decision to work with the Kuwait Environment Protection Agency to review and improve local legislation pertaining to the
environment and the actions of the petroleum industry.

KOC is active in and financially supports local projects that aim to improve the environment, such as the formation of the Marine Colony, the cleaning of local beaches, and the preservation of sensitive nature areas such as the local islands. In fact, the Marine Colony was a first for an oil company and is one of the largest reserves in the Gulf. Covering an area of 54,000 square meters, the reserve includes 1,000 reef balls which are intended to foster Kuwait’s marine life.

On top of its direct efforts to make a positive impact on the environment, KOC routinely holds awareness campaigns that touch on issues such as energy conservation, recycling, safe driving, health related issues such as back pain, and more. These awareness campaigns not only target employees and their families, but extend to students as well. In recent years, KOC has made an active effort to hold regular awareness sessions for students throughout Kuwait.

**Education and Awards**

The continuous drive to better train KOC employees and send them abroad for higher education is demonstrative of the Company’s realization that a highly educated staff of employees leads to a better-run organization. A focus on training has resulted in the construction of many training centers that prepare Kuwaiti employees for life in the oil sector. As a result, this has led KOC to accept more Kuwaiti applicants, which falls in line with Kuwaitization policy of hiring more Kuwaitis in various positions when possible. Approximately 80% of KOC employees today are Kuwaiti nationals.

Health, Safety and Environmental issues are very important to KOC, which was reflected in the creation in 1998 of the annual Chairman’s HSE Awards, which recognize initiatives within the company that focus on reducing damage to the environment while safeguarding the health and safety of employees. Receiving an HSE Award is quite an honor, and many employees and their families are now more aware than ever of the importance of leading initiatives that go a long way in caring for the community.

Corporate Social Responsibility will continue to play a major role in the day-to-day operations of KOC. As the Company grows and makes plans for the future, KOC’s CSR initiatives will grow in turn and increase in their scope, resulting in a community that can be proud of its accomplishments and eager to do more in the future.
KOC has a long history of reaching out to employees and their families and providing them with the support services that define the Company’s reputation as an organization that truly cares about the community it operates in. The Company’s senior officials realize the importance of fostering a sense of community and responsibility, which is reflected in the many services and outreach programs that KOC engages in.

On the occasion of Eid Al-Fitr, Chairman and Managing Director Sami Al-Rushaid visited Ahmadi Hospital in order to extend Eid greetings to patients who were receiving care there. Many of these patients were unable to spend Eid with their families because the necessary treatment they were receiving obligated them to remain at Ahmadi Hospital. Accompanying the Chairman to Ahmadi Hospital was DMD Administration and Finance Khaled Al-Khamees.

During his visit to patients at the hospital, C&MD Al-Rushaid was met by the Assistant Chief Officer (Primary Health Care Services), Dr. Aref Al-Abbasi and the Head of Support of Administrative Services, Qusai Al-Amer. A number of medical and nursing officials also accompanied the officials throughout their tour of Ahmadi Hospital, which saw the officials visiting various sections of the hospital, learning about the function of some of the facilities there, and meeting with patients receiving care. To celebrate the joyous and festive occasion of Eid Al-Fitr, gifts were distributed to patients throughout the hospital.

About Ahmadi Hospital:
- Kuwait Oil Company offers Health Services to employees and their families through Ahmadi Hospital.
- Ahmadi Hospital was inaugurated in April of 1960 to treat KOC employees and their families. In the 1980s, these services were extended to all oil sector employees.
- Ahmadi Hospital provides many services, medical treatment and other relevant support services. Among these important services are: Emergency, General Practice, Internal Medicine, General Surgery, Orthopedics, Dermatology, Obstetrics & Gynecology, Pediatrics, Ophthalmology, Ear, Nose & Throat, Dentistry, Preventive Medical Services, Radiology, Anesthesia, Intensive Care Unit, Laboratory, Physiotherapy and Dietary services.
- Ahmadi Hospital also offers Home Visits to older patients and those who are bedridden. In addition, Ahmadi Hospital can also refer patients that need specialized care to locations abroad so that they can receive the care they need.
The origin of oil has been the subject of an extended debate since its founding in the mid-19th century. Some professionals believe that oil is primordial – that it dates back to Earth’s origin – and thus was made through an inorganic process. This thesis is characterized as the abiotic (also called abiogenic or inorganic) theory. Others argue that oil was produced from the decay of living organisms (primarily oceanic plankton) that proliferated millions of years ago during relatively brief periods of global warming and were subsequently buried under ocean sediment in fortuitous circumstances. This view describes the biotic view of oil.

During the latter half of the 20th century, largely due to advances in geophysics and geochemistry, the vast majority of scientists have lined up on the side of the biotic theory. A small group of scientists, mostly Russians and a small minority of Western scientists (notably Cornell University physicist Thomas Gold), were committed to the abiotic theory. Gold's research work argued that hydrocarbons existed at the time of our solar system's formation and that they are known to be abundant on other planets (Jupiter, Saturn, Uranus, and some of their moons) where no life is presumed to have existed in the past.

**Implications of Abiotic Oil Theory**

The abiotic theory suggests that there are virtually limitless pools of liquid primordial hydrocarbons at great depths in the Earth. These pools slowly replenish the reservoirs that conventional oil drillers tap. The abiotic theorists suggest that conventional drillers, constrained by an incorrect theory, ignore many sites where deep, primordial pools of oil accumulate; if only they would drill in the right places, they would discover much more oil than they are finding now. However, thus far tests of this claim have proven inconclusive.

