The Kuwaiti Digest

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The Kuwaiti Digest

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Letter from the Editor

Qusai Al-Amer
Deputy Chief Executive Officer
Administration

As the heat from another Kuwaiti summer subsides and as we welcome the cooler weather of the fall season, it is our firm belief here at KOC that we are more prepared than ever to address the complex oil and gas challenges which lie ahead. While it may be true that the pace of life in Kuwait slows down somewhat during the summer months, it is nevertheless truly inspiring to see KOC employees remaining steadfast in their efforts to deliver on the same level of commitment to their duties as they do year-round. Therefore, I would like to take this opportunity to extend my sincere thanks and appreciation to all employees and contractors who continue to display high levels of professionalism, responsibility, and integrity as they uphold their duties to the Company and Kuwait.

In the pages that follow, readers will find a number of stories related to the Company's progress and development over the last quarter. Our lead story for this issue covers the recent "Connect Energy Kuwait" event, which witnessed the participation of H.E. the British Ambassador to Kuwait Michael Davenport, KOC CEO Emad Mahmoud Sultan, senior Company officials, and a wide range of visiting delegations from the UK's Oil and Gas business community. This important event came at a notable point in the State of Kuwait and KOC's history, as it marks the 120th anniversary of the signing of the 1899 Treaty of Friendship with the UK and KOC's 85th anniversary. In addition to our lead story, which focuses on the areas where Kuwait and the UK are working together for the benefit of our operational plans, this issue of *The Kuwaiti Digest* also features special reports which offer a glimpse into how our Company is making progress throughout all areas of KOC's activity in the field and beyond.

In regard to KOC operations, the Company has made enormous strides in terms of completing major projects and ensuring we are on the road to excellence. Readers will find articles in the pages that follow which are dedicated to shedding light on the progress KOC is making throughout the areas of our operations, from detailed technical submissions which highlight new breakthroughs in the field to articles which aim to streamline administrative functions in the office. This issue also features stories which all employees can benefit from in some shape or form. I therefore encourage everyone to spend some time with these articles in order to discover how each of you can apply these lessons learned in your respective fields of work.

At KOC, our unwavering commitment to the safety of our personnel and natural environment remains uncompromised, which is highlighted by the recent publication of a KOC book titled *Restoring the Nature of Kuwait*. This book, which was created in collaboration with the Kuwait Institute for Scientific Research, is an important resource for those wishing to learn more about the progress that has been made through the Kuwait Environmental Remediation Program (KERP). In addition, our commitment to safety extends far beyond our concern for bodily or environmental harm, as we must now remain fully committed to the protection of our information security as well, which readers can learn about in a special article which covers KOC's first Cyber-Security event.

In closing, I would like to encourage all employees to continue working toward the goals of our 2040 Strategy while remaining dedicated to the protection and health of our fellow employees and the Kuwaiti population as a whole. Our commitment to our 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.

KOC Hosts "EIC Connect Energy Kuwait 2019"

Connect Energy, a collaborative initiative organized by KOC, EIC, and the UK's Department for International Trade, featured discussions which focused on how to strengthen the close relationship between Kuwait and the UK.

As part of an effort to further develop Kuwait's strong relationship with the United Kingdom, KOC recently hosted the "Energy Industries Council (EIC) – Connect Energy Kuwait 2019" event at the Ahmad Al-Jaber Oil & Gas Exhibition.

The event, which was held under the patronage of His Excellency Michael Davenport, the British Ambassador to Kuwait, also featured the participation of Simon Penney, the UK's Trade Commissioner for the Middle East, Afghanistan & Pakistan, and KOC CEO Emad Mahmoud Sultan. Stuart Broadley, EIC CEO, and members from the British diplomatic staff in Kuwait and visiting trade delegations from the UK were also in attendance. Senior KOC officials such as Qusai Al-Amer, DCEO Administration, Bader Al Attar, DCEO Planning & Finance, Ali Al-Kandari, DCEO North Kuwait, and Bader Al-Munaifi, DCEO South & East Kuwait, were present during the event.

Connect Energy, a collaborative initiative organized by KOC, EIC, and the UK's Department for International Trade, featured discussions which focused on how to strengthen the close relationship between Kuwait and the UK, especially in the fields of commerce, business, and industry.

KOC CEO Emad Sultan delivered the event's opening remarks

KOC CEO Emad M. Sultan, H.E. the British Ambassador Michael Davenport, and senior officials stand for the National Anthem of Kuwait.

by extending a warm welcome to the guests, especially to those from the British diplomatic and business community who made the journey to Kuwait. In his speech, the KOC CEO said that the long and close relationship between the State of Kuwait and the United Kingdom was one that is rich with history, adding that the story of Kuwait could not be told without mentioning the United Kingdom and the immense role it played in shaping modern Kuwait.

"KOC, for example, is the primary engine on which the State of Kuwait's economy runs, and this is a company that was founded by the British in 1934," the CEO said, adding, "While Kuwait has undergone a massive transformation since the 1930s, our relationship with the United Kingdom remains as strong as ever, and today, we seek to build even further on the close cooperation that exists between our two countries in the energy sector and beyond."

The CEO went on to say that, in part, the goal of the Connect Energy event was to facilitate the exchange of knowledge and expertise. "Today, the State of Kuwait and KOC are seeking to expand our knowledge and expertise as we prepare to tackle the challenging projects which lie ahead. From heavy oil in North Kuwait to the protection of our cyber security, and from enhanced oil recovery techniques to the new frontier of offshore production from Kuwait's territorial waters, KOC is looking for the best that the international oil and gas industry has to offer. Time and again, the best the world has to offer often comes from the UK - so we are very honored to have all of you here with us today," he concluded.

His Excellency the British Ambassador to Kuwait Michael Davenport then addressed the audience and said, "This event is an example of our commitment. Here today we have around 50 British companies that lead the world in areas such as exploration, cyber security, digitalization, and artificial intelligence. In March of 2019, we saw the signing of a Memorandum of Understanding between UK Export Finance (UKEF) and KPC. This event will do much in the way of introducing British companies to the opportunities on offer in Kuwait and the facilities that UKEF offer. I look forward to a continuation of our partnership and many similar events that bring new technologies, innovation, and expertise together in a sector that is at the heart of Kuwait's economy, for a long time to come."

The Ambassador went on to say that this event hosted by KOC was the first EIC Connect event with the UK, and he thanked KOC for its support and sponsorship. He also noted that this event was especially remarkable because it came at a time when the State of Kuwait and the UK were observing the 120th anniversary of the signing of the 1899 Treaty of Friendship. A fact, the Ambassador maintained, which demonstrates that the close relationship between the two countries extends far before the discovery of oil was even made.

H.E. Michael Davenport then said that Kuwait and the UK have stood together in the face of challenges and supported each other during times of need. He also elaborated on other aspects of the bond which exists between the two countries which extend beyond the oil sector, such as how Britain serves as a home away from home for many Kuwaitis. He also maintained that Kuwaitis have invested much in the UK, and there are more Kuwaitis studying in the UK than anywhere else in the world. He further upheld this strong relationship by discussing common interests between the two coun-

KOC CEO Emad M. Sultan

H.E. the British Ambassador Michael Davenport

tries, such as safeguarding shipping in the Gulf, and protection against external threats.

In his speech to the audience, the Ambassador added that Kuwait is an important market for the UK, which is partially due to the fact that Kuwait is one of the ten fastest growing export markets in the world. He then praised the participation of KOC's Commercial Teams in an EIC event in Manchester in November 2018, which was followed by a successful event in Aberdeen. He also discussed the UK's role in helping to modernize the Kuwaiti oil sector and increasing capacities for production, and he referred to a utilization and storage event set to take place soon which he hoped both sides could benefit from.

The Ambassador concluded his speech by encouraging the organizers to ensure events like Connect Energy occur on an annual basis before wishing everyone a productive session and fruitful discussion.

Simon Penney, Her Majesty's Trade Commissioner for the Middle East, Afghanistan & Pakistan, was then welcomed to the stage. In his address, Penney said, "Our trading partnership is broad, spanning across multiple sectors from healthcare and education to energy and retail. Annual bilateral trade between the UK and Kuwait has increased by 1.7% year on year. UK exports to Kuwait have increased by 12.3% in the same period, showing that there is a great appetite for British goods and services here."

Penney went on to say that the Gulf is the UK's second largest export market in the world, which is why the UK is very interested in further developing its business relationship with Kuwait. UK brands and institutions are also thriving in Kuwait, he added; however, the oil sector is where the partnership is strongest. He then explained that the UK has been challenging methods of extraction and production, while maintaining a deep commitment to research and development.

The Trade Commissioner then ended his speech by providing prominent examples of Kuwaiti projects in the oil sector that the UK has been working on, such as projects in the North Sea and sustainability and environmentally friendly applications for the field. This cooperation has been made possible by sharing cutting edge knowledge through close partnership, he concluded.

Stuart Broadley, CEO of EIC then addressed the audience. He thanked KOC CEO Emad Sultan for sponsoring the event and explained that there were approximately 50 UK companies in attendance. Founded in 1943, his company was created to help British companies make headway in the international energy sector. Since its inception, it has helped investors insert about $500 billion in energy-related projects.

Broadley went on to say that Kuwait is an important market for companies based in the UK. Some of the companies which he mentioned as being present at the event included Roxtec, OR&A, Petrofac, and GAC, with Al-Rashid and Al-Ghanim International from Kuwait providing one-on-one opportunities, in addition to KOC. He then thanked them for their support, adding that the event took a year of hard

work to organize and would not have been possible without collaborative effort.

The event was then opened for presentations and discussions. Simon Hosking, Cyber Representative to the Gulf from the UK Solution for Protection of Oil Assets, delivered the first presentation, which covered ways to address security challenges. He provided an example of the cyber-attack on Aramco in 2012, which led to extensive losses, and how to avoid such attacks. He maintained that cyber sabotage was a real threat and explained why the oil sector is particularly vulnerable. He went on to explain the difference between IT and OT and why having a connection between the two could pose a threat to companies in the oil sector.

Tim Palmer, Deputy Head of Civil, Infrastructure and Energy Projects in UKEF, followed. He discussed the memorandum of understanding signed with KPC and its subsidiaries, with an aim to increase exports. He provided examples of his company's projects and initiatives, including the Clean Fuels Project in Kuwait, and other projects in Malaysia, Oman and Mozambique, that were made possible with export finance support.

The event then saw a presentation from Faisal Hasan, Senior Planner from the Strategic Planning Team, who talked about KOC's effort to maintain its world-class level of excellence. In part, he explained the importance of achieving balance between maximizing production while maintaining sustainability.

Yousef Sabri, KOC Planning Specialist, then took the stage and shed light on how KOC projects are carefully planned and budgeted. He also talked about the KOC Business Operating System and the Enhanced Capital Allocation program.

The event's following session was titled: "Doing Business in Kuwait (Registration, Procurement, Pre-Qualification, Legal Requirements)". The Kuwait Direct Investment Promotion Authority (KDIPA) led the way by taking the stage to explain why Kuwait was a lucrative market for investment. The representative from KDIPA explained her company's facilitating procedures in order to clarify some of the requirements which are necessary for conducting business in Kuwait.

Meanwhile, KOC's Mosab Al-Ali discussed eBusiness, registration, tenders, and bids. He then opened a Q&A session with the audience. This was followed by Mansour Abdullah delivering a presentation in which he discussed pre-qualified contractors.

The following session of the event featured contractor updates from Wood and Alghanim International. Chris Humphrey, Operations Director of Wood in Kuwait, launched this session by thanking EIC for providing him with an opportunity to share information. He then discussed Wood's projects in Kuwait and the region, while also discussing some of their key projects and future opportunities.

The next presentation was provided by Colin McKenzie, Group President, Energy, from Alghanim International. He provided a brief overview and history of his company, and the different sectors it covers. Meanwhile, contractor updates from Petrofac and others took place before a panel discussion was held, where participants discussed the best ways in which companies from the UK can do business in Kuwait.

EIC Connect Energy Kuwait 2019 provided a valuable service for KOC and the State of Kuwait by creating a forum where individuals were able to meet first-hand and learn more about the best the UK supply chain has to offer.

KOC Organizes 1st Cyber Security Conference

KOC recently organized its first information security conference, which took place at the KOC Tent in Ahmadi. The event, held over the course of two days, included the attendance of KOC CEO Emad Mahmoud Sultan and a host of international experts who specialize in the field of information security.

Senior K-Company officials attended the event's opening ceremony.

The KOC Cyber Security Summit opening ceremony was attended by a number of KOC DCEOs, Group Managers, and Team Leaders, in addition to officials from other K-Companies, members of the Cyber Security Committee in the oil sector, ministry representatives and officials, guests from other GCC countries, and a number of international guests and presenters.

During the event, the KOC CEO delivered two speeches. The first was delivered during the opening ceremony, where Sultan welcomed those in attendance and said that the conference would mark the beginning of a series of activities which the Company intends to organize in the field of information security.

"As we are all aware, international cyber threats are becoming increasingly more sophisticated and complex in nature. Every day, we hear about new types of cyber-attacks that have impacted many organizations in all sectors. These incidents do not just cause losses of billions of dollars; they also have an impact on national critical infrastructures, economic activity, and regional connectivity," the CEO said, adding, "This two-day summit has assembled an array of high-profile experts in cyber security from various organizations across the globe, with an aim of strengthening cyber security awareness and creating an emphasis on knowledge transfer to assist in building the next generation of national cyber security professionals."

> The summit aimed to put Kuwait on the regional and international map in terms of cyber security preparedness by assembling an array of high-profile experts in cyber security from various organizations across the globe.

The CEO went on to say that KOC is committed to social responsibility in all forms, including identifying and empowering the cyber security leaders of the future, which is in line with Kuwait's vision of preparing the country's youth for the challenges of tomorrow.

