

# High Tech for Failaka: An adventure in the Arabian Gulf

Living and working in Kuwait in 1976 during the construction of the Water Supply System to Failaka Island.

Short version translated into English from the German original:

[www.http://ahr-eifel-rhein.de/seiten/reisen/1976\\_Failaka\\_Island\\_Water\\_Supply.pdf](http://ahr-eifel-rhein.de/seiten/reisen/1976_Failaka_Island_Water_Supply.pdf)

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## Background and History

Just a few years after the oil crisis of 1973: The revenues of the countries that had joined together in the OPEC – the Organization of Petroleum Exporting Countries – had increased significantly. The exploration of oil was promoted worldwide; further sources were discovered and developed. In Europe, projects of exploration of oil and gas in the North Sea were conducted in order to reduce the dependency to the OPEC countries. Kuwait, one of the Emirates in the Arabian Gulf region, benefited from this and used a part of the revenues to develop its infrastructure and water supply. About one million people were living in this country; approximately half of them were foreign guest workers. The costs of living were low, fuel was about 5 Eurocent per liter, using the phone in the country was free; but getting a phone connection to Europe was very difficult, it took hours to get a connection.

The water supply was partly fed by the few wells, but its water had a high degree of salinity. Furthermore there was a desalination plant that made it possible to connect even remoted areas of the small Emirate to a drinking water network. It was therefore planned to connect the Island of Failaka which is located 25 kilometers northeast to Kuwait, close to the Shat Al-Arab, to the drinking water network of the Mainland.

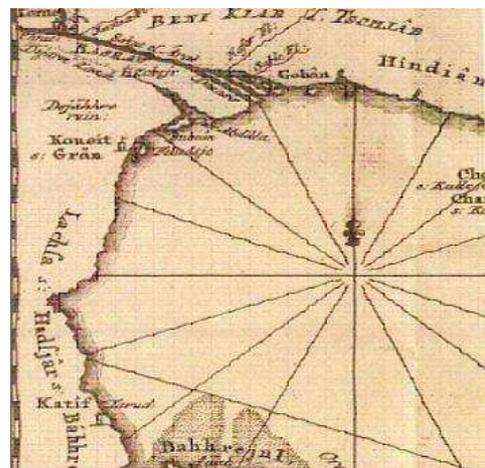
The Island of Failaka belonged to the Dilmun civilization (ca. 3.000 to 2.000 BC), a civilization of mariners; with its center in Bahrain, it may be regarded as one of the important civilizations of the old orient, in addition to Sumer, Egypt, Babylon and the Indus Valley. Archaeological excavations on the island confirm this fact as well as the presence of Greek mariners in the fourth century BC. Niarchos, the admiral of Alexander the Great, was stationed with a garrison on the island.

*The traveler and cartographer Niebuhr came in 1761 to this area;*

*in 1772, he published a map*

*that listed the names Failaka and Koueit / Gran.*

*The name of the island appeared the first time on a map in the year 1482 inspired by the works of Claudius Ptolemy.*

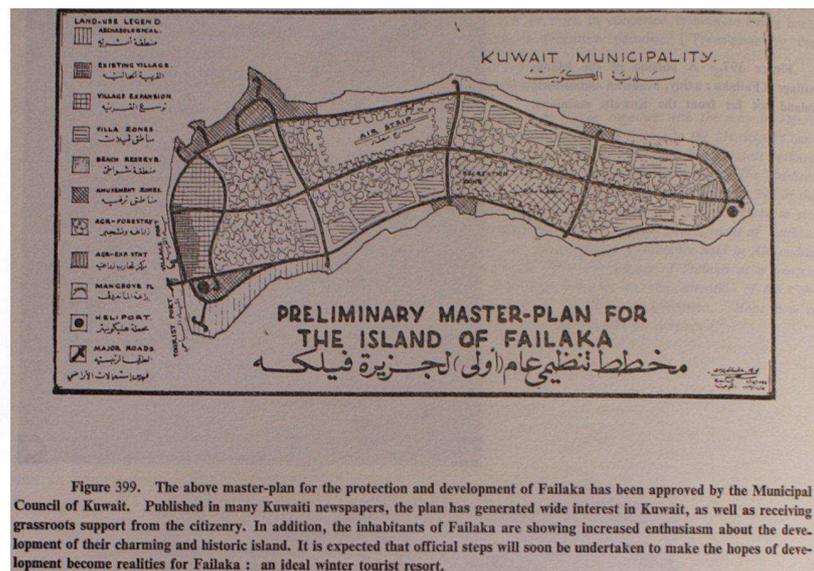
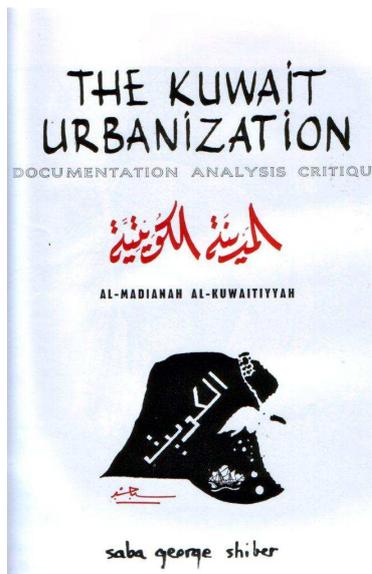


At the time of the Ptolemaic Empire there was a city with the Greek name Ikaros, a kind of a Greek colony. Coins that were found during the excavations show that the island was an important place of trade that was connected to Iraq, Persia, the Mediterranean, the Levant and the Indus valley. After the Persians had colonized the island, and after its islamization, the island came into the area of influence of the Caliphs of Damascus and Bagdad as well as the Persians, until the Portuguese colonized the island in the early modern age in order to build a commercial settlement.

