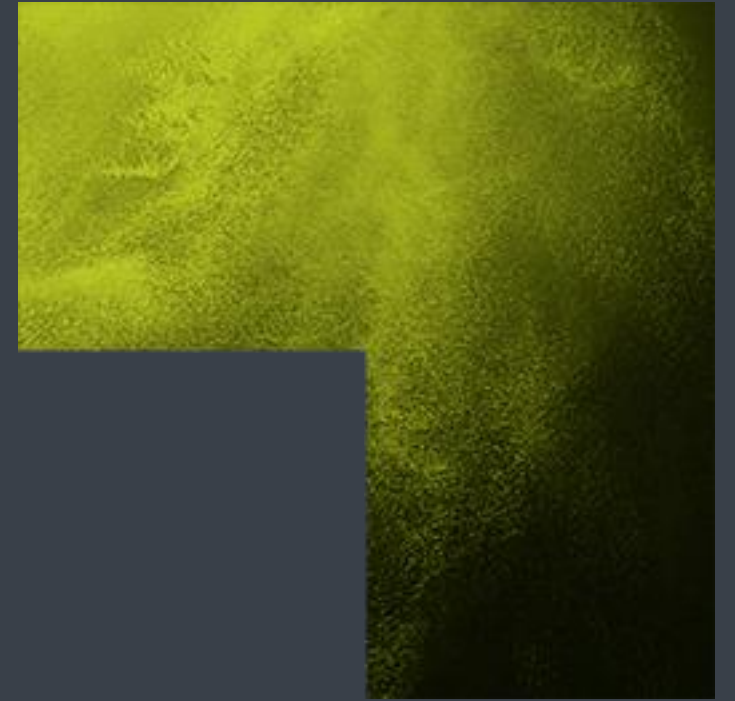
