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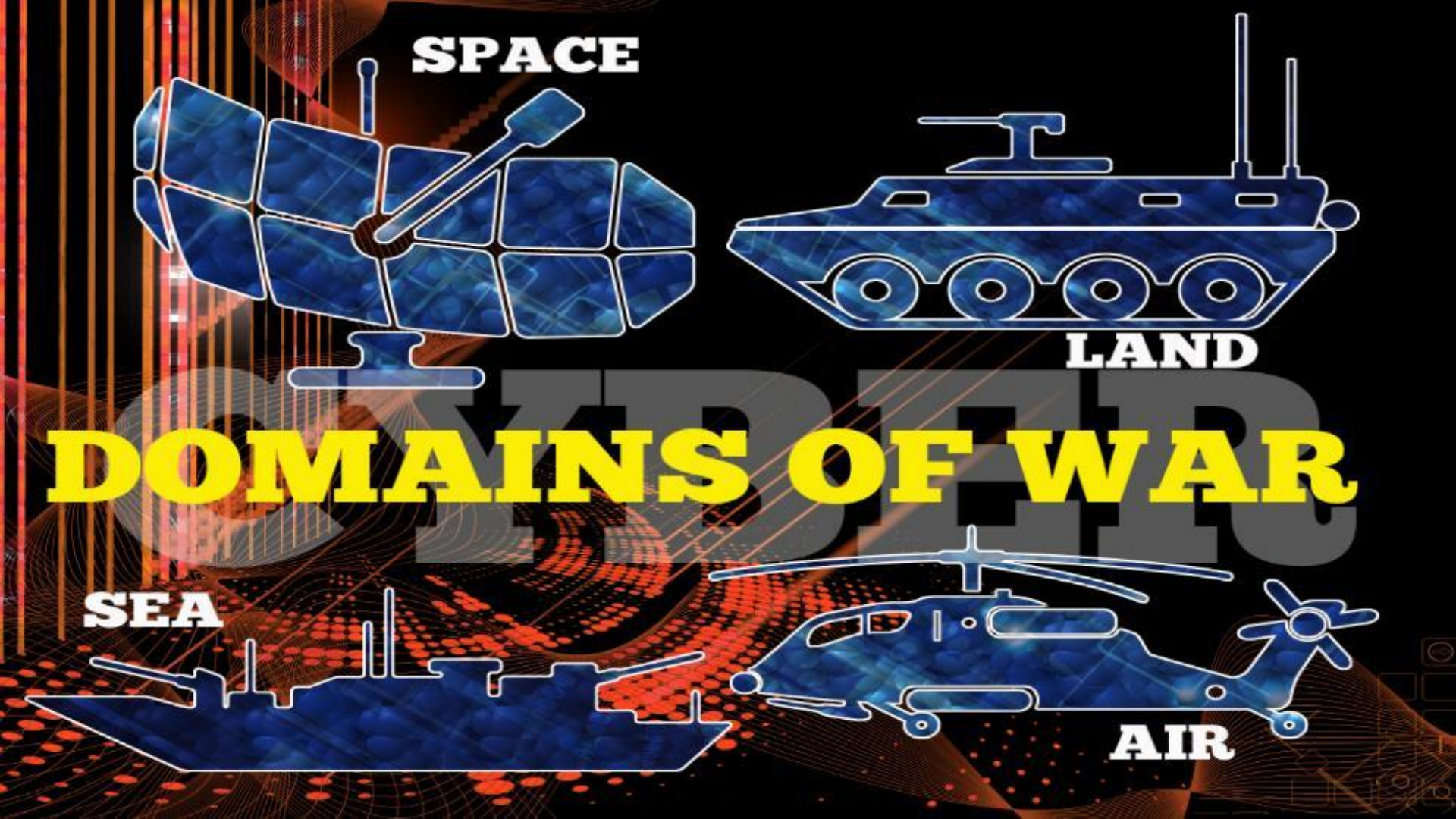
WRC RDI Symposium

An Industry perspective on Water R&D

Technology in Water

By Andile Ngcaba

16 August 2015

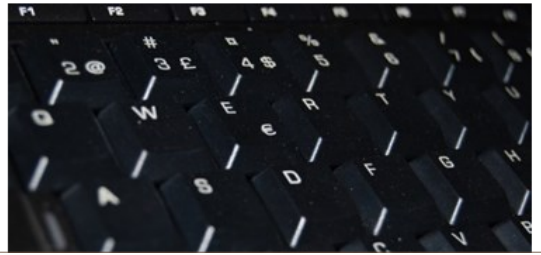

SPACE
LAND
DOMAINS OF WAR
SEA
AIR


Cyber Warfare

News Feature | December 10, 2013

Cyber Attacks Up By 60 Percent At Water Utilities

By *Sara Jerome*
@sarmje



Water and wastewater utilities are experiencing a growing number of cyber attacks.

That's according to data collected by the Repository for Industrial Security Incidents (RISI), an industry-wide organization devoted to tracking cyber crime. They published the data in the 2013 Report On Control System Cyber Security Incidents.

