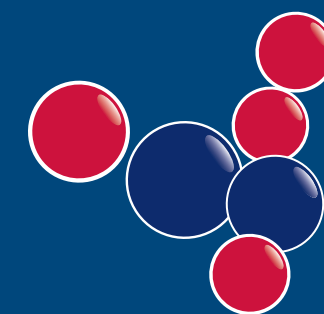


ResinTech SIR-1300

Fe, Mn, H₂S, Arsenic Removal from Water

Parag Deval

Aquatech Amsterdam — November 6th 2019



RESINTECH[®] INC.

INNOVATIONS IN ION EXCHANGE



Background

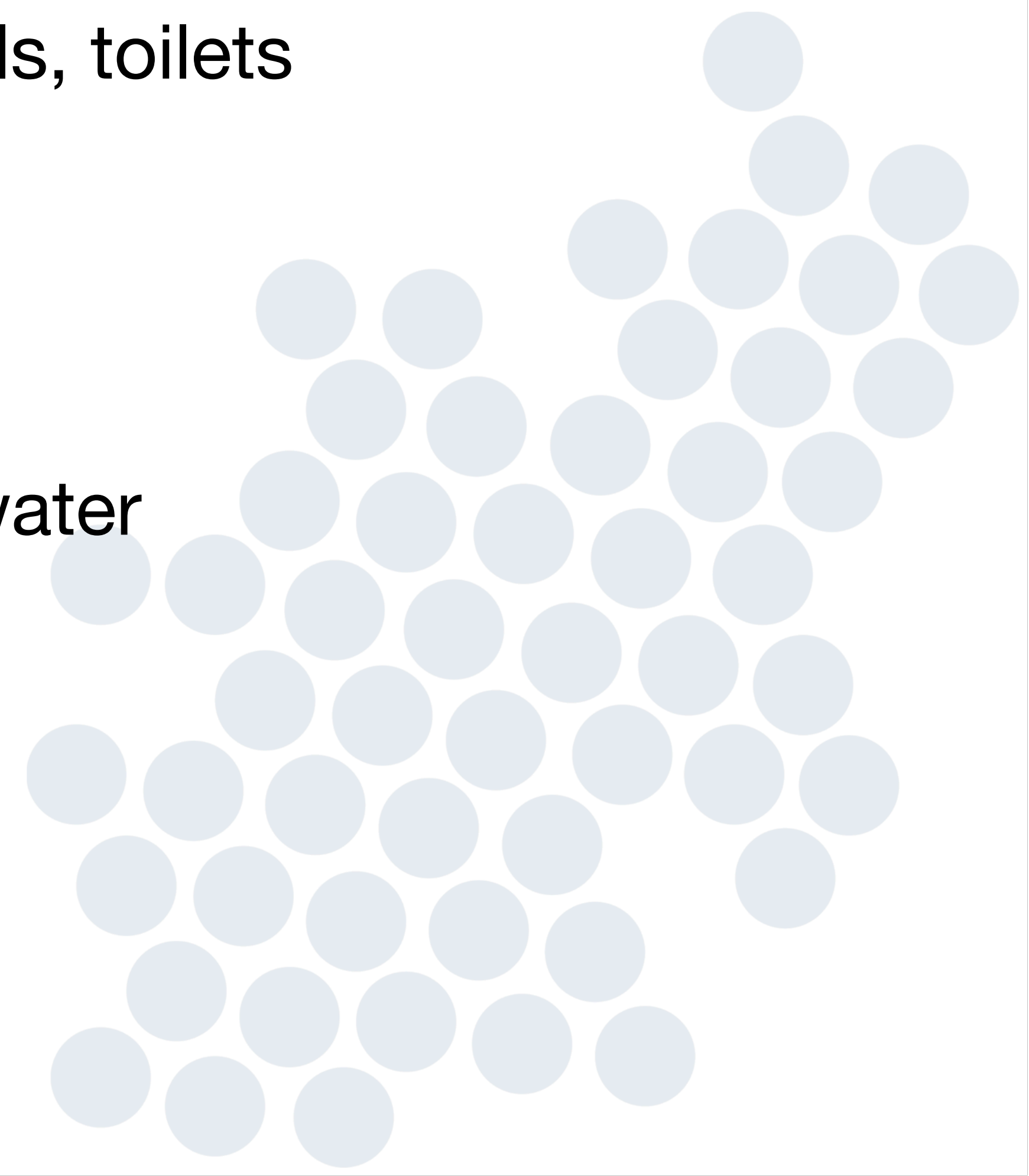
EPA Specs

Fe	<0.3 ppm
Mn	< 0.05 ppm
H₂S	Not Regulated
Arsenic	< 10 ppb

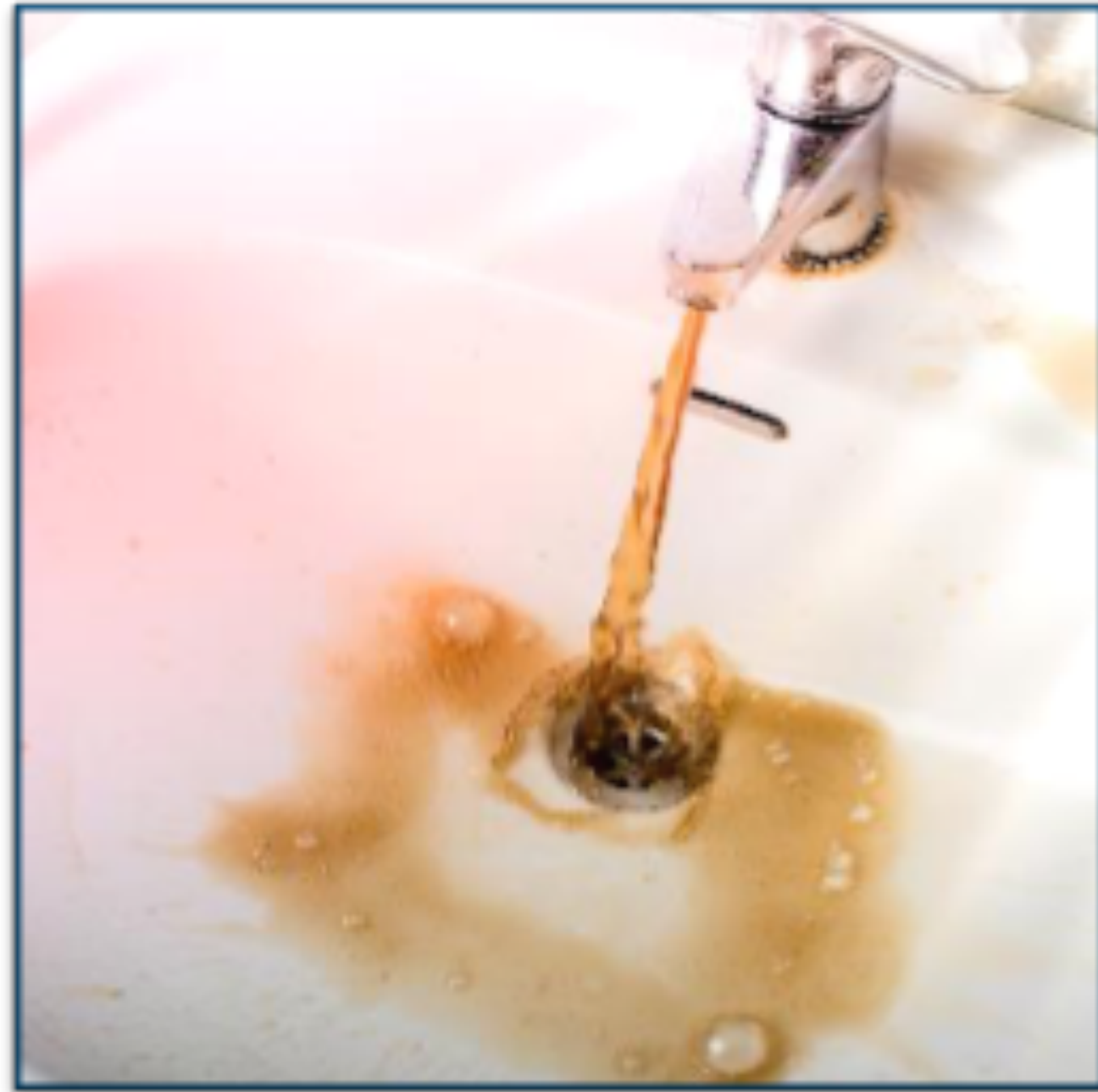
All but Arsenic are secondary contaminants as per EPA



Aesthetic Concerns

- Organic – red stains on fixtures, clothes ,shower walls, toilets
 - Particulates formation inside pipes and toilet tanks
 - Metallic Taste and smell to water.
 - H₂S Gas produces ‘Rotten Egg’ odor and Taste to water
- 