During the immigration of Bedouin tribes from the Arabian Peninsula, the Al-Sabah family came in the middle of the 18<sup>th</sup> century to Kuwait. Until today the ruler of Kuwait originates from the Al-Sabah family. After the rule of the Ottoman Empire and Great Britain, Kuwait and the Island of Failaka became independent in 1961 as a hereditary emirate. Nevertheless, British troops remained in the country in order to secure its borders, particularly with regard to the border disputes with Iraq. In 1973, for example, Iraq occupied areas close to the border; during the following shooting people were killed.

### Failaka: Early national planning targets

Only a short time after Kuwait's independence, the Kuwaiti government issued a study regarding the urban development of Kuwait and many ideas about the development of the island were discussed.



Extract from: *The Kuwait Urbanization (The original copy of this document was donated to Mr. Sabah Al-Reyes, PACE Pan Arab Consulting, Kuwait, in 2008 by the author)*

According to the newspaper Kuwait Times dated 29/12/1961 a so called tourism expert had already said to the responsible authorities:

*“You have this wonderful sun; why don’t you sell it to Europe?”*

The persons in charge dreamed of turning the island into an international tourism destination, for tourists escaping from the cold weather in European winter. The first conceptions of this development were:

*“...the beaches and the beach sweeps of Failaka are so beautiful and clean that they are comparable very easily to the most famous beaches of the world. The remoteness and the isolation of the island and yet its proximity to Kuwait make it an enviable place of serious contemplation as well as an international winter resort, rest and recreation area. Access to Failaka can be guaranteed by reliable helicopter and ferryboat services ...”*

Several years later the government of Kuwait decided to connect the Island of Failaka via an offshore pipeline with the water network of the mainland. The island is flat; it is 14 kilometer long and between three and eight kilometers wide. The island had its own fresh water resources, but there are plans to turn the island into a holiday destination, as it was mentioned in the development plan of 1965. Until this time, almost 2.000 people lived there securing their existence through fishing, trade and agriculture for their own needs. Pearl diving was another source of income until the near past. The coasts of Kuwait,



Iraq and Iran are not far away. New settlements in the south of the island, a high-power supply via an offshore cable and a sufficient water supply via a pipeline were planned. But the required pipeline and submarine cable had to cross the shipping channel between the mainland and the island. Kuwait's port Shuwaik is located northwest to Kuwait city.

In an international tender, the German Joint Venture "Northern Offshore" won the competition for the pipeline. Japanese companies got the contract to lay the submarine cable; Korean companies were assigned to build 2.000 housing units.

*Collage of an artist: Location map of the project "Water supply for the Island of Failaka" with some details of the project.*

## **Northern Offshore**

“Northern Offshore”, a consortium of the German companies Philipp Holzmann, Preussag AG, Ludwig Freytag and Bohlen & Doyen, tendered for the project after these companies had successfully built the pipeline shore approach of the Ekofisk gas pipeline (36 inch) for Norwegian Statoil; this pipeline connected the German Island of Juist with the mainland crossing the tideland. After this, the head office based in the German city of Oldenburg wanted to promote this offshore knowhow worldwide. The Failaka project was the first follow-up order. Preussag AG assumed the technical responsibility for this project.

After finishing his studies at the technical university of the German city Aachen, Matthias Bertram, a young construction engineer, started to work for Preussag in the German city of Hanover. At first, he took part in an one-year project that was financed by the Federal Ministry of Research which was conducted in cooperation with Blohm & Voss, AEG and Mannesmann in order to study procedures of laying pipelines in deep water. At 1976 it was hardly possible to lay large diameter pipelines in depths of more than 100 meters. The research project had the goal to develop techniques (laying, welding, coating, insulating) that make it possible to lay a pipeline safely up to a depth of 1.000 meters. With his theoretical knowledge Mr. Bertram was asked to take part in the Failaka project for four months as an assistant to the Project Manager with the special task to control and supervise the construction of the offshore-part of the route. He agreed immediately and was ready to go for this challenging project.

One of his first impressions of Kuwait were the uncountable fires that he saw during the landing procedure at night. The gas that emerged from the oil production wells was flared; there was no commercial use for it at that time. Leaving the plane he was surprised by the high humidity, the heat and mugginess that he was confronted with at the arrival at Kuwait airport. Rainer, the commercial manager of the project who had lived for several years in Jiddah /Saudi Arabia picked him up with an American Buick auto car.

They went to the “Villa”, a house in the Abdullah Al-Salem district close to the second ring road that was rented for the period of the project. The house was called “Villa” after the board of directors of the Joint Venture in Germany had heard about the rental price: 2.000 Kuwaiti dinars per month, an exorbitant price at that time. The project was planned to be finished within four to six months, so the rental price was accepted. The majority of the team lived in the “Villa”, where two Indian boys were employed to cook and to keep the house in order.