JUL 10, 2014 @ 03:22 PM 7,723 VIEWS

Hacking Gets Physical: Utilities At Risk For Cyber Attacks

Kate Vinton, FORBES STAFF
I write about data breaches, cyber security, and crime.
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FULL BIO

Imagine this: Your city has been out of electricity for a full day because the power grid is being held ransom by an international group of hackers, demanding money before electricity will be restored. While this might sound like the plot of a dystopian novel, Dr. Larry Ponemon, founder of the Ponemon Institute, says this kind of attack on an electrical grid or water system could be in our future if critical infrastructure sectors

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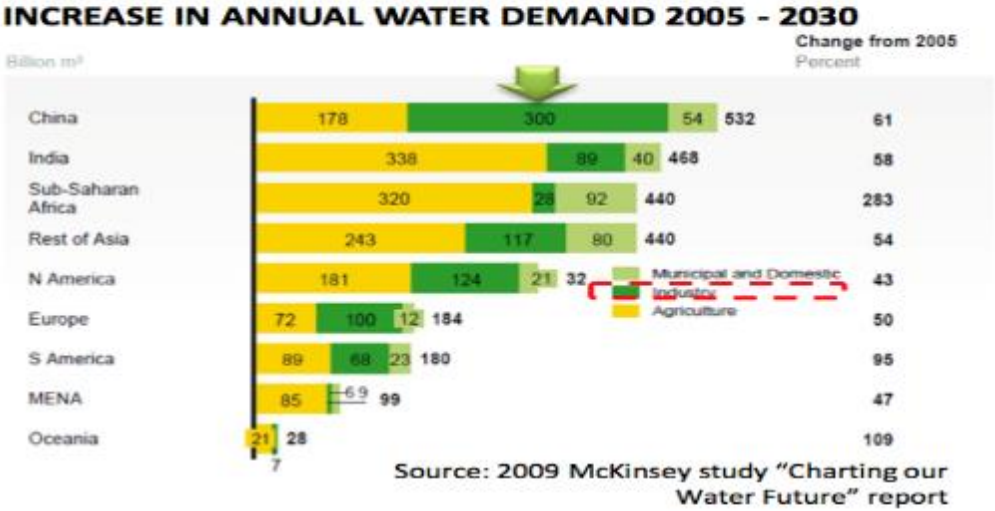
Industrial water market poised for tremendous growth, particularly in Asia

- Industrial water accounts for 22% of freshwater withdrawals globally
- Market size estimated at $29 billion annually
- Accounts for larger share of projected water demand to 2030 vs. municipal



Source: 2009 McKinsey study "Charting our Water Future" report

Key water intensive industries:

