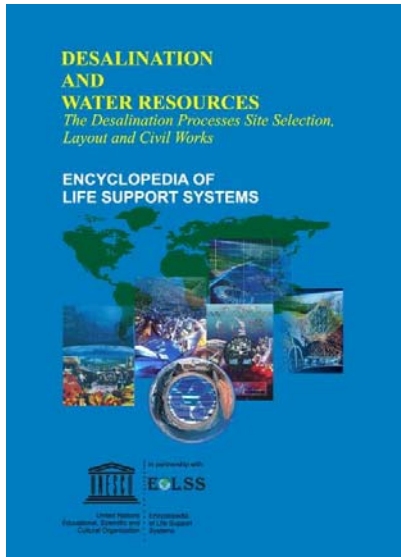


CONTENTS

DESALINATION AND WATER RESOURCES THE DESALINATION SITE AND CIVIL WORKS



The Desalination Site and Civil Works - Volume 1

No. of Pages: 278

ISBN: 978-1-84826-437-3 (eBook)

ISBN: 978-1-84826-887-6 (Print Volume)

For more information of e-book and Print
Volume(s) order, please [click here](#)

Or contact :eolssunesco@gmail.com

DESALINATION AND WATER RESOURCES (DESWARE)

International Editorial Board

Editor-in-Chief: Al-Gobaisi, D. M.K.

Members

Al Awadhi, A. Ali	Hammond, R. P.	Morris, R.
Al Radif, Adil	Hanbury, W. T.	Nada, N.
Al-Mutaz, I. S.	Harris, A.	Ohya, H.
Al-Sofi M.	Harrison, D.	Peluffo, P.
Andrienne, J.	Hassan, A. M.	Rao, G. P.
Awerbuch, L.	Hodgekiess, T.	Rautenbach, R.
Balaban, M.	Husain, A.	Reddy, K. V.
Beraud-Sudreau, D.	Ismat, K.	Saal, D.
Birkett, James D.	Karabelas, A.J.	Sadhukhan, H.K.
Blanco, J.	Kesou, A.	Sage, A.P.
Bodendieck, F.	Krause, H. P.	Sarkodie-Gyan,
Borsani , R.	Kubota, S.	Thompson
Bushnak, A. A.	Kumar, A.	Sommariva, C.
Capilla, A. V.	Kurdali, A.	Strathmann, H.
Catanzaro, E.	Laborie, J.	Temperley, T.
Damak, S.	Leitner, G. F.	Tleimat B.
Darwish, M. Ali	Lennox, F. H.	Todd, B.
Delyannis, E.u E.	Lior, N.	Tony F.
Dempsey J.	Ludwig, H.	Tusel, G.
El-Din, S.	Lukin, G.	Belessiotis, V.
El-Mahgary, Y.	Magara, Y.	Veza, J. M.
El-Nashar, A. M.	Makkawi B.	Vigneswaran, S.
El-Sayed, Y. M.	Malato, S.	Wade, N. M.
Finan, M. A.	Mandil , M.A.	Wang, S.
Furukawa, D.	Marquardt, W.	Wangnick, K.
Genthner, K.	McArthur,N.	Woldai A.
Germana, A.	Meller, F. H.	Watson, I. C.
Ghiazza, E.	Mewes, V.	Wessling, M.
Glade, H.	Michels, T.	Winters, H.
Goto, T.	Miyatake, O.	
Grabow, W. O.K.	Morin, O. J.	

