WORSKSHOP 03

Enabling the Implementation of Inventions & Innovations in Desalination: The Egyptian Experirence

Prof. Dr. Hossam Shawky
Director, Egyptian Desalination Center of Excellency
Desert Research Institute
Egypt

arwadex 2019

TUESDAY 23 APRIL 2019
09:00 - 11:00
InterContinental City Stars, Cairo

INTRODUCTION

Seawater and brackish water desalination are attracting more and more interest and attention, as this technology can provide a solution to the problem of water shortage. The reverse osmosis (RO) process is one of the most popular technologies currently being used for brackish water and seawater desalination for the advantages such as reduced energy, modularity, flexibility, ability to construct small size plants, high permeate quality and minimal chemical addition. The main aim of the workshop is to exchange knowledge on how to reduce the unit cost of water through optimized and new technologies for water desalination by the local manufacturing of desalination plants main components.

WORKSHOP OBJECTIVES

- Establishing water desalination technological local network
- Identifying the challenges facing water desalination
- Suggestion of the areas of research and development that may lead to technical solutions to these challenges
- Recommendations to spread utilizing the desalination
- Reducing the cost of RO system by owning a national knowhow
- Creating a stream of SMEs working in the field of water desalination through incubating startups working in this field

WORKSHOP CONTENT

Course contents four presentations:

- Local manufacturing of 4*40 & 8*40 reverse osmosis membrane element
- Design and Manufacturing of a High Pressure Pumping Unit for SWRO Desalination Plants
- Design and manufacturing of 4*40 & 8*40 reverse osmosis element production line
- Reject Brine Management of Coastal/Inland Groundwater Desalination

WORKSHOP LANGUAGE

English

WHO SHOULD ATTEND

- Ministries of, Water, Desalination & Industry
- Governmental Decision Makers & Officials
- Official Development Authorities
- Hydro-Geologists and Environmental Scientists
- International & Regional Financial Funds
- Investment Banks
- NGO's

ABOUT WORKSHOP INSTRUCTOR

- Professor of water chemistry at Desert Research Center (DRC)
- Former, post-doctor at Pratt School of Engineering-Duke University, USA
- Founder of "Water Desalination & Treatment Unit" and "Water Quality Unit" at DRC
- Director of the "Central Laboratories" at DRC. Currently, founder and director of Egyptian Desalination Research Center of Excellence (EDRC)
- Coordinator of Egypt Water Desalination Alliance

الدورة 12

مؤتمر تحلية المياه في الدول العربية

19-18 شعبان 1440 | 23-24 ابريل 2019

فندق انتركونتيننتال سيتي ستارز، القاهرة، جمهورية مصر العربية

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WORKSHOP TITLE:

Enabling the implementation of Inventions and Innovations in Desalination: The Egyptian Experience

Prof. Dr. Hosam A. Shawky

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Prof. Dr. Hossam Shawky

Director , Egyptian Desalination Center of Excellency, Desert Research Center - Egypt

- Local manufacturing of 4*40 & 8*40 reverse osmosis membrane element.
- Egypt Desalination Research Center Of Excellence (EDRC).
- Design and manufacturing of small mobile PV driven RO water desalination plant.

Prof.Dr. Amr A. Abdel Fatah

Professor at the Mechanical Engineering department, the British University in Egypt (BUE).

- Toward local Development of Desalination Plants Main Components Design and Manufacturing of A High Pressure Pumping Unit for SWRO Desalination Plants.

Dr. Wael Mahmoud Khaireldien

Associate Professor at the Faculty of Engineer, Assiut University The director of integrated technology transfer unit.

- Design and manufacturing of 4*40 & 8*40 RO production line.

Dr. Mustafa Eissa

Associate Professor in the Hydrogeochemistry Dept., Geochemical Modeling and Isotopes Unit, Desert Research Center, Cairo, Egypt.

- Reject Brine Management of Coastal/Inland Groundwater Desalination .