Electronics

Energy & Chemicals

Biomedical Sciences

Pulp & Paper

Mining

Maritime & Offshore

EDB singapore

Population Growth - UN

2011 – 7 Billion people

2025 – 8 Billion people

2050 – 9,9 Billion people

Population in urban areas

2011 – 3,5 Billion people

2050 – 6,3 Billion people

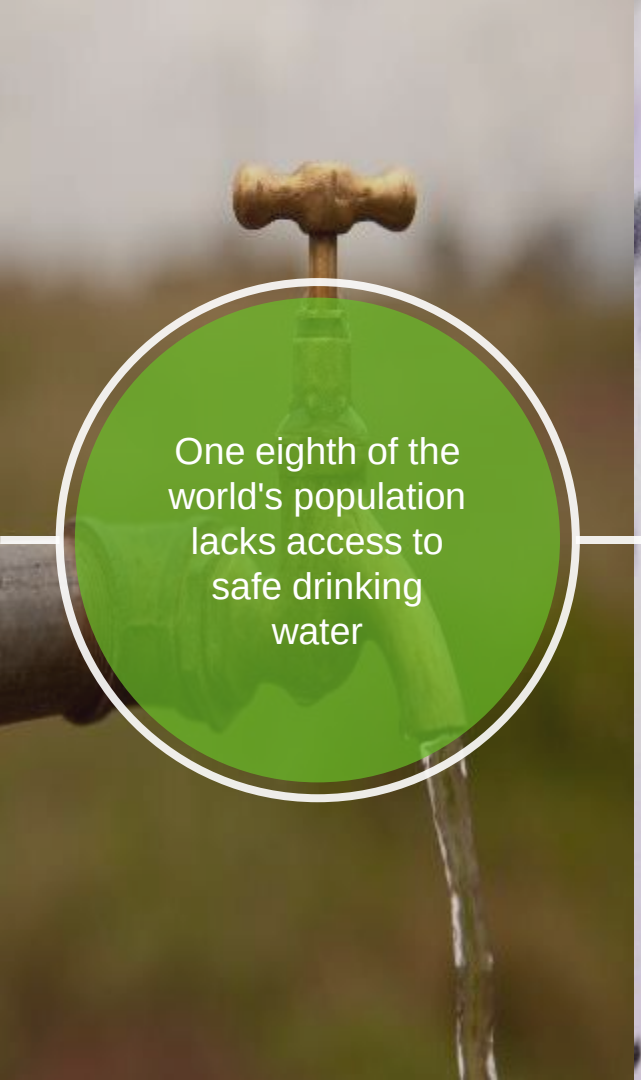
The Earth now and tomorrow

Demand for resources

1,6 times

1,7 times

1,8 times



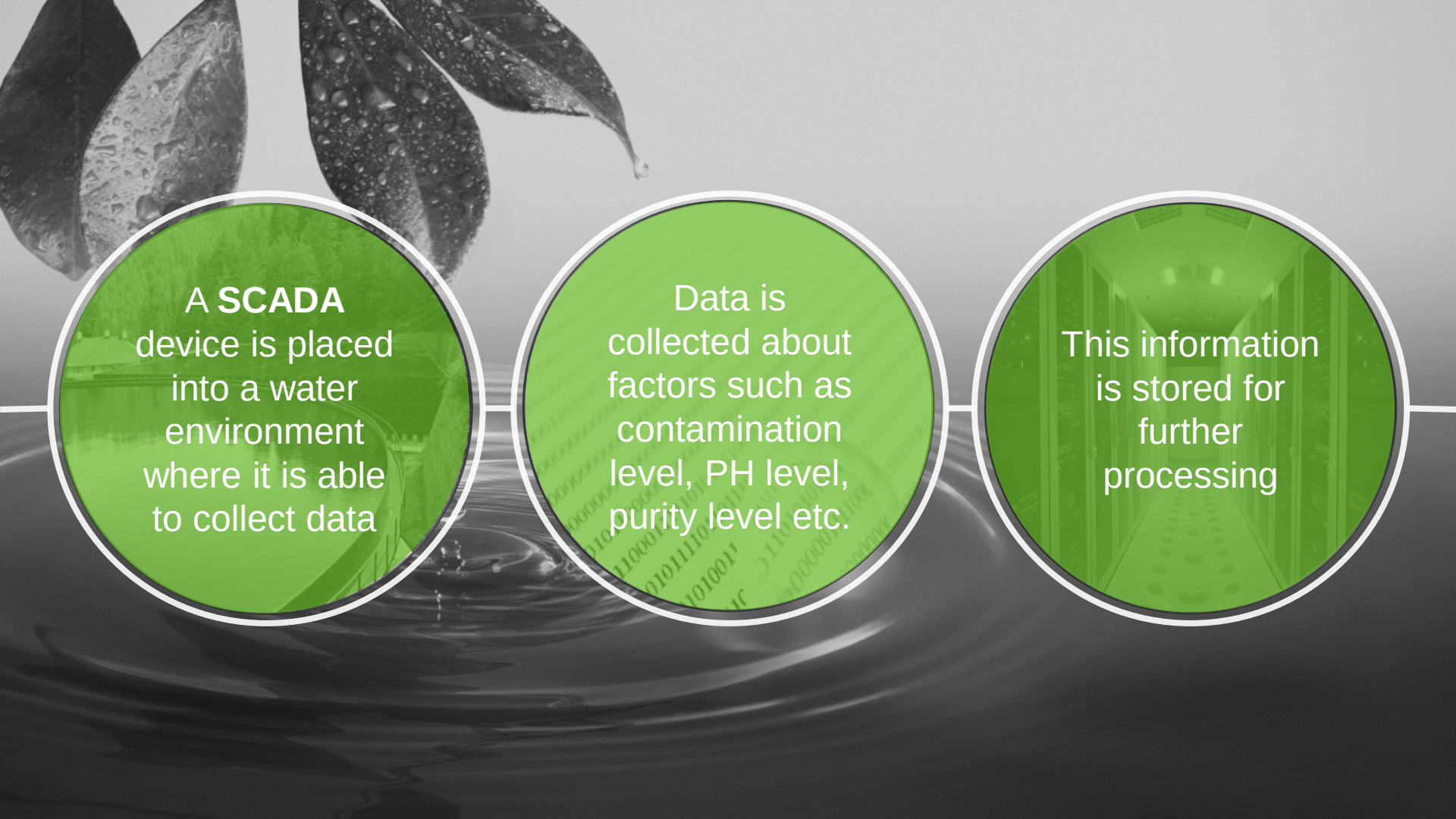
One eighth of the world's population lacks access to safe drinking water

Millions die every year from waterborne and water washed diseases

Access to clean water is a key factor in reducing poverty, improving health and achieving sustainable development.