"This summit aims to put Kuwait on the regional and international map in terms of cyber security preparedness. In addition, we believe this event will do much in the way of identifying and developing the immense potential within our local talents to address the global shortage of cyber security professionals and capabilities," the CEO said.

To conclude his speech, the CEO reviewed the significant benefits, new knowledge, and lessons learned that the conference would focus on, adding that the conference would greatly assist in the creation of a safer cyber security environment for Kuwait. He also reiterated one of the strong themes of the event, which was that "cyber security is everyone's responsibility."

Following the CEO's speech, a number of presentations from international cyber security specialists were delivered to the audience. In general, the presenta-

KOC CEO Emad M. Sultan addresses the audience.

tions addressed the risks posed by cyber-attacks, the means to combat them, and how to maintain the security of KOC's information and data. They also touched on how to build capabilities from the ground up, in addition to shedding light on the recent cyber-attacks which occurred in the Middle East.

Robert Lee, CEO of Dragos Inc., delivered a presentation at the event titled: "The Industrial Cyber Threat Landscape." In his presentation, Lee shared a number of case studies which included attacks on Supervisory Control and Data Acquisition systems, or SCADA.

Lee told the audience that hacking is the first step required in the process of carrying out cyber-attacks on industrial control systems. He also informed the audience that in addition to causing damage to information systems, some attacks had the dangerous potential to injure employees working in facilities. In this regard, he cited an example of a group of hackers who attacked the safety systems of a factory that were designed to ensure the safety of employees. The Dragos CEO then said that defense was often not enough when addressing an attack that is initiated in the virtual world, and that sometimes countermeasures are required to fend off attacks and protect the safety of an organization's systems.

Following Robert Lee's presentation, Chris Roberts of Attivo Networks, a prominent international expert who specializes in developing safety measures against hacking, delivered a presentation titled: "A Hacker Perspective: Where Do We Go From Here?" In his presentation, Roberts revealed the fact that firewalls do not always provide complete protection against outside attacks. He went on to say that going back to the basics of information security is often the best solution. In this regard, he said that a simple matter such as weak passwords were one of the greatest weaknesses of all organizations in terms of information security shortcomings.

The first day of the conference also featured a "Capture the Flag" cyber security competition. Approximately 40 contestants who were divided into 10 teams took part in the competition, which aimed to refine and develop local talents and address the issue of an international shortage of specialized cyber security professionals. The number of Kuwaiti participants exceeded 70%, which is an indication of the promising presence of young individuals from the local community who are capable of filling the future roles Kuwait will require in the field of cyber security.

The second day of the conference began with an opening speech from Dr. Reem Al-Shammari, Team Leader Information Secu-

Robert Lee, CEO of Dragos Inc., delivers his presentation.

rity. In her speech, Al-Shammari provided an overview of the conference's highlights and discussed the importance of cyber security for an organization like KOC. She also commended the Company's senior leadership for supporting this initiative, which she said was necessary in order to ensure KOC was protected from outside attacks which could have the potential to disrupt Company operations.

Meanwhile, Mohammed Al-Doub, Consultant and Information Security Specialist, delivered a presentation titled: "From Zero To Hero in Cyber Security." Al-Doub advised attendees in the audience who were thinking about learning more about cyber security to focus on one specific field instead of many. This, he said, would help them achieve excellence and become experts in their respective fields.

Following Al-Doub's presentation, Maher Yammout, Security Researcher from the Global Research and Expert Analysis Team (GREAT) at Kaspersky, delivered a presentation which focused on Advanced Persistent Threats (APTs), which is a reference to long-term attacks on targeted systems which attempt to gain access to sensitive information.

In his closing speech at the conference, KOC CEO Emad Sultan said that it was his hope for the conference to serve as a catalyst for positive change in terms of how the Company approaches issues related to cyber security. He then thanked the event's organizers and participants, noting that the speakers played a crucial role in creating a high level event which focused on critically relevant topics. The CEO then commended the winners and participants of the "Capture the Flag" competition and wished them luck in future international competitions. He concluded his speech by telling the audience he was confident that, through teamwork and perseverance, KOC would be able to address the cyber security challenges which lie ahead.

Several teams from KOC participated in organizing the events of the conference, including the Information Team, the Public Relations Team, the Community Services Team, and the Information Technology Services Team.

About KOC's 1st Cyber Security Conference

All modern organizations, – in the governmental and private sectors alike – collect, process, and store large amounts of data on computers and other devices. A large amount of that data potentially includes sensitive information, such as financial data, personal information, and other data that, if accessed by unauthorized groups, could lead to serious security breaches or financial losses. Therefore, cyber security, also referred to as Information Security, is crucial to providing the necessary protection from hacking or random access to information, and the sensitive devices that hold that information.

Cyber security, by definition, is any technology which protects computers, networks, programs, and data from unauthorized access, or attacks with the aim of exploitation. In the past, resources were more focused on critical system components and providing protection from known threats, which left other components indefensible, and systems unprotected from less serious risks. Cyber security also includes the prevention of cyber attacks, breaches of data, and identity theft. In this regard, KOC has enacted measures to vigilantly ensure the Company is protected from cyber attacks and hackers. Over the years, KOC has invested a significant amount of time, money, and resources to ensure the Company is protected and able to defend itself from any nefarious activities which could hinder critical operations or create losses.

The idea behind the creation of this event began earlier in the year after it was decided that a cyber security conference and competition would do much in the way of creating awareness among Company employees. Senior Company officials also saw the potential for the event to prepare KOC's next generation of cyber security professionals against future cyber threats. In addition, part of the event's goal was to discover local talent and capabilities in information security, with the idea being to develop that talent and put it on the right track as a first step in addressing the issue of an international shortage of cyber security specialists.

The importance of this event was signified by KOC CEO Emad Sultan's participation in the event. After the CEO shared his belief that cyber security was an important priority for the Company, the Information Security Team began to communicate with those interested in the field of cyber security until the idea was finalized and all the details of the conference were agreed on. The Company then invited a number of international experts in the field of cyber security to deliver lectures on the dangers of cyber attacks and ways to combat them.

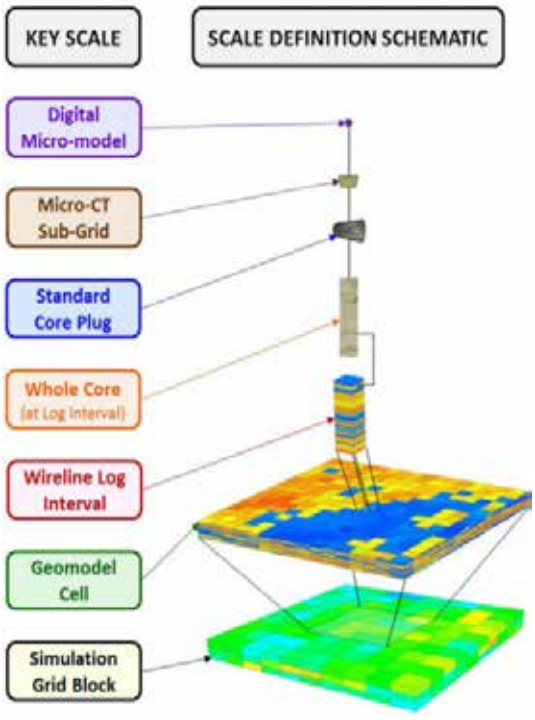
Upscaled Rock Tester for KOC

Submitted by Nabil Al-Adani, Senior Specialist, R&D Programs Team & Eman Al-Kandari, Team Leader R&D Programs Team

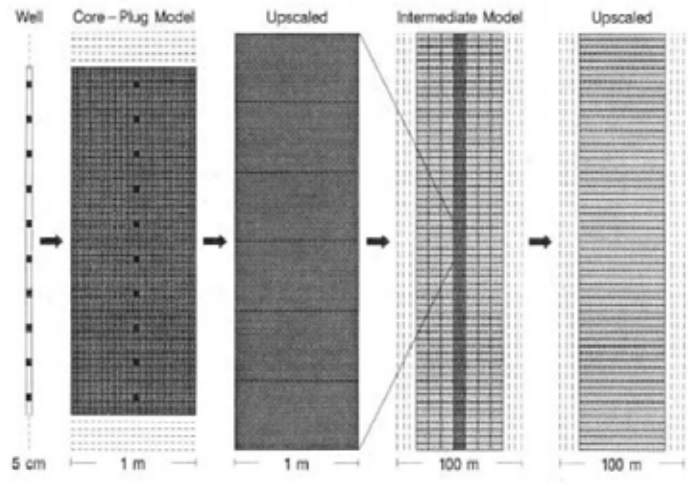
In most cases, an adjustment is applied to permeability and porosity values in a simulator to match the actual production history. Geostatistical modelling includes upscaling and ranking processes in building a 3D simulation model which incorporate microscopic data, thin sections and CT-scans, size, core, depth data, logs, well tests, and seismic data; however, modifications and corrections are still required. [1]

Core plugs 25 to 50cm apart were acquired from wells, which are at least 1,000m apart. The core plug lab data and geological lithological interpretation were integrated through geostatistical modelling. The grids of 100X100X0.5m were upscaled for simulation purposes.[2] The assumed culprit is the heterogeneity and layers connectivity in the model. However, if we can model as accurate as possible the heterogeneity and unknown layers boundaries through larger-scale materials, then we might have a better chance in fixing the model rather than adjusting values later in the simulator.

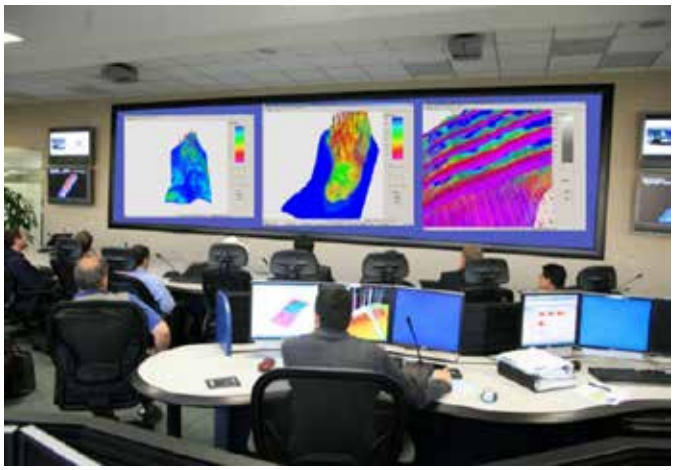
Today, computing power is improving and is exponentially faster compared to the past. A parallel computing concept was used to build a 1 billion cells simulator. The software using the improved hardware is called GigaPOWERS, which features enhanced algorithms. The simulator can now have finer grids to mimic the geological resolution and have a less statistical upscaling requirement. Also, this simulator is four times faster and can handle dual porosity, dual permeability and large compositional models. [3]



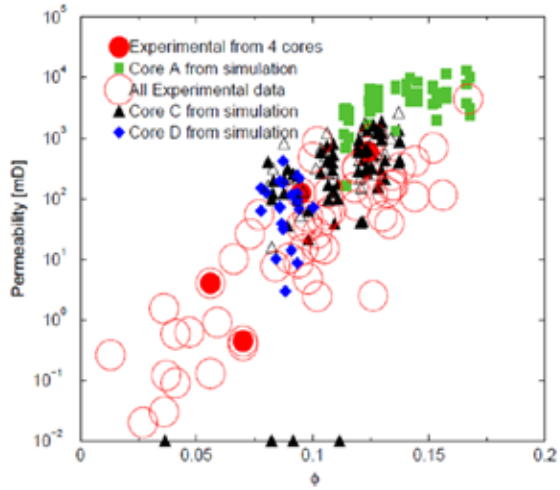
Source: SPE-175560-MS, Figure 1 [1]



Source: SPE-24700-PA, Figure 1 [2]



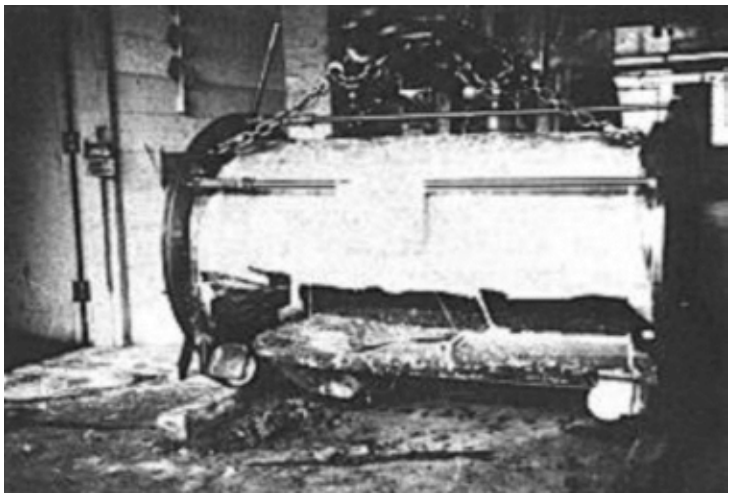
SPE-142297-MS, Figure 14 [3]



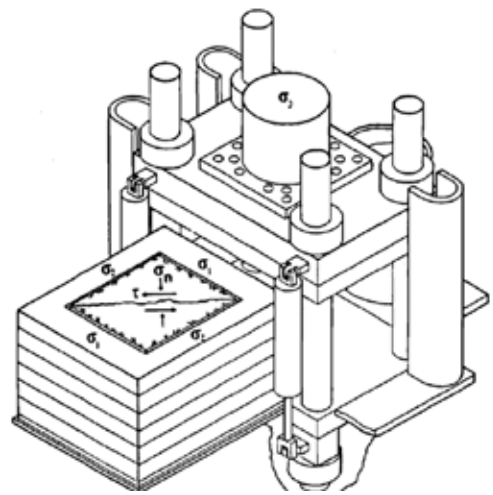
Source: ARMA/NARMS 04-498, Figure 5 [5]