Aesthetic Concerns



Health Concerns

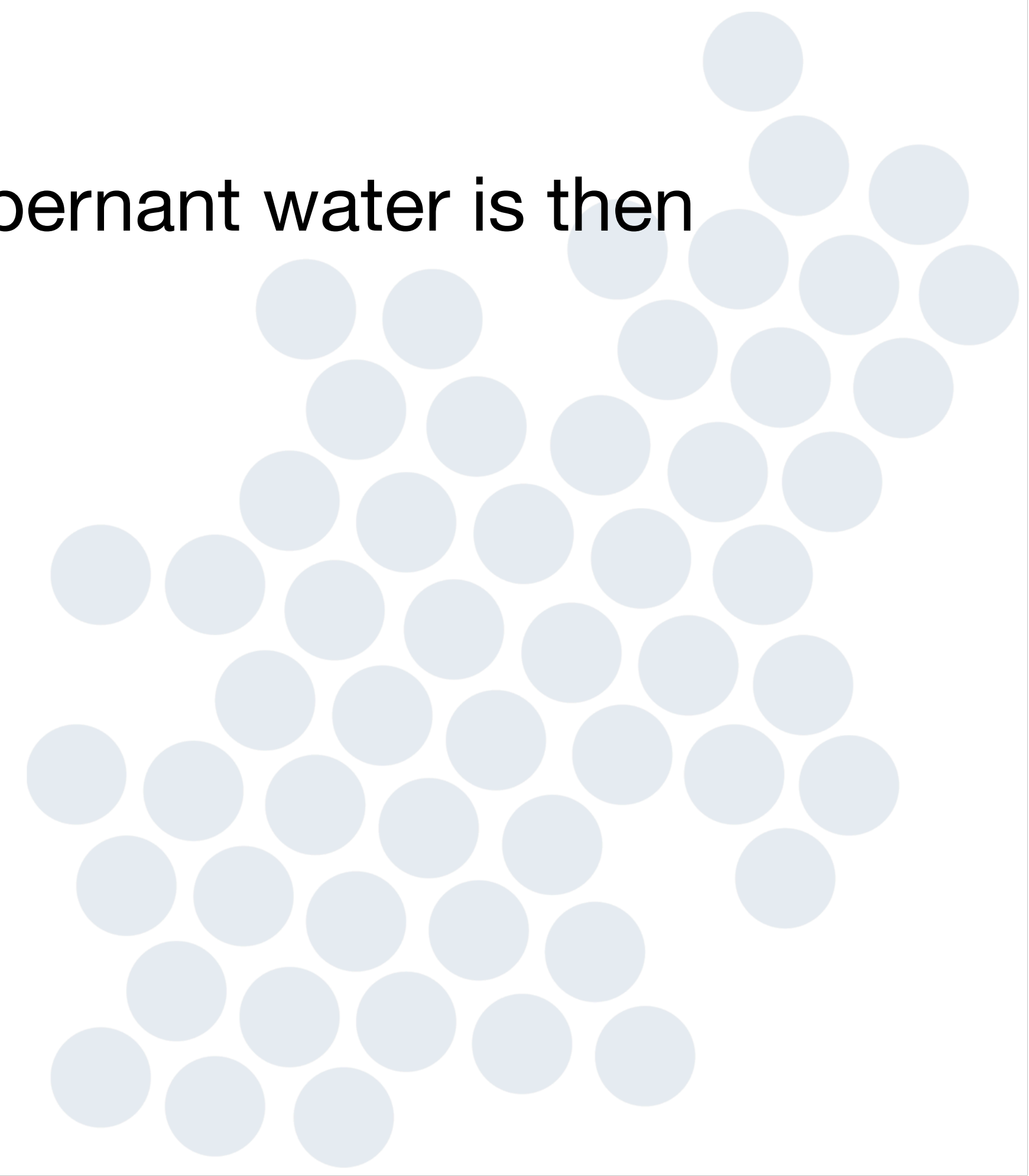
- Fe, Mn in water affects milk production in Milk Dairy industry
- Farms with > 75 lbs of milk per cow when Fe, Mn contents are not there
- Farms with < 50 lbs of milk per cow when Fe, Mn contents are high
- As per WHO report, high levels of Arsenic from drinking water can cause skin and lung cancer, Skin lesions, kidney failure, Heart Attack.
- High Manganese content can be a health risk to central nervous system.



Conventional Processes for Removing these Contaminants



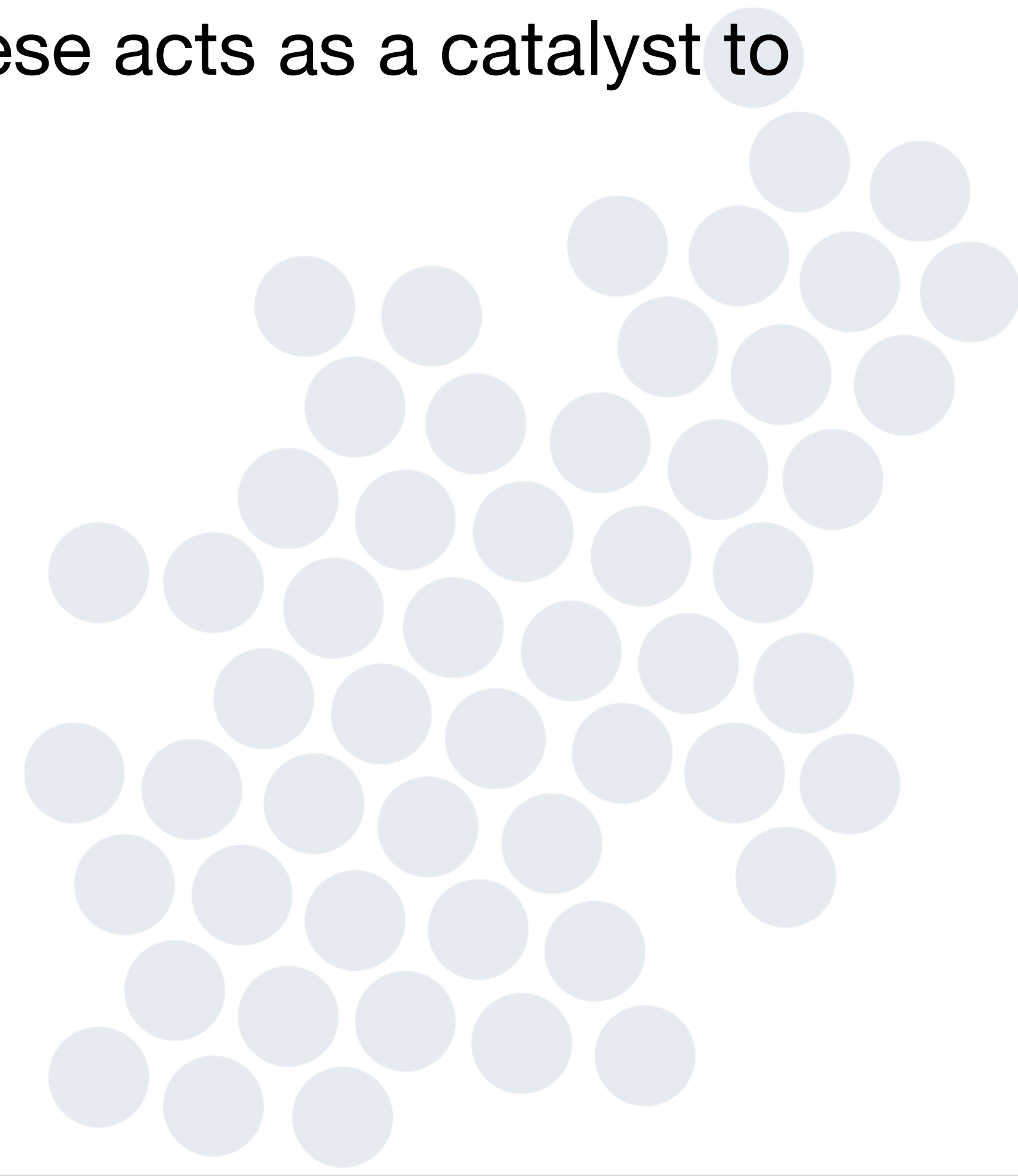
1. Oxidation and chemical precipitation processes

- Aeration, Chlorine, and Ozone are used.
 - They are used to precipitate Fe in retention tank. Supernatant water is then passed through sand filter to get iron free water
- 



2. Greensand

- Naturally occurring Greensand coated with manganese acts as a catalyst to precipitate Fe and Mn.