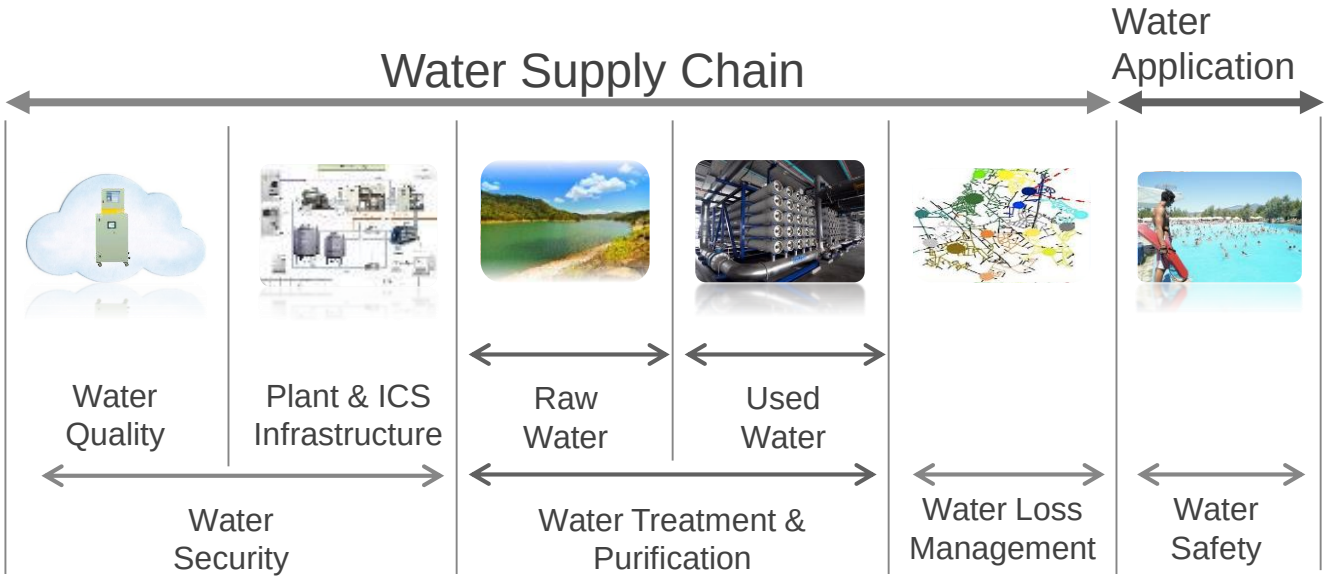
Introduction to **SCADA**

SCADA (supervisory control and data acquisition) is a system operating with coded signals over communication channels so as to provide control of remote equipment.


A **SCADA** device is placed into a water environment where it is able to collect data
Data is collected about factors such as contamination level, PH level, purity level etc.
This information is stored for further processing

SCADA and **BIG DATA**

Big Data analytics offers the data management, exploratory analytics, and data visualization tools needed to discover and project the important behavioural characteristics of highly-complex data infrastructure systems that can be studied through computer simulations. It's in the nature of complex systems to behave unexpectedly and it is only through analytics applied to output that discoveries are