In the core imaging world, the 5mm core plugs were scanned using 3D X-ray voxels. The tomography was correlated to porosity and modelled for permeability, formation factor, and capillary pressure values. There are similarities between the lab and image-derived values. However, heterogeneity effect is evident in some numbers. A 3D image of 8mm to 1cm diameter plugs and around 2.73 cubic mm substance volume of resolution around 4.3 microns was generated using an 80 kV and 200 microAmps X-ray source. The generation of the image took approximately 44 hours, including voxels computer modelling. The linear X-ray attenuation coefficients were correlated to density. A nonlinear anisotropic diffusion (to remove noise) and edge sharpening filters were used to generate a precise bimodal densities distribution. The purpose is to select the cut-off to distinguish porosity from the rest of the material. By comparing the image-derived porosity, permeability and capillary pressure values with lab tests, it was revealed that there are similarities, but they are sometimes overwhelmed by heterogeneity effect. Both carbonate and sandstone samples were tested. Image upscaled models were created to estimate permeability and capillary pressure values.[5]

In a geomechanical world, core samples from 1.85 to 5.9in were tested applying uniaxial compressive strength. The larger the core size is, the weaker the uniaxial compressive strength. A 36in diameter geomechanical cell was used to perform tests on 32in diameter charcoal and limestone samples by applying a uniaxial compression with hydraulic confinement pressure using oil. The tests were compared with 2, 4 and 12in core plugs as well. The 32in core was coated



ARMA-1972, Figure 3 [7]



Source: ARMA-84-0457, Figure 1 [8]

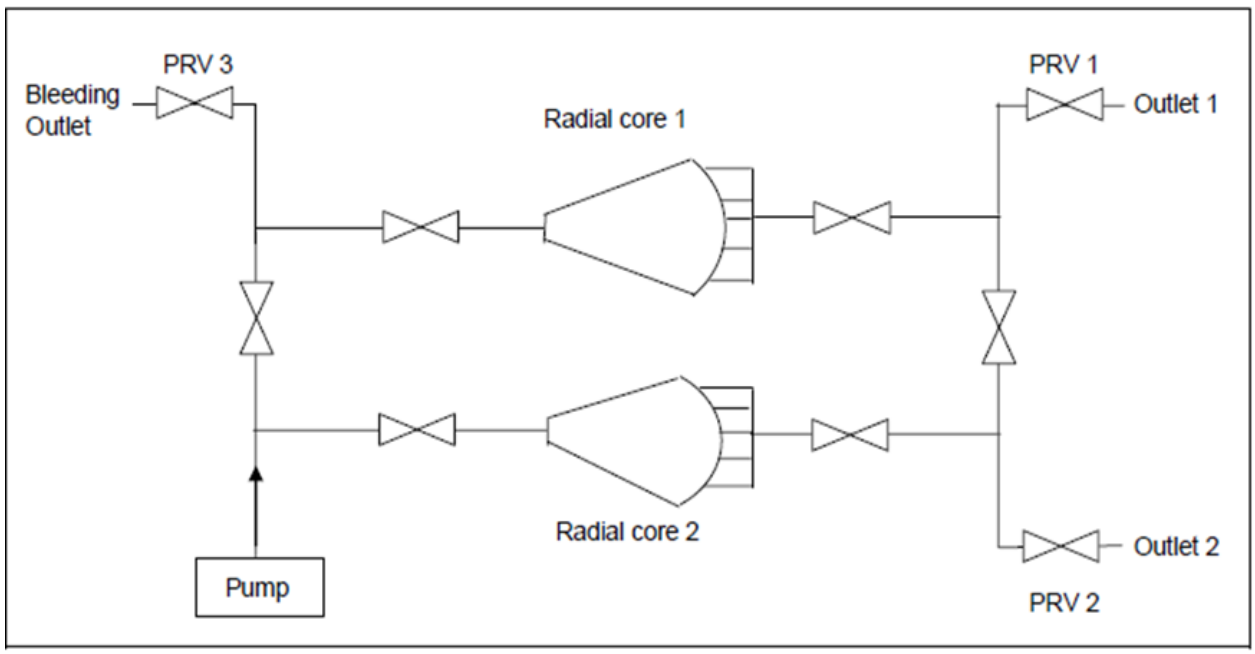
ISRM-IS-2000-430, Figure 2

with waterproofed latex paint to ensure proper insulation while applying the confining pressure. It was found that similar values of Young's and shear moduli were observed. However, the Poisson's ratio did not match.

It should be noted that the bigger the sample size is, the faster it tends to fail. The larger samples tend to fail at much lower strength than smaller ones. [7]

The shear tests were performed on 1.5 ton and one cubic meter fractured blocks of sandstone, tuff, granite, hydrostone and concrete. A maximum uniaxial compressive force of 2.67e6 N was laid on the test material using gas to pressurize. Two horizontal directional stresses of 35MPa at maximum were applied as well on the block. [8]

Going much larger, two mudstone slabs of 14m x 11m x 1.8m in dozer size weighed 510 tons and 1640 tons 21m x 13m x 2m were tested out for the geomechanical purpose in a field using bulldozer D9. Concrete walls were constructed around the slabs for containment purposes. The infill substance in the tested pieces did not demonstrate any significant development of shearing, and there was only minimal vertical dilation. Most shearing occurred at the boundaries between the week and strong material in the test rocks. It was observed in comparison with lab data, that the hand-excavated samples demonstrated similar geomechanical behavior to drilled core plugs. [9]



Source: ARMA-84-0457, Figure 1 [8]

In the fluid flow testing world, a 0.37in diameter hole was drilled into a 1.75in diameter of 4.13in length core. The objective was to simulate a well condition and measure the radial flow from the borehole into the formation. Such mini models helped in controlling parameters and performing a better study of acid reaction with limestone.[10] Having a closer flow shape test sample improves the outcome. Two wedge cores were cut at the apex angles of 31 and 32 degrees with a base width of 1.8cm and an average length of 24cm. The wedge core was used to simulate the radial flow near the borehole. The flow was well simulated using Place iT simulator. The none-viscosified and viscosified aqueous Newtonian fluids were flown in both test samples. A better agreement with simulation results was achieved compared to linear flow in standard lab cores.[11]

A one meter high and 30cm in diameter cylinder was filled with recovered core sand to test the best sand-control solutions. The cylinder was tested at the vertical position. The results were like standard core laboratory tests. However, this setup did not mimic a real well condition.[12] A 32in high and 27.5in squared box was filled with four sand blocks. The boundaries between blocks were filled by the approximately 100mD proppant to ensure permeability and porosity continuity. An overburden pressure with two directional horizontal stress was applied up to a maximum of 55.1MPa. The blocks were saturated with brine and permeability of 300mD was estimated. A 4in hole was drilled in the center, cased, cemented and perforated as well to mimic well sand production. Both oil and water were flown in the tester. Required controlled drawdown tests for sand production were compared with field observation. It was found that such test results were comparable.[13]

Conclusion

It is evident that the larger the samples are, the much closer to reality are the results; hence, the values might be used with more confidence for the reservoir characterization and simulation purposes. Building a large rock tester (2 X 2 X 2 meter) equipped with acoustic, electric and pressure sensors is needed to develop equations and models for integrating field data into large scale models. The complexity of reservoir models due to observed heterogeneity within the carbonate deposits and sand layers in the reservoirs of North, South and West Kuwait can be addressed through such testers. It will help in enhancing the utilization of existing smaller-scale data, like core and well logs. For example, integration of borehole resistivity and acoustic images with seismic data to enhance seismic interpreted attributes are one of the pioneering goals to improve our 3D models with available in-house data.

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Delegating Work

Submitted by Mishaal Al-Rasheedi, Senior Supervisor (Asset Control), Financial Support Team

The word delegate is defined as: "To assign authority and responsibility to a subordinate at a lower level than you." Delegation is a trait that all great managers achieve through their common workload and in their day-to-day work environment. By delegating properly, managers may achieve and finish their organization's tasks in an efficient and timely manner before their deadlines. However, delegating work may not always be as straightforward as it seems, and oftentimes it requires sensitivity and finesse. For example, in many cases the work that is being delegated can be interpreted as relevant, critical, and important by subordinates; however, other times the routine or "busy" work being delegated may be viewed negatively by the party who was asked to complete the task. A good manager, however, is able to effectively delegate all types of work in a way that does not create discord in the workplace.

The delegation of responsibilities should remind everyone in an office setting that the workplace is not a single individual's domain – rather, the end goal of every organization is a team's job. Employees should always be able to work around tasks in an efficient manner, such as when someone with more knowledge in one task or area may be able to delegate another responsibility to a colleague. Great entrepreneurs such as Bill Gates always delegate in order to have an impact in their work or business and their life.

When employees are not excited or motivated to delegate work or receive work delegated to them, it could be because the fundamental process of delega-

tion being utilized is not efficient or effective. Delegation requires knowledge and tact. For example, it will not be effective to delegate responsibilities to individuals if they are not knowledgeable of the subject matter, or if they do not have enough time or resources to complete the job effectively. If jobs are being stalled because of these reasons, it is a clear indication that the way work is being delegated should change. Organizations must ensure that the correct environment exists where employees are encouraged to put forth their best work with maximum efficiency. Managers must also communicate more with employees in order to receive as much information as required for the task.

In terms of effective delegation, managers can consider delegating tasks to groups of employees, as in addition to building morale through teamwork, it allows employees to become better at working with others in a group setting in the future. Managers can also choose to delegate entire projects to employees, as doing so often builds their teamwork abilities, confidence, and increases their commitment to their jobs.

When delegating, managers should elaborate on the required tasks by providing the appropriate training and resources before the job is done. Managers should delegate people with a good track record of positive performance and whose judgments they trust. If tight schedules exist, it may not be possible to check the entirety of their work regularly. It is therefore imperative that the right individual be selected for the right job. However, this does not mean that

managers should not give employees with less experience any tasks. Proper delegation is key – giving employees suitable work that matches their skill levels while also challenging them will build trust and test their abilities.

To be able to delegate effectively, managers can try to incorporate some of the suggestions which follow. First, an analysis of the task or objective must be conducted. In other words, the manager must know the objective of the work and not delegate work that is out of his jurisdiction or understanding. The delegator must choose the right employee to be delegated, and it should be someone with the right knowledge who is capable of completing the task without having to compromise his own work or responsibilities. The delegator must define the task or assignment clearly and provide detailed directions and expectations, such as the due dates and task requirements and objectives. After delegating, the delegator must understand which specific tasks are prioritized, monitor the progress of the work, and set dates for deliverables to ensure work is being conducted in a timely manner. If anything is not completed or is not in order within the timeline, it can be addressed or fixed by bringing in the right people to finish the work. At the end,

an important role as a delegator is to publicly announce or acknowledge the work that was completed by the delegates in order for them to remain motivated for future work.

For effective delegation, one must be able to communicate with their subordinates. Managers must be able to assert themselves to their staff and inform them of their responsibilities and the importance of the tasks they are expected to accomplish. Furthermore, managers must clarify why the assignment is critical to the unit and company. People are more driven when they realize how influential their project is, and how it affects bigger projects and the company as a whole. Those in positions of authority should set certain goals and expect them to be fulfilled. Managers should guide their staff through projects and make sure they meet deadlines. They should also encourage independent thinking and allow employees to come up with their own solutions, while offering guidance and instructions along the way.

In order for managers to reach a certain position, they must first be able to trust the employees that they delegate. They must also be able to trust their own judgement. As witnessed by low performing companies, employees might refuse work or new opportunities because their CEOs and managers lack or have no trust in either their own judgement or their employees, which does not allow them to grow or move forward. For example if a restaurant is doing great with only one location open, and they have the means to open another location, some managers or owners might be afraid of the expansion because of the fear that if they delegated someone in order to maintain the new establishment, they might not be able to keep it to the same levels or standards. However, that represents a lost opportunity. Managers and owners must trust their own judgement in order to move ahead and compete with the market.

In conclusion, employees must be given the formal initiative of working together with managers and supervisors, and managers should properly delegate certain tasks in order for employees to expand their knowledge, with the added benefit of the employees themselves able to properly delegate tasks in the future when they become managers based on the information and methods they have learned which can be attributed to the effective delegation of responsibilities. Delegating is not only a way of finishing tasks more efficiently; it is also an asset to the company when it is conducted properly and in a timely fashion.

Restoring the Nature of Kuwait

KOC & KISR have collaborated on a book which details KOC's conservation & rehabilitation efforts

As part of a collaborative process with the Kuwait Institute for Scientific Research (KISR), Kuwait Oil Company (KOC) recently published the first edition of a book detailing the Company's progress and achievement in regard to its environmental conservation and protection efforts.

In particular, the book highlights the rehabilitation and restoration efforts in areas of Kuwait that were severely damaged during the 1990/91 Iraqi invasion, including the purposeful detonation of more than 700 oil wells which led to one of the worst environmental catastrophes the world has ever seen.

Restoring the Nature of Kuwait, by Dr. Samira Omar and Waleed Roy, touches on KOC's comprehensive program known as the Total Remediation Solution, which includes several remediation projects that are being worked on cooperatively with KISR and the Kuwait National Focal Point (KNFP). These projects include the Kuwait Environmental Remediation Program (KERP), the largest remediation and restoration program in the world which was awarded to Kuwait by the United Nations Compensation Commission (UNCC).

In part, the book details KOC's efforts to conserve and protect biodiversity within its areas of operation, with particular emphasis on the large-scale remediation and restoration programs which aim to allow for the recovery of Kuwait's damaged ecosystems. It also seeks to identify the factors which lead to land degradation while presenting the State of Kuwait's implementation plan for conservation and management of biodiversity.

Restoring the Nature of Kuwait does much in the way of illustrating KOC's efforts towards environmental rehabilitation. It also highlights the collaborative efforts which have gone into the Kuwait Environmental Remediation Program and the work that is being conducted to accomplish the goals set forth in the initiative.

