



# **SULAIBIYA PLANT AT A GLANCE**

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Mohammed Abdulmohsin Al Kharafi Group and Ionics Inc., USA (now GE) are proud of completing the construction of this groundbreaking project in the region, being the first to be executed under a Build, Operate and Transfer (BOT) Scheme. The plant is considered the largest of its kind in the world in using the Reverse Osmosis (RO) technology for wastewater reclamation. The Reclaimed water produced exceeds the specification of the World Health Organization (WHO) standards for potable water.



The short period it took to construct the entire facilities of this mega project, which culminated in successfully producing the first drop of reclaimed water on the 4th of November 2004, is a strong evidence of the Private Sector ability and credibility in fulfilling its commitments. As such, and as a strategic vision of the Government, the Private Sector should be entrusted with a bigger role in infrastructure projects which would translate into its proactive participation in accelerating the development processes.

The inauguration of the project was under the auspices of the late Emir of the State of Kuwait, His Highness Sheikh Jaber Al Ahmad Al Jaber Al Sabah may Allah keep him in His care, and with the presence of His Highness Sheikh Sabah Al Ahmed Al Jaber Al Sabah may Allah Safeguard him, is an evidence of the State's interest in this Project and similar infrastructure projects. The roles played by all stakeholders and Governmental Authorities, among them, the Ministry of Public Works have led to this excellent achievement.

Mohammed Abdulmohsin Al Kharafi Group of Companies together with Ionics Inc., USA (now part of GE) are proud of this achievement and take this opportunity to Again extend their thanks and appreciation to the Lending Banks: National Bank of Kuwait, Gulf Bank and Bank of Kuwait and Middle East, led by National Bank of Kuwait for their continuing support towards the success of this Project.

In this occasion, we also do not forget the thousands of engineers, advisors, technicians, other manual and non-manual staff who have accomplished and continue to operate this magnificent edifice. To them, we present our praise and appreciation for their efforts.

**Nasser Mohammed Al-Kharafi**

President, Kharafi Group of Companies



GE Water & Process Technologies, is proud to be serving the Ministry of Public Works and the State of Kuwait as a participant with the Kharafi Group in the Sulaibiya Wastewater Treatment and Reclamation Plant.

With Sulaibiya, the State of Kuwait showed extraordinary vision for water management by turning to water reclamation as an economical and environmentally friendly source of water for industry and agriculture. Moreover, by adopting the Build -Operate- Transfer (BOT) contracting structure, the State of Kuwait expedited project financing and delivery and mitigated its exposure to project risk.

GE Water & Process Technologies is excited that we will be serving the State of Kuwait alongside the Kharafi Group as part of a world class water reclamation project for decades to come.

**Mr. Alexander Stewart**  
GE Global Commercial Development  
GE Water & Process Technologies  
UDC Board Member

**Ali Ben Haj Hamida**  
Commercial Development Leader  
Middle East & Africa  
GE Water & Process Technologies  
UDC Board Member



**Mr. Alexander Stewart**



**Ali Ben Haj Hamida**

# The Kharafi Group



We are a multinational, multi-faceted group with a wide variety of interests. Our roots are in Kuwait and have been for over 100 years but we operate worldwide.

The activities we cover are those in Construction, Investment, Development, Manufacturing, Commerce, Tourism and Leisure.

The group has since developed into a Grade «A» International Contractor. We have the largest food company in the Middle East (Americana). MAK Group has major stake equity and Board representation in several local and international companies.

Kharafi Group is a major player in projects under the BOT scheme and other privatization schemes. We are the first group regionally who launched, executed and currently executing BOT projects. The Group's record of accomplishments includes:

- In 1996, we have signed the 15-year concession agreement for Beirut International Airport Car Park in Lebanon.
- In 1998 EMAK (A Group's company working in Egypt) was awarded the 40-year concession contract to Build, Operate and Transfer the Marsa Alam International Airport. Construction was completed ahead of schedule and commercial operations commenced in October 2001. Marsa Alam Airport was the first greenfield BOT airport project in the World.