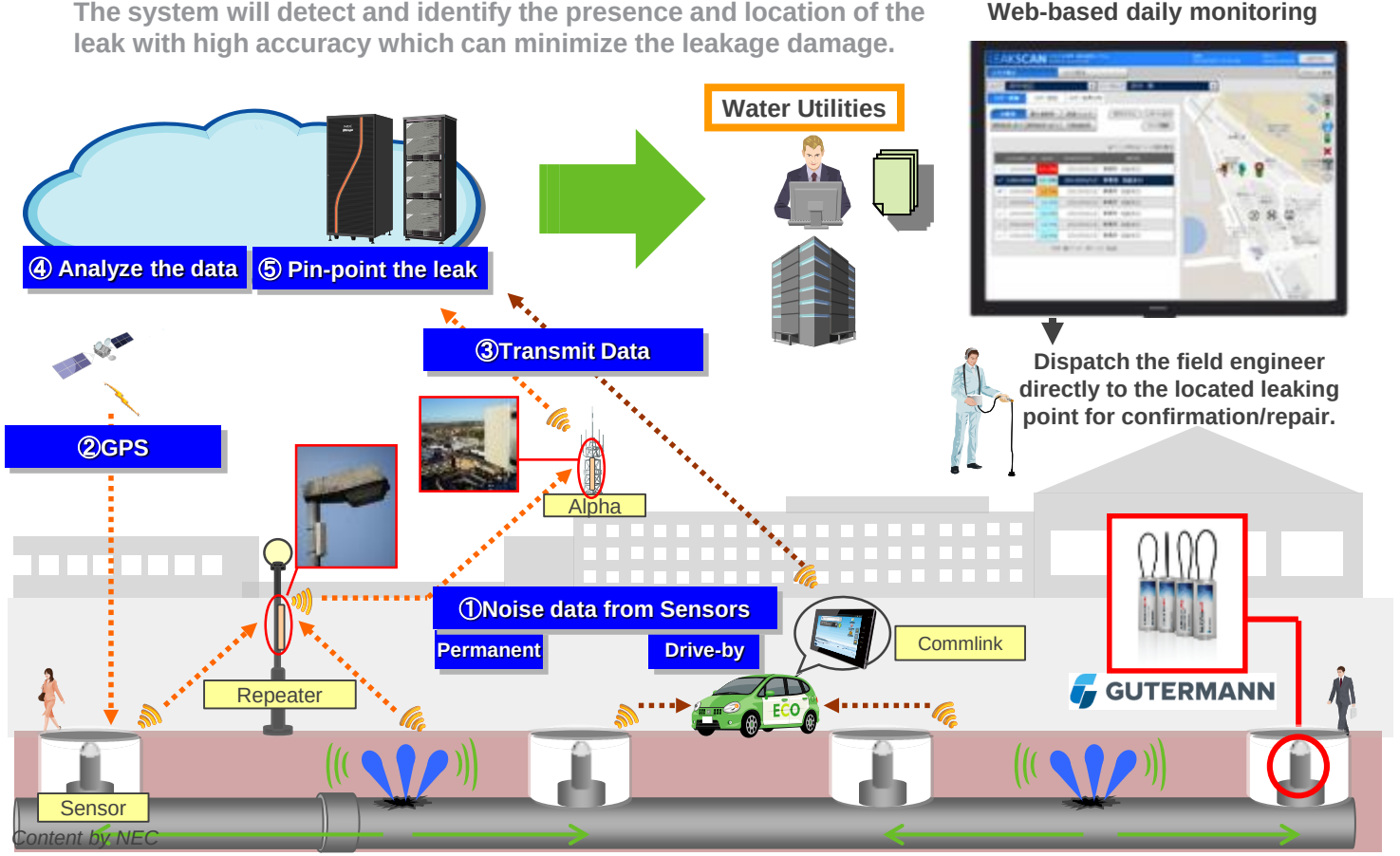


Water Value Network

Content by NEC

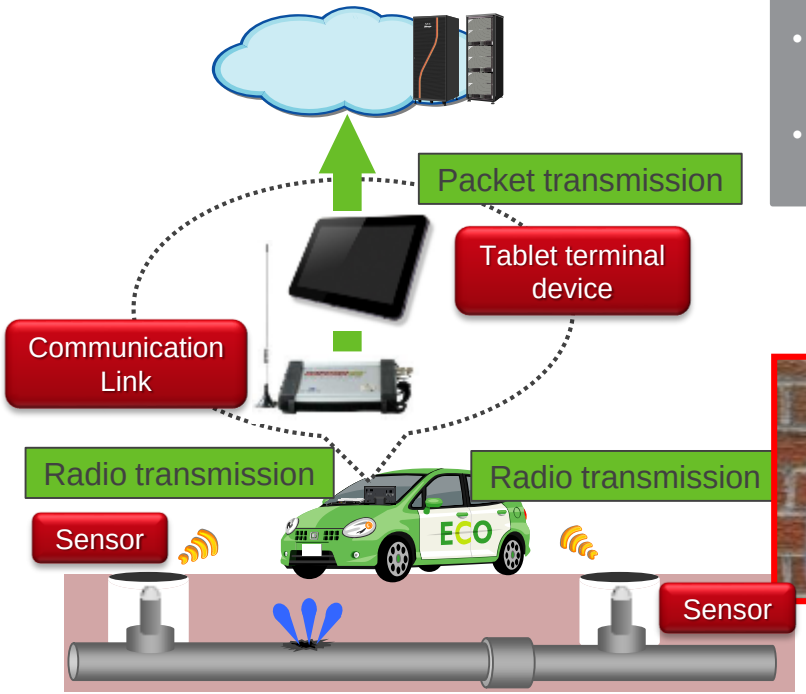
Cloud based system allows you to continuously monitor and easily analyze leak noise characteristic within the pipe network.

The system will detect and identify the presence and location of the leak with high accuracy which can minimize the leakage damage.



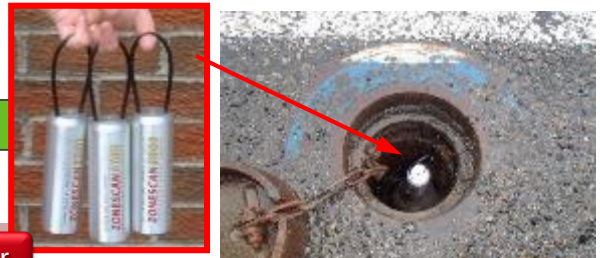
Content by NEC

Water Leak Detection System



Advantages

- initial cost is comparatively inexpensive
- the measuring points can be changed readily