The book, according to the author's foreword, also describes the problem of land degradation in dry land regions which has accelerated to an extreme pace, leading to the loss of vegetation cover and fertile topsoil, increased dust storms, and increasing desertification. Today, Kuwait faces a variety of natural and human-induced challenges that threaten the country's unique and highly diverse coastal and marine environment.

Environmental concerns and an increasing environmental awareness in Kuwait has captured the attention of all sectors in Kuwait to think of effective measures that can resolve these problems without negatively affecting the country's development. In 2002, Kuwait ratified and developed a Biodiversity Strategy and Action Plan aimed at conserving renewable natural resources and restoring and rehabilitating damaged habitats, which was one of the first steps in a process that saw the creation of natural reserves in Kuwait such as the Sabah Al-Ahmad Natural Reserve and more.

In summary, Restoring the Nature of Kuwait details KOC's contribution to the restoration and remediation of damaged ecosystems for the purpose of conserving wildlife and vegetation of vulnerable terrestrial and marine environments. It documents the extended efforts to remediate and restore contaminated soils due to the detonation of oil wells and explores future plans for ecosystem recovery and ecological functioning after remediation and restoration implementation.

The KOC Little Pioneers Science Club

The first KOC Little Pioneers Science Club, which took place over the summer months in 2018, was held again this year at the Ahmad Al-Jaber Oil & Gas Exhibition. The decision to host the event for the second year in a row was made after the first event proved to be an enormous success.

The KOC Little Pioneers Science Club classes included the participation of approximately 50 students aged 7-12. The objective was to provide scientific and practical knowledge about the work conducted at KOC in order to educate young learners about matters related to working in the oil industry and the vital role this sector plays for the Kuwaiti community. The program had the added benefit of creating a productive space where young students were able to utilize their free time over the summer months to expand their knowledge and understanding of Kuwait's oil industry through a program that was both educational and entertaining.

All information delivered to the students was specially curated to fit their specific level of educational understanding. The program included various scientific experiments, educational movies, and field visits. The program team took advantage of the club's location at the Ahmad Al-Jaber Oil & Gas Exhibition, where students were able to visit the various exhibits and enhance their understanding of matters related to exploration and production of crude oil and gas.

"Because the experience of putting on a summer science camp for students was new to us, we wanted to be fully prepared. We made sure that all the preparations were made to deliver a curriculum and experience for the students that was as perfect as it could be," said Rawdh Al-Sumait, Chief Public Relations Officer. She added that the preparation for the program took more than four months in order to test its efficiency before operating the program. It included a review of the content, including scientific and educational materials, worksheets, movies, songs, experiments and activities, distribution of classes, and registration system.

This year, the program was unique because of the participation of various KOC Teams. "In addition to providing a benefit to young students, this experience has also benefited the Public Relations Team, as we have had an excellent opportunity to meet many engineers, researchers, and professionals from throughout the Company. The mutual work and tasks given are equal to more than a year of experience, and we have reaped it in a matter of months. We are proud of this fruitful cooperation, the enthusiasm, and commitment of the program's team and participants," Al-Sumait said.

The program was organized into five topics which were distributed over two weeks. The first week started with engineers and geologists from the Explo-

ration Team. The topic was titled Petroleum Geology & Methods of Oil Exploration. During these lectures, participants were able to identify the processes associated with oil formation, reservoir types, and how exploration is conducted. This was also illustrated with various scientific experiments such as the identification of reservoir forms, types of crude oil, and the manner in which seismic surveys are conducted.

Petroleum engineers from the North Kuwait and West Kuwait Directorates also participated in presenting the topic of Petroleum Engineering. Their presentations began with the history of how humans have used crude oil, and the stages through which petroleum engineering has developed into the new techniques of drilling and production. Participants were then able to identify the process of drilling, step by step, by identifying parts of the drilling rig and their function. They also discussed how oil was pumped out of the ground, and touched on more complicated drilling and production issues such as pressure offsets in wells. This experience of meeting actual petroleum engineers allowed participants to understand the career of petroleum engineering while conducting scientific experiments and creating a simple model for refineries and other facilities in the field.

At the end of the first week, staff from the Marine Operations Group participated by providing lectures about oil exports - from the tank farms to the tankers, and from the tankers to the whole world. Participants were able to identify the different types of tankers, berths, and workers in the field of maritime operations. They also became aware of the difficulties faced by the Group during export operations, including weather fluctuations, piracy, oil spills, and preparedness for the fatal risks faced by maritime operators.

In the second week, the Research & Technology Group presented a topic which focused on the environment, which mainly focused on pollution and environmental preservation. They defined the environmental disasters resulting from oil spills, whether on land or sea, and how the Company deals with such issues during and after

an accident. They also explained the process of water and soil remediation and how to test and search for pollution. The team then presented several experiments on refining and environmental conservation, including how to clean contaminated water from oil spills, and various aspects related to the refining of oil. At the end of the day, participants produced artwork using refined materials such as plastic, paper, milk cans, and more.

The following lectures were presented by the Fire Team, who discussed security and safety and how to deal with fire inside the home or a burning building. The team also had the opportunity to talk about the most massive environmental catastrophe in history - the burning of Kuwait's oil wells in 1991. This was introduced to participants through a film that was screened at the exhibition, where they witnessed the environmental suffering and the patriotic achievement of controlling the well fires by a team of dedicated and patriotic Kuwaiti heroes.

The last two days of the program included presentations related to health and medicine, where the Family Medicine Services Division from Ahmadi Hospital provided medical lectures focusing on health and nutrition. This included advice on detailing the importance of good health so that individuals may live full and productive lives. In addition, the Ambulance Services Section from Ahmadi Hospital provided presentations which touched on first aid and the important role which Ambulance Services play for Ahmadi Hospital.

The closing ceremony for the Little Pioneers Science Club was organized by two teachers from the Ministry of Education, who presented an entertaining and educational workshop. Noura Al-Soula, Team Leader Public Relations, then offered a concluding statement and said, "The Team and staff are looking forward to a repeat of this experience in the coming years. We did not expect such strong commitment and support from parents and participants and their admiration for the program idea. We are now developing the program to include additional improvements for future participants."

#Trashtag: Protecting Kuwait's Environment & Creating Awareness

Since its earliest days, Corporate Social Responsibility initiatives have played a major role in Kuwait Oil Company's day-to-day activities, with Company-sponsored events doing much in the way of creating awareness in the local community. Over the years, however, some proactive and environmentally conscious employees have independently chosen to pursue passion projects of their own.

A group photo of volunteers who took part in a #Trashtag event.

In this interview, *The Kuwaiti Digest* met with Yousef Al-Shatti, Geologist from the Fields Development Team, who recently took it upon himself to organize cleanups around Kuwait which have had the added benefit of creating environmental awareness within the community.

TKD: Yousef Al-Shatti, thank you very much for joining us today to tell us more about the #Trashtag Initiative. Let's start at the beginning – what is #Trashtag, and how did it begin?

Al-Shatti: #Trashtag began as an Internet trend, where people all over the world would take pictures of a place that has been heavily littered, before and after they clean it up. This initiative became very popular all over the internet and in different parts of the world, with places like Bahrain and Egypt also participating. So I thought: Why not do one in Kuwait? We need one. After I organized the first initiative, I found out people loved it, so we kept doing it until it became a movement.

TKD: Is #Trashtag limited to beach cleanups? How did #Trashtag begin?

Al-Shatti: #Trashtag was founded on April 20 of this year, and it involves cleanups for all areas, including beaches, parks, or any littered area. We are even organizing a campaign for the winter in the desert areas.

#Trashtag began on a social media application called Reddit. When I saw the topic trending, I posted about it and asked if anyone wanted to participate in it, and I mentioned I wanted to plan one for Kuwait. People started asking me about how to coordinate and how to join, so we made a WhatsApp group and it grew until we got to where we are now.

TKD: What inspired you to start this initiative?

Al-Shatti: Usually when I go to the beach with my friends, I find myself cleaning up after myself, or if I see plastic bottles, I pick them up. Whenever one of my friends throws something on the ground, I tell them not to, so I was already doing this naturally. That's why when I saw this topic trending, I said, "OK, let's make something of this. This is a good trend."

TKD: What kind of events does #Trashtag host, and what would you consider to be #Trashtag's biggest achievement?

Al-Shatti: We mostly organize and host cleanups, but we try to branch out. Last week we did a blood donation, and we have done a hospital visit for sick children. We have also distributed food to laborers, in addition to some other activities which we are trying to include more of. Mainly, however, our focus is on cleanups.

I would say that turning an internet challenge into a real-life community has been our biggest achievement. We are a community of volunteers from different cultures and different backgrounds, and we are all getting to know each other better while working for the common good.

We formed this community which keeps on giving. This, to me, is the biggest achievement.

TKD: What takes place at a #Trashtag event? How does it usually go?

Al-Shatti: Usually I go and set up the table, set up the stuff, and people can see me, approach me, see our gathering, and just join in! Wear gloves, grab a bag, pick up a grabbing stick and just go on their way! We try to make it more regulated, because we're developing. We're trying to separate the trash instead of just picking up all materials and mixing them in one trash bag, so it can be easier for recycling companies to pick them up. Since we started, I think it's safe to say we have filled more than 600 trash bags. That's a lot of trash!

TKD: How often do #Trashtag events take place and how long do they usually last?

Al-Shatti: The events usually take one hour these days because the weather is very hot, but the first ones we did when the weather was better would last up to two hours. When the event finishes and we wrap everything up, people sit around and talk to each other, so it really depends on how long people want to stay. We try to have an event every week.

TKD: What is #Trashtag's biggest challenge?

Al-Shatti: The biggest challenge we are facing now is that the litter we are picking up is going to the government incinerator, which isn't very eco-friendly. We are trying to tackle this issue by contacting recycling facilities so that we can separate the recyclable litter. We hope to get a hold of a recycling company that is willing to come pick up our gathered litter after our clean-ups.

TKD: Are there any future projects you have in mind for #Trashtag that you'd like to share with us?

Al-Shatti: Right now we are working with KFAS on matters related to raising awareness. I am also trying to do something in cooperation with KOC which involves a tree planting campaign.

TKD: Can you elaborate on your collaboration with KFAS?

Al-Shatti: Our collaboration with KFAS started when they heard about us and reached out. They wanted us to make an awareness presentation for a seminar they were having for high school students. We taught them about how to use plastic and what plastic is doing to the environment and different approaches that they can use to help the environment instead of damaging it.

TKD: Would you say that #Trashtag is in any way related to your job here at KOC as a geologist?

Al-Shatti: On the surface, the two things are not exactly related, but as a geologist, one of the things I feel passionate about is caring for and saving the environment. Seeing waste everywhere is a major problem which can be fixed through awareness and direct action. There is no need for our Earth to be ruined because of ignorance.

TKD: Can you tell to us about the worldwide plastic epidemic?

Al-Shatti: Single-use items in general are extremely wasteful and harmful to the environment. Even single-use items made of paper are not solving the problem, because we are still cutting down trees. The issue is single-use items. Plastic can be good. It is reusable, cheap, and very durable. A plastic water bottle for example can last for ages. I believe the issue is not the materials themselves, but how we use those materials.

TKD: What is plastic doing to the environment?

Al-Shatti: It's non-biodegradable and can stay on Earth for 500 years. It can kill animals by trapping them and choking them when they mistake it for food. It can enter their bodies, and in turn we eat those animals, such as fish, and we then ingest that plastic as well. Through #Trashtag, we are trying to break that cycle from happening and make up for all the damage that has already been made to the environment. We are trying to repair what we can.

TKD: How do you think your cleanups are affecting the culture here in Kuwait?

Al-Shatti: When you compare our culture to the countries you may visit on vacation, where ev-

erything is clean and organized, the only difference between us and them is awareness. Once we raise awareness, once people see us cleaning up, people may think twice before throwing their garbage on the ground. They might think: There's this group that cleans up litter… Maybe I should be more considerate and just throw it in the bin. If we keep doing this, maybe we will get ten people to become more environmentally conscious or aware, and those ten people will then spread the message, talk to their families, and hopefully we can develop our community and get it to a place where respect for the environment is held in high regard.

TKD: How can people join your events?

Al-Shatti: We post about them on social media. We have our Instagram account. Sometimes I post on different social media accounts, like Reddit, or Meetup, where organizations post about events. We try to announce it on all social media platforms and people just have to show up. We provide everything.

TKD: Are there any last things you would like to share with us?

Al-Shatti: This initiative started with a very small group of individuals - maybe 12 or 13 people showed up to our first event, most notably Ms. Carina Maceira and I. Today, we are receiving interest from everywhere. Even embassies have shown interest. The American ambassador visits us regularly. We've also received support from the French, British, and German embassies. This initiative is also getting a lot of media coverage. I never thought it would blow up like this - I was just participating in an internet challenge and now I'm the founder of this huge community. Mashallah, our Instagram account has 2,500 followers, and still growing. We are conducting awareness sessions and making a positive change in the community. Even in our cleanups, we can see people watching us and starting to help us, or picking up the litter after themselves, so it is making a change.

TKD: My final question is, can you please share your social media account with us so that if anyone is interested they can contact you and know where to find you?

Al-Shatti: Most people who join us know us from our Instagram account, which is TrashtagKuwait - just one word. Other than that, I post on Reddit, on the subreddit called Kuwait, and on Meetup. If you go on Meetup, you can see the #Trashtag events pop up.

Kuwaiti Co-Ops to Begin Using Biodegradable Bags

As part of an effort to create a cleaner and more sustainable environment for Kuwait, the Union of Consumer Co-Operative Societies (UCCS) has agreed to replace plastic bags with environmentally-friendly biodegradable bags. Senior government officials have said this new initiative will mark a new chapter in Kuwait's effort to create new measures which are aimed at improving the health of the country's natural environment. In part, utilizing biodegradable bags will have a long-lasting and measurable effect by decreasing the amount of plastic waste throughout the country's landfills. On average, and depending on the type of plastic used and landfill conditions, plastic bags can take anywhere from 20 to 1,000 years to decompose.