**Possible Evidence of Abiotic Oil**

Abiotic theorists often point out evidence of fields refilling as support of the theory. The most frequently quoted example is Eugene Island, located on the tip of a mostly submerged mountain that lies approximately 80 miles off of the coast of Louisiana. A significant reservoir of crude oil was discovered nearby in the late '60s. By 1970 the Eugene 330 platform was producing about 5,000 barrels a day of high-quality crude oil. By the late 1980s, the Eugene 330's production had slipped to less than 4,000 barrels per day and was generally considered to be declining. In 1990, oil production suddenly soared back to 15,000 barrels a day, and the reserves which had been estimated at 60 million barrels in the 1970s, were recalculated at 400 million barrels. Most interestingly, the measured geological age of the new oil was significantly different than the oil pumped in the 1970s. Analysis of seismic recordings has revealed the presence of a “deep fault” at the base of the Eugene Island reservoir which was gushing up a river of oil from some deeper and previously unknown source.

The Abiotic Theory:

Within the mantle, carbon may exist as hydrocarbons - chiefly methane - and as elemental carbon, carbon dioxide, and carbonates. The abiotic hypothesis is that the full suite of hydrocarbons found in petroleum can be generated in the mantle by abiogenic processes, and these hydrocarbons can migrate out of the mantle into the crust until they escape to the surface or are trapped by impermeable strata, forming petroleum reservoirs.

Abiogenic theories reject the supposition that certain molecules found within petroleum, known as biomarkers, are indicative of the biological origin of petroleum. They contend that these molecules mostly come from microbes feeding on petroleum in its upward migration through the crust, that some of them are found in meteorites, which have presumably never contacted living material, and that some can be generated abiogenically by plausible reactions in petroleum.

The presence of methane on Saturn's moon Titan and in the atmospheres of Jupiter, Saturn, Uranus and Neptune is cited as
evidence of the formation of hydrocarbons without biology (Terrestrial natural gas is composed primarily of methane). Some comets contain massive amounts of an organic material almost identical to high grade oil shale (kerogen), the equivalent of cubic kilometers of such mixed with other material; for instance, corresponding hydrocarbons were detected during a probe fly-by through the tail of Comet Halley in 1986.

**The Biotic Theory:**

Most petroleum geologists prefer the theory that attributes oil origination to vast quantities of dead marine plankton or plant material that sank into the mud of shallow seas. Under the resulting anaerobic conditions, organic compounds remained in a reduced state where anaerobic bacteria converted the lipids (fats, oils and waxes) into a waxy substance called kerogen.

As the source rock was buried deeper, overburden pressure raised temperatures into the oil window, between 80 and 180°C. Most of the organic compounds degraded into the straight-chain hydrocarbons that comprise most of petroleum. This process is called the generation kitchen. Once crude oil formed, it became very fluid and migrated upward through the rock strata. This process is called oil expulsion. Eventually it was either trapped in an oil reservoir or oil escaped to the surface and was biodegraded by soil bacteria.

Oil buried deeper entered the "gas window" of more than 160 °C and was converted into natural gas by thermal cracking. Thus, this theory predicts that only unassociated gas—not oil—will be found below a certain depth. At greater depths, even natural gas would be pyrolyzed.
Kuwait’s Water Future

Kuwait is an extremely hot and arid country that lacks any freshwater lake or river system. Even the country’s groundwater supply is mostly saline, with only two relatively small areas in the country being tapped for their groundwater supplies. Rainfall in the country on average varies between 75 mm to 200 mm per year. However, rainfall in Kuwait is extremely unpredictable – as little as 22 mm of rain may be measured one year while the next it may be significantly higher. Still, despite Kuwait’s extreme shortage of natural freshwater resources, it is one of the world’s top consumers of water, with more than 500 liters of water per capita consumed per day.

To discuss the future of Kuwait’s water supply and the country’s plan to ensure its water future, The Kuwaiti Digest met with Dr. Vincent Kotwicki, a Research Scientist in the Water Resources Division of Kuwait Institute for Scientific Research (KISR). Dr. Kotwicki has published a number of books and papers that deal with issues pertaining to arid zone hydrology and water resources management. His latest book, Water on Earth, has a significant portion dedicated to Kuwait’s water issues.

Kuwait’s groundwater resources are very negligible. Due to extremely high evaporation losses and the high deficit in Kuwait’s soil moisture, only a small percentage of the limited precipitation that the country receives infiltrates into the groundwater supply. According to information published by the Public Authority of Agriculture Affairs and Fish Resources (PAAFR), Kuwait’s groundwater can be divided into three categories according to its salt content. The first is fresh groundwater, with a content of soluble salt of less than 1,000 mg/l. This water, which is found in the Rawdhatain and Umm Al-Aish fields, is not used for agriculture and is considered as a strategic freshwater reservoir for drinking water. The second is brackish groundwater, with a soluble salt content ranging from 1,000 to 7,000 mg/l. This water is produced from the Al Shigaya, Al Qadeer, Sulaibiya, Wafra and Abdali fields and used mostly for agriculture and domestic purposes and as drinking water for cattle. The last category of Kuwait’s groundwater supply is saline water, with a soluble salt content of between 7,000 to 20,000 mg/l. This water is not appropriate for agricultural or domestic use.

