Water Arabia 2015

Improvements to Brackish Water RO plants

Peter Szappanos
Veolia Arabia - Operations

Water

Contents

- Context
- Challenges and improvements
- Conclusions and lessons learnt
- Way forward

The contract

- Client: National Water Company – Riyadh City Business Unit (RCBU)
- Management contract from 2008 to 2014
- Client's expectations:
  - *Align RCBU with NWC strategy*
  - *Improve services*
  - *Prepare company for future privatization*
  - *Enable transition from public to private*
  - *Introduce performance based culture and best practices*
- Fixed fee + incentives based on CAPEX and OPEX savings (HR excluded)
- 4 KPIs, 33 performance indicators (26 with O&M), 37 deliverables
- Veolia managers in key positions with Saudi counterparts

Riyadh water supply

Demand

5.5 million inhabitants

- 4-5% growth per year
- 2.1 million m3/day supplied
- Continuity of supply: 70%
- Winter / summer peak factor 1.2

Water sources

- 50% deep wells
- 50% desalinated water from SWCC
- Raw water quality (TDS 1300-2000, Iron 0.2-2, Silica 15-50, Total Hardness 700-1300, Total Alkalinity 120-210 mg/L)

Assets

- 40 treatment plants (37 with RO)
- 1,220,000 m3/day installed capacity
- 630,000 m3/day RO capacity
- 280 deep wells (500 - 2000m depth)
- 60,000 assets
- First plant in early 1960s, RO introduced in late 1980s early 1990s
- OPEX 576mSAR/yr (470mSAR RO)

Employees

- 4,200 employees in total (water plants O&M 1,200)
- Direct employees: 98% Saudi nationals
- Outsourced RO capacity: 22%