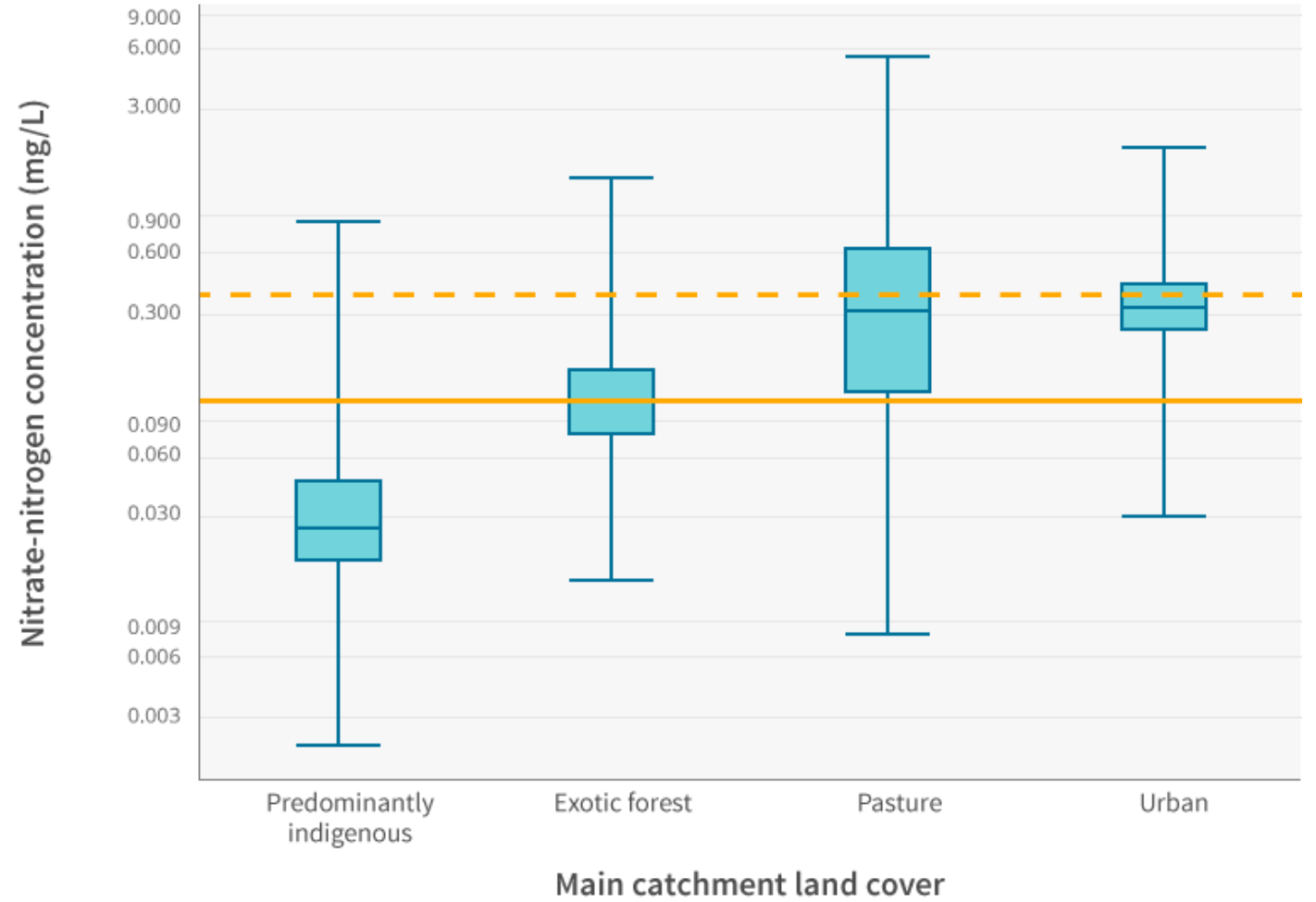