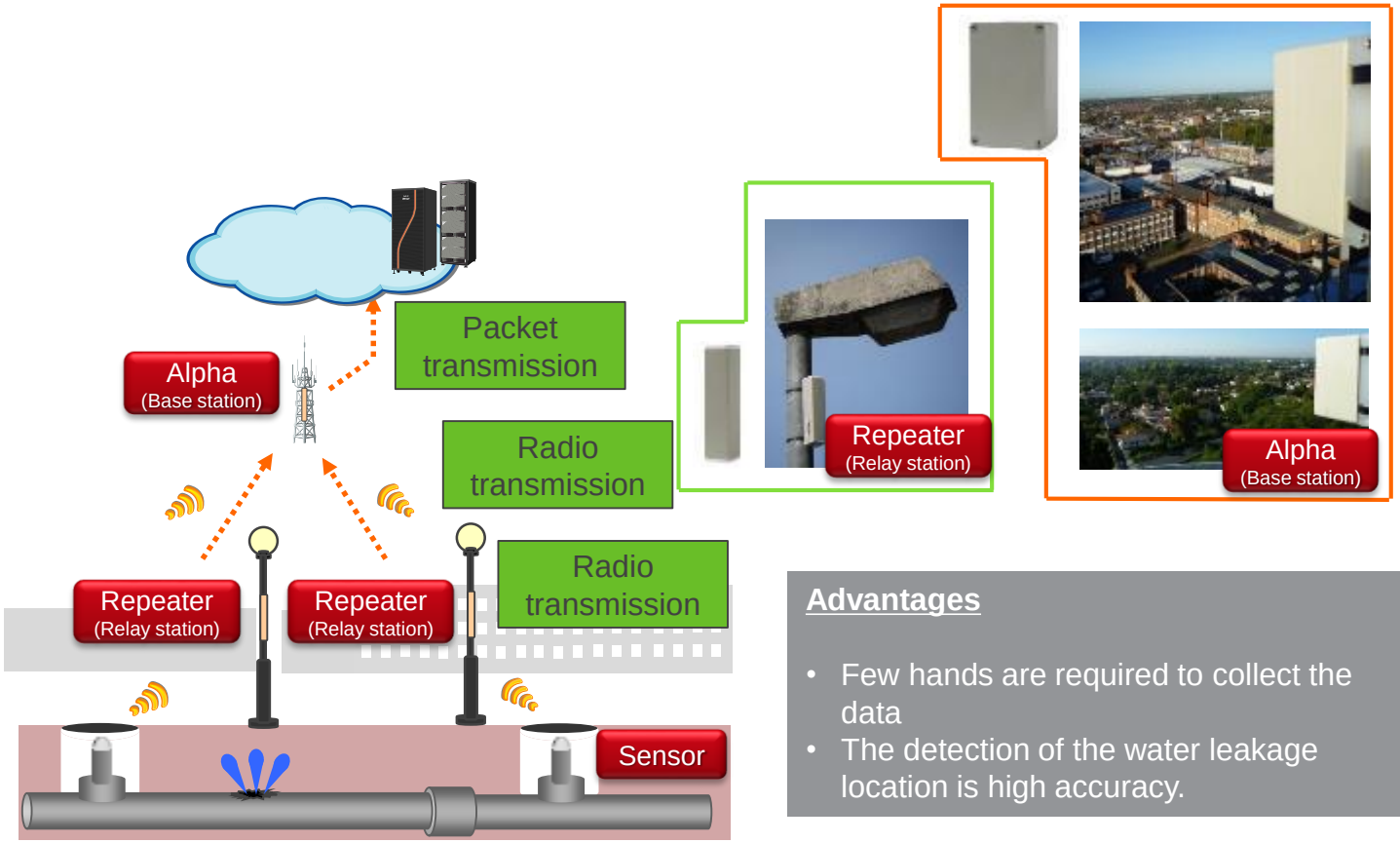


Example of
the installation of a gate valve

The method to collect the recorded data by short-range radio transmission with vehicles fitted with mobile receivers going round the location that the sensors are installed such as valve chambers and fire hydrants

Content by NEC

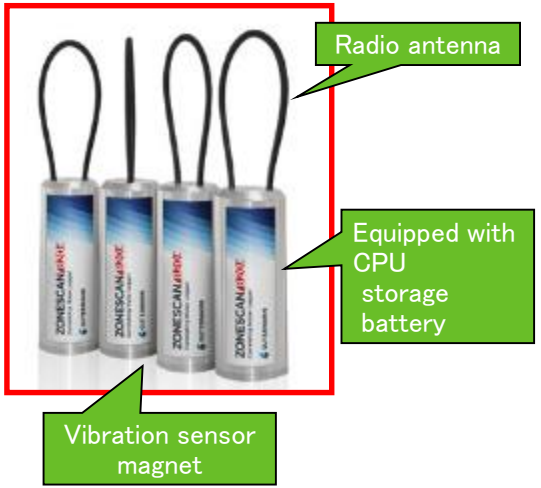
The method to collect the recorded data by radio transmission through the base station with fixed receivers permanently as relay stations (radio receiver) installed light poles near valve chambers and fire hydrants



Advantages

- Few hands are required to collect the data
- The detection of the water leakage location is high accuracy.

Content by NEC



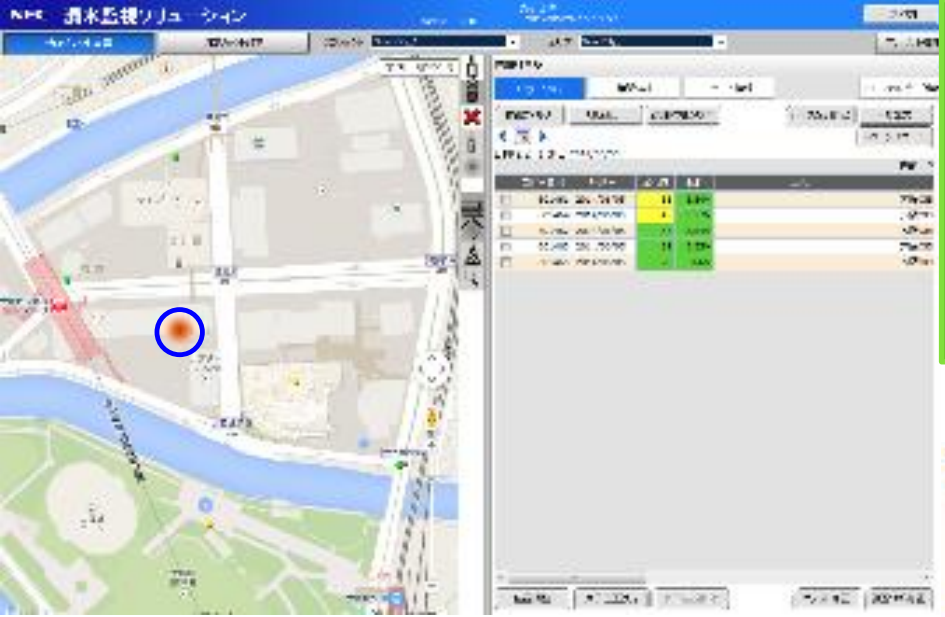
Ex.
the installation of a gate valve

Ex.
the installation of fire hydrants（horizontal）

- Competent for small to medium diameter water distribution network
- Compact and waterproof design for operating environment
- Simple to collect the data by radio transmission
- Sensors can be used co-instantaneously

Ingress protection	IP68
Temperature Range	−20℃～80℃
Communication	Proprietary radio
Battery Life	5 Years ※1
Dimension	Φ42mm×100mm ※2
Weight	310g