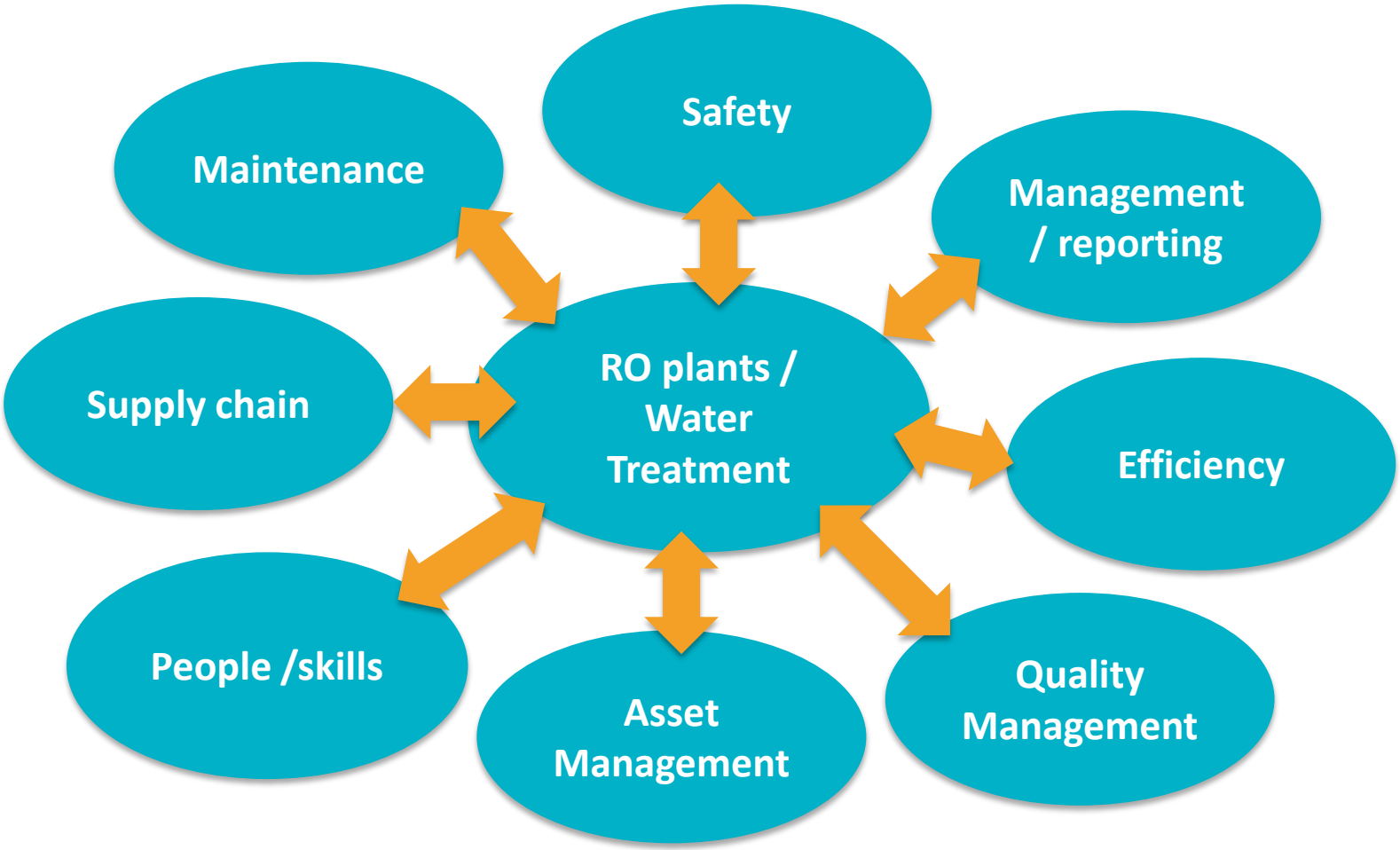
Main challenges

- Produce more water
- Minimize water quality failures
- Improve equipment availability
- Optimize OPEX
- Improve operators skills

Improvements from 2008 to 2014

	2008	2014	Change
ALL PLANTS			
Installed (MLD)	1004	1220	+21%
Actual (MLD)	710	1110	+56%
Utilization	**71%**	**91%**	
PLANTS WITH RO			
Installed (MLD)	594	790	+33%
Actual (MLD)	382	642	+68%
Utilization	**64%**	**80%**	
Installed (MLD) w/o new RO	594	594	
Actual (MLD) w/o new RO	382	465	+22 %
Utilization	**64%**	**78%**	
WATER QUALITY COMPLIANCE			
Compliance	<90%	99.75% Chemical / 99.99% Microbiology	

Approach


Safety
Maintenance
Management / reporting
Supply chain
RO plants / Water Treatment
Efficiency
People /skills
Asset Management
Quality Management

Asset Management

Challenges

- No asset register
- Condition of assets unknown
- Assets operated well beyond their expected design life
- Unclear selection criteria for asset replacement
- Poor delivery of new assets (deadlines, quality, handing over)
- Silo mentality between Ops and AS
- O&M needs not taken on board

Achievements

- Asset condition survey and register
- Criticality survey
- Summer Action Plan
- Investment Planning
- Focus on reliability, availability and criticality, serviceability when selecting equipment for replacement
- Improved cooperation between Asset Services and Operations (early buy-in)
- Standard specifications
- Clear handing over procedures

Asset Renewals (examples)

- Full RO replacement – 1 site
- Stage conversions – 3 sites
- Backwash system upgrade 2 sites
- Chemical dosing 4 sites
- Cooling tower replacements 5 sites

Energy Optimization

Challenges

- 20% reduction expected by 2014 against a 2.33 kWh/m3 baseline
- Production uses 80% of RCBU's consumption
- Oversized pumps in boosters
- Low efficiency wellpump motors
- 3-stage ROs
- Fixed speed pumps

Achievements

- 8% reduction achieved
- Energy efficiency audit in 2009
- More efficient motors in wells (10 mSAR/yr saving) min 20 units per year replaced
- Replaced pumps in 4 boosters
- Accelerated RO stage conversion program (one plant left)
- Pressure management in the network (modulated PRVs)
- VSDs is standard for new boosters
- Set up internal energy efficiency unit