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EGYPT DESALINATION RESEARCH CENTER OF EXCELLENCE (EDRC)

The mission of EDRC is to conduct research for the development of cost-effective, robust desalination technologies that produce sustainable new supplies of water for different purposes. Moreover, the Center is seek to bring together scientists, engineers, water policy-makers and water system operators in Egypt, Middle East and Africa region to work on areas of research that will reduce the cost of desalination.

EDRC FACILITIES

EDRC FACILITIES

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ARWADEX - 6

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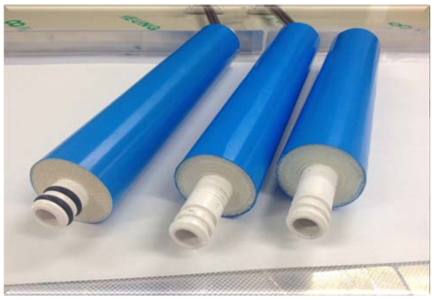

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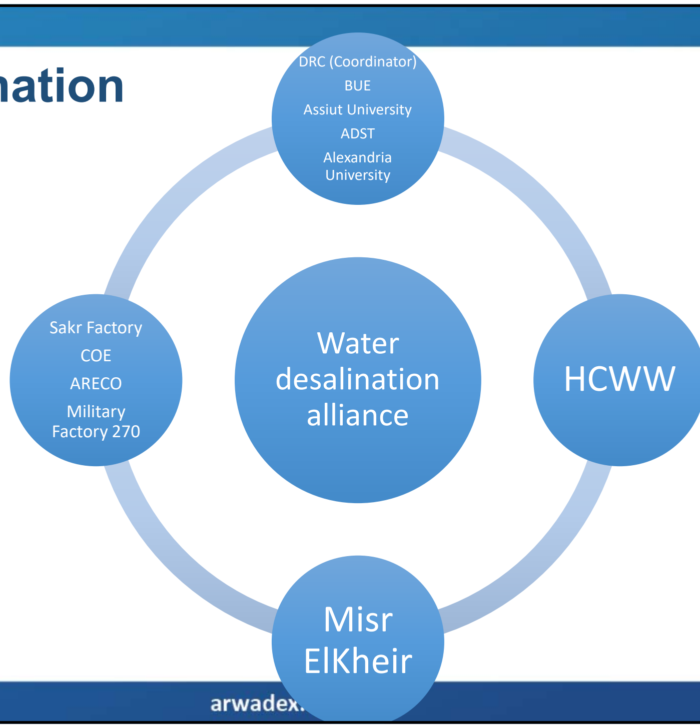
Water Desalination Alliance



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Cost evaluation

BW 4040 element			
Description	quantity	unit price	total price
RO flat sheet	9.15 m^2	3.8	34.77
Feed spacer	4.575m^2	0.53	2.42
Permeate spacer	5.5	1.2	6.6
Pipe	1PCS	1.7	1.7
O-ring	4PCS	0.07	0.28
End-cap	2PCS	0.23	0.46
Y-Ring	1PCS	0.18	0.18
Glue (A, B)	0.21	10	2.1
Resin	0.17 kg	9	1.53
Tap	0.5 roll	1.23	0.615
FRP	0.55 Kg	0.86	0.473
Total			52 $
Final price (25% added for labor + maintenance)			64 $
Expected price after the end of project (+ 25%)			46.25 $
World wide price			249 $

BW 8040 element			
Description	quantity	unit price	total price
RO flat sheet	38 m^2	3.8	144.4
Feed spacer	19m^2	0.53	10.07
Permeate spacer	21.24	1.2	25.488
Pipe	1PCS	5.3	5.3
O-ring	4PCS	0.07	0.28
End-cap	2PCS	0.9	1.8
Y-Ring	1PCS	0.46	0.46
Glue (A, B)	0.85	10	8.5
Resin	0.42 kg	9	3.78
Tap	0.67 Roll	1.23	0.8241
FRP	1.1 Kg	0.86	0.946
Total			202 $
Final price (25% added for labor + maintenance)			252.5 $
Expected price after the end of project (+ 25%)			156.25 $
World wide price			360$

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Design of a small mobile PV driven RO water desalination plant to be deployed at the north west coast of Egypt

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Development of a mobile stand-alone solar driven reverse osmosis seawater desalination plant for sustainable development in Shalateen

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تصميم و تصنيع خط أنتاج أغشيه التناطح العكسى 4×40 و 8×40.