CONTENTS

Site Selection

1

A. Sanver, *Bechtel Power Corporation, Gaithersburg, MD, USA*
S.C. May, *Bechtel Technology and Consulting, San Francisco CA, USA*

1. Introduction
2. Basic Elements of Site Selection
3. Desalination Plant Site Selection
 - 3.1. Study Start-up and Information Gathering
 - 3.1.1. Miscellaneous processes
 - 3.1.2. Hybrid process
 - 3.1.3. Design criteria
 - 3.2. Identification of Candidate Regions
 - 3.3. Identification of Candidate Sites
 - 3.4. Final Site Selection
4. Conclusion

Design Guidelines of Seawater Intake Systems

16

C.D. Hornburg, *Water Consultants International, Inc., Fort Lauderdale, Florida, USA*

1. Introduction
2. Site Conditions
 - 2.1. Water Depth
 - 2.2. Seabed Conditions
 - 2.3. Waves and Currents
 - 2.3.1. Waves
 - 2.3.2. Currents
 - 2.4. Understanding Sediment Transport
 - 2.4.1. General
 - 2.4.2. Threshold Velocity
 - 2.4.3. Scour
 - 2.4.4. Littoral Transport
 - 2.4.5. Beach Profile
 - 2.4.6. Effects of Sediments and Suspended Solids
 - 2.4.7. Settling
 - 2.4.8. Suspension
 - 2.5. Tides and Storm Surge
 - 2.5.1. Tides
 - 2.5.2. Storm Surge
 - 2.6. Marine Organisms
 - 2.7. Oil Pollution
 - 2.8. Pollution
3. Types of Intake Structures
 - 3.1. General
 - 3.2. Lagoon Type
 - 3.3. Pipe Type
 - 3.4. Channel Type
 - 3.5. Other Types of Intake
4. Pump Basin
 - 4.1. Wave, Tide, and Storm Surge
 - 4.2. Trash Removal
 - 4.2.1. Nature of Trash
 - 4.2.2. Elements of Trash Removal
 - 4.2.3. Trash Racks
 - 4.2.4. Traveling Screens
 - 4.3. Intake Basin Design

- 4.4. Model Tests of Intakes
- 4.5. Intake Basin Design for Small Pumps
- 4.6. Pump Basin Materials of Construction
- 5. Problems Associated with Improper Design or Operation
 - 5.1. Introduction
 - 5.2. Cooling Water Supply Temperature and Salinity
 - 5.2.1. Operational Conditions and Effects
 - 5.2.2. Recirculation Temperature Increase
 - 5.2.3. Recirculation Salinity Increase
 - 5.2.4. Shallow Flow/Intake Point
 - 5.3. Heat Reject Tube Erosion
 - 5.3.1. Detection
 - 5.3.2. Tube Thinning
 - 5.3.3. Tube Pitting (Local Erosion)
 - 5.4. Heat Reject Tube Problems
 - 5.4.1. Detection
 - 5.4.2. Ammonia and Sulfides
 - 5.4.3. Silt and Organic Material
 - 5.5. Plugging of Tubes - Trash and Debris
 - 5.6. Decreased Cooling Water Flow
 - 5.6.1. General
 - 5.6.2. Low Level in the Pump Basin
 - 5.6.3. Supply Piping from the Intake Pumps
 - 5.7. Fouling of Reject Tubes
 - 5.7.1. Marine Biofouling
 - 5.7.2. Contaminant Fouling
 - 5.8. Vacuum Problems
 - 5.8.1. Jeddah I - Venting System and Air Inleakage
 - 5.8.2. Jeddah II
- 6. Case Studies
 - 6.1. Konarak Desalination Plant
 - 6.1.1. Description
 - 6.1.2. Background
 - 6.1.3. Site Conditions
 - 6.1.4. Pipe-type Intake
 - 6.1.5. Channel-type Intake
 - 6.1.6. Jetty-type Intake
 - 6.1.7. Evaluation of Intake Types
 - 6.1.8. Location of Outfall
 - 6.1.9. Conclusions and Recommendations
 - 6.2. Sitra Desalination Plant
 - 6.2.1. Description
 - 6.2.2. Background
 - 6.2.3. Site Conditions
 - 6.2.4. Causes of Tube Failures
 - 6.2.5. Conclusions and Recommendations