The recent announcement to ban plastic bags was made after advisors from the Kuwait Environment Public Authority (EPA) met with heads of Kuwait's co-operative societies and Deputy Chairman of the UCCS Khaled Al-Hodheiban.

The replacement of the plastic bags for biodegradable ones aims to protect Kuwait's environment and reduce harm caused by non-biodegradable plastic bags that can threaten the health of Kuwait's citizens and wildlife. It will also reduce the overall load and volume of trash that Kuwait's landfills receive on a daily basis.

About Plastic Waste

Disposable shopping bags are convenient, but they are a major source of waste and pollution in Kuwaiti society. Plastic shopping bags on land are one of the most common types of litter. Buildups of huge quantities of plastic bags are well known to block local drainage systems. For example, floods in urban areas are often exasperated by blockages in drainage systems from plastic shopping bags. Plastic shopping bags also pose health risks to human populations over the years as they leach toxins into water supplies.

Plastic bags also are problematic to recycle. While the recyclable symbol of three arrows in a circle is on many plastic shopping bags, it often is a marketing trick. There are no regulations about how that symbol is used, and every city and country has different regulations about what can be recycled. Many plastic bags that are collected by recycling companies cannot really be recycled. Most of these bags actually end up in landfills and sit there for hundreds of years.

Midway Atoll in the North Pacific Ocean is the home of the biggest albatross colony on Earth. These birds fly there to nest on these highly isolated islands, and they forage at sea, often hundreds of miles out, to look for food for offspring. Unfortunately, thousands of these precious birds have been found dead at Midway because they had ingested large amounts of plastic bag shards and pieces. All of the plastic that was found in these birds is brought to the island by adult birds who then feed it to young birds. It is estimated that four tons of plastic accumulates here daily.

Impact on Wildlife

The majority of wildlife on Earth is in our seas and oceans. This means there are hundreds of other animals and birds who are at risk of injury and death

by ingesting or being entangled in plastic bag flotsam. Floating plastic shopping bags can be mistaken to be jellyfish by marine animals who consume them. One species that is at risk from the bags are sea turtles. They risk extinction in part because of ingesting large amounts of plastics. Shards of plastic fester in the stomach because the plastic cannot be properly digested.

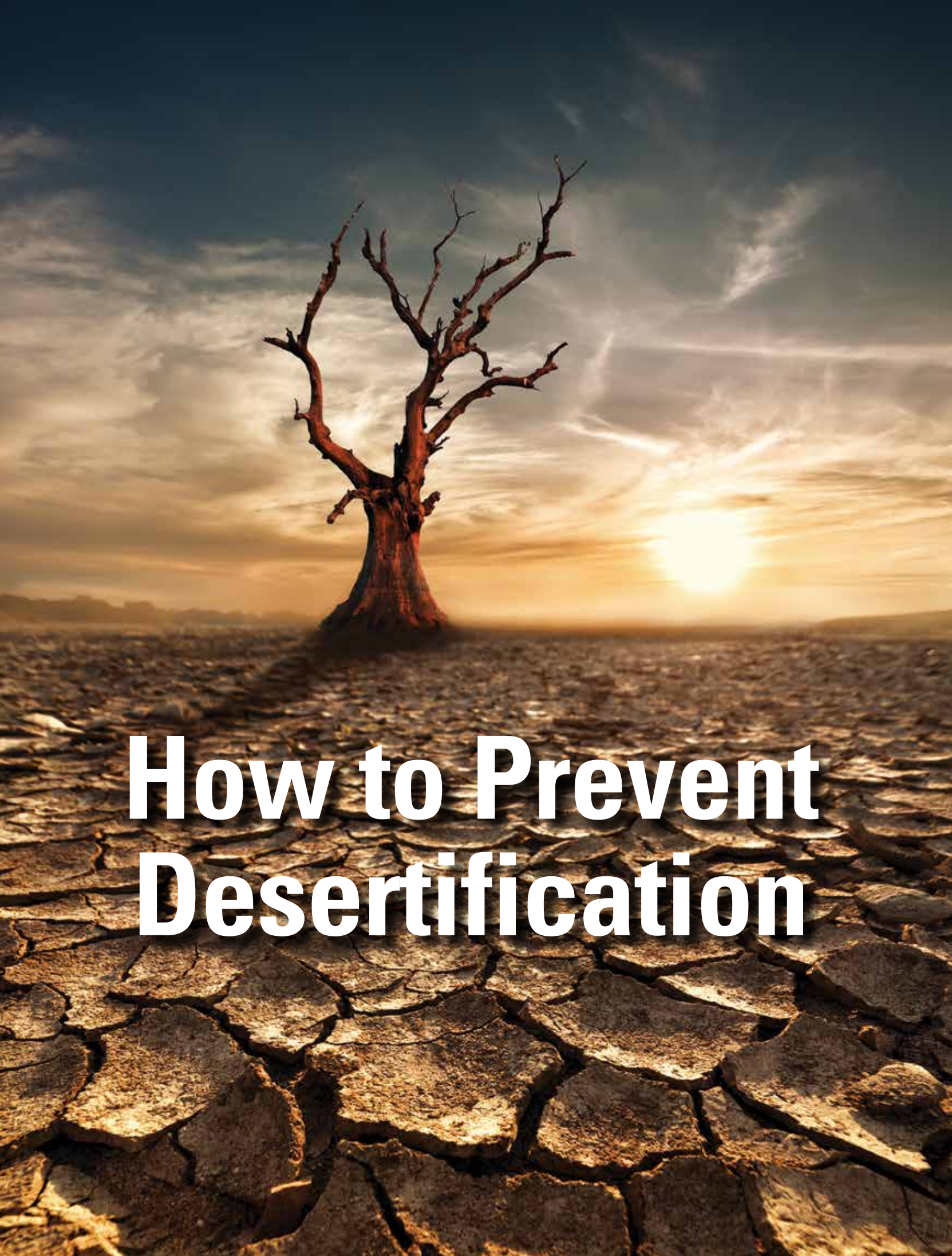
An autopsy of the stomach of a beached whale found 20 square feet of plastic shopping bags that took up its whole stomach. Similar cases have been observed over the past few decades after plastic bags were introduced.

Environmental Impact

Litter from plastic bags is not just on land. Plastic shopping bags have heavily contributed to a huge amount of plastic debris found in the North Pacific Ocean. This is known as the Great Pacific Garbage Patch. It is estimated to be double the size of Hawaii, and could even be as large as the entire continental US. The Wild Studies Institute has reported that as all drains go to the ocean, 80% of this trash in the ocean originated from land.

How You Can Reduce Plastic Bag Usage:

1. Educate yourself about how plastic bags affect the world. Plastic shopping bags are a huge environmental problem around the world and are causing huge issues that affect human and animal health. Also, educate your friends, family, neighbors and children about the impact plastic bags have on the world.
2. Use reusable shopping bags. Obviously, a major step is to use your own reusable shopping bags instead of plastic bags. Reusable shopping bags are available in many colors and styles. You also can buy them in various weights for different types of products, such as heavy cans and other weighty/bulky items.
3. If you have any plastic bags at home, reuse them. Plastic bags can be difficult to recycle, so it is wise to reuse plastic shopping bags at home for as long as you can. They are good to line small trash cans.
4. Find stores that offer a credit for using reusable bags. Some countries have passed plastic bag bans and more are doing so every year. Some stores will offer a cash credit for bringing reusable bags. Ask the next time you are checking out if you can get a discount for using reusable shopping bags.
5. Count the plastic bags brought into your home in a week. When we actually count the number of bags we bring in weekly, it can spur us to take action.
6. Spread the word. Decline plastic bags at the checkout counter and remind the cashier and others around you that plastic bags hurt the environment. Yes, reusable shopping bags cost you initially, but they can be used endlessly and help the planet.
7. Fundraising. Reusable bags are extremely versatile, which makes the possibilities for fundraising virtually endless. You can sell them outright, use them in school, college, or community fundraisers, or even create themed gift totes by filling them up with an assortment of items.



How to Prevent Desertification

What is Desertification?

Desertification describes the process in which more and more land gradually becomes a desert. The problem associated with desertification does not merely concern itself with land simply becoming hot and dry; rather, the real problem associated with desertification concerns itself with soil becoming useless for growing crops. Around the world, desertification is most likely to occur in areas where rainfall is scarce.

What Causes Desertification?

Ecosystems in dry areas like Kuwait are already very fragile, and can rarely sustain the increased pressures that result from intense population growth. Many of these areas are inappropriately opened to development, when they cannot sustain human settlements.

The most common cause of desertification is the over cultivation of desert lands. Over-cultivation causes the nutrients in the soil to be depleted faster than they are restored, and improper irrigation practices can result in salinated soils and depletion of aquifers.

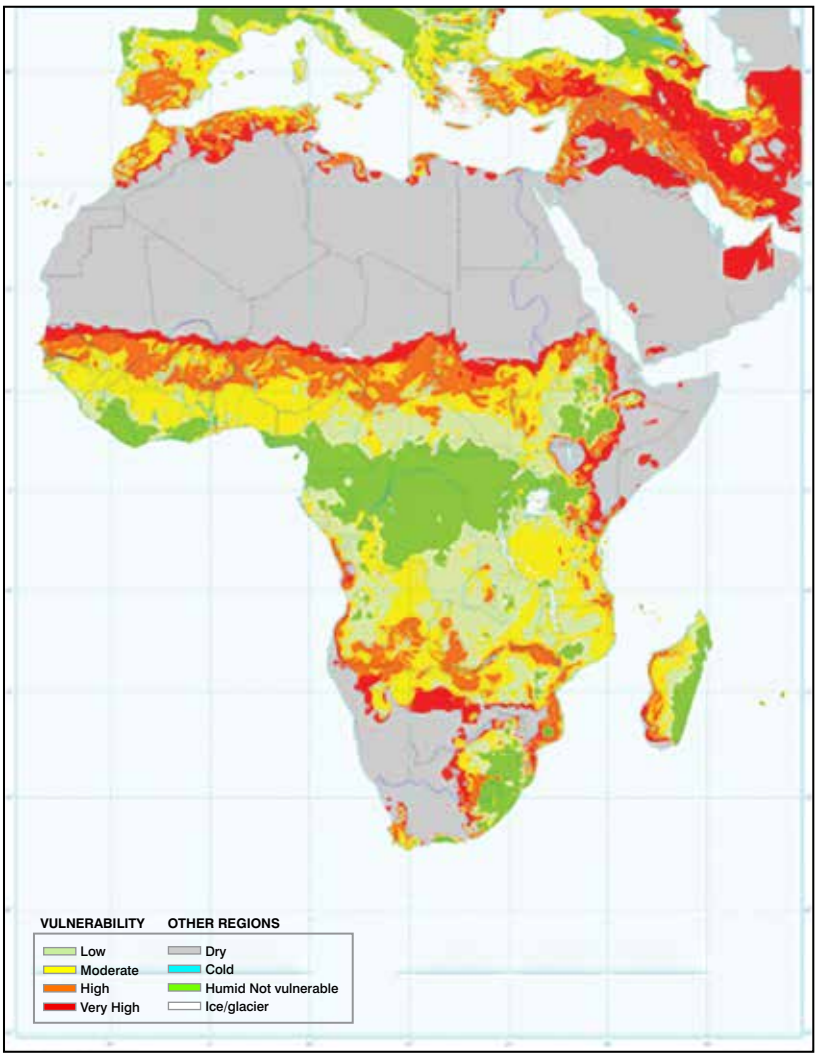
Vegetation plays a major role in determining the biological composition of the soil. Studies have shown that in many environments, the rate of erosion and runoff decreases exponentially with increased vegetation cover. Overgrazing and disruption of desert plants in Kuwait removes this vegetation and causes erosion and loss of topsoil.

Desertification in Kuwait

Desertification is a process which became better understood during the 1970s. About 15% of the world's population lives in arid and semi-arid areas. These countries, including Kuwait, face the danger of desertification unless measures are taken to control this process.

As a dry, arid country, Kuwait is one of 17 countries listed as being at 'extreme risk' on Mapelcroft's Water Stress Index, which is made up of calculations of water consumption and the renewable supplies of water. In fact, it comes in third after Bahrain and Qatar.