Academy of Scientific Research & Technology

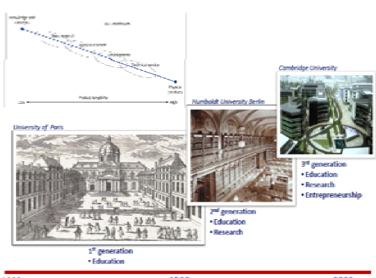
ITTU Integrated Technology Transfer Unit

Dr. wael mzahmoud khair eldien

We listen, we discuss, we develop, we deliver

Who we are and how can we help

Integrated Technology Transfer Unit (ITTU) is a unit formed in February 2009 at ASSIUT university to Transferring Assiut university into a third generation university



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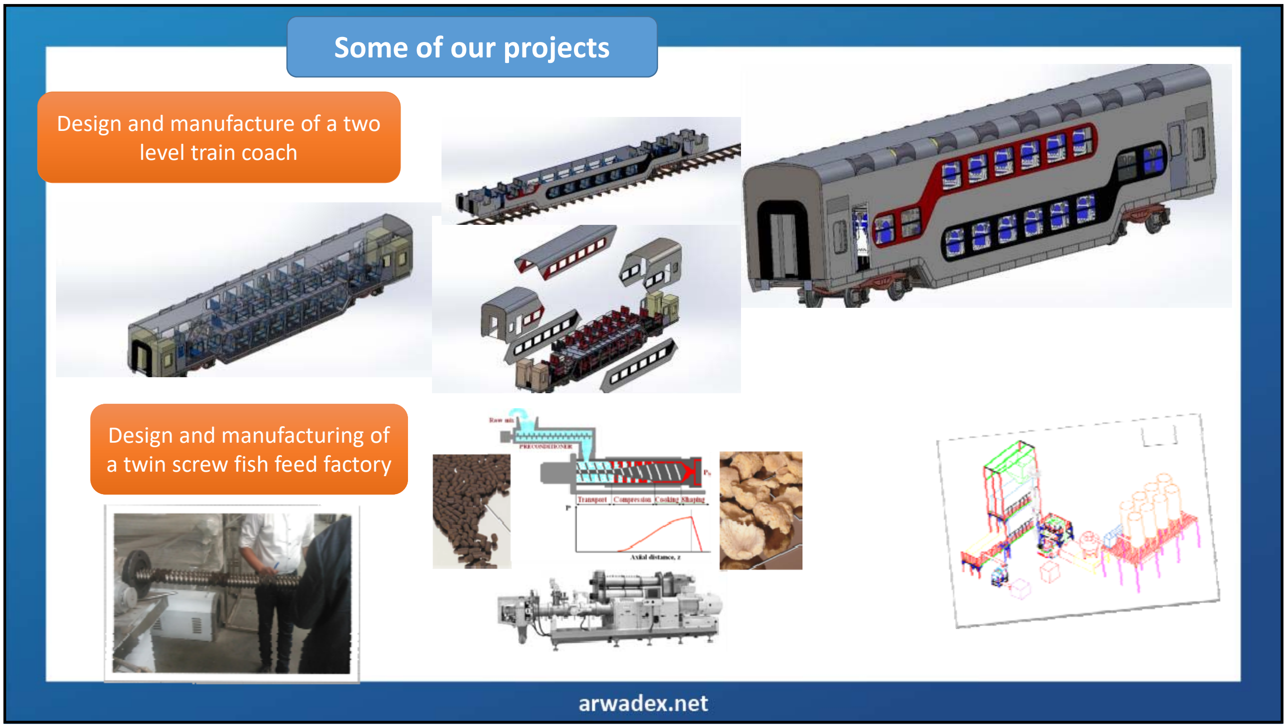