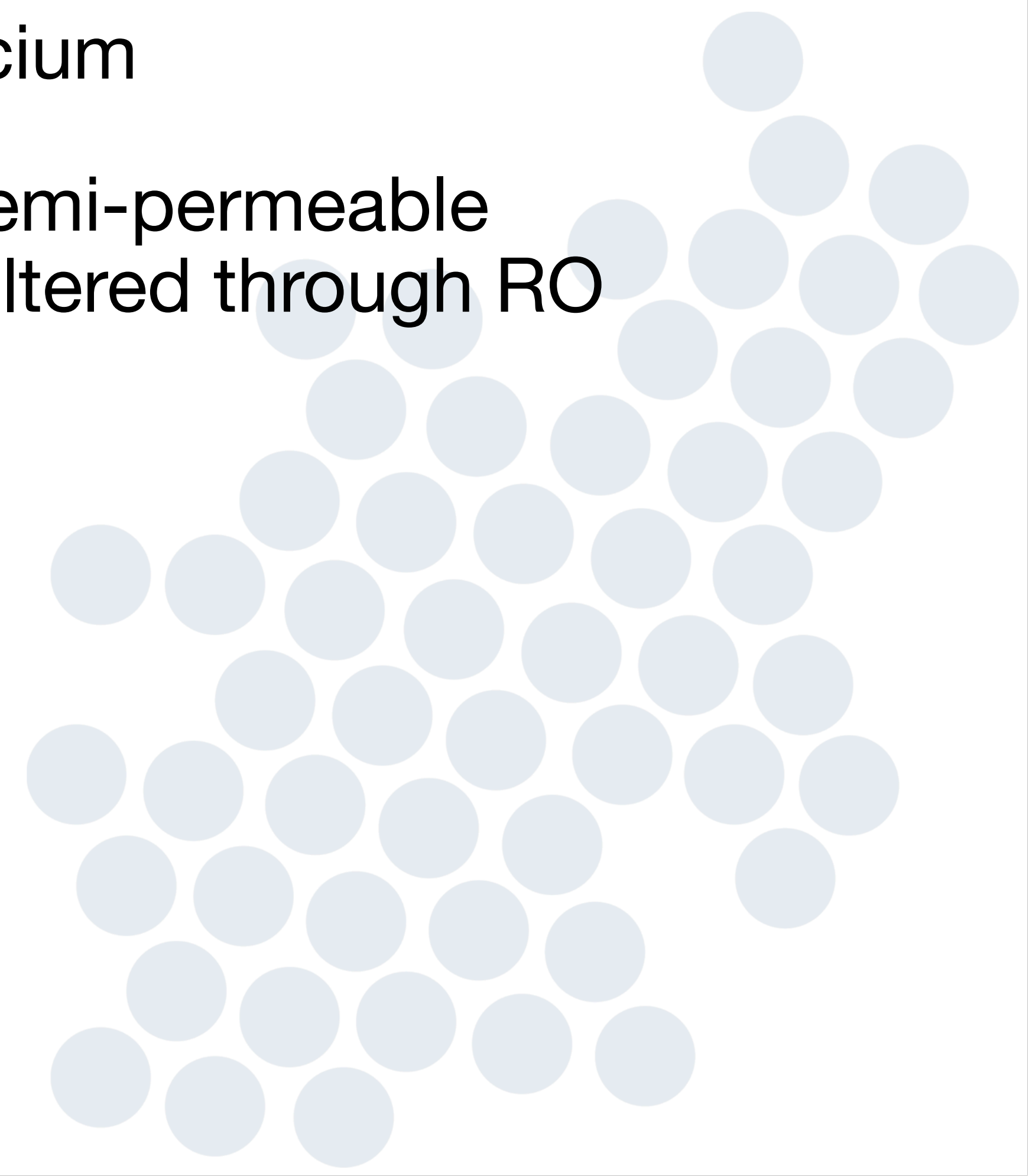


3. Water softening resin

- Can treat low-level of Fe and Mn up to 1-2 ppm.
- Work well with low TDS of <500 ppm.
- Requires low dissolved O₂ levels so as to avoid formation of particulates
- pH needs to be lower than 8. (At higher pH, precipitation occurs and reduces the performance of resin)

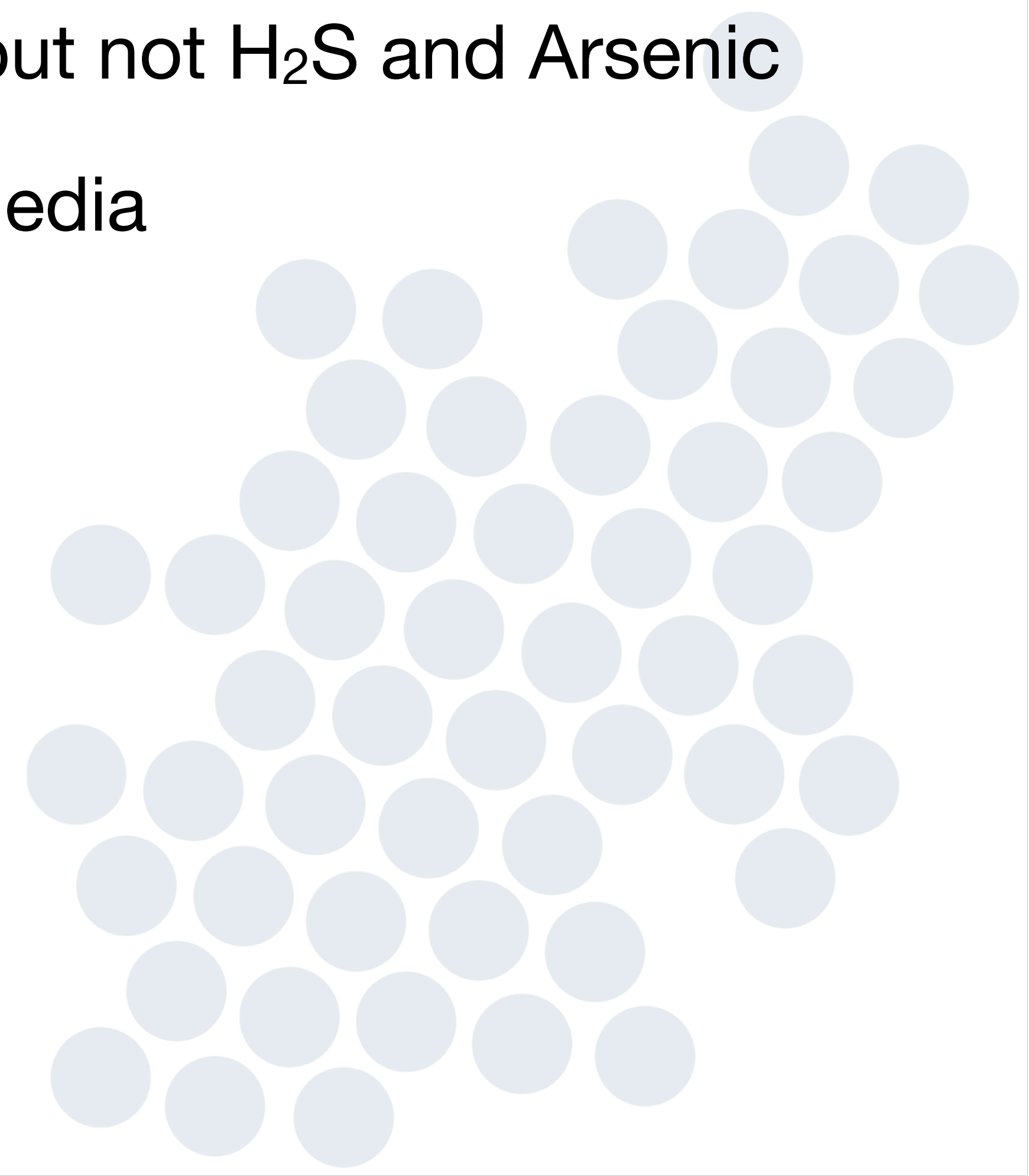


4. Reverse Osmosis

- Generally removes salt, Manganese, Iron, Lead, Calcium
 - Most mineral constituents of water are trapped by semi-permeable membrane and removed from drinking water when filtered through RO
- 