AMMONIA - WATER TREATMENT CHALLENGES

NICKY SMALBERGER
DANIEL STEVENSON

HARRISON
GRIERSON





--- Trigger value lowland 0.444 mg/L
 — Trigger value upland 0.167 mg/L

AMMONIA IN RAW WATER



HUMAN FACTORS



NATURAL PROCESSES



1. Ashleigh Collis (2017), "Cows in water supply shock town" retrieved from www.nzherald.co.nz accessed on 13 August 2019
2. Cedrick May (https://commons.wikimedia.org/wiki/File:Decomposition_and_New_Life_1.JPG), <https://creativecommons.org/licenses/by-sa/4.0/legalcode>

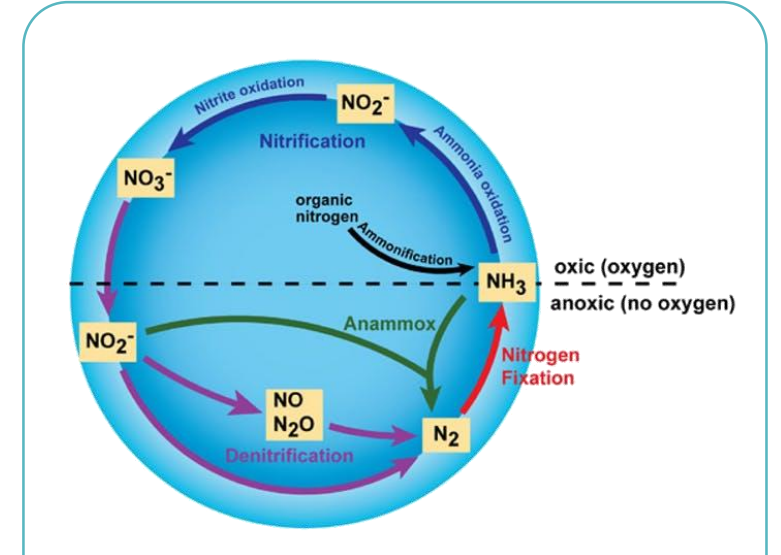
AMMONIA - TREATMENT CHALLENGES



TASTE & ODOUR



CHLORINATION EFFICIENCY

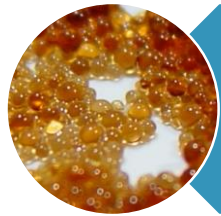


OXIDATION OF AMMONIA

TREATMENT PROCESSES



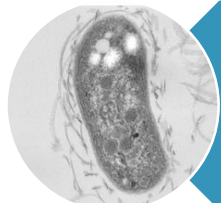
AMMONIA REMOVAL



ION EXCHANGE

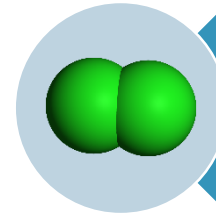


REVERSE OSMOSIS

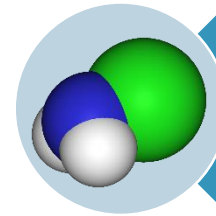


BIOLOGICAL
AMMONIA REMOVAL

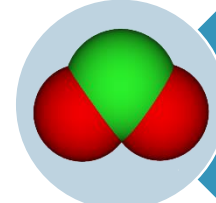
ALTERNATIVE DISINFECTION



BREAKPOINT
CHLORINATION



CHLORAMINATION