Some of our projects
Design and manufacture of a two level train coach
Design and manufacturing of a twin screw fish feed factory
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خط انتاج اغشية التناضح العكسى تحالف المياة
التعرف على المشكلة و التكنولوجيا الموجودة
1-الخط الصغير الموجود فى بحوث الصحراء
2- مناقشات مع فريق مركز بحوث الصحراء
3-زيارة لمصنع فى الصين
المرحلة الأولى
تصميمات أولية لخط اللف و مناقشات مع فريق بحوث الصحراء و تصنيعة و تجارب تشغيل تليها تعديلات و تسليم الخط
المرحلة الثانية
تصميمات أولية لماكينة ال casting و مناقشات مع فريق بحوث الصحراء و تصنيعة و تجارب تشغيل و جارى عمل تعديلات
المرحلة الثالثة
تصميمات أولية لخط ال coating و مناقشات مع فريق بحوث الصحراء و تصنيعة و تجاربة
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المرحلة الأولى
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Termination Table
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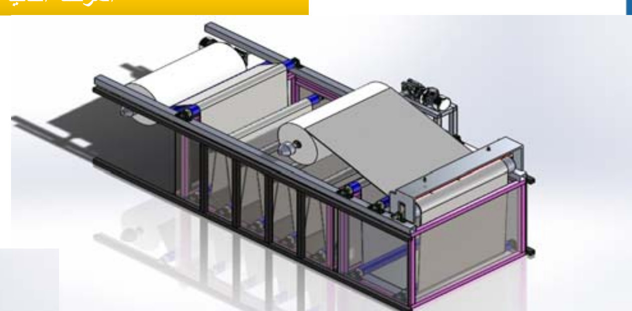
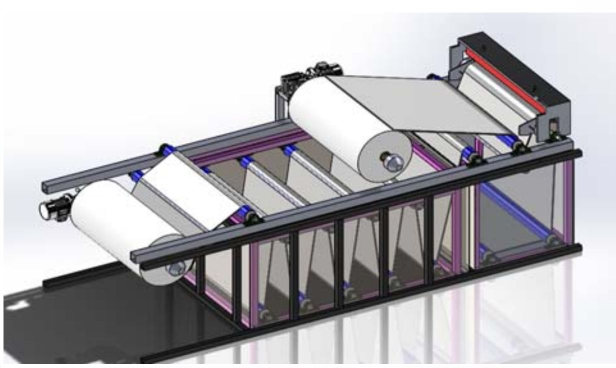
Fiberglass table

المرحلة الثانية





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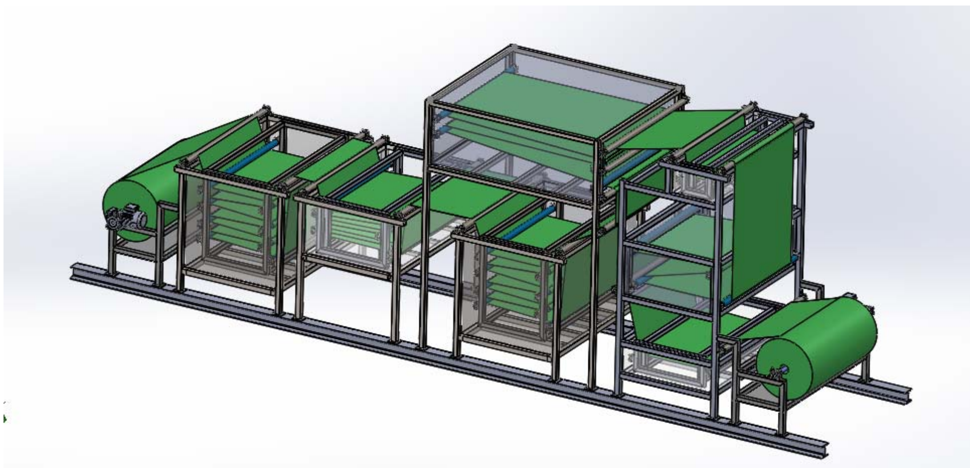
المرحلة الثالثة