Over the years, studies have shown that Kuwait’s groundwater quality and quantity are deteriorating due to the continuous pumping of water. In Wafra, 50 percent of the
wells pumped water with a salinity level higher than 7,500 ppm in 1989, reaching 75 percent and 85 percent in the years 1997 and 2002 respectively. In Abdali, these figures were estimated at 55, 75 and 90 percent respectively. During an interview at his office in Shuwaikh, Dr. Kotwicki maintained that “Kuwait’s natural recharge is only 160 million cubic meters per year. However, we produce 610 million cubic meters of freshwater per year, which is almost four times more than the natural recharge.” This huge disparity in the amount of water Kuwait consumes compared to what is naturally available is reliant on Kuwait’s efforts at water production, which relies heavily on seawater desalination. Without seawater desalination, it would be impossible for Kuwait to provide the amount of freshwater that is readily available to its population.

**Desalination in Kuwait**

Kuwait’s first desalination plant was established at Ahmadi Port in 1951 with a very modest production capacity. Over the years, Kuwait’s production capacity greatly increased as new technologies developed and new plants were built. According to Dr. Kotwicki, the desalination of water in Kuwait will continue indefinitely because Kuwait simply has no other choice but to desalinate water because of the country’s lack of freshwater resources.

While the Ministry of Electricity and Water does provide an excellent service in its ability to continuously supply Kuwait with freshwater, there are concerns surrounding the feasibility of the economic costs associated with providing an abundance of desalinated water to the general population. One of the major concerns, says Dr. Kotwicki, deals with the cost of the government subsidizing water in Kuwait, which by comparison to the rest of the world, is exceptionally discounted. “Water subsidies in Kuwait account for 2.5% of gross domestic product, or 6% of the nation’s oil revenue,” said Dr. Kotwicki. “This is expected to increase in 2025 to 25%, and in 2050, 100% of gross domestic product will go toward the production of water and electricity.”

To get an idea of just how much Kuwait’s water needs have grown and are currently growing, consider the following: Freshwater...
production rose from 80 million m³/year in the late 1950s to 610 million m³/year in 2010 while per capita consumption of freshwater rose from 21 m³/year in 1959 to 163 m³/year in 2010. According to information published by Dr. Kotwicki, if the present water consumption trend continues, a quadrupling of water desalination would be required by 2025. What, then, is Kuwait doing to guarantee a water supply for its future?

**The Way Forward**

In his interview with The Kuwaiti Digest, Dr. Kotwicki pointed out that to put the water issue into perspective, we should consider the fact that 100,000 people are added to the planet every day. In a month, that is equivalent to approximately 3 million people, roughly the same amount of people who live in Kuwait. All these new people will be competing for a very limited water supply, and if measures are not taken to adequately prepare for the world’s future water needs, the results may be catastrophic.

“We should treat water with more reverence,” said Dr. Kotwicki, adding that he believes people today treat water as a simple commodity instead of life’s most valuable resource. “Water is the most important thing in life – we’d die in a few days without it. Without water there would be no life. Everything around us was created by water,” said Dr. Kotwicki, who maintained that educating people, especially the young generation, about the importance of water is a good first step toward getting them to care about life’s most important resource. As the Kuwaiti proverb goes, he said, “What is learned in youth is carved in stone.”

Despite being in the precarious position of using an amount of water that is many times more than what nature can sustain, Dr. Kotwicki believes that the future can be promising if we make preparations today for the future needs of tomorrow. There are solutions, he maintains, that can help us solve future water needs. Dr. Kotwicki believes that there is a good side to Kuwait’s water consumption. “When we use more and more water, we produce more and more wastewater, which can be used as a resource. For example, the Sulaibiya Plant, which was commissioned in 2005, is one of the biggest wastewater treatment plants in the world. It uses Reverse Osmosis (RO) technology on top of the primary, secondary and tertiary treatments, which include mechanical treatment, then biological treatment and chemical treatment. If you use RO on top of the tertiary treatment, you will have water that is better than water from the tap.”

However clean this water may be, Dr. Kotwicki acknowledges the fact that many people would be unwilling to drink wastewater that has been converted to pure water, no matter how clean it may be. Surprisingly, this water is so pure that even the majority of farmers prefer to not use it because of its lack of essential nutrients and minerals, which have to be added if it is to be used for agricultural purposes. What, then, can be done with this water?

“What we should do,” Dr. Kotwicki said, “is put this water in the
Dr. Kotwicki explained that putting fresh water back into the ground for a year or two cleanses it naturally and is referred to as “artificial recharge of groundwater.” Another term used to describe this practice is “water banking,” and its meaning is effective on two accounts. On one hand, governments are providing a valuable service by physically storing water in the ground for future use. Like money in the bank, this water acts as a security for future water needs. Artificial recharge of groundwater is extremely convenient because groundwater doesn’t evaporate like surface water and is naturally cleansed by the ground. Most importantly, it can be available for use in times of emergency. “If all desalination plants were to go out of commission, Kuwait would have 20 million m³ of water which would be sufficient for 10 days, maybe two weeks at the rate we are using now. If we stored more water in the ground, we would have a so-called ‘strategic reserve’ for the country which would be very good,” Dr. Kotwicki said. Given the fact that other major cities throughout the world measure their strategic reserves in years, compared to Kuwait’s strategic reserve of about 10 days, it would be an extremely beneficial undertaking to grow Kuwait’s emergency supplies through the artificial recharge of groundwater. Today, a pilot study is being conducted in the Al-Zaglah depression to evaluate the effectiveness of injecting water into the ground.

Water Mining
Desalination and artificial recharge are both viable options for the future that have been proven. However, there exists another method which Dr. Kotwicki acknowledges as more challenging, yet not totally out of the realm of possibility.