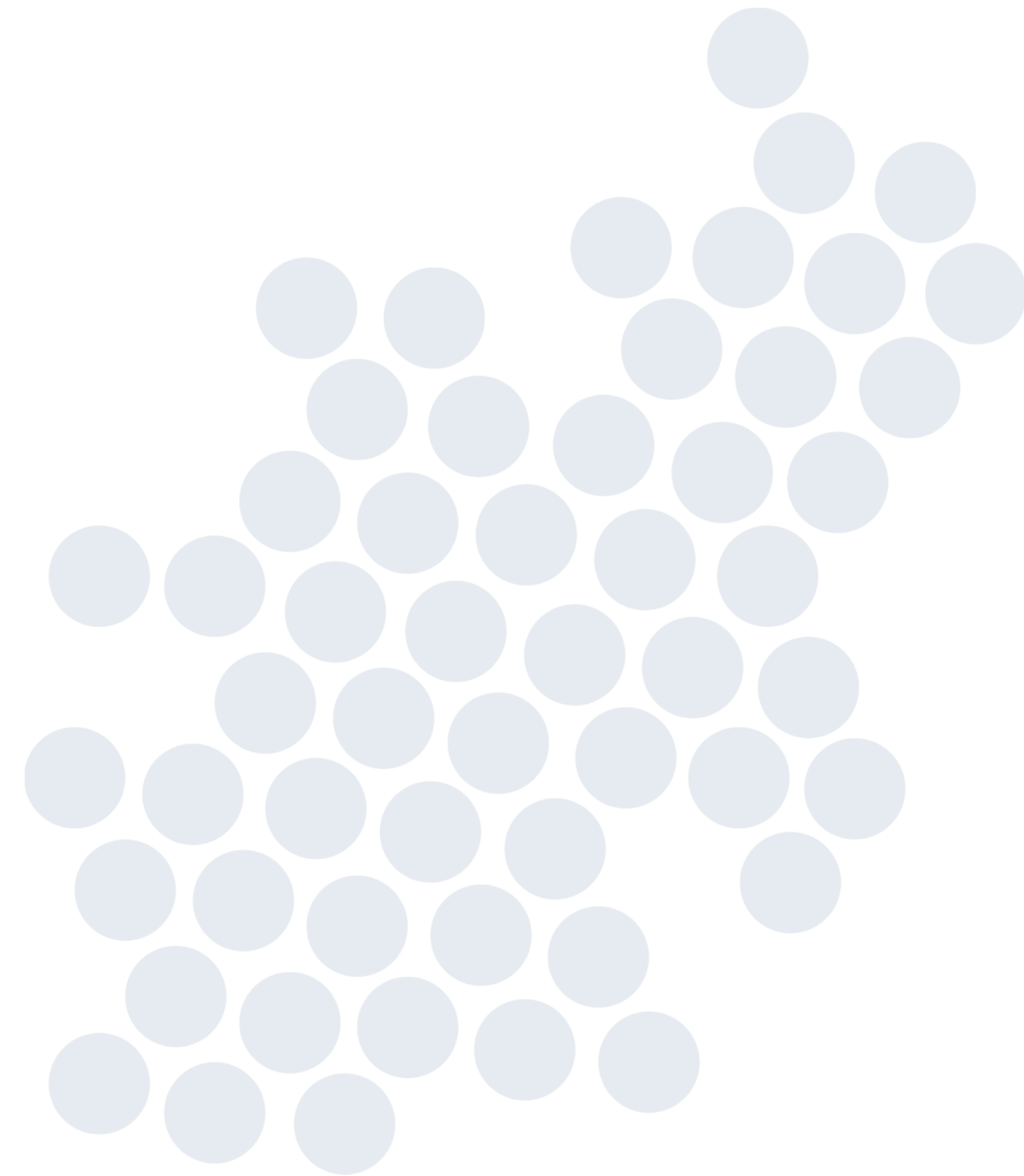
5. Birm

- Removes dissolved iron and Manganese efficiently but not H₂S and Arsenic
 - H₂S should be removed prior to contact with Birm media
- 



6. Pyrolox

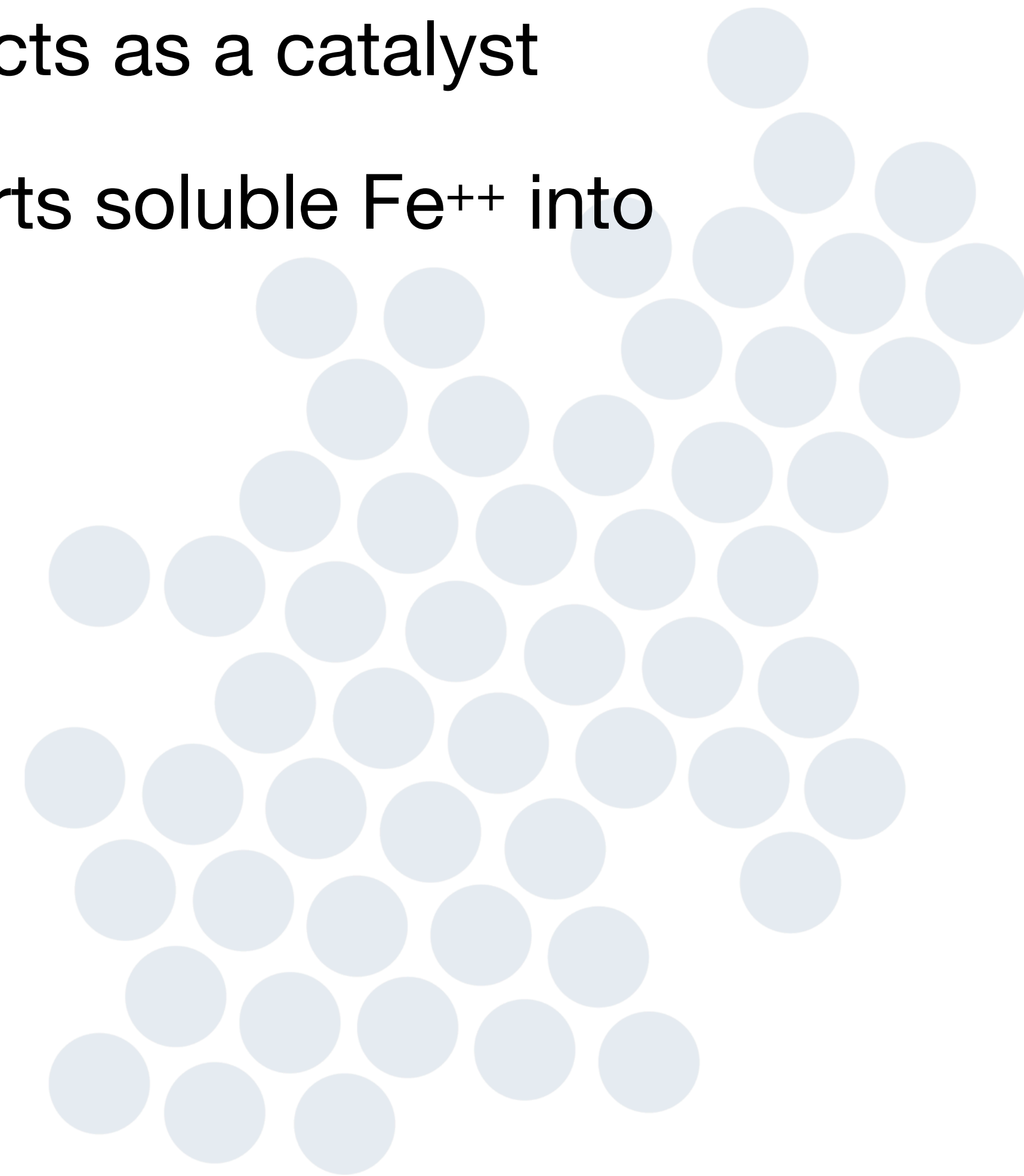
- Granular media used to remove Fe, Mn, H₂S
- It is a naturally mined ore



7. Ion Exchange

ResinTech SIR-1300

- REDOX Media with catalytic property where MnO_2 acts as a catalyst
 - ▶ Fe^{++} and O_2 get attracted to MnO_2 which converts soluble Fe^{++} into insoluble Fe^{+++}
 - ▶ Soluble Mn^{++} is converted to insoluble Mn^{+++}
 - ▶ H_2S is reduced to yellow sulfur particulate



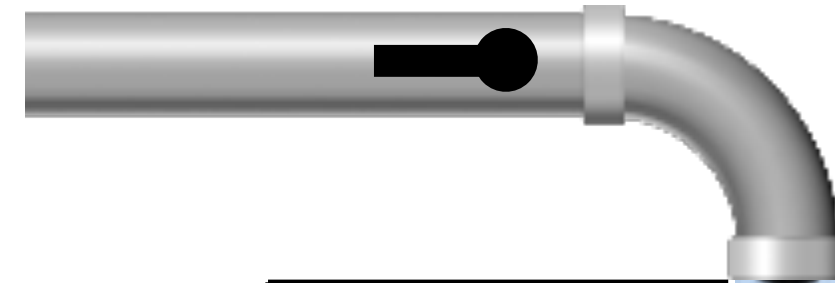
7. Ion Exchange

ResinTech SIR-1300

- Similarly for Arsenic removal, arsenic is co-precipitated with the iron onto MnO_2 media as ferric arsenate.
- MnO_2 reduces to MnO and ferric Hydroxide is precipitated.
- During backwash (water and Air scour), ferric hydroxide, insoluble manganese, ferric arsenate, precipitated sulfur get removed. MnO gets converted to MnO_2 . No chemical regenerant is used.