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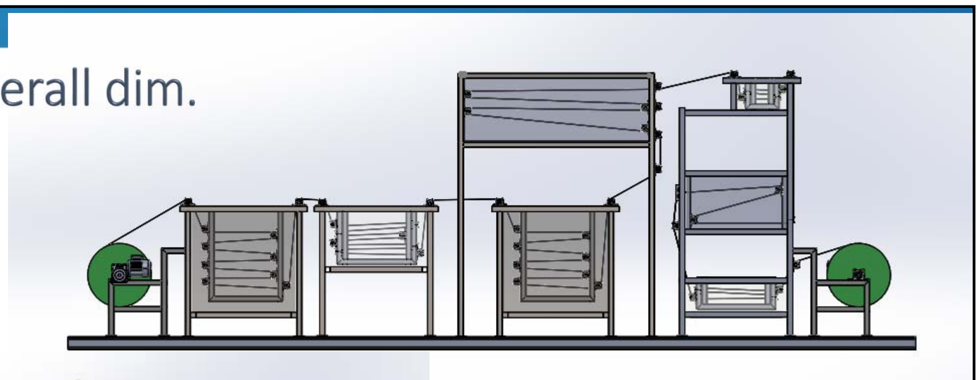
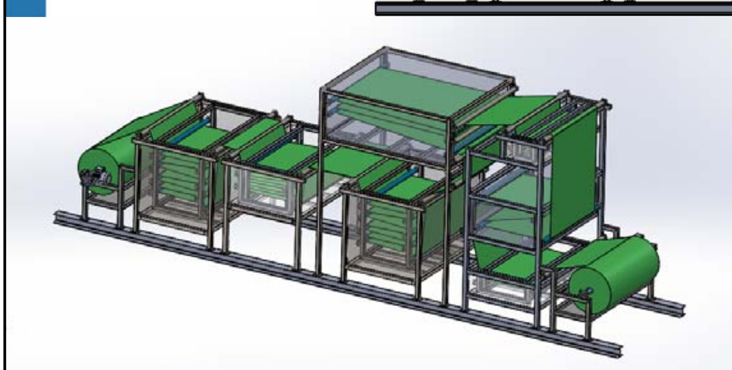
Coating overall dim.





8m *1.67m *2.5m

Linear speed 0.5 or 1 m/s

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Toward Local Development of Desalination Plants Main Components

Design and manufacturing of High Pressure Pumping Unit for SWRO Desalination Plants

Dr. Amr Abdelkader
The British University in Egypt

Main Objectives

- ***Design, local manufacturing and field testing of an energy efficient high speed single stage centrifugal high pressure pump prototype of 150 - 200 m^3/h capacity with built in condition monitoring system for medium Seawater Water Reverse Osmosis (SWRO) desalination plants.***
- ***Development of a complete technical package for technology transfer hat allows the local mass production of the proposed pumping system.***

Main Specifications

- **Flow capacity : 150-200 cubic meter/hour.**
- **Head : 600-650 meter.**
- **Rotational speed : 4500-5500 r.p.m.**
- **Power : 450-520 KW.**

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Reject Brine Management of Coastal/Inland Groundwater Desalination

Dr. Mustafa Eissa
Associate Professor in the Hydrogeochemistry Dept.,
Desert Research Center, Cairo, Egypt

How to Manage Brine Disposal

1- Brine Treatment
Membrane Treatment Systems
Thermal Treatment Systems

2- Brine Disposal
Brine Disposal in the Ocean
Deep Well Injection of Waste Brine

3- Brine Evaporation Ponds

4- Brine Incineration

Environmental Impact of Brine Disposal to the Sea

1- Temprature

Temperature of the sea water generally varies between 10ºc to 25ºc which increases about 60% to 40ºc near the area of the brine disposal (Danoun 2007) which impact the distribution of natural balance of marine flora and fauna species respond.

2- Salinity

Has the potential to heavily affect local marine biota (Medeazza 2005).

3- Dissolved Oxygen (DO)

DO is inversely proportional to the salinity level, so with the increasing rate of salinity dissolve oxygen is decreasing which consequences hypoxia (Haurwitz et al. 2008) which condition harm to the aquatic organisms.