According to a Kuwait Institute for Scientific Research's (KSIR) report on combating desertification, Kuwait faces many water-

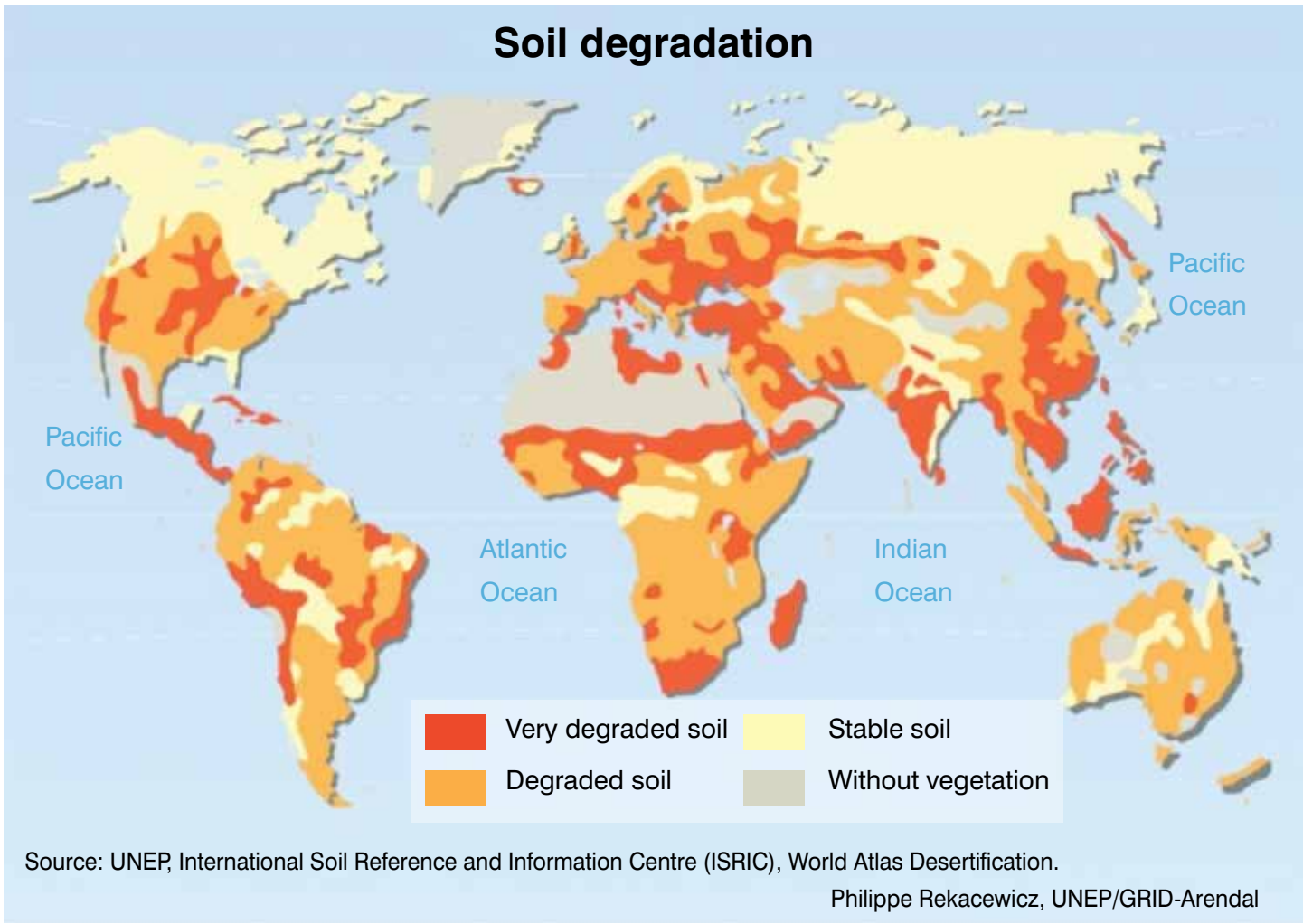


related challenges. Combating desertification and creating a green cover in an arid region like Kuwait is always challenging because of many factors such as low rainfall, high evaporation, poor groundwater quality, poor soil properties and extreme weather conditions. A growing population and high standards of living have also resulted in excessive demands for water.

A recent study was conducted to research the causes of desertification in the agricultural and range lands of Kuwait. Soil and water samples were taken from ten different farms located in Wafra and Abdaly. These samples were taken from three different depths: 0.0cm, 30cm and 60cm. The analysis showed that the salinity increased with depth, especially when the hardpan, which is a dense layer of soil found beneath the uppermost topsoil layer, was near the surface. It also showed that the soil electrical conductivity of new farms was far less than that of old farms, which range from 0.6 to 10 milli mohs/cm. This indicates that excessive irrigation will increase the salt content in the soil.

Water samples that were taken from the study farms contained a very high salt content, which shows that the level of water in the wells has decreased while the salt content has increased to about 10,000 ppm. The presence of high salt content in the water and in the soil is considered one of the major causes of desertification in farmlands.

A study of plants in the biosphere reserve at different locations was also included. It showed that overgrazing coupled with high



Source: UNEP, International Soil Reference and Information Centre (ISRIC), World Atlas Desertification.

Philippe Rekacewicz, UNEP/GRID-Arendal

animal density on range land created an environmental disequilibrium. This factor of overgrazing plus high temperature, high evaporation rate, off-road vehicles, high density camping and flood irrigation contributed to desertification in Kuwait.

Strong preventive measures must be taken to overcome the desertification of the agricultural and range lands in Kuwait.

Possible Solutions to Desertification

1. Afforestation, or re-planting trees, especially in shelter belts. Planting grasses can help stabilize the soil and cut down on erosion by wind and rain.
2. Using good farming practices such as proper crop rotation and the use of manure as a fertilizer.
3. It is important that young trees and plants are protected against overgrazing and damage from vehicles.
4. Poor irrigation methods should be avoided so that water is not evaporated on the surface which wastes water and increases salinity.
5. Drought can be triggered by deforestation, so aforestation should help reduce this. Proper usage of water on the agricultural level should also be emphasized.

Most desertification can be controlled by human activity. This can be achieved by people not misusing the land and by reducing the pressure of too many people living in an area.

Strong preventive measures must be taken to overcome the desertification of the agricultural and range lands in Kuwait.

Visit Buenos Aires

Will you be in Kuwait for the winter months? Are you someone who just can't stand the cold? If creating an endless summer is on this year's agenda for you, why not make a journey to somewhere far south of the equator, where summer is just about to begin? If any of these questions have ticked some of your travel dreams, why not consider beautiful Buenos Aires, the capital city of the South American country of Argentina.

Sprawling all the way from the Bolivian border south to Tierra del Fuego, Argentina is the world's eighth-largest country and one of the most geographically diverse. It boasts South America's lowest floodplain and tallest mountain - Aconcagua, at nearly 23,000 feet - and claims one of the continent's largest and most cosmopolitan urban centers as its capital. Of the more than 40 million people that call Argentina home, three million live in its capital, Buenos Aires - a dense city known for its art and literature that's nicknamed the "Paris of South America." The rest of the population are spread across the country's vast expanses of rolling plains and grasslands.

The best time to travel to Argentina depends on where you want to focus your trip. Some factors to consider: Summer, which is December through February, is

the best time to visit the extreme landscape of Patagonia. You'll find fewer crowds in Buenos Aires during the summer, but it can get hot, too. The prime time to visit Buenos Aires is in the spring (October through November), when the temperatures are cool and the purple jacarandas are in bloom. A great time to see Mendoza or the Lake District is in the fall, when the foliage comes alive and there are fewer crowds.

Argentina's culture - from cosmopolitan Buenos Aires to the rustic sheep and cattle ranches of the Patagonian wilderness - varies as widely as its landscape. Porteños, as residents of Buenos Aires call themselves, are famously scholarly and literary. Argentine literature has very much made it into the mainstream through worldwide translations of authors like Jorge Luis Borges and Julio Cortázar. The impact of the 20th century European immigration wave is apparent; many porteños enjoy nothing more than spending their free time drinking café con leche and reading in one of the capital's many cafés. Strong communities of filmmakers, musicians and artists, as well as students from the city's many universities, maintain a thriving intellectual life for the city. Buenos Aires is also famous for its many restaurants and vibrant nightlife.

No Argentine travel guide would be complete without mentioning the most famous Argentinian food, the asado, or platter of grilled meats. Vegetarians won't find much to their tastes outside Buenos Aires, but for meat-eaters, the country is a paradise. Adventurous eaters should try morcilla, a famous Argentinian type of sausage. Buenos Aires is famous for its gelato shops, where the city's Italian influences can be felt - and tasted!

Outside the city, the iconic symbol of rural Argentina is the gaucho, the Patagonian cowboy. Gaucho culture famously involves sheep-wrangling, horse-riding and knife-fighting. If this is the side of Argentina you'd like to see, transportation matters will have to be considered. Argentina is a large country, and it has wide spaces between its various tourist destinations. As such, Argentina travel is often time consuming. A bus to Bariloche from Buenos Aires, for example, takes 22 hours. A better option, for most travelers, is to take domestic flights through Aerolíneas Argentinas, the national airline, which services most areas of the country. To get off the beaten path, however, you might want to rent a car and see the country for yourself.

MEDICINE FROM THE MIDDLE EAST

At the height of Islam's golden age, the medicine practiced by Arabs throughout their empire was the most advanced in the world. Modern medical practice and knowledge, as broad and expansive as it has become, has one common thread – its roots can be partially traced to the Arab pioneers who contributed to the foundation of modern medicine as we know it.

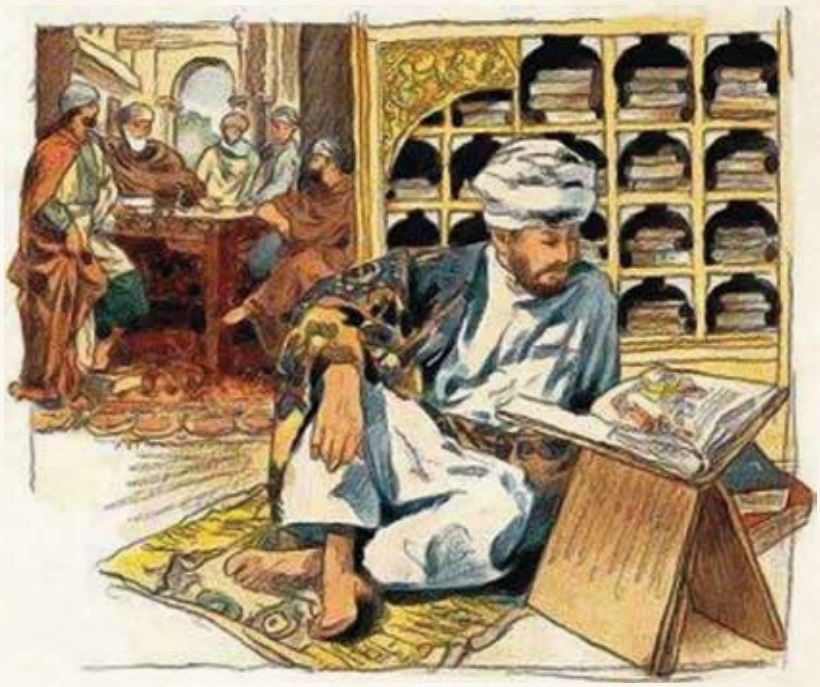
The first trained Arab physician was Al-Harith ibn Kaladah, who shortly before the advent of Islam had traveled to the school of Jundi Shapur in Persia to study medicine, then returned to the peninsula to practice. The Persian wars had brought Greek physicians captive to Persia, and Alexander's conquest had made Greek its official language, so educated Persians were brought in contact with Greek scientific literature. The school was already flourishing when Nestorian Christians from Edessa, near modern Aleppo, sought refuge in Persia after the East Roman emperor Zeno in Constantinople ordered Edessa's university closed for supporting the Nestorian heresy. The university had taught a pure Hippocratic medicine; the native Christians, learning Greek so as to be able to read the Scriptures, had also come in contact with Greek medical writings. The coming of the Nestorians to Jundi Shapur strengthened the Greek element there-the scientific method of close observation and carefully preserved notes on symptoms,

treatment and results that made the medicine of Greece the first essentially modern medicine.

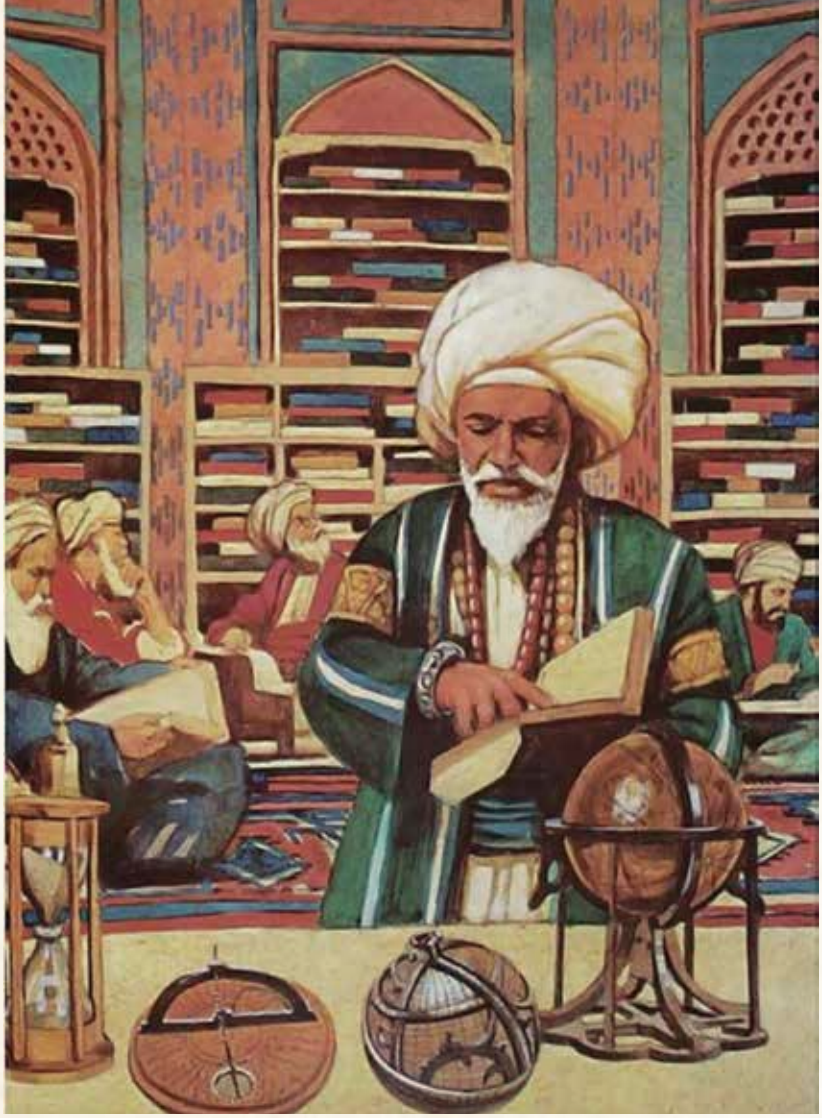
In A.D. 630, Jundi Shapur surrendered peacefully to the armies of Islam. It was to remain the greatest center of medicine in Islam until Baghdad, under the Abbasids, drained it first of its best teachers then, inevitably, of students.