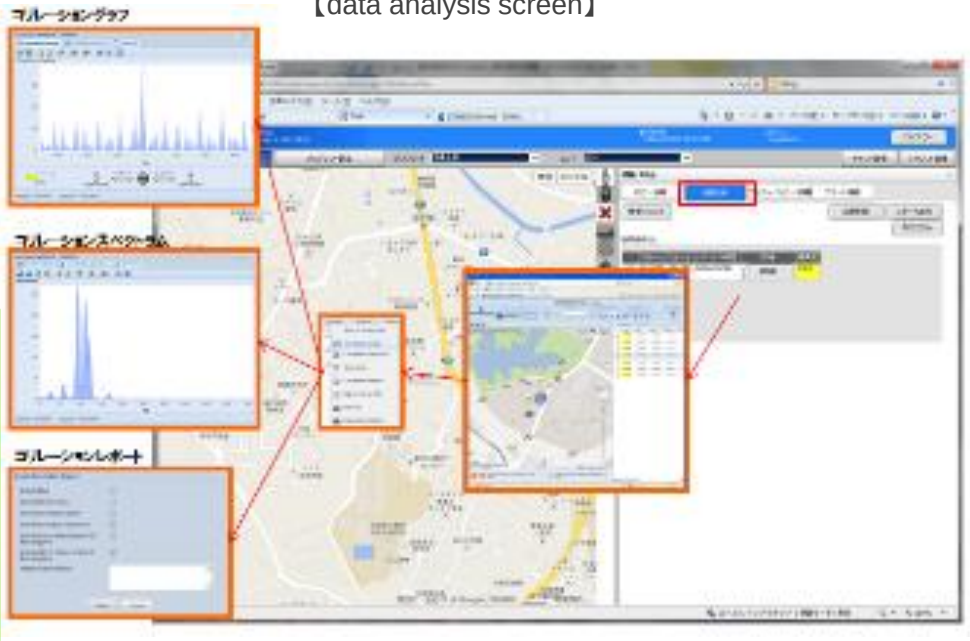
※1 depends on the using condition
※2 the dimension of the radio antenna is not included



【main screen】

① Monitoring the condition of the leakage daily monitoring the presence of a leak
② Identification of the leak position perform correlation analysis automatically and show the leak position
③ Alert function inform the position that has a high probability of the leakage
④ History recording system show the record of investigation and repair on a map
⑤ Link to pipe line ledger map（mapping system）data input/output is possible with your mapping system

【data analysis screen】



Network leak-noise data is viewed by users through the system interface. Data correlation is conducted according to a daily schedule to support operational management.

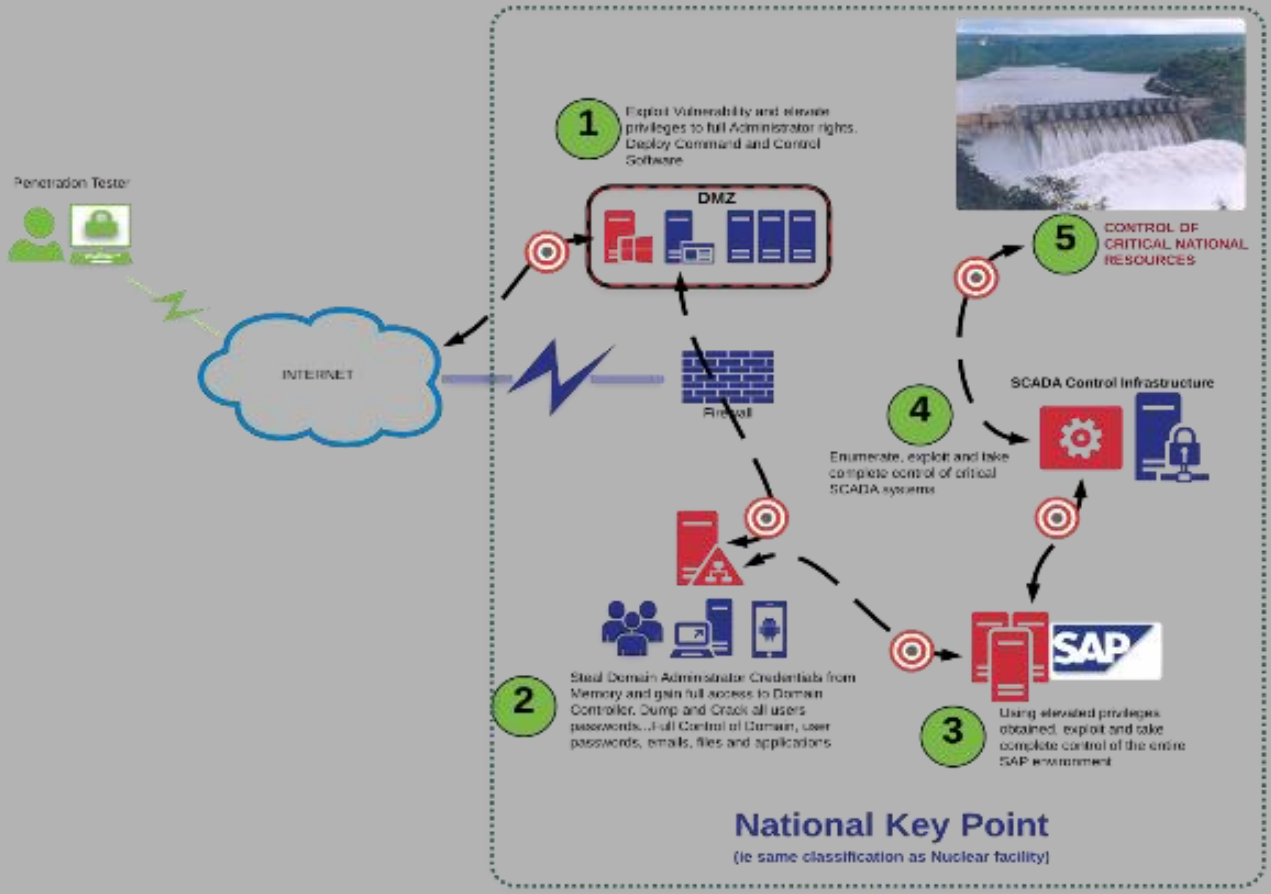
Network nodes and detected leaks are indicated using GIS overlay that enables fast and accurate location of leaks to support efficient isolation and repair of pipework.