4- Other Aspects

Total Alkalinity (twice to its normal level). The pH range, Antiscaling agents (polyphosphates, polymers of maleic acid, sulphuric acid and antifoaming agents like fatty acids, alkylated polyglycoles etc….). which are discharged with brine and effect the marine species around the outlet (Medeazza 2005

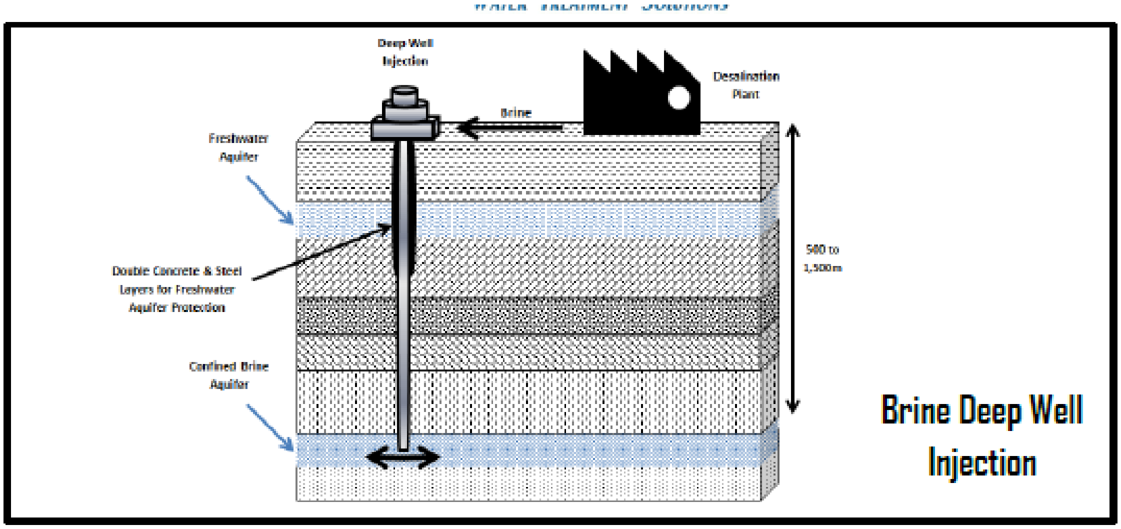
Solution

1- Changing the location of the brine disposal/ Treatment before discharge

2- Redesigning the desalination plant

3- Coupling the desalination plant with existing treatment plant

Brine Deep Injection Well



1. Potential Environmental Impacts

2. Criteria and Methods for Feasibility Assessment

3. Injection Well Costs

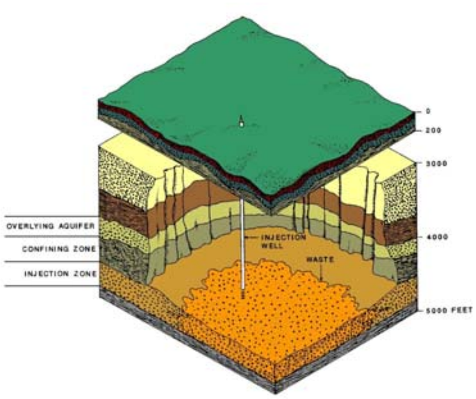
Advantage and Disadvantages

Advantages (+)	Disadvantages (-)
Suitable for inland plants	Only if confined saline aquifer available
Moderate Costs	Potential groundwater contamination
Low Energy Consumption	/

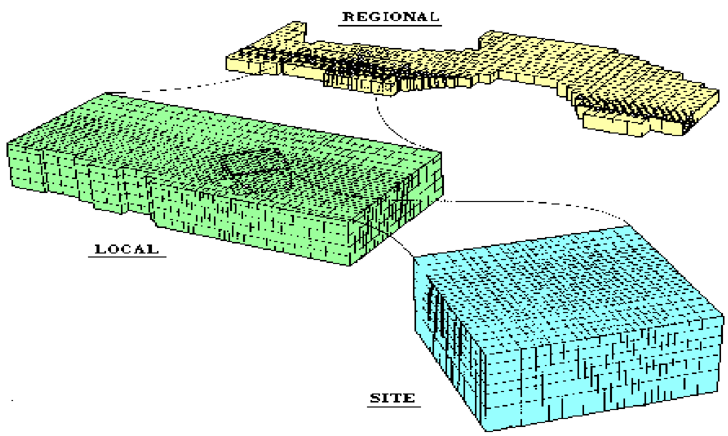
Advantage and Disadvantages

1) corrosion or excessive feed pressure could result in a failure of the injection well casing and leaking of the brine through the well bore
2) vertical propagation of the brine outside of the well casing to the shallow aquifer
3) if the overlaying confining bed has high permeability, solution channels, joints, faults, or fractures we'll have vertical brine migration
4) nearby wells, which are inappropriately cemented or plugged or have an inadequate casing could provide a pathway for the injected brine