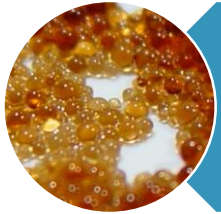


CHLORINE DIOXIDE

TREATMENT PROCESSES



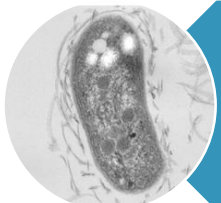
AMMONIA REMOVAL



ION EXCHANGE



REVERSE OSMOSIS

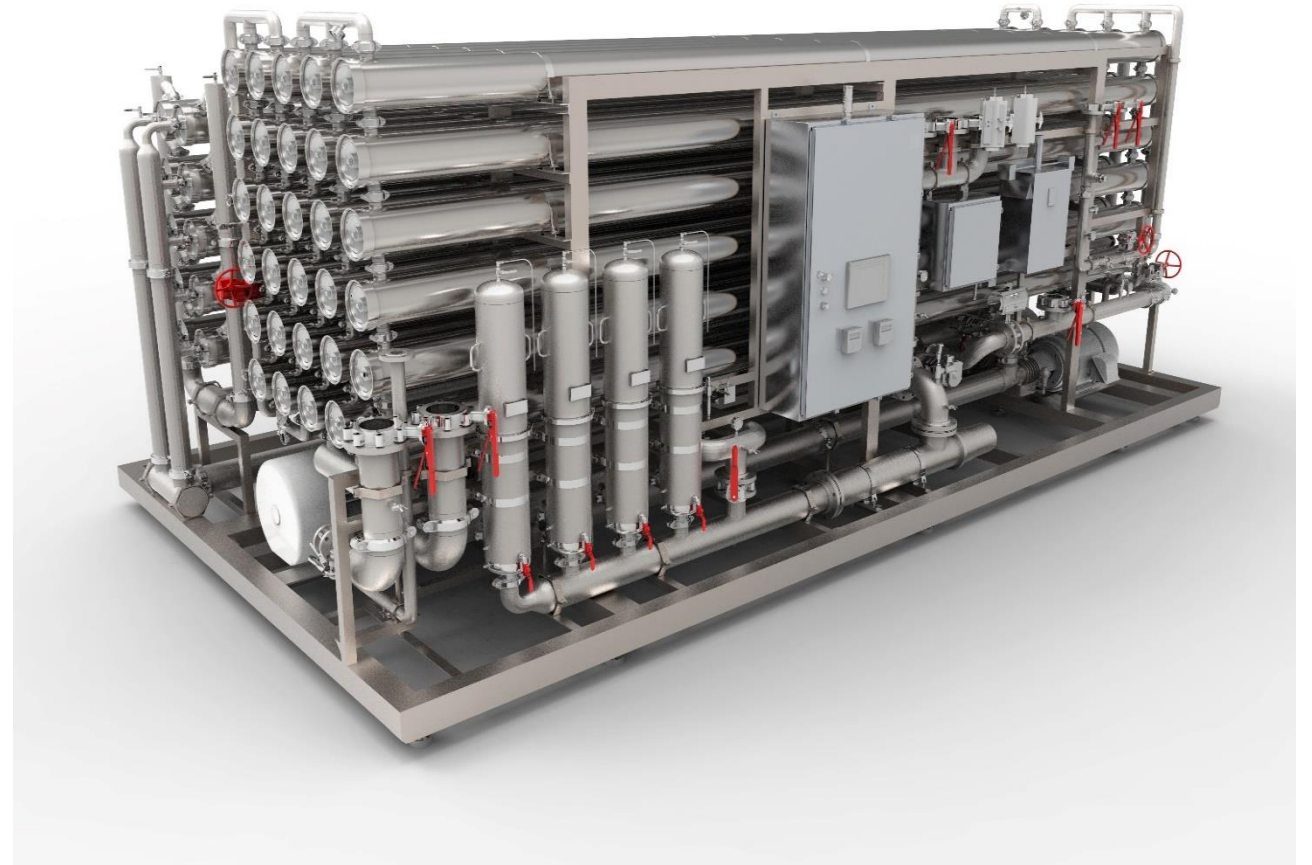


BIOLOGICAL
AMMONIA REMOVAL

AMMONIA REMOVAL - ION EXCHANGE & REVERSE OSMOSIS



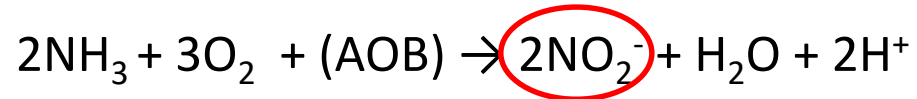
- Common WTP processes
- Proven Technologies
- High capital and operating costs
- Affected by Hardness
- Increased waste streams



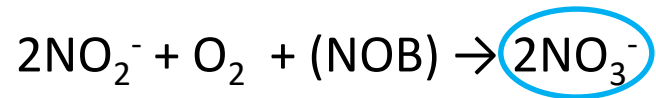
BIOLOGICAL AMMONIA REMOVAL



Ammonia Oxidising Bacteria (AOB)



Nitrogen Oxidising Bacteria (NOB)



Nitrite – DWSNZ MAV
0.2 mg/L - short term
3 mg/L - long term

Nitrate – DWSNZ MAV
50 mg/L - short term

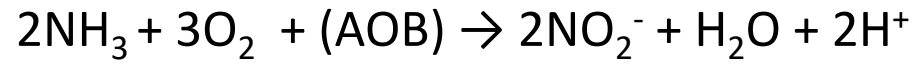
Shopping List

- Bacteria
AOB
NOB
- Oxygen
- Bacteria Food (Phosphate)
- pH 7-9
- ~~Cold Temperatures~~

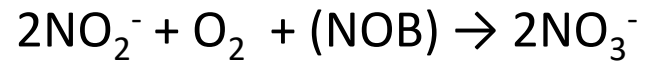
BIOLOGICAL AMMONIA REMOVAL



Ammonia Oxidising Bacteria (AOB)



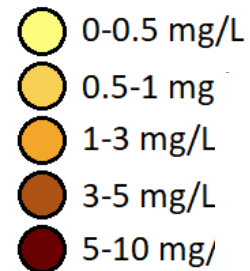
Nitrogen Oxidising Bacteria (NOB)