## **Life in Kuwait**

The construction works started with some delays, so there was enough time at the beginning of the project to visit the city and the whole country on weekends. The old, narrow souk was worth seeing, with its fruit merchants and coolies who carried several things for their Kuwaiti masters in a huge basket or bag on their back.

Additionally to that, the old shipyard, where the traditional Dhows were built, modern mosques and houses under construction were worth seeing.



*A shipyard specialized in the construction of Dhows, a mosque, the Emiri Palace*

Fishermen sold huge fresh shrimps directly at the beach; In local supermarkets in old clay ovens freshly baked traditional flat bread was offered to the customers.

Apart from the souk, the water towers and the Emir's palace, there were only few places of interest in the city.



*Kuwait's Souq in 1976*

During some of the many extremely hot days the engineers went swimming in the area of Mina Saud close to the border with Saudi Arabia and in the former neutral zone between Saudi Arabia and Kuwait. In this region the beach was clean, whereas the beach in the area of Mina Al-Ahmadi, a few kilometers in the north close to an oil shipping point, was partly covered with oil clumps.

Al-Ahmadi was the center of Kuwait's oil industry; the headquarters of the oil companies were located here.

Trips into the desert were very appealing and charming, especially at the end of November when the first rain came down and the desert turned for a few moments into a green gleam. The annual amount of rain adds up only to 100 mm in some regions. Grains carried by the wind began to germinate fast, but after a short period of time it withered, were burned by the heat and covered by sand. Sometimes, heavy sandstorms moved across the country and limited the view to a few meters. It was the time during that many rich Kuwaitis left the city and went to the desert where they pitched their traditional Bedouin tents and lived there for a short period of time with their families. They arrived by an off-road vehicle instead of camels that they had used in the past.

It was interesting to visit the area around Shatt Al-Arab and Bubiyan Island, with its nice landscape and people. These trips were a little bit dangerous because this area close to Iraq was under strict military control of both countries. In the month of December 1976, Matthias, Rainer and his girlfriend Sandy – who had come from Jeddah for a visit – toured through this area. At a branch of the Shatt Al-Arab, opposite the Island of Bubiyan, they met some fishermen with whom they began to talk. They were invited to eat with them the grilled fish; they talked in a friendly atmosphere about this and that: about the project for which they were in the country. Later, one of the Kuwaitis presented himself as a member of the secret service; he wanted to know – in a very detailed way – what they do in this region of the country and why they had entered the prohibited zone. The friendly atmosphere had finished; Matthias, Rainer and Sandy were happy that they were allowed to leave this region without big problems.

Another nice activity was a trip with the speedboat, equipped with a Johnson outboard motor. The boat was bought for getting quickly to the lay barge; it was especially reserved for the client and the Lloyds inspector, but on weekends it was possible to use the boat for small tours or for taking a diving tour. One of these trips almost ended with an empty tank, in the border area between Iraq and Iran.

Jim Noon the Lloyds inspector, Kurt the welding expert of Northern Offshore and Matthias went from the port Ras Al Arad in Salmiyah to the Lay Barge "Baas Kobus" that laid at anchor close to the landing point of Failaka Island. One of the seamen from the barge navigated the boat. The visibility conditions were extremely poor; hence, it was very difficult to see the crossing ships in the highly frequented shipping channel. Therefore, it was important to go precisely by compass. Matthias who knew the area and the conditions best told the steerman to go on the 35 degree position, but more than once he realized that he went on the 30 degree position. On the first glance, this is not a big difference, but after driving 25 kilometers under bad weather conditions this is no trifle. So after the expected journey time they came neither to the island nor to the barge. They continued the travel hoping to see the island soon. Now, Matthias was steering on his own, trying to compensate the deviation. But no chance; during the dense sandstorm it was not possible to see anything. The tank was half empty; hence, they decided to begin the return trip. For safety reasons they asked the crew of a Dhow that crossed the way about the direction to Kuwait. After some time, an uninhabited island appeared in the middle of the sandstorm. It seemed to be the island Mishan that is located few kilometers in the north of Failaka. That was an essential landmark and therefore they reached the barge soon. The crew on the barge had already contacted the office on the mainland announcing the missing of this boat and its crew. What had happened? Because they drove under poor visibility conditions into the given direction, the boat

deviated from its destination, coming into the open sea, turning into the direction of the peninsula Al-Fao/Iraq without seeing Failaka.

### **Surveying the offshore-part of the route**

While the arrival of the lay barge to Kuwait delayed, there was enough time to examine the route that was specified by the client. Before that, a Japanese consultant had conducted a study about the selection of a possible sea route. Based on that study the length of the pipes was determined, and pipes were ordered and shipped. During the signing of the contract, the client, the MEW, Ministry of Electricity and Water, was assured that the executing company would review the study.

The recommended offshore part of the route, approximately 25 kilometer long, connected Salmiyah, a southern suburb of Kuwait City with the northwest of the Island. From a geological perspective the route consisted of two parts:

Beginning in Salmiyah, the pipeline crossed the area of the beach, running through the dead coral reefs and the shipping channel with its depth of about 30 meters. In the second half of the route, the coral reefs were covered by a thick layer of mud. The water level sometimes differed two meters between low tide and high tide.

