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# Boosting direct potable reuse: measures to be taken to help shorten the knowledge gaps and uncertainties surrounding this technology

**XVI World Water Congress**

**May 29th – June 2nd 2017, Cancún, Mexico**

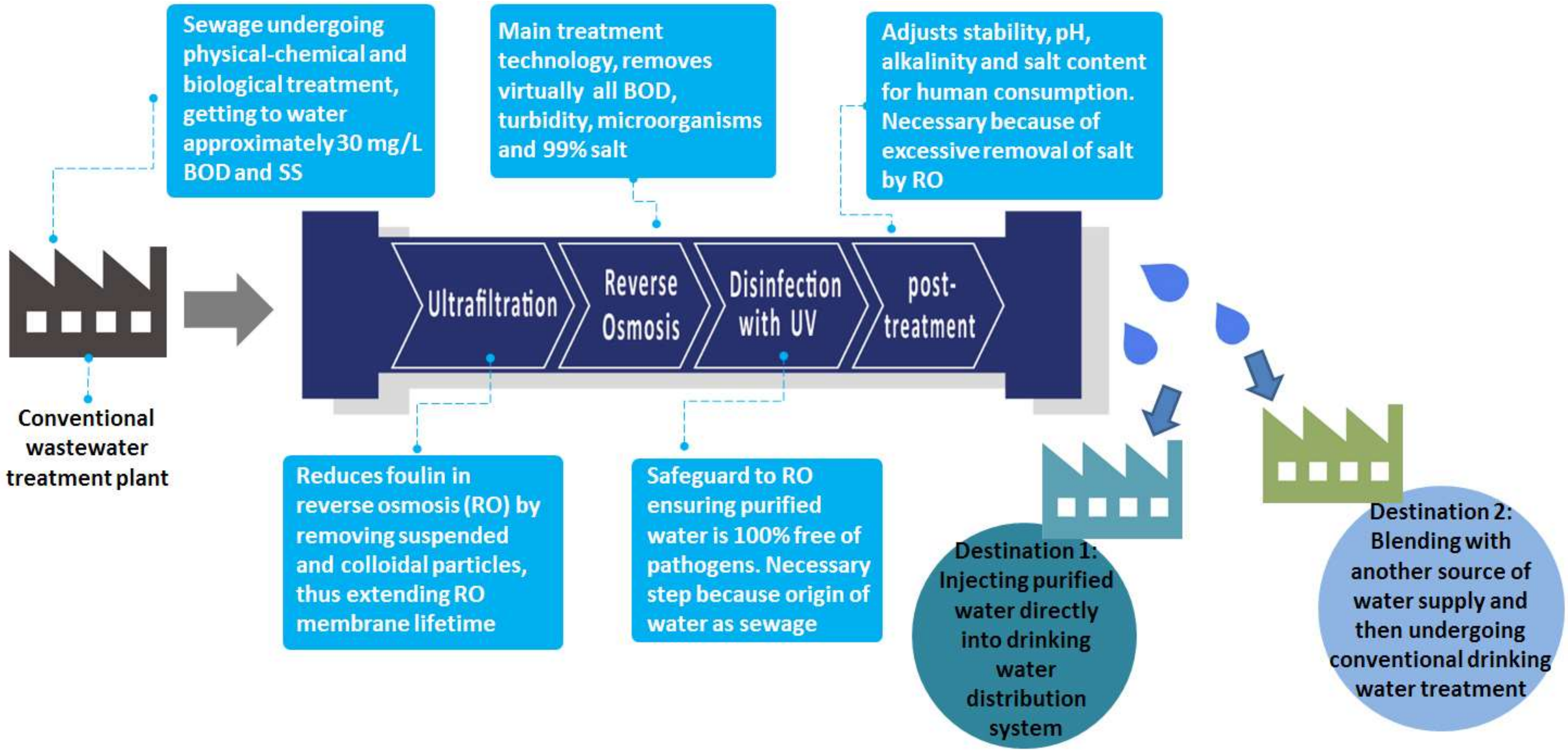
Where are we heading to?

-United Nations (UN) considers water scarcity one of the main problems to be faced by the world in the 21st century, projecting a 40% global water deficit under the business-as-usual (BAU) scenario by 2030.

- Most vulnerable communities -> single sources of water supply that are climate dependant

As a result, we will be looking progressively for alternative sources of water supply: desalination and water reuse

-Direct potable reuse: water, normally originated as municipal wastewater (sewage ), which after conventional treatment undergoes advanced and then is used for human consumption


Sewage undergoing physical-chemical and biological treatment, getting to water approximately 30 mg/L BOD and SS
Main treatment technology, removes virtually all BOD, turbidity, microorganisms and 99% salt
Adjusts stability, pH, alkalinity and salt content for human consumption. Necessary because of excessive removal of salt by RO
Conventional wastewater treatment plant
Ultrafiltration
Reverse Osmosis
Disinfection with UV
post-treatment
Reduces foulin in reverse osmosis (RO) by removing suspended and colloidal particles, thus extending RO membrane lifetime
Safeguard to RO ensuring purified water is 100% free of pathogens. Necessary step because origin of water as sewage
Destination 1: Injecting purified water directly into drinking water distribution system
Destination 2: Blending with another source of water supply and then undergoing conventional drinking water treatment

-Steady source of supply, climate independent, relatively cheap
-DPR plants around the world:
Windhoek, Namibia (1968)