Dr. Kotwicki maintains that in the past, the climate was cool and wet on the Arabian Peninsula. Sea levels were 120 meters lower than they are today. In the Arabian Gulf, the maximum depth of the waters is a mere 90 meters, which means that as little as 7,000 years ago, the Arabian Gulf’s waters were dry land. Rivers from Iraq and throughout the Arabian Peninsula flowed into the sea, but they were also flowing underground into the sea, creating underground aquifers. Much of this water is thought to exist under the protection of layers of sediment in the Arabian Gulf. The possibility of tapping these underground water supplies in the Gulf remains lucrative, and may even guarantee the region’s growing thirst for water. In the United States, for example, New York is said to have an 800-year supply of similar water sources, and in Surinam, a supply for 200,000 years is said to be available. However, in order to turn the prospect of pumping fresh water from under the seabed into reality, much more exploration and research is needed.

The Uniqueness of Water
“All resources on this planet can be substituted. Different metals can be used in place of each other, plastic can be used instead of timber, but there is no substitute for water. It is the only thing that has no substitute whatsoever,” said Dr. Kotwicki.

As a proponent of educating the general public so that we may be better prepared to face our future water needs, Dr. Kotwicki has made efforts throughout his career to create water awareness. His latest book, Water on Earth, is a valuable tool for information regarding the role of water on Earth and its use by man, with a special emphasis on water usage in Kuwait.
A new type of tightly controlled light wave may be able to eliminate signal loss in on-chip optical devices. An international, Harvard-led team of researchers have demonstrated a new type of light beam that propagates without spreading outwards, remaining very narrow and controlled along an unprecedented distance. This "needle beam," as the team calls it, could greatly reduce signal loss for on-chip optical systems and may eventually assist the development of a new class of powerful microprocessors. Based at the Harvard School of Engineering and Applied Sciences (SEAS) and the Laboratoire Interdisciplinaire Carnot de Bourgogne, CNRS, in France, the applied physicists both characterized and created this needle beam, which travels efficiently at the interface of gold and air. The needle beam arises from a special class of quasiparticles called surface plasmons, which travel in tight confinement with a metal surface. The metallic stripes that carry these surface plasmons have the potential to replace standard copper electrical interconnects in microprocessors, enabling ultrafast on-chip communications. The so-called needle beam, the technical term for which is a cosine-Gauss plasmon beam, propagates in tight confinement with a nanostructured metal surface. One of the fundamental problems that has so far hindered the development of such optical interconnects is the fact that all waves naturally spread laterally during propagation, a phenomenon known as diffraction. This reduces the portion of the signal that can actually be detected.

First All-optical Nanowire Switch Created

Laser light is emitted from the end of a cadmium sulfide nanowire.

Computers may be getting faster every year, but those advances in computer speed could be dwarfed if their 1’s and 0’s were represented by bursts of light, instead of electricity. Researchers at the University of Pennsylvania have made an important advance in this frontier of photonics, fashioning the first all-optical photonic switch out of cadmium sulfide nanowires. Moreover, they combined these photonic switches into a logic gate, a fundamental component of computer chips that process information. The research was conducted by associate professor Ritesh Agarwal and graduate student Brian Piccione of the Department of Materials Science and Engineering in Penn’s School of Engineering and Applied Science. The research team’s innovation built upon their earlier research, which showed that their cadmium sulfide nanowires exhibited extremely strong light-matter coupling, making them especially efficient at manipulating light. This quality is crucial for the development of...
Following a traumatic head injury, a cascade of secondary problems can occur. Cells start to release excessive amounts of a toxic free radical, superoxide (SO), into the blood. It causes inflammation and overwhelms the brain's natural defenses. Limiting the amount of SO after brain injury is key to effective emergency treatment and full recovery of trauma patients. On this premise, US researchers from Rice University and Baylor College of Medicine have developed carbon nanoparticles that are capable of immediately destroying thousands of SO molecules at once. This is a major medical breakthrough considering our body's natural SO neutralizer, superoxide dismutase (SOD), can interact with just one SO molecule at a time. The nanoparticles developed by the researchers are called combined polyethylene glycol-hydrophilic carbon clusters (PEG-HCC). They are known antioxidants because of the way they interact with free radicals and are already being tested to enhance cancer treatment. They have also been shown to restore cerebral blood flow in animal studies of brain trauma. The researchers have repeated the tests three times and obtained the same results. They plan on getting another laboratory to replicate the study to show that neurological function is definitely improved following the treatment. In future studies they hope to devise a method of getting the nanoparticles to target specific cell types that are affected after trauma and also hope to elucidate the precise mechanism of action of these promising carbon compounds.

Voyager 1 Soon To Be First Man-Made Object to Leave the Solar System

Thirty-five years ago, NASA launched a spacecraft known as Voyager 1 into the skies over Florida. That space-traveling appliance has now traveled farther than any other man-made device - some 11.3 billion miles or 121 times the distance between Earth and the sun. It is now hurtling through the boundary of our heliosphere (the farthest reaches of our sun's winds) at a speed of 38,000 miles per hour. Soon, nobody quite knows when, it will break into interstellar space, the first creation of life here on Earth to do so. Less than two weeks after Voyager 1 launched in 1977, it was already 7.25 million miles away. (The moon, for comparison, is just 238,900 miles from Earth.) When NASA's Voyager 1 and Voyager 2 first rocketed out of Earth's grip in 1977, no one knew how long they would live. Now, they are the longest-operating spacecraft in history and the most distant, at billions of miles from Earth but in different directions. Cameras aboard the Voyagers were turned off long ago. The nuclear-powered spacecraft, about the size of a subcompact car, still have five instruments to study magnetic fields, cosmic rays and charged particles from the sun known as solar wind. They also carry gold-plated discs containing multilingual greetings, music and pictures - in the off-chance that intelligent species come across them. Since 2004, Voyager 1 has been exploring a region in the bubble at the solar system's edge where the solar wind dramatically slows and heats up. Over the last several months, scientists have seen changes that suggest Voyager 1 is on the verge of crossing over. When it does, it will be the first spacecraft to explore between the stars. Space observatories such as the Hubble and Spitzer space telescopes have long peered past the solar system, but they tend to focus on far-away galaxies.
The importance of heavy oil within the oil industry, and particularly within the State of Kuwait, is increasing as light crude reserves dwindle, the price of oil increases, and new technology eases the difficulties of producing and refining. In fact, KOC plans to have 900,000 barrels per day, or nearly a quarter, of its planned capacity of four million barrels per day by 2020 coming from heavy oil.