- In 2001, UDC (One of the Group's companies in association with Ionics, Inc., USA (now GE) signed the 30-year concession contract to Build, Operate and Transfer Sulaibiya Wastewater Treatment and Reclamation Plant in Kuwait. The Plant is considered to be the largest of its kind in the world using the Reverse Osmosis (RO) technology.

The Kharafi Group is diverse, but not fragmented. Major subsidiaries operate autonomously, while Head Office operations provide corporate services and a central focus for Group strategy. There is continued cross support among companies and divisions, so that when you are dealing with one member of the Group, you are dealing with all.

Our philosophy of management is to cultivate self-confidence and encourage decision making; to foster the entrepreneurial spirit and combine it with strict business discipline and the latest state-of-the-art technology and business methods. It is a philosophy that led us to the front rank of companies in the Middle East, having an annual turnover approaching US \$ 4.00 Billion. Our success has propelled it into reaching our growth, development and goal of excellence that exceeds our customers' expectations.

# GE Water and Process Technologies



A world leader in water, water reuse, wastewater treatment and process solutions, GE Water & Process Technologies brings the best technologies to enhance customers' efficiency while protecting the environment. GE offers the broadest portfolio of water and process technologies, including: separation equipment; membrane & filtration technology; diagnostic tools; specialty chemicals; mobile water capabilities; service; and financing.

The Sulaibiya project is a terrific example of water reclamation using multiple GE technologies. GE is participating in the operation and maintenance of the Sulaibiya plant.

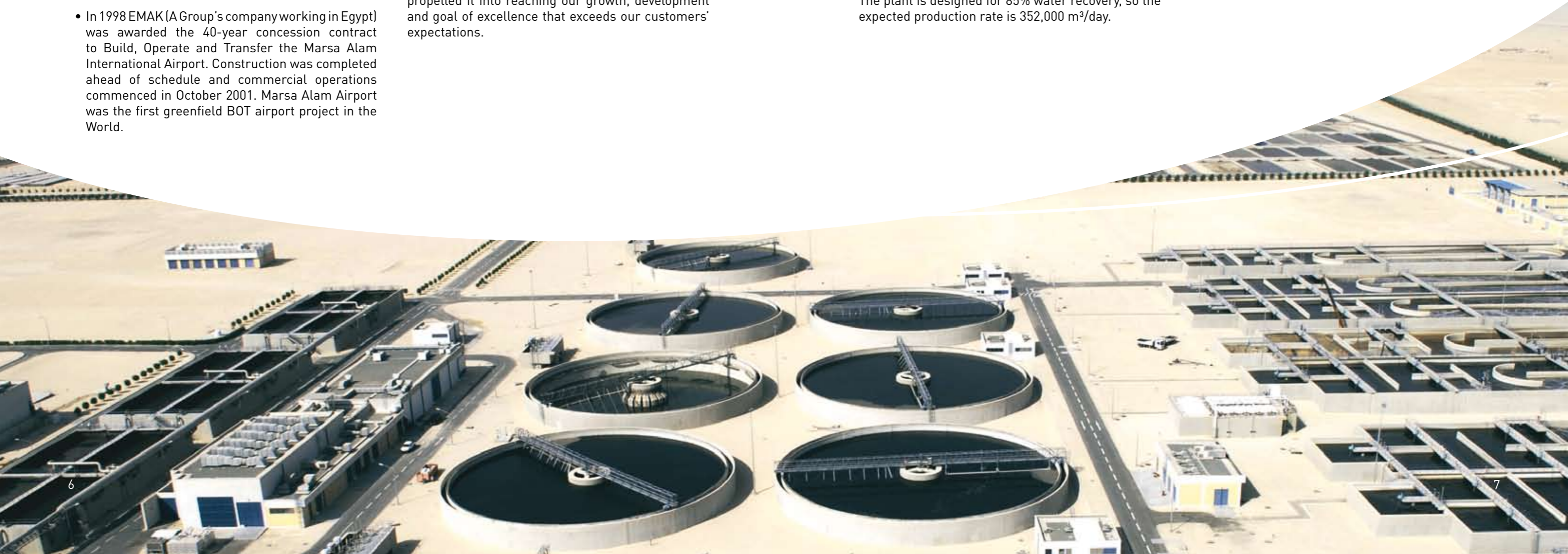
The water reclamation plant is designed to treat 425,000 m<sup>3</sup>/day of secondary effluent, which is prefiltered with disk filters and then fed to the ultrafiltration (UF) system.