Close to the landing point in Salmiyah groove like depressions in the coral reef were found. Therefore, the Japanese partners had planned an alternative route in this area. The examination of the area by Northern Offshore showed that also the alternative route couldn't guarantee the security of the pipeline. So it was necessary to find a more secure alternative, because the warranty period was 30 years; not a short time.

Apart from these problems with the pipeline routing the team realized that there were other things, which could endanger the safety: High current velocity at the sea ground of up to 0.8 m/sec. could lead to significant drag and lift forces. So, it was absolutely not sufficient to examine the critical points of the route with an echo sounder. The team needed a complete surveying program with side scan sonar, echo sounder, measurements of the flow rates and the examination of underground conditions at least at some points of the route.

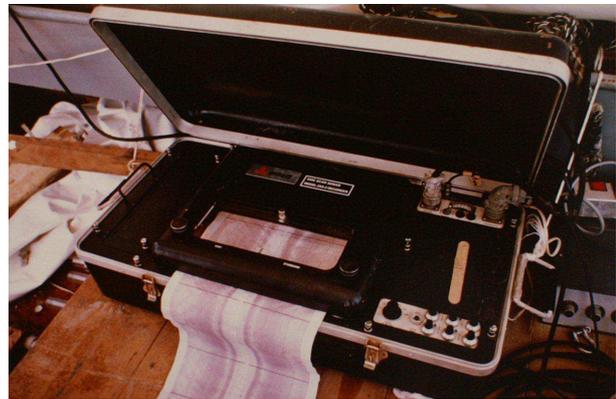
Preussag Meerestechnik, a subdivision of Preussag AG, conducted this task for the Joint Venture, using a special trisponder measuring system with points of reference in Salmiyah, the island and the measuring boat, NO 21, and later on the Lay Barge.

Matthias, the responsible employee for these works, stayed for many weeks on board of the Northern Offshore 21, the boat that was redesigned for the measuring and on board of the Baas Kobus. He was accompanied by three colleagues from the Preussag Meerestechnik. That was an challenging and exciting task for a young engineer, although Matthias had to struggle with seasickness quite often.

The results of the further surveying showed that it would be possible to lay the pipeline with few deviations from the originally planned route, avoiding both the critical points on one hand and the lengthening of the route. But it became absolutely necessary to position the pipeline in this critical coral reef area exactly and to observe possible free spans between the touch points of contact between sea ground and pipeline.



*Installation of a decca trisponder in Salmiyah and the calibration check at the landing point / Failaka*



*A track recorder and a side scan sonar record (survey equipment)*



*Surveying the construction site and the pipeline route*

These free spans could become very critical under certain current velocities. It was not possible and not wanted by the client to dig a trench for the pipeline in the area of the shipping channel or the coral rock. Therefore the client accepted the risk that a ship going to or coming from the port of Shuwaik anchors in the area of the pipeline.



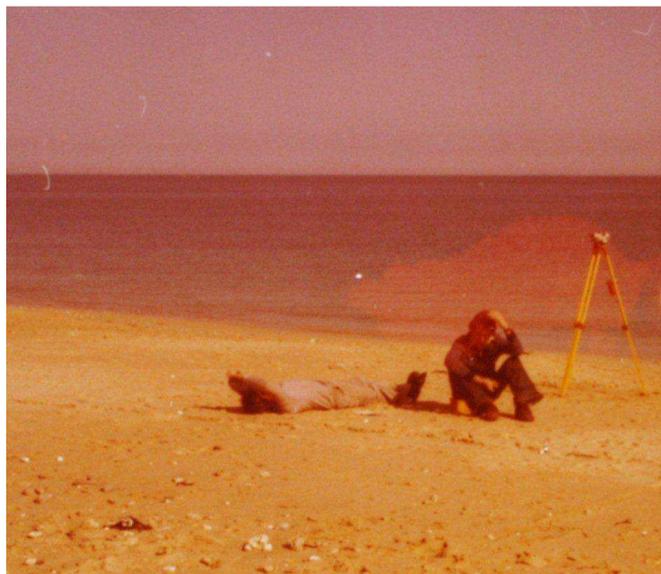
*Placing moored surface marker buoys, a side scan sonar and the construction site sign-board*

For measuring of the offshore part of the route it was necessary to stay on board of the Lay Barge for longer periods, a strange experience at stormy weather. It happened that the team woke up at night through the roar of the sea, getting the impression that water would be entering into the crew's cabin at some points.

During a heavy storm it happened that the Northern Offshore 21 that was fixed alongside to the Baas Kobus sank. Sometimes, the flood and the storms were so strong that the quay in Kuwait Mainland as well as the floor of the pipeyard and the site office were flooded. Thus, one of the employees was shown with his car at the front page of the Arab Times on April 7, 1977.