**What is Heavy Oil?**

Although the words heavy and viscous are often used interchangeably when referring to
heavy oil, density and viscosity are not related. Heavy oils are, however, more dense than regular crude and any oil with an API of less than 22 is considered to be heavy, while an API of less than 10 is considered super-heavy. The density of heavy oil is due to an increased number of carbon atoms in the oil molecules themselves (high molecular weight) as well as the presence of additional molecules such as inorganic salts, asphaltenes, naphthenes, paraffins, and metals. Heavy crude is formed as a result of the biodegradation of light crude as bacteria consume the lighter ends and leave the heavier hydrocarbons.

**Where is Heavy Oil Found?**

Heavy oil is found around the world in over 30 countries, with the largest reserves off the coast of Venezuela and in the Canadian province of Alberta; according to the Society of Exploration Geologists (SEG) the two countries together control almost 80% of known heavy oil reserves. Over 900 billion barrels of heavy oil are known to exist in the Middle East. The tar sands of Canada contain super heavy oil that does not flow at all, and as a result, the oil is mined in massive open pits.

**How Cost Effective is it to Produce Heavy Oil?**

The current high price of crude oil makes it economically viable to develop heavy oil reservoirs. However, other factors must also be considered, included the availability and cost of fresh water, energy usage and environmental impact. The production and processing of heavy oil uses more energy and produces more emissions of GHG and CO2 (due to the higher proportion of carbon to hydrogen in the oil molecules). In addition, heavy oil often contains impurities such as sulfur, vanadium, and other heavy metals, which are costly to remove. According to the California Independent Petroleum Association, the price spread between light and heavy crude is approximately US $12.50 per barrel. The National Energy Board of Canada calculates the operating cost (not including cost of capital, taxes, or royalties) of steam-based recovery techniques to be CDN $10-14 per barrel compared with cold recovery techniques which cost CDN $6-10 per barrel.

**What Technology is Used to Extract Heavy Oil?**

The extraction of heavy oil depends on the characteristics of the oil and each individual reservoir; what works in one may not work in another. That being said, there are several “standard” technologies in use with steam injection, either cyclic steam simulation (CSS) or steam-assisted gravity drainage (SAGD), being the most common.

CSS is also known as “huff and puff” and relies on a single tunnel to inject steam into the reservoir and consequently remove the liquefied bitumen. This technology is relatively old and is being gradually replaced by SAGD, which uses horizontal drilling with two drill holes, one above the other two. Steam is then injected in the upper hole and the liquefied bitumen is pumped through the lower hole to the surface. This method is not only more efficient than CSS, but it also allows for continuous recovery of oil.

An experimental technology which also uses horizontal tunnels is the vapor extraction process (VAPEX). Ethane or butane are used to dissolve, rather than heat, the bitumen and although operation costs are lower than SAGD, the technique requires more tunnels. Toe to heel air injection (THAI) is another experimental technique which uses combustion to liquefy the bitumen, which is then collected and brought to the surface.

**What is the foreseeable future for heavy oil?**

Experts predict that while the production of light and medium crude will remain level or even decline, production of heavy oil will grow gradually as demand for oil increases. Since supply will not be able to keep up with demand, the gap will need to be filled by gas liquids, biofuels, GTL, and CTL.

**Heavy Oil and KOC**

Heavy oil with an API of 11-17 is known to exist in the KOC fields in the South East and West (Burgan and Umm Gudair and the Neutral Zone) and in the North (Ratqa), with the North showing the most promise. In order to cope with the refining of heavy oil, KOC will have to increase refining capacity. The importance of heavy oil to Kuwait’s oil industry will increase over time as traditional oil reserves diminish, demand for oil increases, and new technology makes the production of heavy oil more feasible.
C&MD Sami Al-Rushaid recently expressed satisfaction over the launching of a new project that he said “would enhance the KOC strategy to produce 4 million barrels of oil per day and contribute to the expansion of relevant export operations.”

In a speech he delivered upon the signing of a roughly 140 million Euro (approximately KD 50 million) contract with the Dutch Damen Shipyards Gorinchem to purchase 14 tugboats, Al-Rushaid added that the new project was intended to meet the need to expand oil exports as a result of increasing output.

The C&MD said he was pleased to know that the tugboats already in operation within KOC for the past 25 years were also built by Damen Shipyards and that he was glad to see this tradition continue through the signing of the new contract. He expressed hope that the shipbuilding company would observe the contract provisions within the agreed period of 35 months.

Meanwhile, Dutch Damen’s Area Director for the Middle East, Martin de Bruijn, labeled the project as a major and unique one and said that its importance lies in the continuation of the fruitful cooperation for over 25 consecutive years with a company of the caliber of KOC. He also said that he was pleased to be part of such a huge strategic program for the next 25 years and beyond.