Water inlet with Fe, Mn,
H₂S, Arsenic



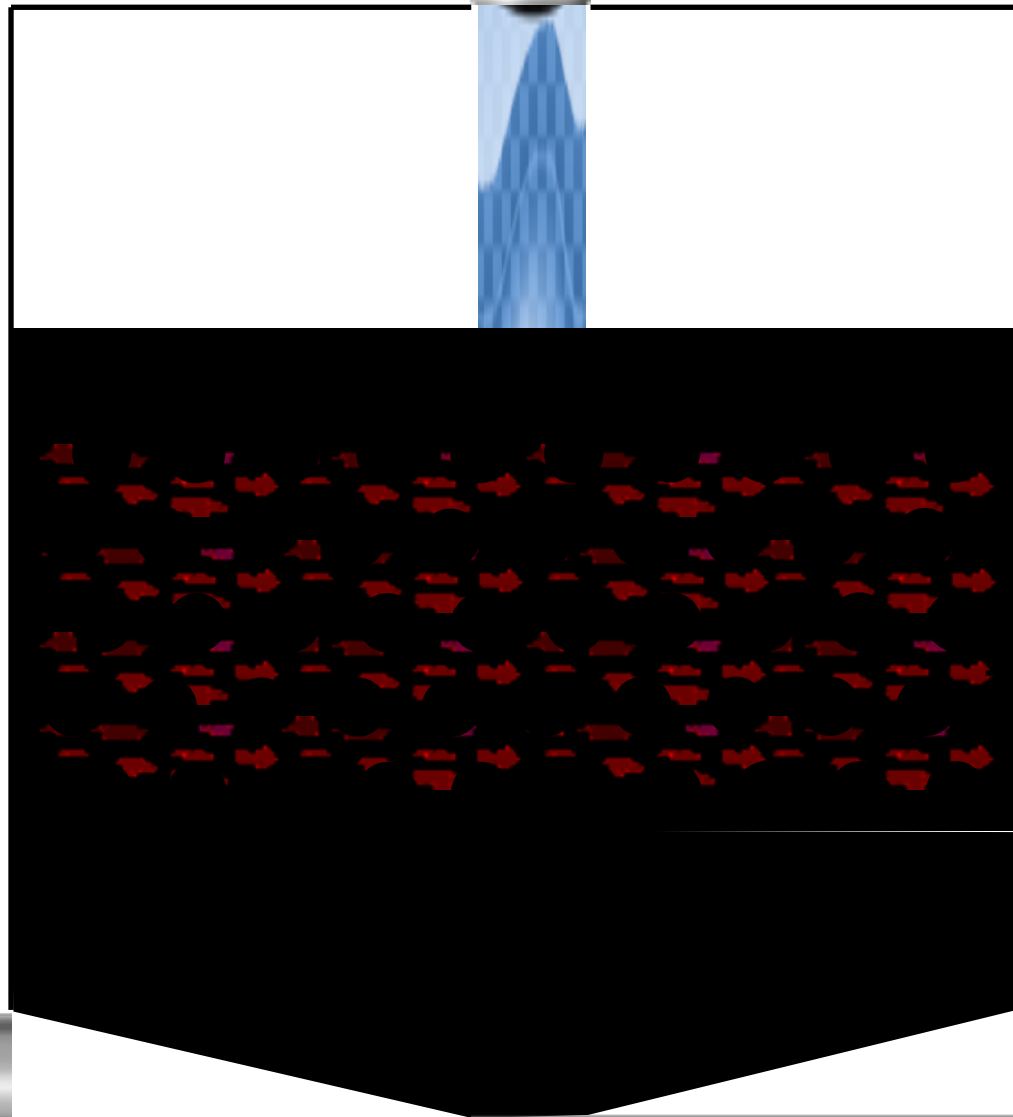
Particulates Outlet



New Resin Media

Captured particulates
accumulate in resin bed

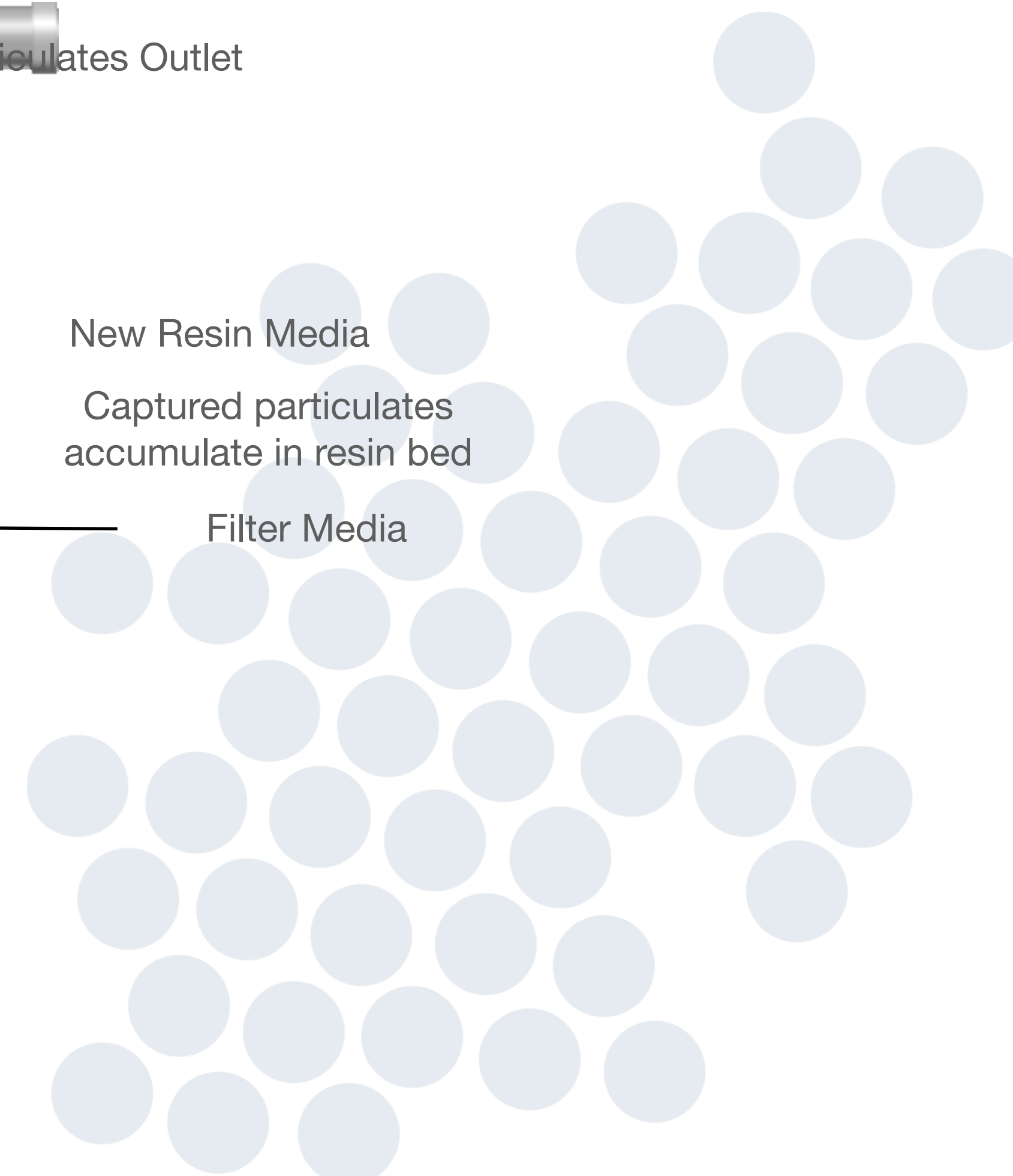