Maintenance Optimization

Challenges

- 60,000 assets across water plants
- >95% availability expectation for critical equipment
- **Reactive state** maintenance
- Maintenance often driven by spares availability
- Legacy equipment issues

Achievements

- Asset survey and register
- Criticality survey
- Equipment availability 95.5% in 2014
- Number of planned WOs up by 110%
- Completed WOs up to 96%
- Rolled out CMMS
- Introduced predictive maintenance (vibration, thermal, oil analysis)
- Winter Shutdown Maintenance
- Framework contracts
- Standard specifications
- Root cause analysis
- Closer to **Planned-Proactive state**

Process Optimization

Challenges

- Recurring water quality failures especially in TDS
- Legacy RO membranes
- Pre-treatment problems
- High chemical cost
- Sampling irregularities
- Lack of filter and RO performance monitoring
- Treatment of return backwash

Achievements

- Conducted chemicals savings review
- Phasing out lime softening and introducing antiscalent
- Replacing soda ash with caustic soda
- Reduced chemicals costs by 54%
- Standardized RO membrane selection
- Uniform sampling (sampling plan)
- Optimized coagulant dosing for back wash treatment
- RO operations and troubleshooting training
- On-line analyzers

People

- Carried out Skills Assessment (by Veolia Foederis system)
- Training Needs Analysis
- Training (safety, technical, soft skills and management skills, international training, Veolia Knowledge Transfer training)
- Up to 25,000 training days/year
- Technical training: RO operation, troubleshooting, Chemical preparation and dosing, Process optimization, Sampling, etc
- New job descriptions
- Annual appraisal and bonus system
- Management by objectives
- Overtime optimization

Safety

- Change in safety culture – it is an integral part of operations and critical for business continuity
- RCBU targets based on severity and frequency
- New safety organization
- Safety procedures: full revision and update
- Training on all procedures
- New safety equipment
- Comprehensive safety survey and action plan
- Accident reporting

Specific areas:

- Acid dosing
- Pressure vessels
- Chlorine dosing

Quality Management

- Set up a Performance Team
- Formal certification (ISO 14001, OHSAS 18001, ISO 9001) for 2 sites
- Standard Operating Procedures: 30 per plant for Operation and 100 for maintenance
- Document Management system
- Standard specifications
- Internal audits

Conclusions

- Significant gains were made (volumes supplied, water quality, equipment availability, OPEX savings)
- Some targets were missed mainly due to budget limitations
- Change the mindset in many key areas
  - *Planning and budgeting*
  - *Performance management / Accountability*
  - *Operation and Maintenance*
- Active support from Client (National Water Company) and RCBU employees
- Veolia's expertise and experience was key in meeting the contract challenges

Lessons learnt

- Performance base line must be clear to avoid disputes over incentives
- Cost of change and impact of targets must be well understood (especially in terms of asset renewals) in advance
- For lasting impact knowledge transfer is key (sufficient training budget is paramount!)
- Support services (Finance, HR, Procurement) must also be up to speed otherwise targets cannot be reached
- Duplicated management structure can be at times slow down decision-making

Way forward for RCBU Water Plants

Challenges / changes

- Supply will outstrip demand (due to increased supply from SWCC)
- Strategic project will affect the way plants work
- Existing deep wells: reduction in dynamic water levels and gradually deteriorating water quality
- More pressure to improve quality and efficiency
- From demand to efficiency driven environment

Possible answers

- Process optimization (low pressure membranes, fine tuning of pre-treatment, etc)
- Continue with energy and chemicals optimization
- Improve automation levels
- Headcount optimization (find additional tasks, in-source activities, re-train)
- Closure/mothballing of least efficient plants?
- Maintenance: reach Proactive – Right First time stage
- Obtain ISO certification for all plants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Thank you
Peter Szappanos
Veolia Arabia - Operations
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