BIOLOGICAL AMMONIA REMOVAL - PALO IOWA



Ammonia Levels



BIOLOGICAL AMMONIA REMOVAL - TAI PO, HONG KONG

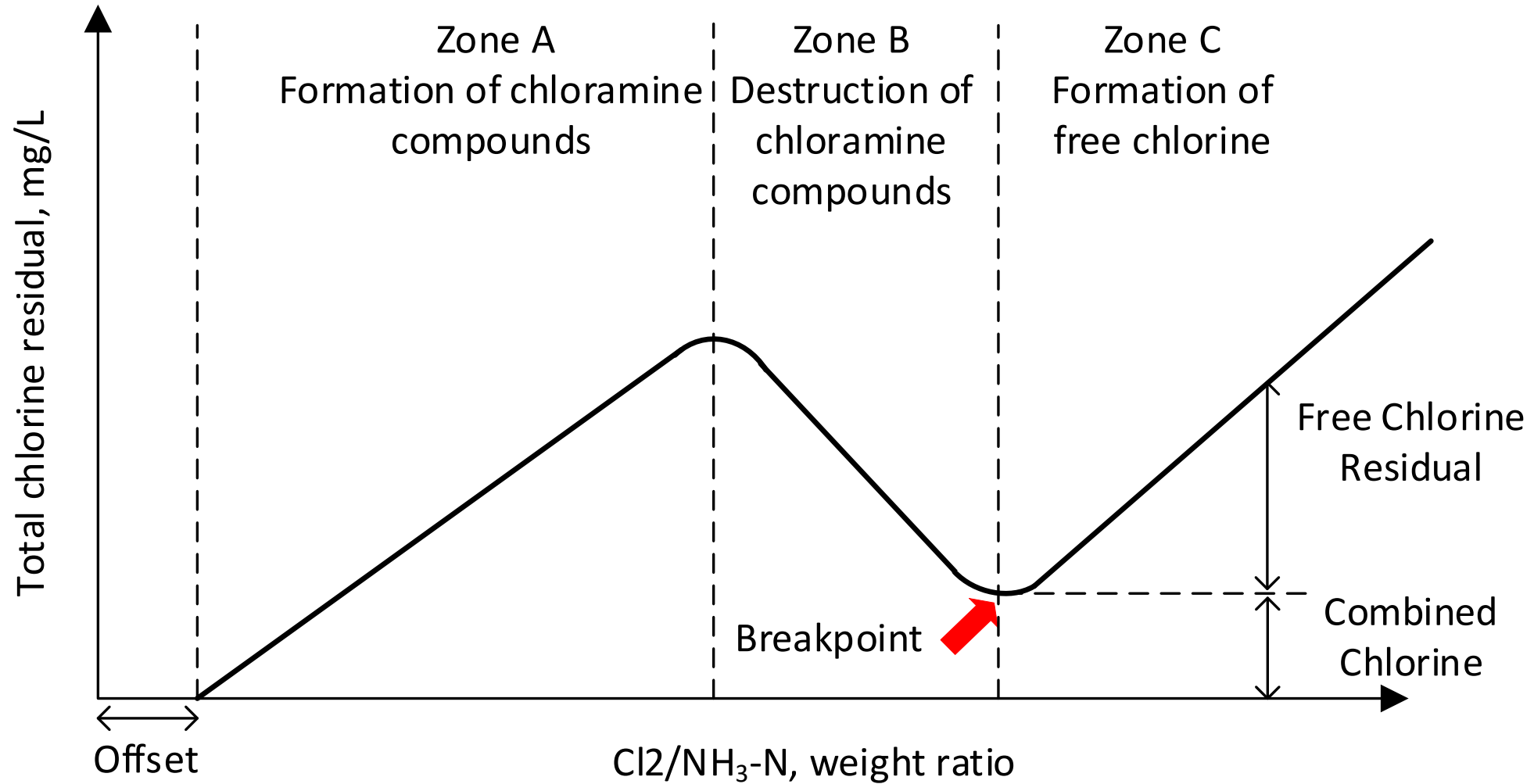


- 400 → 800 → 1,200MLD
- DAF
- Primary Biological Filters
- Secondary Rapid Gravity Filters
- 80-90% ammonia removal
- 75% manganese removal