The UF system treats 100% of the flow after biological treatment. The feed from the UF to the reverse osmosis (RO) system is also 425,000 m<sup>3</sup>/day. The plant is designed for 85% water recovery, so the expected production rate is 352,000 m<sup>3</sup>/day.

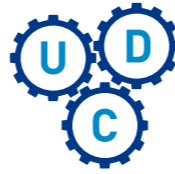


GE is committed to develop and bring to market technologies that promote energy efficiency, lower harmful emissions, increase supplies of water, and reduce our use of fossil fuel\_it's called ecomagination.

For more information visit [www.ge.com/water](http://www.ge.com/water).



# Utilities Development Company



This project has proved with no doubt, the important role of the Private Sector in the development process through activating the local investments as well as attracting the foreign investors.

Mohammed Abdulmohsin Al Kharafi and Sons Group through its strong alliance with Ionics (now GE) Inc., USA started together in 1998 with the Pre-qualification for the Sulaibiya Wastewater Treatment and Reclamation Plant Tender. In May 2001, both established Utilities Development Co., as the first Special Purpose Company (SPC) in the State of Kuwait, to execute the Concession Contract under the Build Operate and Transfer (BOT) scheme.

On 7th May 2001, the Concession Contract was signed between the Government of the State of Kuwait represented by the Ministry of Public Works and Utilities Development Company.

## Sulaibiya Project

The Sulaibiya Wastewater Treatment and Reclamation Plant is a groundbreaking project, not only in the Middle East where it is the first infrastructure facility of its size to be executed as BOT but also worldwide as it is the largest of its kind using the reverse osmosis (RO) technique in domestic wastewater reclamation.

The Plant initially treats up to 375,000 cubic meter of raw domestic wastewater per day when it begins operations. The capacity would eventually reach up



to 600,000 cubic meters per day during the 30-year concession period. The Plant treats around 60 per cent of Kuwait's total domestic wastewater.

The Concession Period started on the 7th of July 2002. The Plant was constructed in less than 29 months and the Concessionaire is now operating and maintaining the Plant and until the expiry of the Concession Period.

The specifications of the Reclaimed Water produced from Sulaibiya Plant exceeds the World Health Organization (WHO) standards for potable water. However, the use of such Reclaimed Water is limited to agricultural and industrial applications and possibly in a variety of other usages such as gardening, car and building washing. In addition, it could be re-charged in an underground aquifer to become a strategic water storage.

The Government of the State of Kuwait will buy all the Plant production of Reclaimed Water.



## The Start

The Project Journey started in 1998 with the pre-qualification of consortia that include local and foreign investors, in addition to specialized contractors for building a wastewater treatment and reclamation plant under Build, Operate and Transfer (BOT) scheme in linewith the State of Kuwait Government's plan to target the effective participation of the private sector in building up the national economy, through the execution of infrastructure projects.

Such projects were previously restricted to the Governmental Sector. In addition, the Government plan targets the local Private Sector to participate in strategic projects and at the same time encourage foreign investors to participate in the development process. This has been achieved in Sulaibiya Plant Project.





## Development Period

Signing the Concession Contract on 7th May 2002 was the start of a series of meetings and extensive communications between more than 10 cities around the Globe. However, most of these meetings were held in Kuwait and the working hours during this 14-month development period exceeded 300,000 man hours. This period ended on 7th July 2002.

During that period, the basic design of the Project was completed, and on 24th June 2002 the Facility Agreement was signed with National Bank of Kuwait, Gulf Bank and the Bank of Kuwait and the Middle East. Also the Engineering, Procurement and Construction Contract (EPC); and the Operation and Maintenance Contract which continues until the end of the Concession period, were also signed.

On 7th July 2002, both the Ministry of Public Works and Utilities Development Company signed a document... a document announcing the commencement of the Concession Period and the start of the Construction.