Practical Application of SEAWAT Model to Deep Well Injection



- Developed over past 10 years
- Originally developed for deep well injection
- Intercomp, Intera, GeoTrans, Earthward Consulting
- Originally developed



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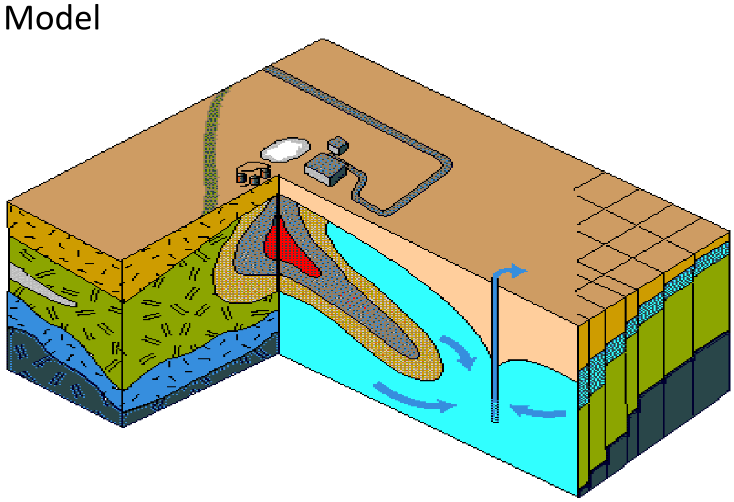
- Basic Plume (piston) Model
- Simple Radial Dispersion Model
- DuPont Model



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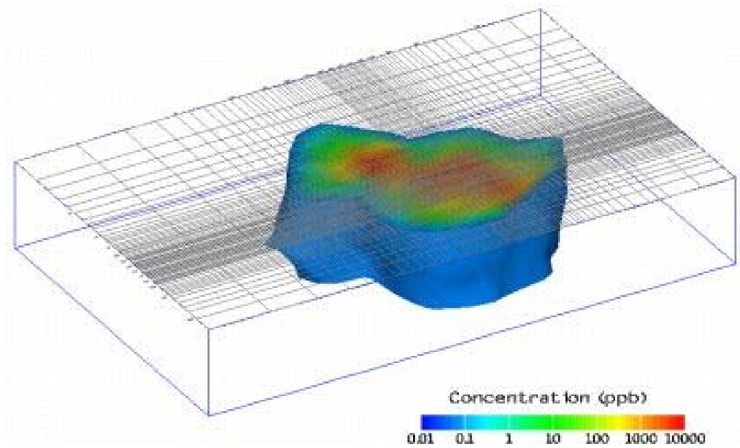

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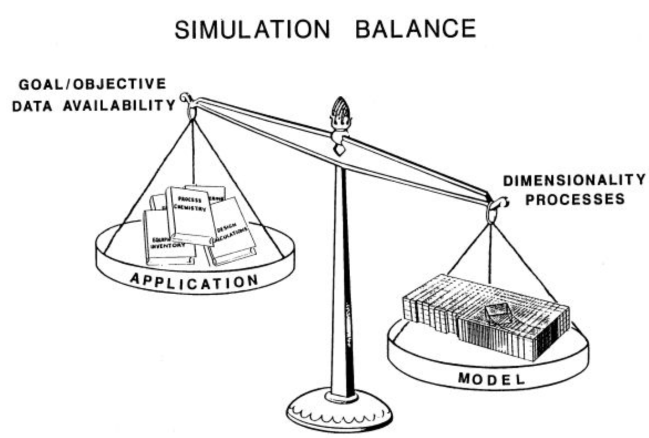
Model Balance