The record of medicine among the Arabs between Ibn Kaladah and the Abbasids is incomplete. With the Abbasids, the scientific approach of Greek medicine, as taught by the physicians of Jundi Shapur who were attracted to the great capital, was elaborated and extended by Arab intellect to bring forth the golden age of Arab medicine.

It was the time of the Arab world's greatest physicians, Rhazes and Ibn Sina, whose portraits hang in the great hall of the School of Medicine at the University of Paris. Rhazes' 141 works established his reputation as one of the keenest thinkers and greatest clinicians of the Middle Ages, during which his Kitab Al-Asrar (Book of Secrets) was a chief source of clinical knowledge in Europe. Second only to Rhazes was Ibn Sina; his Al-Qanun fil-Tibb (The Canon) was the textbook in medical schools of Europe for 500 years. Brilliant though lesser physicians of the Abbasid period described some 130 eye diseases and also contributed a clear conception of the pulmonary circulation of the blood (some 500 years before the Portuguese Servetus, who was credited with the discovery). Some were so confident in their surgical skill that they did not hesitate to operate for cataracts on a one-eyed man. The Abbasid caliphs, in the impetus of the day's almost Renaissance-like thirst for knowledge, dispensed money lavishly on translations from Greek, Syriac and Indian scientific writings, a practice reaching its peak when Al-Ma'mun, the son of Harun Al-Rashid, founded a state college of translators.



The period saw some remarkable advances, such as the world's first apothecary shops and pharmacopoeia, and as early as 931 some examination was required for all practicing physicians to test their qualifications. In addition, a staff of doctors made visits to outlying towns and to prisons. Harun Al-Rashid



built the first hospital of Islam in Baghdad. Before the end of the Abbasid empire there were hospitals - some with special libraries and courses for medical students - in every major city of the realm. They were divided into separate sections for men and women, each with a complex of wards - for internal medicine, surgery, orthopedics, diseases of the eye and convalescent rooms - and a hierarchy of chief physicians, heads of the various departments, orderlies and nurses.

Before the disintegration of the Abbasid empire, Arab science had made its last significant advances. The indiscriminate reverence for past authorities, in science as well as in philosophy, that was to be the curse of medieval Europe, was stifling Arab intellect, and the brilliant light of scientific medicine among the Arabs was going out.

Europe, meanwhile, had long since entered her dark ages. The monasteries, the few centers of learning, preserved some of the classical writings and dispensed a strange mixture of alchemy, remedies embalmed in the classical texts and, in cases of dire need, fervent prayers. In addition, in scattered spots in Europe a spark of science, lit from the sinking light of the East, smoldered on.

One was Salerno, near Naples, whose embryo medical school, influenced at first by a few classical texts, was revolutionized by the coming of Constantine the African. An Arab physician born in Carthage, he eventually came to Salerno under the patronage of the Norman conqueror Robert Guiscard, and settled down to translate his Greek and Arabic medical manuscripts. Later writings from Salerno clearly show Constantine's influence in their attempts to learn from nature rather than from past authorities and in their stress on careful and collected notes.

Another was Montpellier in southern France, a cosmopolitan and tolerant university town on the road between Spain and Italy, a natural refuge for the Spanish Arabs and Arabized Spaniards driven out by the growing intolerance of Spain's Christian rulers. Some were physicians, many bilingual in Arabic and Spanish and some also knowing Latin. In short, they had access to, and could pass on, both the Arab medical writings and Arabic translations from Greek. By the 14th century there was a medical school at Montpellier whose curriculum included Hippocrates and Ibn Sina, and which was turning out translators, teachers, medical writers, and practitioners of the first order.

With the Renaissance came the great revival of interest in classical learning. The Greek writings revived interest in science. An efficient thermometer, the microscope, taking the pulse, clinical teaching of medicine, even reasonably sophisticated facial plastic surgery were some of the contributions of the age.

The era of the Industrial Revolution saw improvements in public health such as the licensing of midwives, increased interest in the health of mothers and children, the compulsory registration of births, deaths, and cases of contagious disease. By the 19th century the existence of bacteria had finally found credence, laying the foundation

for the knowledge of the nature of infection, and other revolutionary developments in medicine took place. One was the use of anesthesia, which reduced the necessity for speed in operations and permitted more careful work. Another was the discovery of the nature of sepsis - then the rule, not the exception, in hospitals - and of effective antiseptics. Before, surgeons had hesitated to operate even with anesthesia, for fear of a fatal infection. The last of the 19th and the beginning of the 20th century brought in immunizations against disease, surgery of the brain and heart, improved plastic surgery, the use of X-rays, drugs, more specialization, and great government interest in public health.

After the Abbasids - first under the Mamelukes, then under the Ottoman Turks, who defeated the Mamelukes, Arab science had suffered a quick decline and a long stagnation. On July 1, 1798, Napoleon landed at Alexandria in a bid to cut the British lifeline to India. He failed, but in the attempt he brought the East and the West face to face. Among the troops that the Ottoman Turks sent to repel him was the illiterate son of an Albanian tobacco merchant, Muhammad Ali, risen to officer on the staff of the Turkish governor of Egypt. When the governor left, Muhammad Ali stayed - with a picked regiment of Albanian guards under him. In two years, he was master of Egypt.

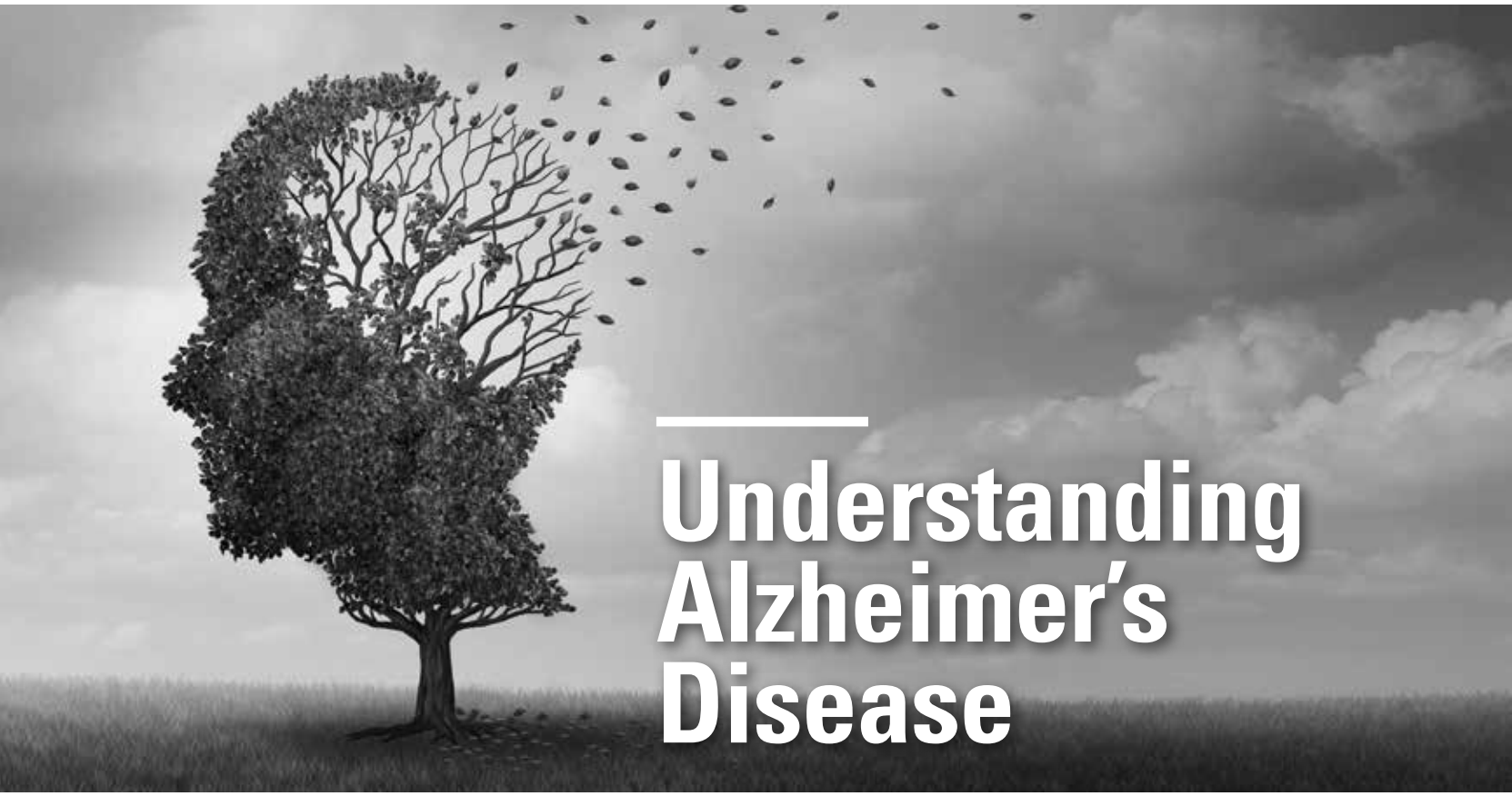
He built canals, schools and factories. He founded a ministry of education, a civil service, and a navy, and he introduced cotton from the Sudan, imported an army of foreign advisers, military and professional and educational, and sent Egyptians out to England, Italy, Austria, and France to be educated. And last but not least, with the help of Dr. Antoine Clot - better known as "Clot Bey" - he founded the Arab world's first modern school of medicine in Cairo, Abu Za'bal, later known as Qasr Al-Ayni, in 1827.

Lebanon, meanwhile, was ruled by a man friendly to Muhammad Ali, the Emir Bashir Al-Shihabi. Tolerant and open to new ideas, in 1806, he had himself and his family vaccinated against smallpox and encouraged others to do likewise. In 1813-1816 the plague raged through Lebanon. Bashir ordered a special fund set aside for isolation of the sick in special quarters set up outside the towns, set up roadblocks and prohibited the holding of markets and fairs.

Once when Bashir became seriously ill, Muhammad Ali sent Clot to care for him. On his return, Clot took with him five promising Lebanese youths to study at Qasr Al-Ayni; they returned to be Lebanon's first modern doctors. It was also the repercussions of Muhammad Ali's modernization in Egypt that introduced modern medicine into Syria. While campaigning there his son, Ibrahim Pasha, sent back some bright Syrian boys to study at the medical school and they also returned to practice in their country.

In conclusion, Arab civilization has played an invaluable role in preserving the continuity of scientific progress. Its greatest contribution was that it was collected in critical moments for humanity, when the numerous cultural barbarians have destroyed the world's cultural heritage. Rescuing the supreme books of ancient civilizations, Arabs, unlike many conquerors, have shown an objective respect for the human search for knowledge. These books were protected on Arab soil and translated into many languages, building the foundation of modern medicine.

The majority of this article was first published by Leslie Farmer in 1969.



Understanding Alzheimer's Disease

Alzheimer's disease is an irreversible, progressive brain disease that slowly destroys memory and thinking skills, and eventually even the ability to carry out the simplest tasks. In most people with Alzheimer's, symptoms first appear after age 60. Estimates vary, but experts suggest that as many as 30 million people around the world may have Alzheimer's disease.

Alzheimer's disease is the most common cause of dementia among older people. Dementia is the loss of cognitive functioning - thinking, remembering, and reasoning - and behavioral abilities, to such an extent that it interferes with a person's daily life and activities. Dementia ranges in severity from the mildest stage, when it is just beginning to affect a person's functioning, to the most severe stage, when the person must depend completely on others for basic activities of daily living.

Alzheimer's disease is named after Dr. Alois Alzheimer. In 1906, Dr. Alzheimer noticed changes in the brain tissue of a woman who had died of an unusual mental illness. Her symptoms included memory loss, language problems, and unpredictable behavior. After she died, he examined her brain and found many abnormal clumps (now called amyloid plaques) and tangled bundles of fibers (now called neurofibrillary tangles). Plaques and tangles in the brain are two of the main features of Alzheimer's disease. The third is the loss of connections between nerve cells (neurons) in the brain.

Although we still don't know how the Alzheimer's disease process begins, it seems likely that damage to the brain starts a decade or more before problems become evident. During the preclinical stage of Alzheimer's disease, people are free of symptoms but toxic changes are taking place in the brain. Abnormal deposits of proteins form amyloid plaques and tau tangles

throughout the brain, and once-healthy neurons begin to work less efficiently. Over time, neurons lose their ability to function and communicate with each other, and eventually they die.

Before long, the damage spreads to a nearby structure in the brain called the hippocampus, which is essential in forming memories. As more neurons die, affected brain regions begin to shrink. By the final stage of Alzheimer's, damage is widespread, and brain tissue has shrunk significantly.

What Causes Alzheimer's

Scientists don't yet fully understand what causes Alzheimer's disease, but it has become increasingly clear that it develops because of a complex series of events that take place in the brain over a long period of time. It is likely that the causes include some mix of genetic, environmental, and lifestyle factors. Because people differ in their genetic make-up and lifestyle, the importance of any one of these factors in increasing or decreasing the risk of developing Alzheimer's may differ from person to person.

Less than 1% of the time, Alzheimer's is caused by specific genetic changes that virtually guarantee a person will develop the disease. These rare occurrences usually result in disease onset in middle age.

The exact causes of Alzheimer's disease aren't fully understood, but at its core are problems with brain proteins that fail to function normally, disrupt the work of brain cells (neurons) and unleash a series of toxic events. Neurons are damaged, lose connections to each other and eventually die.

The damage most often starts in the region of the brain that controls memory, but the process begins years before the first symptoms. The loss of neurons spreads in a somewhat predictable pattern to other regions of the brains. By the late stage of the disease, the brain has shrunk significantly.

Researchers are focused on the role of two proteins:

- **Plaques:** Beta-amyloid is a leftover fragment of a larger protein. When these fragments cluster together, they appear to have a toxic effect on neurons and to disrupt cell-to-cell communication. These clusters form larger deposits called amyloid plaques, which also include other cellular debris.
- **Tangles:** Tau proteins play a part in a neuron's internal support and transport system to carry nutrients and other essential materials. In Alzheimer's disease, tau proteins change shape and orga-

nize themselves into structures called neurofibrillary tangles. The tangles disrupt the transport system and are toxic to cells.