## The Construction

During 29 months, several Kharafi Group companies, among them Mohammed Abdulmohsin Al-Kharafi for General Trading, Contracting and Industrial Structures (MAK),

The National Company for Mechanical and Electrical Works (Kharafi National) and the Kuwaiti-British Readymix Concrete Company, in addition to the German Company Philip Holzmann and the Italian company Italba a subsidiary of Ionics Inc., (USA), all have joined their efforts in order to execute this groundbreaking mega Project, which is really considered a source of pride for the State of Kuwait.



By mid 2004, preparations started for the testing, commissioning and operations and on 14th August 2004 the diversion of the wastewater commenced from the old treatment plant at Ardiya to the New Pumping Station at Ardiya, from where it was pumped through the transfer pipelines to Sulaibiya.

After long and intricate series of testing for treatment and reclamation processes, the first drop of reclaimed water was produced from the Plant on Thursday 4th November 2004

## Project's Facilities

Sulaibiya Plant Project includes the Preliminary Treatment and Pumping Station at Ardiya, the Transfer Pipelines from Ardiya to Sulaibiya and the Treatment and Reclamation Plant at Sulaibiya.

The preliminary treatment of the wastewater starts with sand and grease removal upon its arrival at Ardiya Pumping Station. After which, the wastewater is directed to two Buffer Tanks each 67 meters diameter and 7 meters depth. These tanks regulate the flows arriving to Ardiya before being pumped to Sulaibiya.

The Pumping Station contains 8 pumps of which 2 are standby, to transfer the wastewater through three pressure pipelines, 1400 millimetres each extending over 25 kilometres from Ardiya to Sulaibiya.

In order to safeguard the environment at the Ardiya Pumping Station in view of its proximity from residential areas, all facilities in this Pumping Station are covered. In addition, all those facilities are furnished with state-of-the-art odour control and removal equipment and odour monitoring systems. The Facilities are also surrounded with a green belt of trees to enhance the environment.

The biological treatment at Sulaibiya starts in 9 Aeration Tanks each 147 meters long, 28 meters wide and 8 meters depth. The Aeration Tanks are supplied with air from the Blower Building which contains 5 blower units.

From the Aeration Tanks, the water flows to 9 Circular Secondary Clarifiers each 56 meters diameter and 8 meters depth. The secondary treated water then flows to a Collection Basin in order to start the reclamation processes. The suspended solids are directed to the Gravity Belt Thickening Building, after which they are sent to 4 Aerobic Digesters each 58 meters long, 24 meters wide and 7 meters depth. These Aerobic Digesters are supplied with air from 3 blowers in a Blower House. After completing the digesting process, the remaining sludge is directed to the Sludge Drying Beds. The sludge is then stored in a special area for around 6 months in order to be suitable for use as a natural fertilizer.



The reclamation process starts after the arrival of the secondary treated water from the Collection Basin to the Ultra-Filtration Building, which contains 5 trains containing 8704 filter units in total. These filters secure the complete removal of the suspended solids and microbes. A periodical fully automated backwash process cleans the filters regularly.

From the Ultra-Filtration building, the water flows to the Reverse-Osmosis Building which contains 6 independent trains for reclamation. Each train contains 7 skids and the total number of membranes in these skids is 20,832, through which the water passes to the Permeate Basin. From this Basin, the reclaimed water flows through pipelines to the Ministry of Public Works' Data Monitoring Centre (DMC) at Sulaibiya.

Most of the treatment and reclamation processes in the various Plant facilities are fully automated and use the latest state-of-the-art computer and control systems.

## Plant Operation & Maintenance

After producing the first drop of reclaimed water on Thursday 4th November 2004, and upon the early commencement of the commercial operations of the Plant on 1st December 2004, The National Company For Mechanical and Electrical Works (Kharafi National) started to operate and maintain the Plant until the expiry of the concession period, with the participation of United Utilities company of the UK.

Ionics(now GE), remains involved with the operation and maintenance of Sulaibiya, not only as a shareholder in UDC, but by having Italba, one of its subsidiaries, operating and maintaining the ultra-filtration and reverse osmosis part of the Plant.