Filter Media

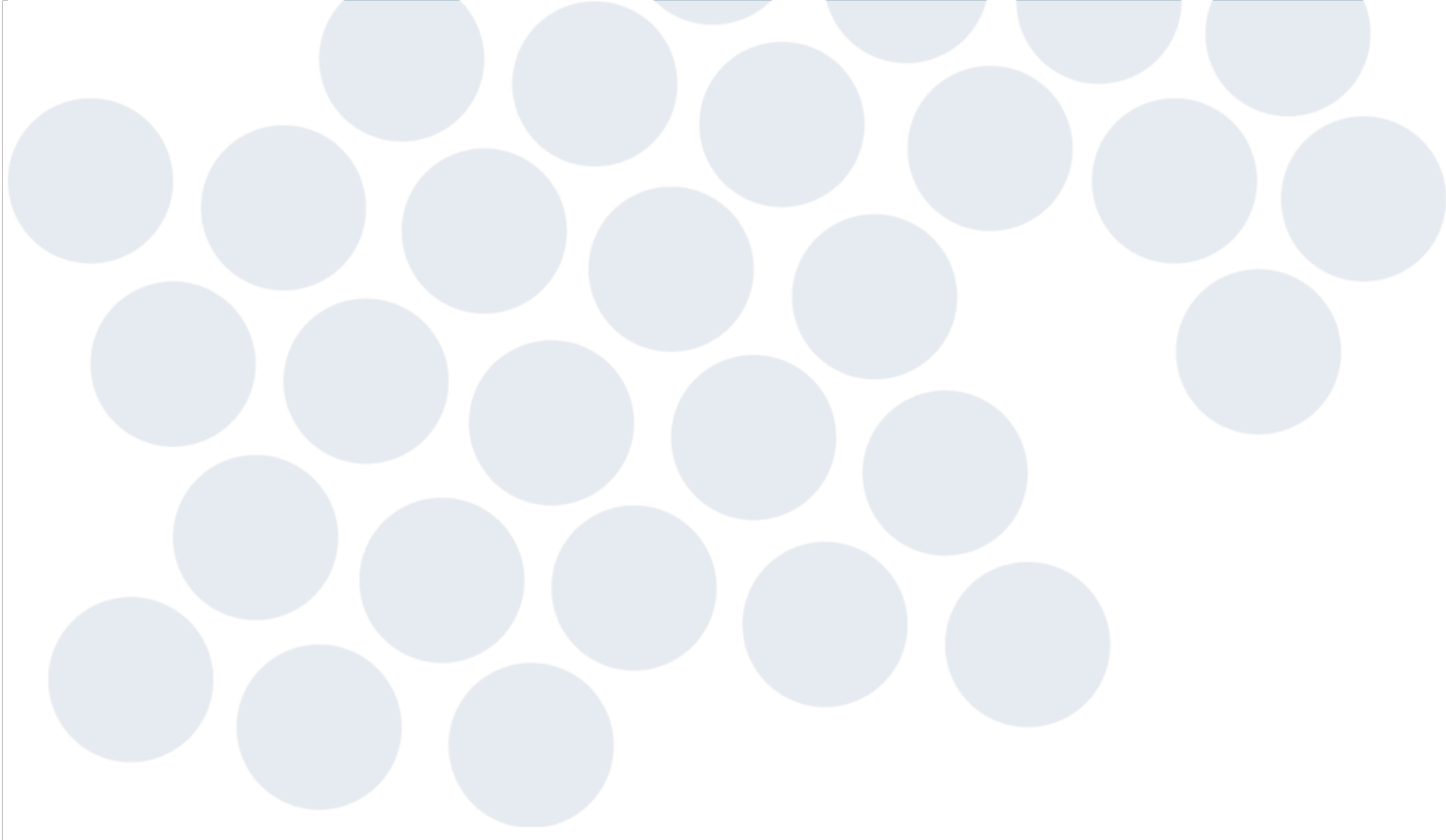


Backwash Water and
Air scour

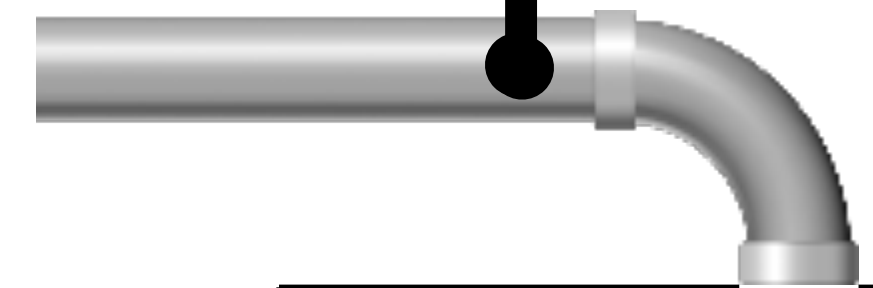


Outlet water minus Fe,
Mn, H₂S, Arsenic

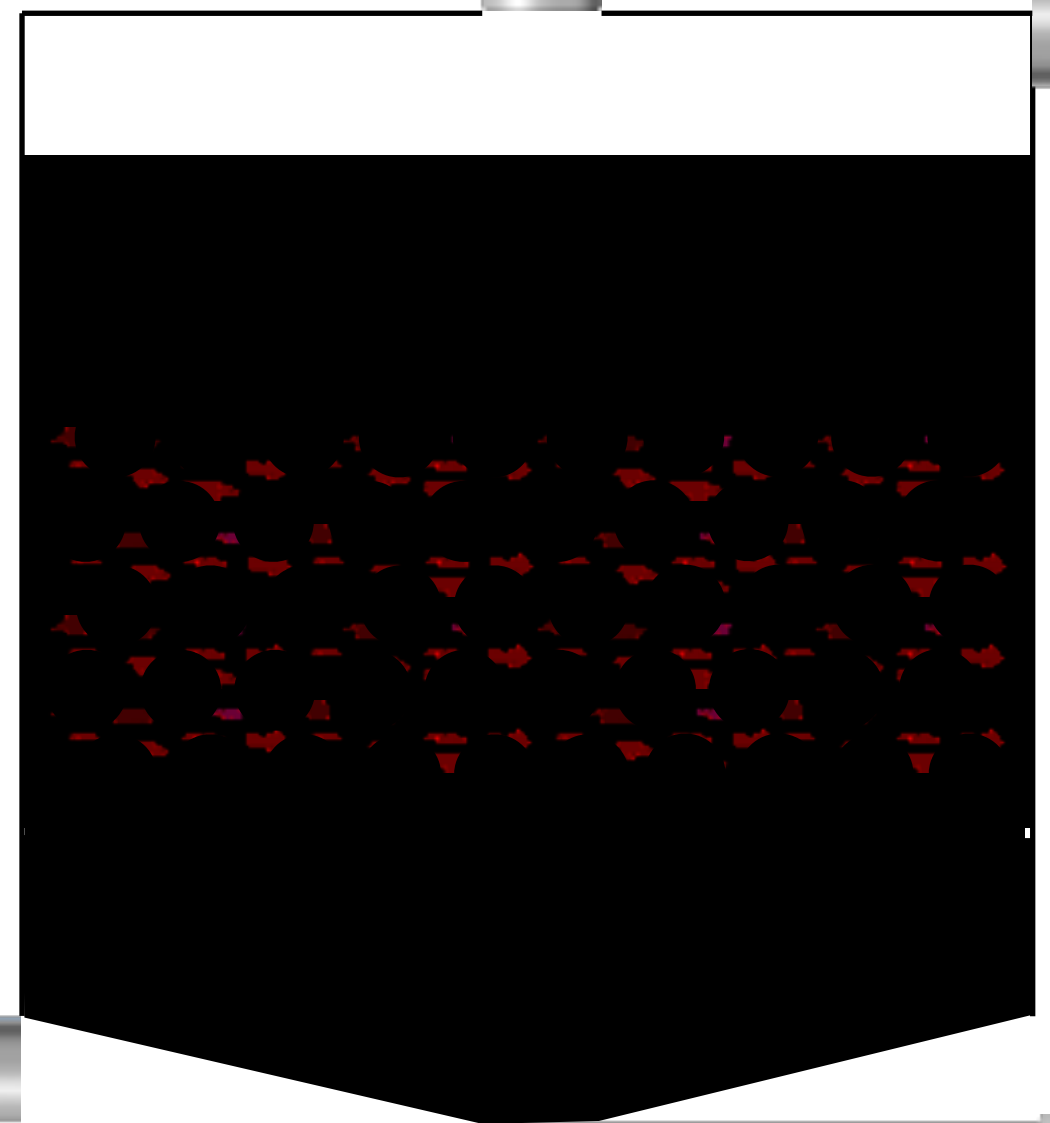