*The front page of the Arab Times dated April 7, 1977*



*A survey at 50 degrees Celsius in the shadow*

Some employees had their problems with the unusual and monotonous situation on board of the lay barge Baas Kobus. But the cook of the ship used to say that it is not that bad until an employee pulls a banana with a leash. In this case it would be time for a vacation. Well, no one reached this point. From a technical point of view the measuring of the onshore part of route was not that difficult, but the weather conditions turned the work on the island sometimes into a huge challenge. So, it happened shortly before one of Matthias' three yearly flights home to his family that he wanted to survey the pipeline route on the island. That wasn't a big task, only one kilometer. In the night before he slept on board of the barge that was anchored offshore Failaka. It was agreed upon that a local survey assistant should come to the island in order to support him. But the assistant didn't leave the mainland and Matthias stayed alone on the island with his measurement devices. So, he tried to work together with local people who hadn't any knowledge of surveying or any experience in the use of surveying equipment; a nearly impossible task. After a few hours the sun shone vertically on the treeless island. Temperatures of 50 degrees, in the shadow; but there was no shadow at all. Matthias was afraid of collapsing, so he knocked on the doors of some local houses asking for "Mayya", water. A housewife brought a bowl of water to the door. Such small things became essential for survival and caused a great thankfulness: "shoukran", thank you. Finally they conducted the work before a ship was picking him up in the evening, bringing him back to the barge.

### **The laying of the pipeline to Failaka**

The additional offshore surveying works took some time, but didn't cause an extension of the construction period, because of other problems. Just before Matthias' first flight from Germany it had turned out that the barge and its components were not fully prepared for the special needs of this project. One of the employees in Germany had – during the preparatory stage – mixed the units of measurements, forwarding the wrong data to the external consulting office. The consequence would have been a big material load excluding the possibility of a secure laying of the pipeline. So it became necessary to build a completely new stinger in order to guaranty that the admissible stress during laying of the pipeline was not exceeded. Additionally it was necessary to install a new, more powerful tensioner at the barge to make sure that maximum pull forces could be transmitted into the pipe string. This was necessary to guarantee a certain predefined radius of the pipestring (lower bend) during the laying procedure.

These modification works had to be conducted on site in Kuwait, since the team didn't realize the wrong calculations before the barge was shipped to Kuwait. During the alteration works the pipe yard was built at the beach, in the south of the newly installed Kuwait Water Towers, the new symbols of Modern Kuwait. The seamless 10" pipes with a length of twelve meters and a wall thickness of 14 mm (sockets with 17 mm) were produced by Mannesmann in Düsseldorf and equipped with an internal cement lining and an external PE-coating as corrosion protection. Additionally to that the pipes were equipped with an external concrete coating (30 mm) in order to ensure buoyancy control.

To improve corrosion protection the external concrete coating was reinforced with a plastic reinforcement instead of "chicken wire" that is normally used in the offshore construction sector. The concrete wasn't coated as jet-concrete but as formwork concrete. The pipes were transported by ship

from Düsseldorf to Rotterdam, from there to Kuwait, and from the port of Kuwait by barges and tugboats to the pipe yard, for stocking and further processing.

### **Arrival of the ocean ships carrying the pipes**

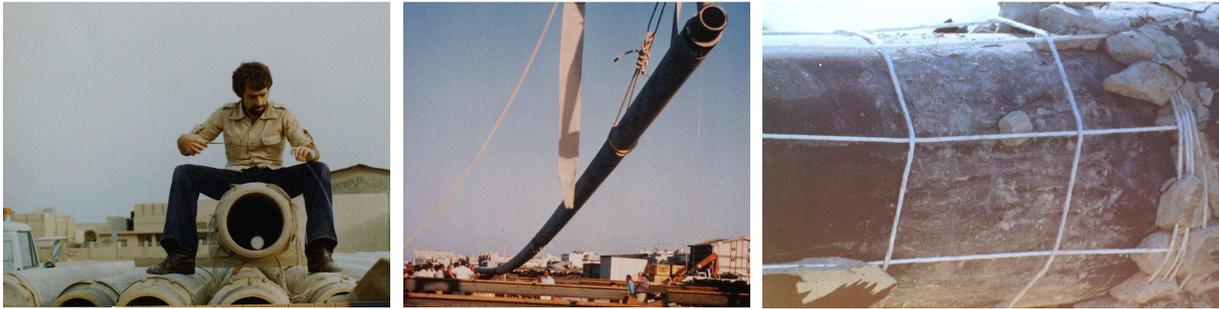
Before the offloading of the ocean going ships in the port of Kuwait it was necessary to carry out the custom procedures on board of the ships.

Matthias will never forget one of these procedures: He went from the pipe yard to the port Shuwaik close to Kuwait city with captain Andreas Attema and Rainer using the Waddensee, a 500 HP tugboat of the Dutch sub-contractor of Northern Offshore. The vessel anchored in the roadstead, close to the port. When they arrived, the crew of the vessel threw a rope ladder to them, in order to get from the Waddensee onboard of the ocean going vessel. The altitude difference between the Waddensee and the deck of the vessel was around 25 to 30 meters. Rainer was the first climbing the freely hanging rope ladder. Matthias was the next one to climb. The higher he climbed the more he got a bad feeling. He was really afraid of losing control. The consequences would have been bad. This was not the moment to show any weakness. But finally he reached the deck; he will never do this again.

The pipes were discharged and stacked at the pipe yard of Northern Offshore. Shortly after this, Mr. Kalotti a Palestinian construction engineer who worked as Project Manager for the client MEW refused to accept the pipes! The reason: On the one hand the thickness of the concrete coverage ranged between 28 and 29 instead of 30 mm, and on the other hand there were small cracks in the concrete mantle. For a couple of days the team discussed this topic with the clients engineer trying to convince him with several tests of the quality of the pipes. The sub-contractor from Düsseldorf, Koenig Company, who had applied the concrete mantle was attending the discussions; he feared that his company would not survive the refusal of the pipes.