Big Springs, Texas, United States

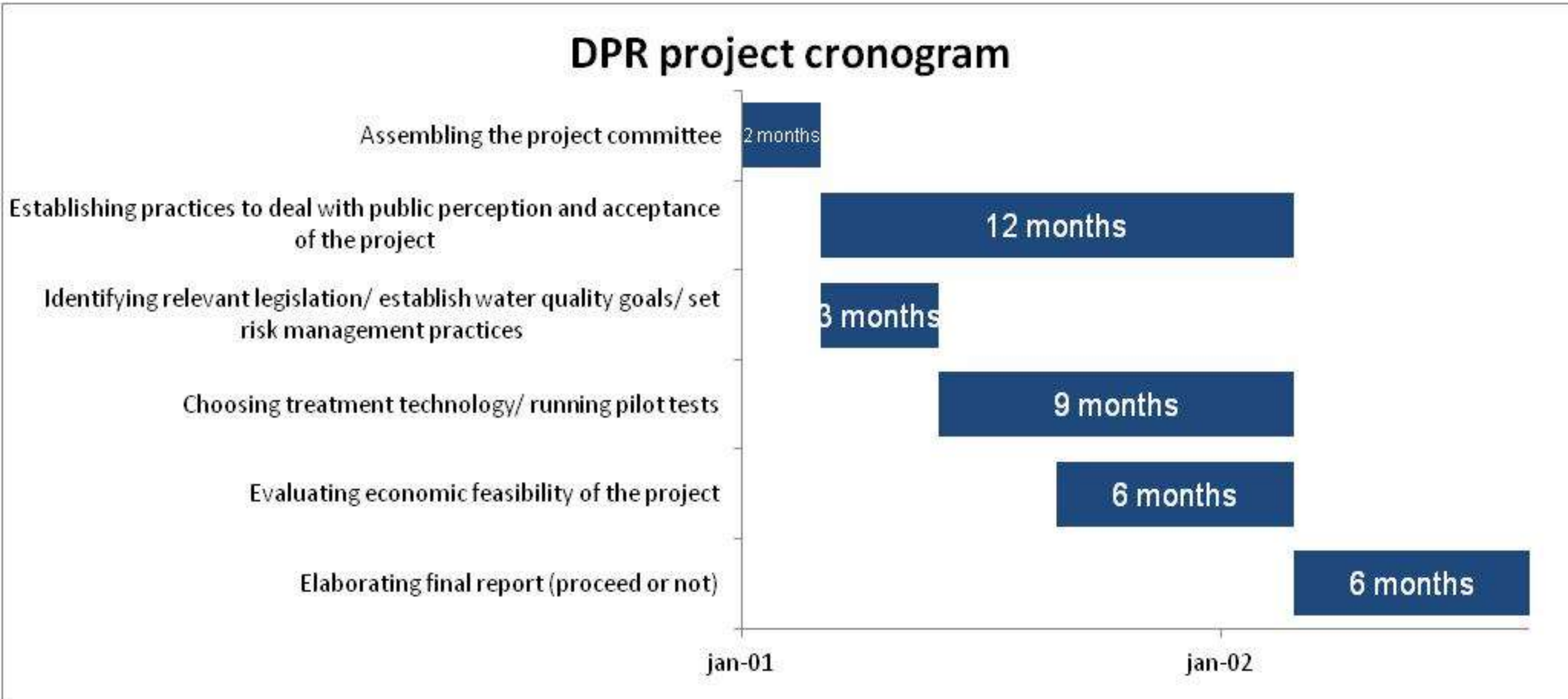
Whichita Falls, texas, United States

El Paso, Texas, United States (in construction - 2019)

Limited, still a novelty -> many open questions remain, knowledge gaps.

Biggest drawbacks:

1) Public acceptance
2) Lack of specific legislation
3) Water quality concerns
4) Economic feasibility


DPR project cronogram
Assembling the project committee
2 months
Establishing practices to deal with public perception and acceptance of the project
12 months
Identifying relevant legislation/ establish water quality goals/ set risk management practices
3 months
Choosing treatment technology/ running pilot tests
9 months
Evaluating economic feasibility of the project
6 months
Elaborating final report (proceed or not)
6 months
jan-01
jan-02

# Economic feasibility - NPV

-For a design flow of 25 million gallons per day (MGD), with net production of purified water of 17 MGD.
-Calculate investment by considering equipment (UF, RO, UV reactor) cost. Its respective mounting, valves, instrumentation, electrical, civil, painting was calculated as % of equipment price

# Economic feasibility - NPV

-Calculate operating costs (expenses) considering electricity for membrane pumps ($0.1049/kWh), chemicals consumption for membrane cleaning, operating labor cost, management/administrative costs, maintenance, monitoring.

-Also considered: cost for permitting, pilot tests, operator training and insurance (EPA manual)

-Adjusted both expenses and revenue for inflation considering 1% per year, 10 years lifetime.

Considering the following purified water prices:

- $1.02/100 cubic feet (hcf), which is the real price of water billed in the city of Sacramento, California, as of 2017
- $3.81/hcf, real price of water billed in New York City as of 2017
- Intermediate values of $1.5/hcf and $2.5/hcf.

| Calculation | Total calculated in US dollars |
|---|---|
| **Investment (year 0)** | 45,856,386 |
| **Expenses (per year)** | 7,003,319 |
| **Revenue (per year)** | $1.02/100cf - 8,687,000 |
| | $1.50/100cf - 13,030,500 |
| | $2.50/100cf - 21,090,000 |
| | $ 3.81/100cf - 32,266,000 |

*Project feasible for water price of at least $0.0034/gal or $2.50/hcf*

Is DPR feasible?

-It can be done sucessfully with current technologies available, getting to suitable water quality, main drawback (public acceptance) can be handled, economically feasible atwater rates of \$2.54/hcf, or \$0.0034/gal, for 17MGD production.

- DPR can be boosted if stakeholders are willing to pay money and attention on the management of project during the initial planning phase

Thank you

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