## Major Project Benefits

- Save the Government the financial burden of huge investments.
- Curb marine environmental pollution as no partially treated wastewater would be disposed off in the Gulf.
- Reuse of the reclaimed wastewater in a safe manner that preserves the environment.
- Eliminate the current problem of proliferation of unpleasant odors from the now abandoned conventional wastewater treatment plant at Ardiya. Those odors started to disappear with the commencement of the new Plant operations.
- The Project has a strategic objective that is to recharge the reclaimed water into the underground aquifer to be a strategic water reserve for the State of Kuwait.



- Transform sludge into natural fertilizer suitable for all agricultural purposes.
- The State of Kuwait buys the reclaimed water from the Concessionaire at a competitive price agreed upon in the Concession Contract.
- When the Concession Period expires, the Plant ownership will be transferred to the State of Kuwait, free of charge. By then, the total savings to the State will be around KD3.2 billion (\$11.00 billion) over the lifetime of the concession.

Sulaibiya is the first in a series of similar projects in the region through which problems related to the scarcity of water resources could be solved. Similar projects are also beneficial as they reduce the need to build more expensive seawater desalination plants.





### Sulaihiya Plant In Numbers:

Plant capacity at start of operations	425,000 cubic meters per day = 93.5 million imperial gallons per day
Plant capacity after expansion	600,000 cubic meters per day = 132 million imperial gallons per day
Ardiya site area	60,000 square meters
Sulaihiya site area	110,000 square meters
Three transfer pipelines (Ardiya-Sulaihiya)	
Diameter of each	1400 m
Length of each	25 km
Concession Period	30 years - started 7th July 2002
EPC Turnkey Contract Duration	29 months - started on 7th July 2002
Operations and Maintenance period	Up to year 2032
Working man-hours for EPC works	7,000,000 man-hours
Date of Commercial Operation	1 <sup>st</sup> December 2004

العارضية وخطوط النقل إلى الصليبية  
Ardiya And Pipelines To Sulaibiya

الصليبية - المعالجة البيولوجية  
Sulaibiya - Biological Treatment



مبنى إزالة المواد الصلبة العالقة  
Screening Building



أزالة الرمال والزيوت  
Sand & Grease Traps at Ardiya



أحواض التهوية  
Aeration Tanks



مبنى مدخل المياه بمحطة الصليبية  
Sulaibiya Inlet Structure



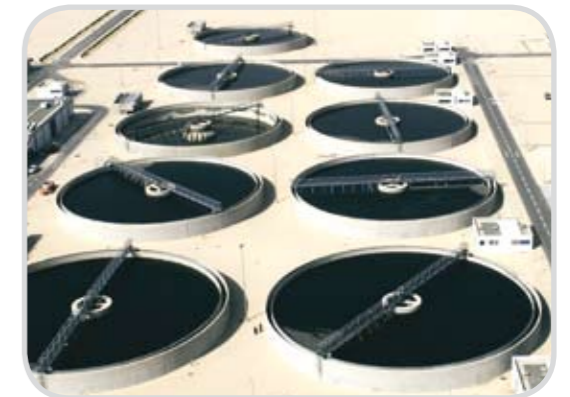
مبنى مضخات العارضية  
Pump House at Ardiya



مبنى معالجة الروائح  
Odor Control Building



مبنى التحكم بالتدفق  
Flow Control Chamber



أحواض الترسيب  
Secondary Clarifiers



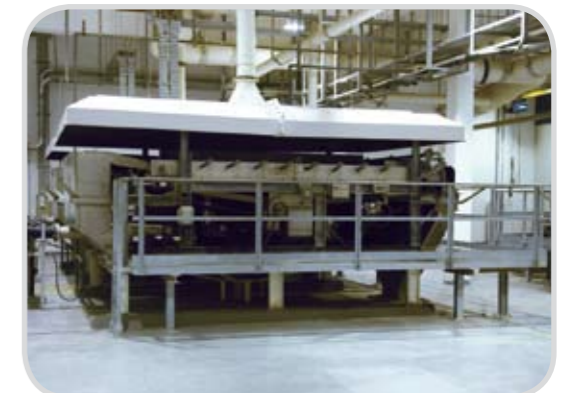
خطوط الأنابيب  
Pipelines



خزانات التعويض علي خطوط النقل  
Surge Vessels



أحواض التجفيف  
Drying Beds



مشخنة الحمأة  
Gravity Belt Thickeners