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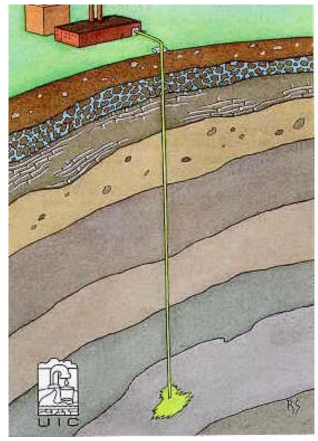
Model Balance

- Pressure
- Transport
- Heat
- Radionuclide degradation
- Chemical interaction
- Hydroloysis
- Fractured media



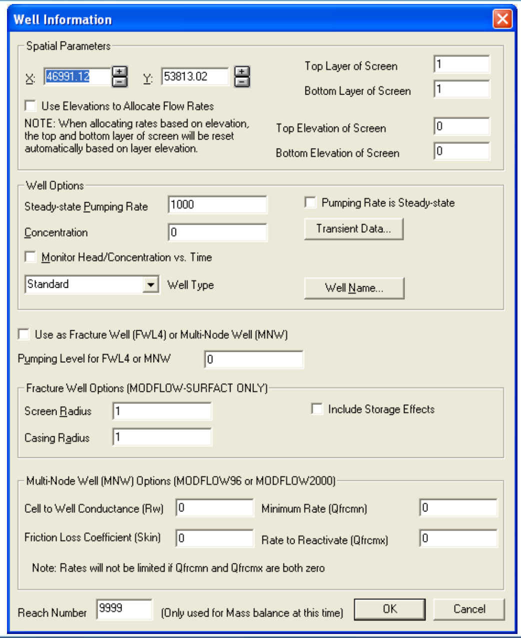
Injection History

Transient Boundary Condition Data

	Starting Stress Period	Ending Stress Period	Head (Q for Wells)	Concentration	Flow (Stream Only)	Width (Stream Only)
1	1	1	13726.20321	1	0	0
2	2	2	53614.97326	1	0	0
3	3	3	32111.22995	1	0	0
4	4	4	15786.09626	1	0	0
5	5	5	35711.22995	1	0	0
6	6	6	5833.15508	1	0	0

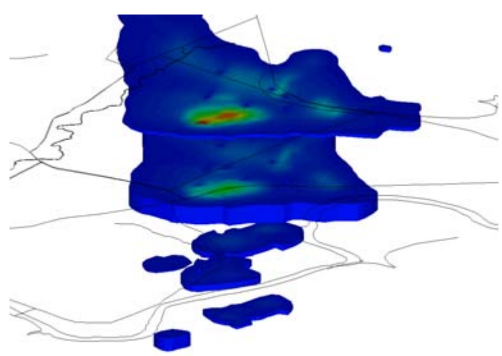
OK Cancel

Injection History



Model Output
Plume Visualization

- Exploded view using SEAWAT
- Animation of simulated plume development



Model Prediction

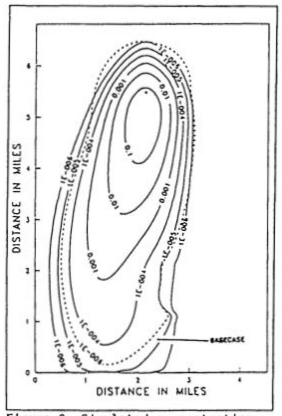


Figure 9. Simulated concentration using uniform fluid density, Case C.

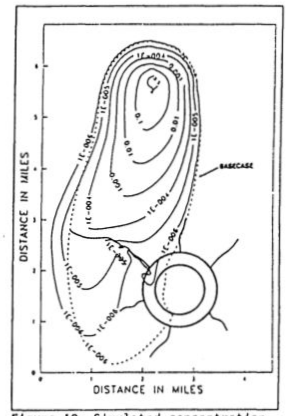


Figure 10. Simulated concentration assuming radial faults are non-transmissive, Case D.

مركز بحوث الصحراء
DESERT RESEARCH CENTER
DRC

STDF
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