Treating Alzheimer's Disease

Alzheimer's disease is complex, and it is unlikely that any one intervention will be found to delay, prevent, or cure it. That's why current approaches in treatment and research focus on several different aspects, including helping people maintain mental function, managing behavioral symptoms, and slowing or delaying the symptoms of disease.

Managing Behavioral Symptoms

Common behavioral symptoms of Alzheimer's include sleeplessness, agitation, wandering, anxiety, anger, and depression. Scientists are learning why these symptoms occur and are studying new treatments-drug and non-drug-to manage them. Treating behavioral symptoms often makes people with Alzheimer's more comfortable and makes their care easier for caregivers.

Slowing, Delaying, or Preventing Alzheimer's Disease

Alzheimer's disease is not a preventable condition. However, a number of lifestyle risk factors for Alzheimer's can be modified. Evidence suggests that changes in diet, exercise and habits — steps to reduce the risk of cardiovascular disease — may also lower your risk of developing Alzheimer's disease and other disorders that cause dementia. Heart-healthy lifestyle choices that may reduce the risk of Alzheimer's include the following:

- Exercise regularly
- Eat a diet of fresh produce, healthy oils and foods low in saturated fat
- Follow treatment guidelines to manage high blood pressure, diabetes and high cholesterol
- If you smoke, ask your doctor for help to quit smoking

Studies have shown that preserved thinking skills later in life and a reduced risk of Alzheimer's disease are associated with participating in social events, reading, playing board games, creating art, playing an instrument, and other activities that require mental and social engagement.

Alzheimer's Symptoms

Transforming Supertankers into Sources of Renewable Energy

Today, at any given time, there are more than 10,000 oil tankers making their way across the world's oceans. Their combined cargo, approximately 3.8 billion barrels of crude oil, is the fuel which powers our modern lives, and the source material for everything from plastic goods to chemicals of an almost infinite variety.

The oil tanker is perhaps one of the most iconic symbols of man's industrial progress. Among these ocean giants are some of the largest man-made objects ever created, and without these gigantic vessels, our lives as we know it would be forced to grind to a halt. And while hydrocarbons are expected to play a major role in the world's energy mix for the long-term, there is no denying that our deep reliance on oil and gas for almost every aspect of life is slowly changing. This, in turn, means that the growth in construction of these giants of the sea will eventually slow down. This begs the question – What will happen to some of these super massive oil tankers as they retire from service? What use can they have for mankind when they have reached the end of their operational lives?

A growing number of futurists

Feasibility tests in a laboratory setting have shown the huge displacement that oil tankers generate would help to ensure they remain buoyant.

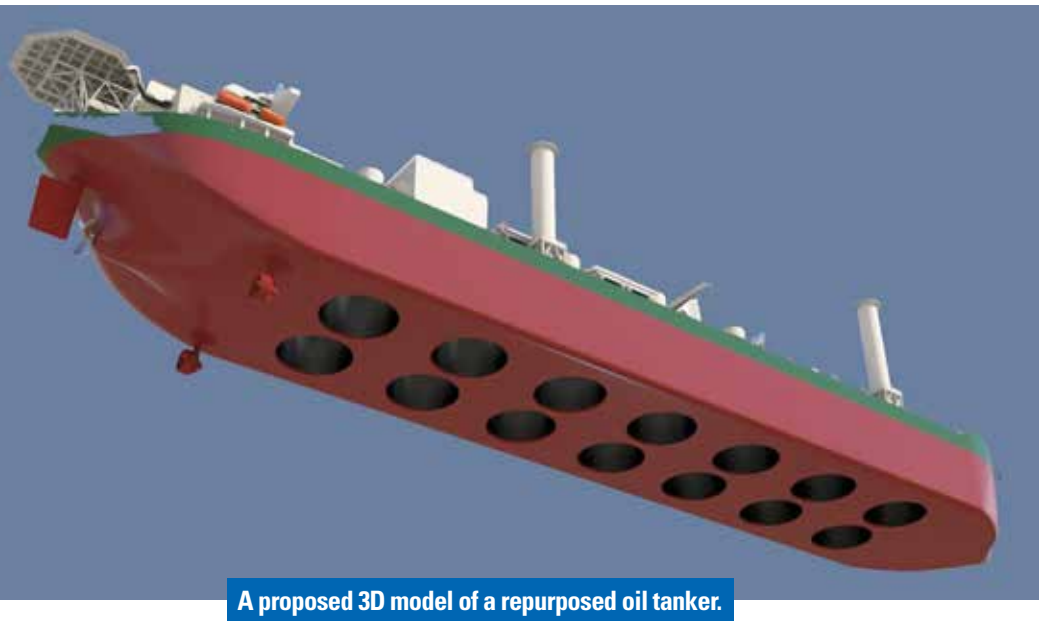
and forward-looking industrial engineers believe that old oil tankers can be rehabilitated and transformed into sources of clean, renewable energy. Some engineers believe it is possible to use the enormous hulls of oil tankers to create floating power stations that can convert ocean swells into electricity. While this plan to create the world's first "waveships" may seem far-fetched at first glance, detractors should be reminded that the technology and engineering-knowhow currently exists to create this dream into reality. The only remaining requirement is a bit of ambition and bold support – either from national governments or the oil sector itself.

As Managing Director of ShipEco Marine, Andrew Deaner is a believer in the possibility of "waveships" being utilized on a commercial scale. "The current problem with most wave energy projects is that they are fixed in place, close to the shore so they can be connected to the electricity grid. This isn't necessarily where the best waves are. With a ship you are mobile, so you can move to the edge of low-pressure weather systems where the waves are bigger and there is more energy," he said in a recent explanation of how these proposed waveships may be utilized.

Transforming a supertanker into an environmentally friendly mobile power station draws on other areas of the oil industry for its inspiration. Diving support vessels for installing and repairing oil wells and pipelines on the sea bed have special chambers cut through their hulls, known as moon pools, which allow submersible vehicles to be lowered safely into the ocean. On choppy seas, the water levels in these moon pools can move up and down as waves pass along the length of the ship. This in turn can change the air pressure inside the chamber above the pool of seawater as it rises and falls, which works like a giant piston. Future waveships would have turbines placed at the top of the chamber that are driven by the air as it is pulled back and forth by the water. These turbines could then be placed in columns all down the length of an oil tanker.

Feasibility tests in a laboratory setting have shown the huge displacement that oil tankers generate would help to ensure they remain buoyant. Depending on the hull size, a tanker could have a capacity to produce between 10 and 30 megawatts of electricity. A very large tanker could have up to 35 moon pools, each 20m in diameter.

The technology needed to do this is not impossible to create. In fact, it already exists. In the 1970s, the Japan Marine Science and Technology Center built a boat shaped buoy that used air turbines at the top of 22 bottomless chambers cut into the hull. But tests of the vessel, which was anchored in the Sea of Japan, showed its ability to absorb energy from the waves was "disappointing." More recent-



A proposed 3D model of a repurposed oil tanker.

ly, however, engineering giant Siemens has developed a more efficient "hydroair" turbine that can turn the oscillating flow of air inside a water filled chamber into electricity. Another firm, called Ocean Energy, has also built buoys that use a similar principle that are being tested in the Atlantic Ocean.

Like many other wave energy devices, these systems are mounted on platforms that are moored in place and so rely upon the weather at a single spot in the ocean to generate sufficient waves. Wave energy generators also need to be able to transmit the electricity they produce back to shore, and so need to be close to the coast so they can be connected through cables.

Some, however, believe this is limiting the potential of wave power. They say that putting oscillating air flow turbines above moon pools on board ships could allow them to chase storms around the oceans to get the best waves. Out on the open ocean where unimpeded winds can generate larger waves, the amount of energy that can be generated is many times greater than can be produced in coastal areas, which is a completely different approach to wave energy.

The project has already received the backing of the UK government, which funded some of the feasibility studies and scale model tests. These have shown that tankers can be modified to create moon pools without compromising their strength and stability. The next challenge would be getting hold of a suitable ship. Second-hand oil tankers are not cheap and even an ageing, relatively small ship can cost millions of dollars on the open market.

The number of large oil tankers being scrapped reached record levels in 2018, with more than 100 vessels being sent for demolition. Converting these vessels into waveships could be a tempting alternative to scrapping them.

Deaner's vision goes beyond simply turning these ships into power stations where the energy will be stored onboard in expensive, heavy batteries. Instead, he sees these giant ships becoming floating, self-sustainable factories by putting the electricity they produce to immediate use. "We are looking at making products onboard so we are not tied to any electricity grid connection," he says. "We are looking at producing fresh water – we think we could make somewhere between 18,000 and 36,000 tons a day before bringing it ashore. We could also make hydrogen or liquid nitrogen, which we could sell to industry."

However, not everyone is convinced by the idea. Stephen Salter, a leading wave energy expert at the University of Edinburgh who invented one of the early wave energy devices commonly known as Salter's Duck, says air turbines may struggle to cope with the wide range of flow speeds caused by natural waves on the ocean. He also worries about how resilient an oil tanker would be on the high seas with holes cut in its hull.

In addition to creating energy, a Norwegian company called EnviroNor is developing technology it hopes can be used to convert oil tankers into mobile waste water treatment plants. These offshore treatment plants could then be sent to cities around the world that are struggling with water shortages. EnviroNor say a single tanker could treat the waste water from a city of 250,000 inhabitants. Mooring these converted tankers alongside wind farms, they could also use renewable energy to desalinate water for coastal cities.

Portions of this story were sourced from a BBC article by Richard Gray.

The Well Diggers of Old Kuwait

As part of an effort to shed light on the traditional professions, crafts, and customs of Old Kuwait, The Kuwaiti Digest presents a new series of articles which aim to provide a historical context for young Kuwaitis in the 21st century who may be interested in learning more about Kuwait's history.

The first article in this new series focuses on the well diggers of Old Kuwait, who had the critically important role of ensuring fresh water could be accessible in a harsh desert environment where no other overland water sources existed.

Water wells, or *Al-Jleeb*, were considered one of the most significant necessities of old Kuwaiti households because of the role they played for matters such as bathing, drinking, and washing utensils. The majority of water wells inside the city contained a high salinity content and used to be known as *Al-Kharij* water, except for very limited areas with low salinity waters used for farming. Water came out at a depth ranging between three to ten *ba'as* (1 *ba'a* was approximately 2 meters,

and this unit of measurement varied by region). The majority of the Sharq area of Kuwait was famous for its proximity to water at the land surface, while the Mirgab area and a number of areas in Qibla were noted for the depth of their water.

A number of Kuwaitis specialized in digging wells, while some were famous for precisely and rapidly carrying out their work. Usually, two people dug up the well – one of them to dig and the other to extract mud from the well through a drum fixed with a rope, carrying it away from the hole. According to a number of sources and written material associated with this profession in Old Kuwait, many well diggers were blind. In terms of work, the well was dug up by using *Al-Heeb* and *Al-Sakheen*, until its depth reached almost one and a half meters below the water level. Then, the water would be cleaned and the *Al-Astad* would start building a wall of rocks around it approximately one meter in diameter. The process of building the wall is known as *Al-Tawy*, and this was a careful and exhausting task, as the space for the *Al-Astad's* movement was very limited; in addition, the irregularity of the rocks used in the building process added to the complexity of the process. The well walls used to be built in sandy areas, especially in the Sharq area, so that the walls would not collapse and cause concealment or backfilling of the well. In the Qibla area, the majority of wells were built without walls due to the presence of the strong soil there.

The process of digging the well and building its wall took around three to ten days, according to the type of soil. A number of well diggers were famous for digging up the well in one or two days. Well walls were built with large sea rocks, connected together starting from the well base to the top. Cement was not used, but instead rocks were placed on top of each other, as the rock was placed on the two rocks in the row below it, and so on. This method is called *mokhowlafa*. Also, a "neck" was built for the well, which was a wall above the ground surface approximately one meter tall. The diameter of the wells were approximately one meter, after building the wall using rocks which were approximately 25cm thick.

The types of soil differ from one area to the other, which reflects the ease or difficulty of digging the well and building its wall. If the land was solid, it was difficult to dig and required greater effort and lon-

ger time, but it was easier to build its wall. But if the land was sandy, the sand and mud would continue falling from each side while digging the well, which might lead sometimes to backfilling a big part of the well after reaching the well bottom and coming out of the water. This would require starting the work again. The accumulation or collection of water at the bottom of the wall required the place to be dry to a certain extent. That forced the *Al-Astad* and his workers to extract large quantities of water from the well as soon as possible in order to be able to build the foundation.

Among the most famous well diggers at the beginning of the last century in the city was a blind man known as Dhabeeb Al-Azmi, who was famous for completing wells within one or two days. He used to complete the work in a perfect manner during such a short period, assisted by his brother. The wage for digging up the well was approximately one Rupee at the beginning of the last century, which gradually increased until it reached ten Rupees in the 1940s. The house owner used to receive the well after ensuring that the water level was reached, and then he would hand over the wage to the digger. The deeper the depth of the well, the more the digging fee would increase.

The *Al-Astad* or the well digger would also build the drain, which did not differ to a great extent from the well in terms of digging and building; however, it was wider. As for building its walls, it resembled *Al-Tanoor* (mud oven) in its shape. The *Al-Astad* would start building its foundation, which was normally wide with a diameter of two meters or more. The *Al-Astad* would start narrowing it down gradually while building the wall, until the building might reach the ground level, at which point, the diameter of its opening would be around half a meter. This method of building gives strength to the drain wall and its upper part might look like the roof of a dome, where the rocks are placed on each other, giving it additional strength and preventing it from falling down.

This information was sourced from The Old Crafts, Trades, and Commercial Activities in Kuwait by Mohamad Abdul Hadi Jamal.

KOC rig worker in the field

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