ALTERNATIVE DISINFECTION



BREAKPOINT CHLORINATION



BREAKPOINT CHLORINATION - ISSUES

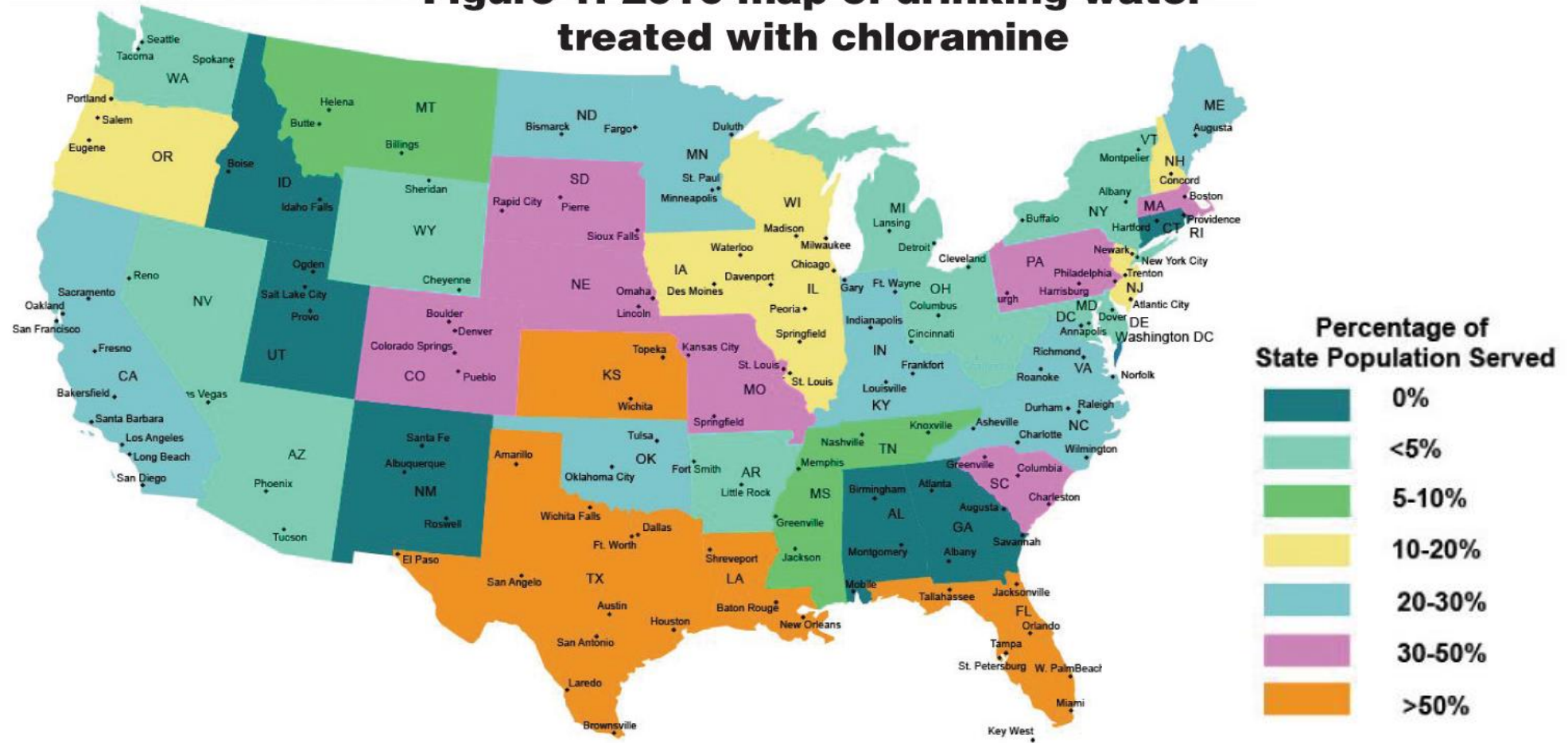


- High chlorine dose rates
- High Operating Costs
- Taste and Odour Complaints
- Oxidation Timeline
- Disinfection By-products

CHLORAMINATION



Figure 1. 2010 map of drinking water treated with chloramine



CHLORAMINATION - ISSUES



Figure 1. 2010 map of drinking water treated with chloramine



CHLORINE DIOXIDE



CHLORINE DIOXIDE - ISSUES



- Highly Unstable
- Generated onsite
- Chlorites – 0.8 mg/L MAV
- Chlorates – 0.8 mg/L MAV



TREATMENT SUMMARY



	ION EXCHANGE	REVERSE OSMOSIS	BIOLOGICAL FILTERS	BREAKPOINT CHLORINATION	CHLORAMINATION	CHLORINE DIOXIDE
AMMONIA	✓	✓	✓	✗	✓	✓
DISINFECTION BY-PRODUCTS	✓	✓	✓	✗	✓	—
DWSNZ COMPLIANCE	—	✓	✓	✓	✗	✓
CAPITAL COST	✗	✗	—	✓	—	—
OPERATING COSTS	✗	✗	✓	—	✓	✓
TASTE AND ODOUR	✓	✓	✓	✗	✓	✓

NZ CASE STUDY - PATEA WTP - CHLORINE DIOXIDE



THOUGHTS FOR NEW ZEALAND



Secure Bore Status?

Biological Filters?

Mandatory Chlorination?

Chloramination?

Rising Ammonia Levels?

Chlorine Dioxide?



HC 