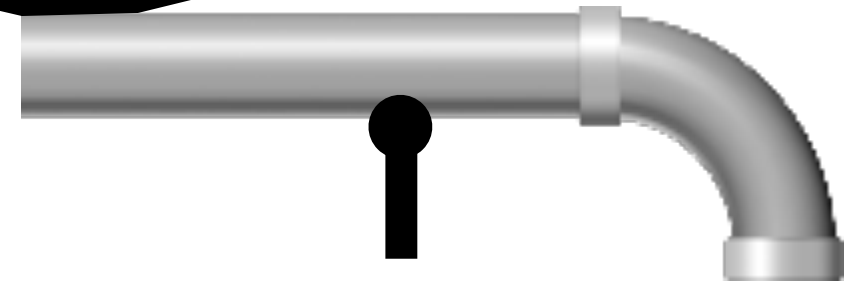
Water inlet with Fe, Mn,
H₂S, Arsenic



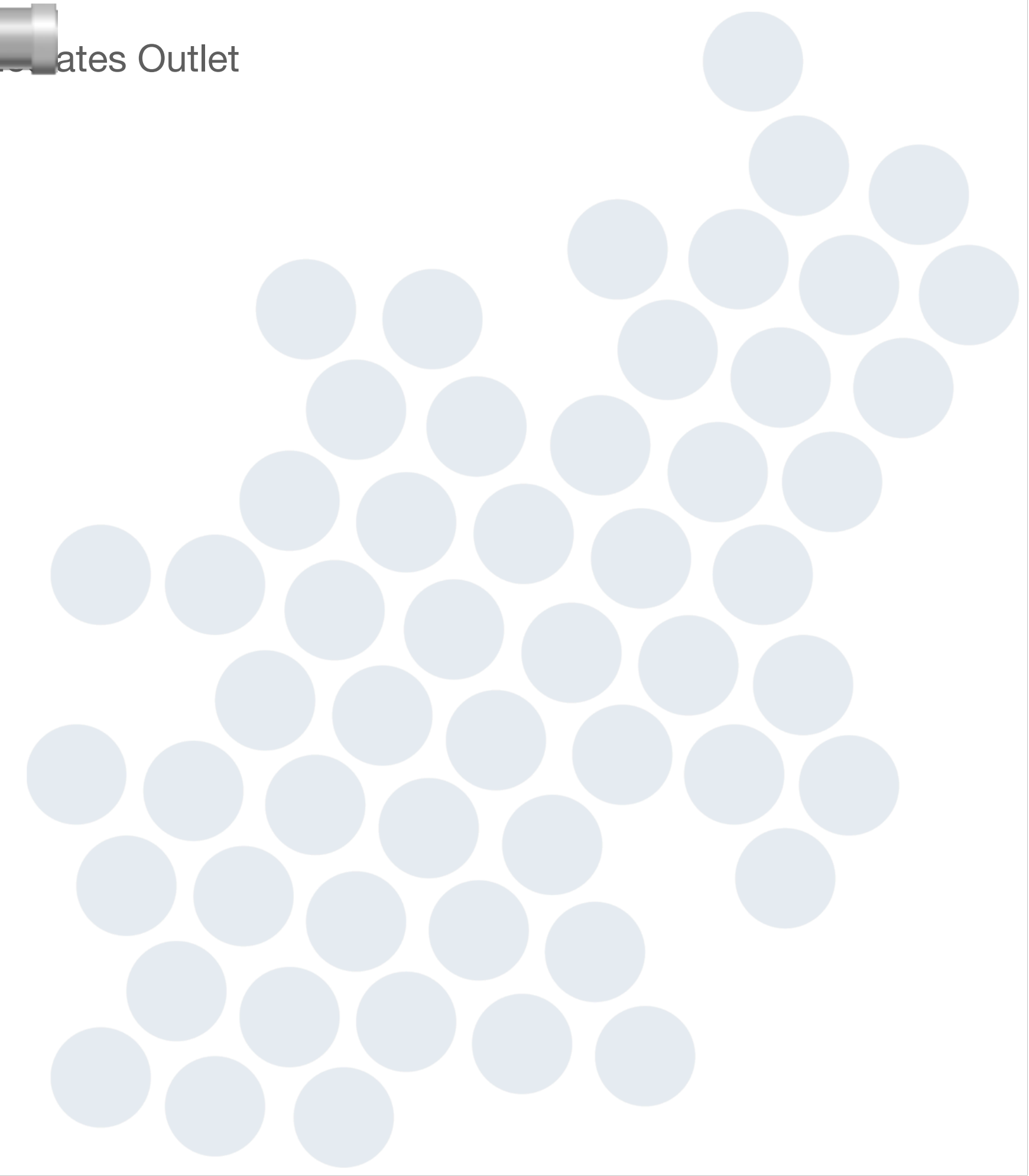
Permeates Outlet

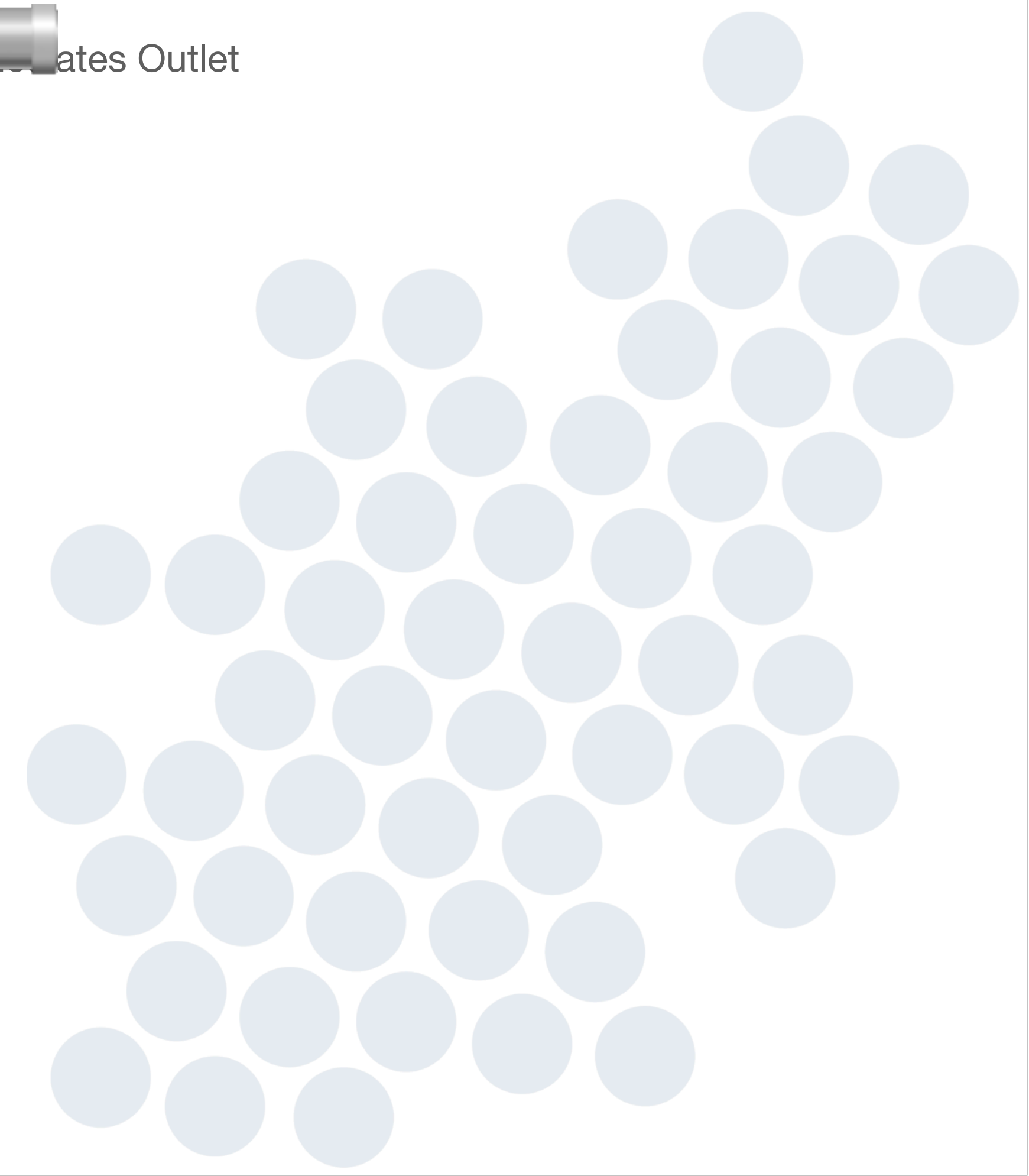
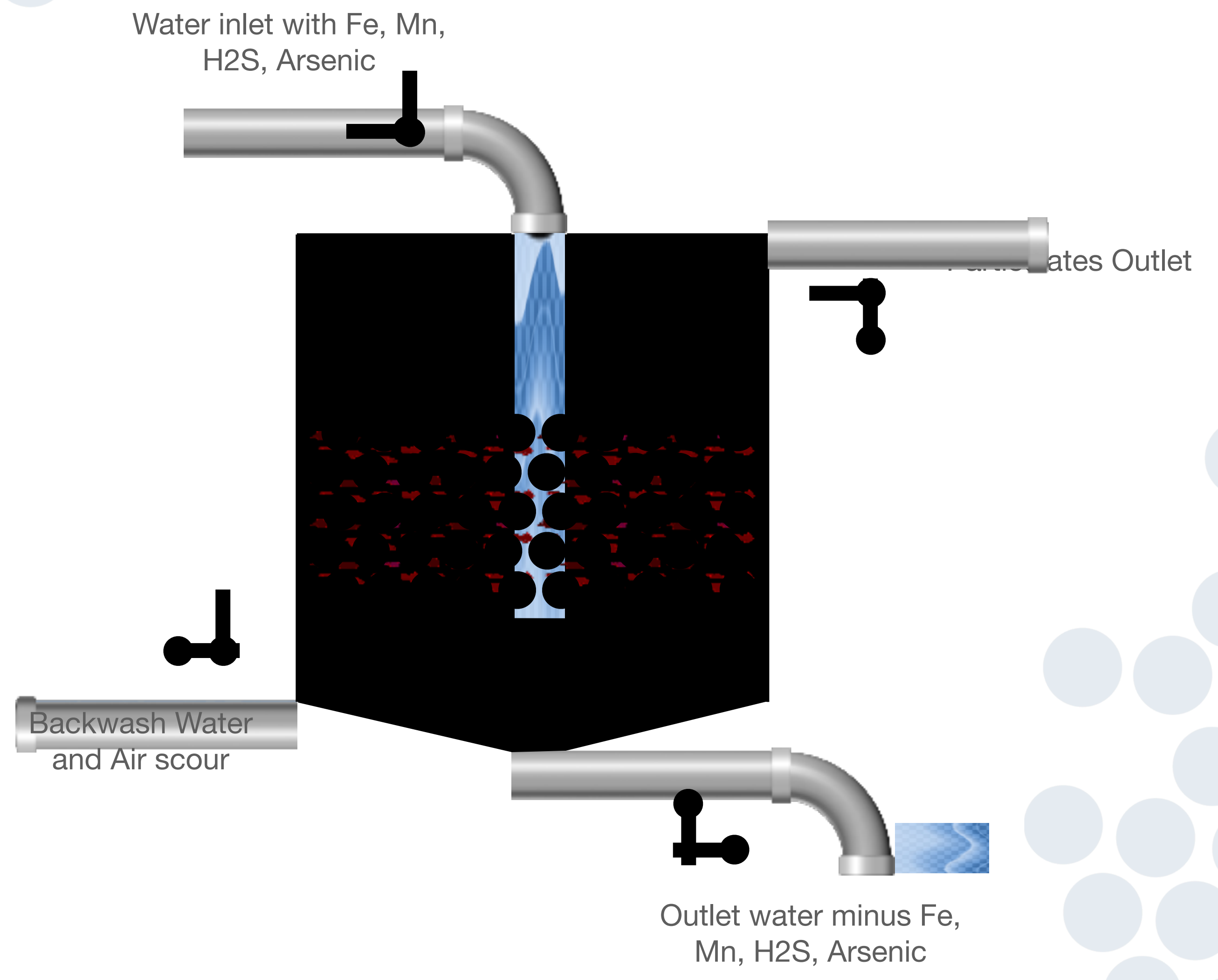