He also maintained that the technical staff in Holland was ready to begin the implementation of the contract and to provide the necessary training to build a promising future of mutual cooperation.

The contract was signed for KOC by the Acting Marine Operations Manager, Hasan Al-Bairami, and for Damen Gorinchem by the Sales Manager Middle East, Boran Bekbulat.

About Damen

The two Damen brothers Jan and Rien started the company in a shed next to the family home in 1922. Five years later they formalized the company as Damen Brothers. It remained a small but prominent boat builder until Kommer Damen joined the company. In 1969 Kommer Damen purchased the company from his father and introduced the modular shipbuilding concept in the building of small boats and launches. This concept of standardization (now called The Damen Standard) has evident advantages such as shorter delivery times, reduced costs and proven designs. The concept was an immediate success and in 1973 the expansion of Damen Shipyards in Gorinchem began.

Damen kept on growing gradually and soon the group started exporting. Because Gorinchem was strategically placed for the dredging industry, auxiliary equipment and workboats were built. The Damen dredging workboats quickly became the standard in many foreign markets and Kommer Damen saw the opportunity to export. Later on, Kommer Damen took over numerous yards specialized in niche markets where he saw an opportunity to invest. And Damen started partnerships and business cooperations with yards all over the world.

Today the company has more than 6,000 employees working at 35 companies worldwide. Since the introduction of modular shipbuilding (The Damen Standard), Damen has built over 5,000 vessels and annually up to 150 vessels are built. At dedicated

A group photo was taken on the conclusion of the ceremony, and Damen’s Area Director for the Middle East presented C&MD Al-Rushaid with a picture representing the tug boats.
shipyards strategically located all over the world. Damen carries out the mass production of standard hulls for certain popular vessel types. Damen Shipyards operates in many shipbuilding sectors and has become a prominent and recognized shipbuilder throughout the world.

**A Brief Look at Tugboat History**

The use of steam power to propel ocean vessels began to make its way onto the world scene in the late 1700s, and by the early 1800s, riverboats were being fitted with steam engines. The steam engine quickly became the most efficient and widely used way to propel boats. In March of 1802, William Symington of Scotland made history by fitting his patented steam engine on his paddlewheel boat, which he had named the “Charlotte Dundas.” By doing so, Symington had created the world’s first official tugboat.

On her maiden trip, the Charlotte Dundas, with her 10 horsepower steam engine, carried 20 passengers and pulled two loaded barges 19 1/2 miles along the Forth & Clyde Canal near Glasgow, Scotland. This six-hour trip was the only journey she took. Canal proprietors, fearing she would erode the canal banks with the paddlewheel, banned paddle wheelers on the canal. So, the Charlotte Dundas was left sitting where she stopped. Five years later, American Engineer Robert Fulton brought the steamboat to North America. Though steamboats were initially used for passenger carry, the potential and profitability for towing was quickly realized. In 1825, the Rufus King was built specifically for towing sailing ships into the New York harbor. Within 10 years, towing operations were in ports around the world assisting ships in and out of harbors, rivers and canals. The fierce competition for assisting led to the additional practice of salvage work. By the mid 1800s, more and more freight was being moved on the waterways, so the practice of using barges also came into use. To improve efficiency, ship designers began experimenting with other forms of propulsion. Screw propellers were adopted by tugs in the 1870s. Their metal blades provided much more power than paddlewheels. Iron and steel hulls were becoming more common. The size and ability of tugs began to support these new propellers. Companies then started building larger tugs and expanding into ocean salvage work. When the diesel engine showed up on the ship building scene, things were forever changed. Diesel was lighter and cheaper to run and the boats needed fewer crewmembers. Although steam engine powered tugs stuck around until the 1950s, by then most had been converted to diesel.

Both World War I and II brought a surge in tugboat building and the need for them in the war efforts. By WWII, new upgrades in ship design, propulsion technology, communication and navigation equipment fueled the tugboat business. There of course is always a downside. This modernization of the tugboat as well as other factors in the shipping industry led to the decline in the number of ships needed.

Today, as few as two or three tugboats can maneuver even the largest of ships in and out of harbors. New approaches to towing barges have allowed them to be more effectively towed on the open seas. Tug and barge operations can carry such large loads at cheaper rates than they can even compete with cargo ships. Yet despite the decreases in tugs needed to do the work today, the builders are still building. Newer, bigger, stronger ships are always needed for the various river, harbor and ocean work. And the older, very well built tugs of yesterday are upgraded and refitted to do their share of the load as well.
Asthma is a chronic lung disease that inflames and narrows the airways. Asthma causes recurring periods of wheezing (a whistling sound when you breathe), chest tightness, shortness of breath, and coughing. The coughing often occurs at night or early in the morning.

Asthma affects people of all ages, but it most often starts during childhood. Recent reports indicate that an estimated 15 percent of the Kuwaiti population, an equivalent of 450,000 citizens and residents, suffer from asthma.

Overview
To understand asthma, it helps to know how the airways work. The airways are tubes that carry air into and out of your lungs. People who have asthma have inflamed airways. This makes them swollen and very sensitive. They tend to react strongly to certain inhaled substances.

When the airways react, the muscles around them tighten. This narrows the airways, causing less air to flow into the lungs. The swelling also can worsen, making the airways even narrower. Cells in the airways might make more mucus than usual. Mucus is a sticky, thick liquid that can further narrow the airways. This chain reaction can result in asthma symptoms, which can happen each time the airways are inflamed.

Understanding Asthma

Asthma
Figure A shows the location of the lungs and airways in the body. Figure B shows a cross-section of a normal airway. Figure C shows a cross-section of an airway during asthma symptoms.