Water Intakes by Wells And Infiltration Galleries

92

J. Schittekat, *Tractebel Development Engineering Belgium, University of Leuven, KUL, Belgium*

- 1. Introduction
- 2. Well Hydraulics
 - 2.1. Equilibrium Well Equations
 - 2.2. Non-equilibrium Well Equation
- 3. Water Well Design
 - 3.1. Depth of the Drilling
 - 3.2. Casing Diameter

- 3.3. Well Diameter
- 3.4. Casing and Screen Materials
- 3.5. Gravel Pack, Material and Size Distribution
- 3.6. Slot Size, Location and Type
- 3.7. Development and Improvement of the Well
 - 3.7.1. Different Techniques to Improve the Well Capacity
- 4. Infiltration Galleries
 - 4.1. Yield Requirements
 - 4.2. Water Quality Requirements
 - 4.3. Construction Difficulties
 - 4.4. Maintenance Considerations
 - 4.5. Design Principles
 - 4.6. Bed-Mounted Infiltration Galleries
 - 4.7. Terrestrial Infiltration Galleries
 - 4.8. Maintenance of Infiltration Galleries
 - 4.9. Radial Collector Outward from a Large Vertical Caisson
- 5. Cost Assessments of Water Intake

Effluent Discharge Using Boreholes and Ponds **111**

J. Schittekat, Tractebel Development Engineering Belgium, University of Leuven, KUL Belgium

- 1. General Conditions
- 2. Injection Well
- 3. Pond or Infiltration Trench
- 4. Cost Assessments: Effluent Recharge by Wells

Overall Site Layout **117**

J. Andrianne, Tractebel Energy Engineering, Civil Engineering Dept, 7 Ave. Ariane B 1206 Brussels, Belgium

- 1. Introduction
- 2. Overall Layout of the Site
- 3. Layout Design Guidelines
 - 3.1. Analysis of systems/buildings that make up a desalination installation

MSF Plant Layout **128**

Klaus Wangnick, Wangnick Consulting GmbH, Germany

- 1. General Conditions for the Site Layout
- 2. Small MSF seawater desalination plants
- 3. Medium and Large-size MSF Seawater Desalination Plants
 - 3.1. Cross tube condensers, brine recirculation system, one tier
 - 3.2. Long tube condensers, brine recirculation system, one tier
 - 3.3. Long tube condensers, once-through, one tier
 - 3.4. Cross tube condensers, once-through system, one tier
 - 3.5. Others: new features which can influence the site layout
- 4. Floating MSF Seawater Desalination Plants

Reverse Osmosis Plant Layout **147**

John Potts, Hutcheon Engineers West Palm Beach, Florida, USA

- 1. General Considerations
- 2. Small RO Plants
- 3. Large RO Plants

Electrodialysis Plant Layout

165

J. Maoz, *TAHAL Consulting Engineers Ltd., Israel*

1. Introduction
2. Criteria for Selection of ED Plant Site
 - 2.1. Proximity to Feed Water Source
 - 2.2. Proximity to Electricity Source
 - 2.3. Proximity to Water Consumption Centers
 - 2.4. Proximity to Main Water Supply Transmission Lines
 - 2.5. Proximity to Brine Disposal Site
 - 2.6. Proximity to Regional Operation Center
 - 2.7. Land Availability
 - 2.8. Ecological-Environmental Constraints
3. Equipment Installed at ED Plant Sites
4. Structures for ED Plant and Equipment
 - 4.1. ED Stacks
 - 4.2. Power System
 - 4.3. Pretreatment Plant
 - 4.4. Post-treatment Facilities
 - 4.5. Connection of ED Plant to Feed Water Source
 - 4.6. Piping in the ED Plant
 - 4.7. Brine Disposal
5. Installation of ED Plants on Mobile Units

Civil Engineering in Desalination Plants

174

M. Gregoire, *Tractebel Energy Engineering, Belgium*

1. Introduction
2. Site Investigations
3. Design
 - 3.1. Loads and Load Combinations
 - 3.2. Types of Foundations
4. Time Scheduling
5. Cost Control
6. Quality Control