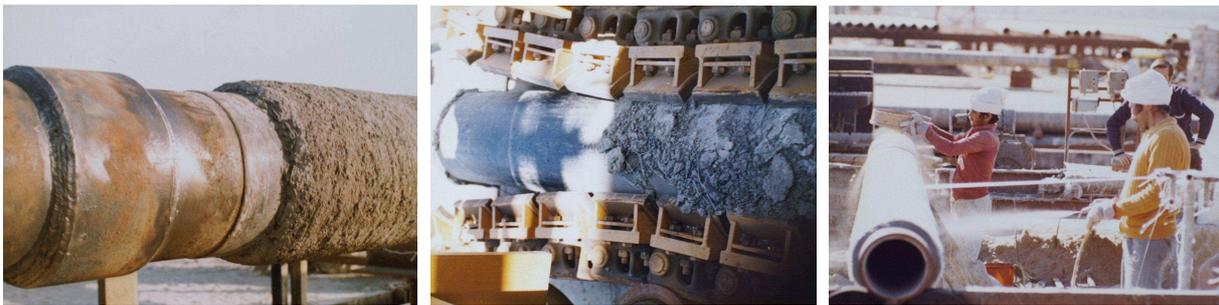
They conducted tests to renovate the pipes with chemicals as well as bending tests in order to show the load capacity of the pipes, but without any effect. Finally not only the client but also the project management was convinced that it was not possible to lay the pipes with this concrete. The client demanded to coat the concrete in a jetcrete procedure and reinforce it with chicken wire, the normal procedure in the field of offshore pipe laying. The Ekofisk pipeline, the previous reference project of Northern Offshore, was also built in this way. Therefore, it was necessary to dismantle the 25 kilometer long concrete coating without damaging the corrosion-resistant layer. The project team of Northern Offshore developed a cutting machine that cut the concrete mantle from two sides in order to detach it in two shells. The pipes were shipped to Sharjah, at the other side of the Arabian Gulf, in order to be concreted as requested by the client and to be reshipped to Kuwait. The Joint Venture Partner Company L. Freytag sent a concrete specialist from Canada to Sharjah in order to supervise the project exactly and continuously.

Shortly after the first pipes were reshipped to Kuwait, the client refused the pipes again. He criticized again the existence of cracks in the concrete as well as the fact that the concrete mantle didn't reach the required thickness. Mr. Kalotti was ready to accept the thickness, but not the cracks. Indeed it was not possible to bend the concrete on the rigs of the pipe yard or to hold it in the tensioner without the cracks becoming wider or the concrete structure dissolved completely.



*Testing the “Koenig” concrete at the pipeyard*

In order to solve the problem as a whole, the team decided to coat the concrete mantle with additional three layers of fiberglass reinforced plastic mesh and to reach by this method the required thickness and to prevent further cracks and the dissolving of the concrete. At the pipe yard 25 kilometers of pipes were wrapped and coated with a winder. First tests at the pipe yard with the wrapped pipes showed that they were able to withstand the load and the transport to the barge.



*“Bredero Price” concrete at the yard and in the tensioner; Glass fiber reinforced plastic coating at the pipeyard*

But: When the team started laying the pipeline on the barge for the first time they realized that the tensioner was not capable of transferring the necessary pull load into the pipestring. The surface of the wrapped pipes was too smooth, too slippery. The pipe slipped through, the surface hadn’t the required roughness. This problem was solved by adding sand into the upper layer of epoxy resin what led to the required roughness. The MEW accepted the pipes, it was time to start the laying procedure.

### **Pull-in landing point Failaka**

The discussions about the concrete were still going on when the Baas Kobus was located 500 meters off the coast of Failaka. Additionally to the captain, Walter Adler, a German-born American joined the offshore team; he was responsible for the offshore laying of the pipe.

Walter looked back to an interesting past; he told us: during the Second World War he was a captain of a submarine boat until he was captured by the French. Later he tried to get from there as a stowaway to a cargo ship going to the Caribbean. When the crew found him he was left in Haiti where he was put into jail. There he got to know friends of Francois Duvalier who became shortly after this president of

Haiti (Papa Doc). Walter belonged to his first government working as a counselor for the agricultural sector. After this he went to America where he began to work for the offshore contractor Brown & Root.

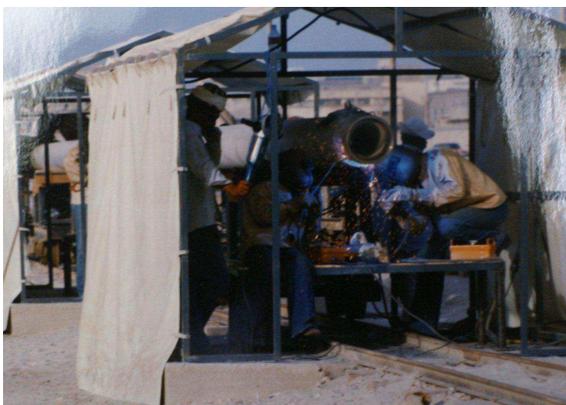


*Trench and shore approach offshore Failaka*

The flat west coast of Failaka is completely covered with mud. And beneath the mud there was coral rock. Additionally to that, the Kuwaiti government had dumped sand onto the coast. It was not possible for the Lay Barge to get to the landing point; because of this, the contractor dug a 500 meter long ditch throughout the sand, mud and coral rock, using a small pontoon equipped with four anchors.