Sometimes asthma symptoms are mild and go away on their own or after minimal treatment with asthma medicine. Other times, symptoms continue to get worse. When symptoms get more intense or more symptoms occur, you’re having an asthma attack. Asthma attacks also are called flareups or exacerbations. Treating symptoms when you first notice them is important. This will help prevent the symptoms from worsening and causing a severe asthma attack. Severe asthma attacks may require emergency care, and they can be fatal.

What Causes Asthma?
The exact cause of asthma isn’t known; however, researchers think some genetic and environmental factors interact to cause asthma, most often early in life. These factors include:

- An inherited tendency to develop allergies, called atopy
- Parents who have asthma
- Certain respiratory infections during childhood
- Contact with some airborne allergens or exposure to some viral infections in infancy or in early childhood when the immune system is developing

If asthma or atopy runs in your family, exposure to irritants (for example, tobacco smoke) might make your airways more reactive to substances in the air. Some factors might be more likely to cause asthma in certain people than in others. Researchers continue to explore what causes asthma.

Who Is at Risk for Asthma?
Asthma affects people of all ages, but it most often starts during
childhood. Young children who often wheeze and have respiratory infections - as well as certain other risk factors - are at highest risk of developing asthma that continues beyond 6 years of age. The other risk factors include having allergies, eczema, or parents who have asthma.

Among children, more boys have asthma than girls. But among adults, the disease affects men and women equally. It's not clear whether or how sex and sex hormones play a role in causing asthma. Most, but not all, people who have asthma have allergies. Some people develop asthma because of contact with certain chemical irritants or industrial dusts in the workplace. This type of asthma is called occupational asthma.

What Are the Signs and Symptoms of Asthma?

Common signs and symptoms of asthma include:

• Coughing. Coughing from asthma often is worse at night or early in the morning, making it hard to sleep.

• Wheezing. Wheezing is a whistling or squeaky sound that occurs when you breathe.

• Chest tightness. This may feel like something is squeezing or sitting on your chest.

• Shortness of breath. Some people who have asthma say they can't catch their breath or they feel out of breath. You may feel like you can't get air out of your lungs.

Not all people who have asthma have these symptoms. Likewise, having these symptoms doesn't always mean that you have asthma. The best way doctors have to diagnose asthma is to use a lung function test, ask about medical history (including type and frequency of symptoms), and do a physical exam.

How Is Asthma Treated and Controlled?

Asthma is a long-term disease that has no cure. The goal of asthma treatment is to control the disease. Good asthma control will:

• Prevent chronic and troublesome symptoms, such as coughing and shortness of breath

• Reduce your need for quick-relief medicines

• Help you maintain good lung function

• Let you maintain your normal activity level and sleep through the night

• Prevent asthma attacks that could result in an emergency room visit or hospital stay

Asthma is treated with two types of medicines: long-term control and quick-relief medicines. Long-term control medicines help reduce airway inflammation and prevent asthma symptoms. Quick-relief, or "rescue," medicines relieve asthma symptoms that may flare up.

Your level of asthma control can vary over time and with changes in your home, school, or work environments. These changes can alter how often you're exposed to the factors that can worsen your asthma.

Your doctor may need to increase your medicine if your asthma doesn't stay under control. On the other hand, if your asthma is well controlled for several months, your doctor may decrease your medicine. These adjustments to your medicine will help you maintain the best control possible with the least amount of medicine necessary.

Asthma treatment for certain groups of people—such as children, pregnant women, or those for whom exercise brings on asthma symptoms—will be adjusted to meet their special needs.
The AWARE Center recently hosted a presentation by Dr. Teresa Lesher which focused on presenting introductory information about the Quran, Islam's Holy Book. Dr. Lesher was born and raised in the United States but has lived her adult life in the Middle East, where she is an Associate Professor of Information Science. Dr. Teresa holds her PhD in Information Science from the UK and teaches at the Kuwait College of Basic Education. She held the position of General Manager of the AWARE Center for three years and returns often to host presentations related to Arab and Islamic culture. She has spent the last 30 years as a Muslim focusing on the study of the Quran.

During the AWARE Center Diwaniya Event, Dr. Lesher told the audience that the Holy Quran is one of the divine scriptures, with one major and fundamental difference. Although the Quran mentions the divine scriptures that Christians and Jews follow, what sets the Holy Quran apart from those scriptures is that the Holy Quran is considered the last testament and final version of divine revelation. In addition, the truly remarkable aspect of the Holy Quran is its original and unadulterated content. The Torah and the Bible were written by numerous individuals over different periods of time, and they have also been altered throughout history. The content of the Holy Quran, however, has remained intact and exactly as it was received since its beginning.

“The Holy Quran is considered a revelation from God, the Creator,” Dr. Lesher said. “It is a message that was received by the Prophet Muhammad (PBUH), who was responsible for conveying it to all of mankind. The exact wording of the Quran is essential in communicating the divine message, and the way the words in the Holy Quran are pronounced today is the exact same way in which they were heard by the Prophet Muhammad (PBUH).”

Composed of a collection of verses (Ayat) which make up 114 chapters (Suras), The Holy Quran is the central religious text of the Islamic faith which Muslims consider as the verbatim word of God. Revered by many as the finest piece of literature in the Arabic language, Dr. Lesher went on to say that Muslims believe that its text was revealed to the Prophet Muhammad (PBUH) through the angel Jibril over the course of 23 years beginning on December 22, 609, when Prophet Muhammad (PBUH) was 40, and concluding in 632, the year of his death. Before his death, the Prophet Muhammad (PBUH) specified the order of the placement of chapters (Suras) of the Holy Quran as told to him through divine instruction.