Seismic Design

183

J. D. Renard, *Tractebel Energy Engineering, Avenue Ariane 7, B-1200 Brussels Belgium*

1. Introduction
2. Earthquakes
3. Determination of the Seismic Level
4. The Seismic Design of Structures
 - 4.1. Fundamentals of the Seismic Design of Structures
 - 4.2. Recommendations, Guidelines, Codes and Regulations
5. Lifelines and Equipment
6. Other Consequences of Earthquakes

Mechanical Vibration Insulation

192

J.D. Renard, *Tractebel Energy Engineering, Avenue Ariane 7, B-1200 Brussels Belgium*

1. Introduction
2. Origin and Type of Vibrations
 - 2.1. Periodic Vibrations
 - 2.1.1. Harmonic Vibrations

- 2.1.2. Alternate Vibrations
- 2.2. Nonperiodic Vibrations
- 3. Vibration Analysis
 - 3.1. Resonance
 - 3.2. Dynamic Amplification
 - 3.3. Consequences on the Machine Foundation Design
- 4. The Reduction of Vibrations
 - 4.1. Monolithic Foundations
 - 4.2. Antivibration Systems

Wind Design 202

L. M. Marneffe, Tractebel Energy Engineering, Avenue Ariane 7, B-1200 Brussels, Belgium

- 1. Introduction
- 2. Historical Background
- 3. Wind Speed to be Considered on a Site
- 4. Wind Effects on a Structure
- 5. Rigid and Flexible Structures
- 6. Vortex Effects
- 7. Case of a Chimney
- 8. Scaled Models

Durability and Repair of Reinforced Concrete In Desalination Plants 212

G. Matta, Dr Gabriel Matta and Associates, Abu Dhabi, United Arab Emirates

- 1. Introduction
- 2. Corrosion Mechanism
- 3. Steps to Improve Durability
- 4. Additional Protection Systems
- 5. Repair of Deteriorated Concrete
- 6. Periodic Monitoring
- 7. Conclusion

Link to Power Station 220

C. Sommariva, Ansaldo Energia S.p.A., Piazza Monumento 12, 20025 Legnano, Italy

- 1. Introduction
- 2. Basic Considerations
- 3. Process Affecting Parameters
- 4. Process Patterns Applicable
- 5. Typical Arrangement
- 6. Cost and Maintenance Aspects

Disposal and Recirculation of Saline Water 235

Gerard A.L. Delvigne, WL/Delft Hydraulics, The Netherlands

- 1. Introduction
 - 1.1. Plant Intake and Discharge of Water
 - 1.2. Temperature and Salinities in Seawater and Effluent
 - 1.3. Marine Conditions near the Plant Site
 - 1.4. Modelling
- 2. Definitions and Characterizations
 - 2.1. Water Regions
 - 2.1.1. Seas and Oceans

- 2.1.2. Coastal Waters
- 2.1.3. Bays
- 2.1.4. Estuaries
- 2.2. Effluent of Desalination Plant
- 2.3. Outfalls
- 2.4. Intakes
- 3. Hydrodynamic Flow and Recirculation Modelling
 - 3.1. Numerical and Physical Modelling
 - 3.2. Numerical Modelling of Processes
 - 3.3. Size of the Modelling Area in View of Recirculation
 - 3.4. Size of the Modelled Area in View of the Hydrodynamics
 - 3.5. Subgrid Plume Modelling
- 4. Case Study
 - 4.1. Introduction
 - 4.2. Initial Phase
 - 4.3. Preliminary Study Phase
 - 4.4. Detailed Study Phase
 - 4.4.1. Far Field and Near Field Flow Modelling
 - 4.4.2. Detailed Studies on Intake/Outfall Configuration
 - 4.4.3. Other Detailed Studies

Index **255**

About DESWARE **261**