Then, it was necessary to get the pipeline from the laying barge to the island, but there were no big winches available with that this could have been done from the island. So they used the winches installed on the Lay Barge. At the landing point an anchor point was dug in that served as fixed point of a diverter pulley for the pull-in procedure of the pipeline.

The twelve meter long pipes were welded together at the pipe yard in order to get fifty long pipes that were shipped by a transport barge to the Baas Kobus. The pipes were put onto the ramp of the lay barge and in the welding station the pipes were connected to one long continuous pipestring; the area of the welding seam was x-rayed, coated and filled up with a fast-binding epoxy-sand mixture. After this the pipestring could be pulled another fifty meter towards the Island by means of the winches and the anchor point at the Island. To keep the pipestring afloat during pull-in, oil drums had been attached as buoys. Soon the first part of the laying procedure in the shallow water offshore Failaka was done.



*Welding stations at the pipeyard in Salmiah*



*Pull-In procedure offshore Failaka Island*

During the laying of the pipe in the shallow water, the preparations on the other side of the route, at the landing point in Salmiyah, were going on.

### **Shore approach to landing point Salmiyah**

In contrast to the Island the beach at the mainland near Salmiyah was sandy and therefore used as bathing beach for the male youth.

The engineers had to conduct some security measures during the construction period. They dug a ditch from the landside using an excavator of the type O&K RH14. It was planned to dig the rest of the ditch from the waterside, using a locally rented pontoon carrying the excavator. Therefore the pontoon was equipped with three new and one used dual drum winch in order to stabilize the pontoon with anchors.

In order to get as close as possible from the waterside to the land the pontoon carrying the excavator was positioned during high tide, around three or four o'clock at the night. The tugboat Waddenzee had to anchor in deeper water, since parts of the shore was falling dry at low tide. A small boat pulled the pontoon the last meters and anchored alongside. The low tide was already starting, when Andres and Matthias advised the local employees how to use the winches and keep the ropes tight.

They were demonstrating this when the excavator started to dig and the driver of the excavator hit the bucket into the coral rock for the first time. Expectedly the traction went from the pontoon via the anchor ropes to the anchors. But the winch, where they were demonstrating the steps of the work procedure to the labourers could not stand the load. The handle of the winch turned back abruptly with full speed and threw Matthias to the side.

It took some time until the team realized what had happened: The safety catcher of the winch hadn't work because it was corroded and got stuck.

Immediately after the accident, chaos broke out on board of the pontoon. Only Andres Attema remained calm. Matthias, dazed but conscious, laid with two big bleeding wounds on his right arm on the floor of the pontoon. He heard that his colleagues feared that he would bleed to death as well as they contacted the site office in order to get a doctor. The crew of the Lay Barge off the coast of Failaka was just having breakfast when they heard the chaotic radio traffic through their loudspeakers on the barge. The only thoughts of Matthias were: Oh my God, shall I die here? I don't want to die here. In the meantime Andres had bandaged the arm in order to stop the bleeding. Although the beach was only 200

meters away from the pontoon, it was not possible to carry the seriously injured man to the mainland crossing the water with the sharp coral rock. Hence, he was laid onto the mattress of a local worker and carried to the small boat laying alongside the pontoon. In the deeper water he was put onto the Waddenzee that went to the port of Ras Al-Arad. His colleagues Rainer and Hartwig were waiting there with a car. They had asked for an emergency doctor, but no one came and there was not time to waste. They laid the injured on the rear seat of the car and brought him to the hospital close to Salmiyah. The doctors were already informed and therefore they were prepared to start the operation immediately. In addition to the injuries at the arm, where one of the aortas was laid open, but – thank god – not damaged, the doctors treated the broken nasal bone and the broken middle finger of the left hand. The medical treatment in the hospital was excellent. In addition for safety reasons the colleagues of Matthias had asked a Syrian physician who had studied in Germany to visit and check him in the hospital from time to time. Matthias was most happy about the visit of his two colleagues at work from the pipe yard Mohammed and Hanoun, two Kurdish men from Iraq.

The healing process was good, and after ten days it was possible to fly him to Germany for further treatment. On his trip to the airport he just went to the beach of Salmiyah waving to his colleagues on the pontoon.



*Digging the trench at the landing point in Salmiyah*

Now they continued the pipe laying works without Matthias, a colleague from Germany came in order to conduct some of Matthias tasks.

They planned that he should return – after staying a few days in the headquarters in Oldenburg and Hanover – to Kuwait not later than mid-October. During this time his colleagues had laid the pipeline in the flat water off the coast of Failaka as well as they had done the mainland shore approach in Salmiyah. They were just turning into the deeper parts of the route in the area where the shipping channel had to be crossed.

Two days before Matthias returned to Kuwait the project manager called him in Hanover: During a storm the pipe was broken – before it was let down in a secure way – and sank unsealed to the sea ground. Additionally to that the catamaran of the Baas Kobus carrying the electrical power supply of the

Lay Barge had sunk. Bad news. Fortunately, no people were injured. The same day Matthias and his technical line manager went to Kuwait.