Content by NEC

Vulnerabilities changing the way we should view **Water Management**

Utilisation of innovative off-the-grid solutions are the solution to mitigate against the
Impact of cyber terrorism. Innovations and systems that are self-sufficient and independent of public utilities Including water, sewage and Natural gas systems as well as the electrical grid, should be the way forward for many progressive countries.

Compromise of a National Utility



SCADA Security Vulnerabilities

But what if water utility infrastructure is **hacked?**

Interruption of supply and services to the local area or nationally

National and Local Government Political implications.

International and local Reputational damage

Social unrest due to non delivery of services.

Financial loss due to unauthorized access to financial systems and interruption of services.

Water Security Validation

42 units deployed across Singapore to date

Large scale deployment with PUB – 42 units of 3VOtox installed across Singapore, with approx. 70 more units to be installed by end 2014


NORSE
Attacks originating from: Yinchuan, China
ATTACK ORIGINS
Country
686 China
481 United States
87 Russia
67 Hong Kong
34 Portugal
27 Thailand
22 Japan
21 Mil/Gov
19 Netherlands
19 Iran
ATTACK TARGETS
Country
1224 United States
71 Hong Kong
62 Thailand
49 Portugal
29 France
27 Singapore
26 Australia
22 Iceland
20 Austria
19 United Kingdom
ATTACKS
Timestamp
Attacker
Organization
Location
IP
Target
Location
Type
Service
Port
2014-09-05 03:34:04.58 InterNAP Network Services, San Francisco, United States 63.251.62.53 Saint Louis, United States unknown 33449
2014-09-05 03:34:05.16 Ecatel LTD unknown, Netherlands 93.174.93.51 Saint Louis, United States unknown 16218
2014-09-05 03:34:05.95 Hurricane Electric Stanford, United States 184.168.139.72 Seattle, United States ntp 123
2014-09-05 03:34:06.25 CHINANET GUANGXI Nanning, China 222.218.148.22 Kirksville, United States telnet 23
2014-09-05 03:34:06.84 InterNAP Network Services, San Francisco, United States 63.251.62.53 Saint Louis, United States unknown 33450
2014-09-05 03:34:07.32 SingleHop Chicago, United States 198.20.69.98 Saint Louis, United States unknown 789
2014-09-05 03:34:07.74 Comcast Cable Woodbridge, United States 23.253.61.59 Saint Louis, United States unknown 52436
2014-09-05 03:34:07.88 InterNAP Network Services, San Francisco, United States 63.251.62.53 Saint Louis, United States unknown 33451
ELITE
NWO
AGENDA
ATTACK TYPES
Service Port
263 EtherNet/IP-1 2222
253 ms-sql-s 1433
107 ssh 22
81 telnet 23
77 domain 53
45 unknown 53413
42 ntp 123
41 netbios-dgm 138

Recent technology innovation

AquaSel

- Non-thermal brine concenrator
- Reduces wastewater volume by 10 to 50 times
- Reduces fresh water intake by 10% - 20%
- Environmentally friendly process that minimizes waste chemical and energy consumption

ZeeWeed 1500-600

- Improved module performance to achieve > 4 log virus rejection and increased permeability
- Increased module surface area means fewer modules, racks, connections needed for a reduced footprint
- Lower operational costs with fewer modules for the same flow

LEAPmbr

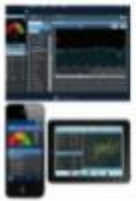
- Boosts productivity 15%
- Reduces MBR footprint by 20%
- Helps reduce membrane aeration equipment and controls by 50%
- Lowers operating costs with 30% in energy savings

LEAPmbr

Recent technology innovation

InSight Monitoring & Diagnostics

- Transform data into meaningful information and insight
- Early issue detection
- Increase productivity and engagement
- Analytical data
- Asset optimization



Embreak

- Lower neutralizer and emulsion breaker usage
- Energy cost savings and reduced furnace emissions
- Reduced slop oil production
- Increased crude charge rates

EMBREAK

GenGard

- Total treatment approach for neutral and alkaline pH cooling waters
- Only halogen stable technology in the world
- Uncompromised performance under stressed conditions

MerCURxE

- Capable of achieving limits to parts per trillion levels
- Lower solids generation compared to competitive chemistries
- Effective on mercury and other traditional heavy metals
- Better environmental toxicology profile than competitive materials

Achieving Water Reuse in the USA

Challenge: Expanding population required increased wastewater treatment

Solution: GE's MBR technology to treat wastewater for reuse and safe disposal

Brightwater Plant – Seattle, WA

- Water produced for irrigation , heating & cooling and industrial processing
- Average daily flow of 31 MGD (117,348 m3/day)
- Reduces TSS and BOD discharge to Puget Sound by 1,000,000 lbs (454,000 kg) each year
- Positioned to cost-effectively address future regulations

Water & Process Technologies Business Overview

CASE STUDY

Content by GE

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Back-Up Solutions