“At first glance, the Quran may appear fragmented or disorganized,” Dr. Lesher said, “However, it exceeds human conceptions of human organization. There is a purposeful organization to the Holy Quran which begs further study and contemplation.”
she said, adding that she liked to view the Holy Quran as a “gift” which, when unaveled, revealed richer and deeper meaning underneath its layers. What makes the gift of the Holy Quran even more valuable is the fact that there is only one version of it, and it has never been altered. Every single letter and diacritic mark is uniform across every single copy of the Holy Quran, which is quite an accomplishment considering the fact that it is the most widely printed book in the world.

**Lessons for All Mankind**

By reading and studying the Holy Quran, one can come to understand that Allah (SWT) addressed the Prophet Muhammad (PBUH) with various instructions, encouraged him to do or say certain things, and even reproached him on various occasions. While some of these instructions were directed specifically for Prophet Muhammad (PBUH), the underlying essence of the Holy Quran serves as a manual for guiding all of mankind and providing us with lessons about morality and spirituality. In part, the Quran provides instructions on how to conduct oneself as a son or daughter, parent, employee, or person.

“If you want to know how to be happy, I recommend reading the Holy Quran,” Dr. Lesher said. “Reading the Quran will allow you to discover patterns of instructions on how to be happy.” Dr. Lesher went on to say that studying the Holy Quran aids in the development of moral reasoning and spirituality. Thought processes such as logic and assimilation are also developed through study of the Quran, and reciting and memorizing the Quran is a common practice among Muslims which can help in keeping a sharp mind while increasing memory.

**Translations and the Language of the Quran**

Although Arabic was an established language at the time of the revelation of the Holy Quran, there is no doubt that it became more sophisticated and complex after its arrival. Before the Holy Quran, Arabic was rudimentary in nature; however, the language was refined thanks in great part to the diacritic rules that were introduced in the Quran. In addition, the Holy Quran encouraged higher thought and learning, as is evidenced in the meaning of the name of the Quran itself, which relates to the Arabic verb qara’a, meaning “he read” or “he recited.”

“Today, there are countless numbers of books in Arabic that discuss the meaning of various words, passages, and suras of the Quran,” said Dr. Lesher. “Arabic is a deep and rich language, so a single passage can have pages and pages of commentary.”

To understand this commentary, Dr. Lesher pointed out that it is of great benefit to understand the Arabic language itself, as no knowledge of the Holy Quran does it justice if it is not understood in its original language. “It is impossible to portray the Holy Quran’s depth, rhythm, connotations and subtlety in a different language other than Arabic,” she said, adding, “You can’t really call a translation the Quran, but only an approximation of the Quran. In translation, things are lost, and this is definitely true in the case of the Quran.”

After her presentation to the audience, Dr. Lesher invited those in attendance to take part in a diwaniya discussion of the Holy Quran, where audience members asked questions and engaged in thoughtful discussion about Islam’s holy book.

*The AWARE Center, which stands for Advocates for Western-Arab Relations, is a non-profit, non-governmental, and non-political organization that works towards promoting positive, constructive relations between Westerners and Arabs by organizing social activities and information services related to Arab and Islamic culture. In its mission statement, the AWARE Center states that it is dedicated to becoming the “Cultural gateway for Westerners to explore Arab/Islamic culture and civilization by facilitating social encounters, educational activities, dialogue, cultural exchange, and intercultural friendship.” Part of this goal is accomplished by hosting a new speaker every week.*

*Audience members listen to the presentation*
The Export Operations Group, in cooperation with the General Fire Service Directorate, recently organized an awareness campaign called “Nabiha Tosal” (We Want It To Reach Everywhere). The campaign was launched at several malls inside Kuwait with the aim of getting citizens and expatriates acquainted with fire hazards and the ways in which to prevent and fight them.

Group Manager Fadhel Boresle said that KOC was the first to undertake the responsibility of spreading awareness amongst different segments of society about the dangers of fires and the ways and means to prevent them and protect lives by efficiently organizing exhibitions, conducting presentations, issuing publications, holding contests and awarding prizes to participants from the public and private sectors.

Manager Boresle hailed the role of firefighters in serving their homeland and society, as well as their sacrifices to maintain security and safety for all, especially during emergency cases which require bravery and teamwork in the face of danger.

The Export Operations Group Manager Fadhel Boresle, HSE TL Mohammad Al-Basry, HR Officer Saad Al-Hajri, Occupational Health Specialist Abdul Raheem Al-Kandari, and Snr. Safety Engineer Ahmad Al-Fodari.

KOC employees and firefighters both took part in the awareness campaign.

Activities, including the Farwaniyah Firefighting Squad, the Technical Rescue, the Marine Rescue, the Dangerous Substances and the Prevention Sectors.

Those who took part in the campaign for the General Fire Service Directorate included the Deputy General Manager for Prevention & HR Development Brigadier General Yousef Al-Ansari, the Deputy GM for Financial & Administrative Affairs Brigadier General Khaled Al-Tarkeet, the Acting Director of the PR & Information Department Lt. Colonel Nasser Al-Ansari, and the Acting Awareness & PR Section Captain Yousef Al-Blooshi.

KOC was represented by EOG Manager Fadhel Boresle, HSE TL Mohammad Al-Basry, HR Officer Saad Al-Hajri, Occupational Health Specialist Abdul Raheem Al-Kandari and Snr. Safety Engineer Ahmad Al-Fodari.
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