The first task in this chaotic situation was to secure the pipe that had filled up with salt water and to hope that the client would be ready to accept the pipe. With the help of a local diving company (Adel Al-Hamad Sub Sea Services Kuwait) that was mandated by the client to check the quality of the offshore pipe, the water-side of the breakage of the pipe was closed with a plug.

After this, fresh water had to be pumped into the pipe until the salt water was replaced completely.

It was not possible to continue laying the pipe with the Baas Kobus. An heavy offshore crane (500 tons) had to be found in order to get the catamaran out of the water that could have been an obstacle to the ships in the shipping channel.

Regarding the laying of the last ten to twelve kilometers of the pipeline, negotiations were conducted with the American contractor McDermott. The company was engaged at this time in the United Arab Emirates and was ready to conduct the laying of the pipe in the shipping channel for a daily amount of 40,000 US-Dollars (100,000 Deutsche Mark at this time) with the barge McDermott DB 9. The crew of the barge (ca. 60 men) was working day and night in two teams, each of them working twelve hours. The team of Northern Offshore only had to conduct special tasks (X-Ray, ultrasonic examination, defining the Route, isolating, coating ...). The Project Manager was supervising the group working at day, Matthias the group working at night. Pipe laying and also the welding were conducted by the crew of the DB 9. Most of the crew of the barge were Filipinos, but the captain, his deputy and the persons responsible of steering the barge were Americans.

There were some other critical situations, for example when some ocean going ships didn't notice the lay barge and its anchorage during the works in the shipping channel so that it became possible that the anchor rope are cut what would result in the inability to navigate the DB 9.

But in the end everything was going well and after two weeks it was possible to weld the Tie-In, i.e. the connecting weld between the two pipestrings. These two sealed pipes laying on the sea floor were lifted, the position of the connection weld was marked, the pipes were cut, the ending sections were prepared, a socket was welded on one end, in order to connect the two ending sections, before laying the whole pipe on the sea floor.



*Pipe laying with the McDermott's DB 9*



*Lowering one end of the pipestring by means of a stinger*



*Recovering the two ends of pipestrings alongside the laybarge*



*Aligning the ends of the two pipestrings before welding the "Tie-in" weld*



*A diver controls the "Tie-In" after the final abandoning of the pipeline*

In the night before Christmas 1977, the pipes were connected successfully. However, the problems didn't end although most of the employees left Kuwait visiting their families.

Matthias spent only a couple of days with his family until he returned to Kuwait. During his absence Al-Hamad had analyzed the quality and the conditions of the laid pipeline.

Soon after his return he was called by Bill the chief diver in the team of Al-Hamad being asked to come to his office in the evening. He explained that he would show him in a confidential way a film that he would give to his client one day later.

In the course of time a common base of mutual confidence had established that served the goals of the project. They helped each other if necessary. Thus, the Northern Offshore team had helped Al-Hamad to localize the flow meter that they had lost in the sea, using their trisponder measuring system and side scan sonar.

The film showed that there were many free spans between the pipe and the sea floor because of the coral reefs. Although there were only 10 to 15 centimeters of space between pipe and sea floor, it was possible that the strong current (0,8 to 1,0 m/s) causes a response acceleration what would be a great danger. The film showed some signs of a response acceleration. Al-Hamad showed this film in advance

so that the Northern Offshore team could prepare for the following consultations with the client. They decided to fill the empty pipe with fresh water in order to reduce the danger of response acceleration. The subsequent calculations demonstrated that there might occur some problems if the length of free spans exceeded twelve meters in length. Thus, Matthias decided to put jute bags filled with a mixture of sand and sulphur resisting cement between all free spans longer than ten meters. This proposal was forwarded to Mr. Kalotti.

After a couple of days and several tests with this system, Mr. Kalotti was convinced and he agreed. Thus, the free spans were treated by the divers of Mr. Al-Hamad in the approved way. Unfortunately, a diving accident happened to Bill, the chief diver, a strong man and a Mormon from Salt Lake City. He stayed too long under water, and after it became clear that putting him into the decompression chamber didn't solve the problem he was brought to Aberdeen / Scotland in order to be treated professionally. Presumably he never worked again as a diver after this day.

After the construction of a pumping station in Salmiyah, the installation of a cathodic protection system, the construction of a pig launching station in Failaka and the final examination of the pressure of the pigging of the pipeline, the construction works were completed and it became possible to start operating the pipeline.

### **Failaka and its water supply**

As it was proposed in the development study conducted in 1965, Failaka was finally connected to the water system of the mainland of Kuwait, through an offshore pipeline. This was at this time the offshore pipeline with the highest technical standard in the world, at least in the opinion of the captain of the Lay Barge McDermott DB 9. The Japanese had installed three high voltage current cables, while the Koreans had built some of the housing units in the south of the island. Well, in principle there was nothing that could hinder the realization of the aims of the first planning phase: There was plenty of water, the power supply was secured, houses for the tourists were built and a marine hovercraft guaranteed a quick connection from the mainland at Ras Al-Arad to the new small port of Failaka.

*Inhabitants of Failaka are waiting in Ras Al-Arad for a ferry boat bringing them to the island*





*Houses in the western part of Failaka, close to the archaeological sites and the landing point of the pipeline.*

But in the beginning, the tourists didn't come as it was supposed in the development planning. Meanwhile Matthias hopes to come back to Failaka one day to see the place where he did one of his first engineering Projects and survived some critical situations with God's help.