Backwash Water and
Air scour



Outlet water minus Fe,
Mn, H₂S, Arsenic

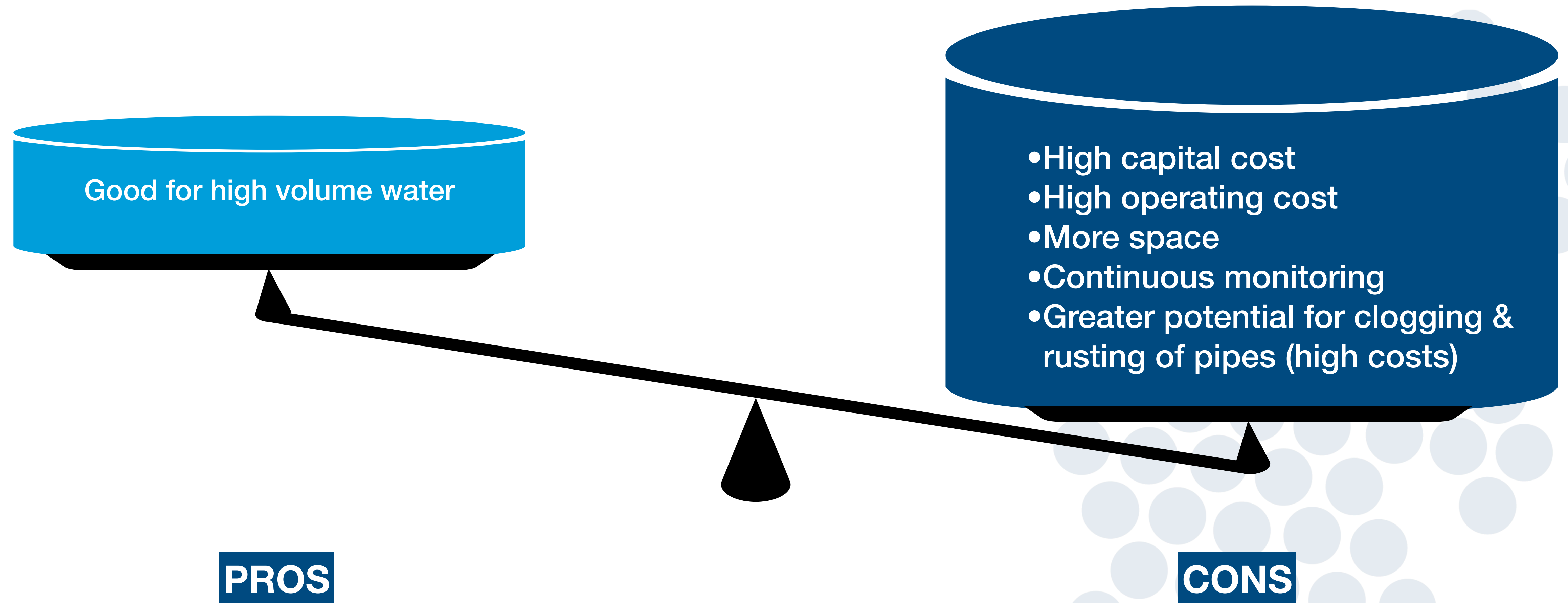




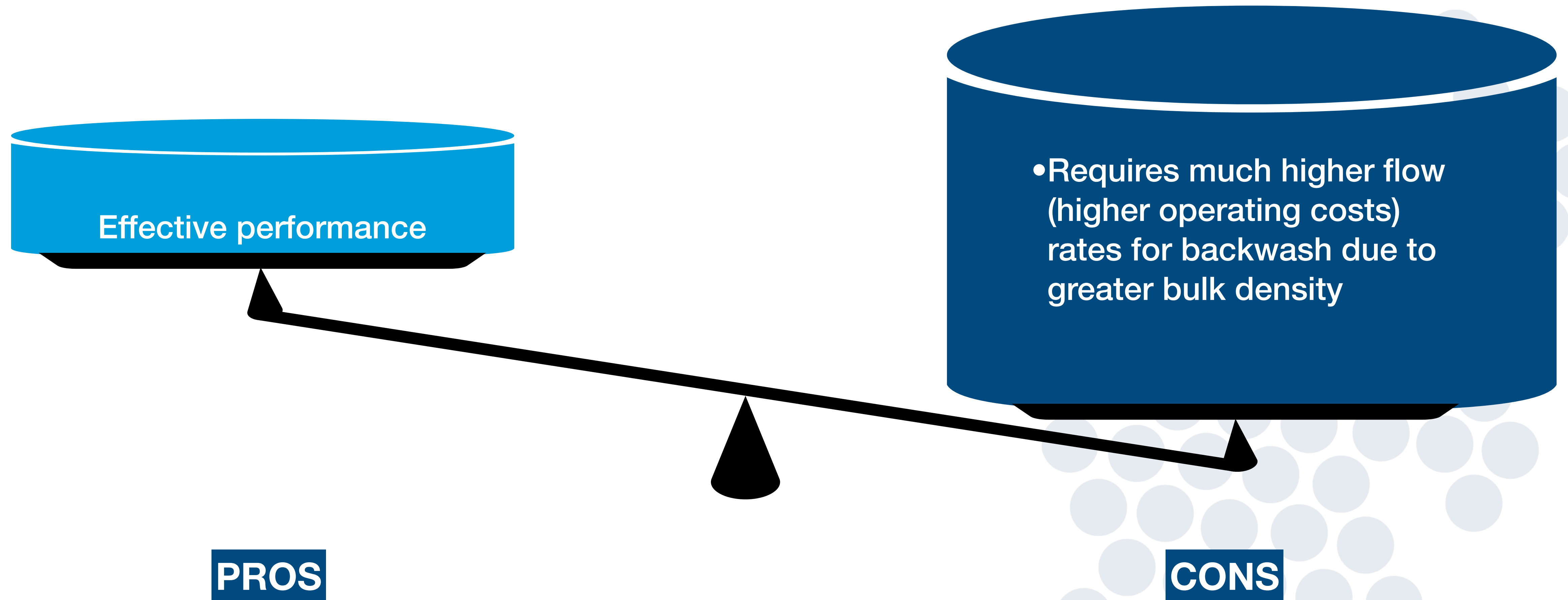
Pros & Cons



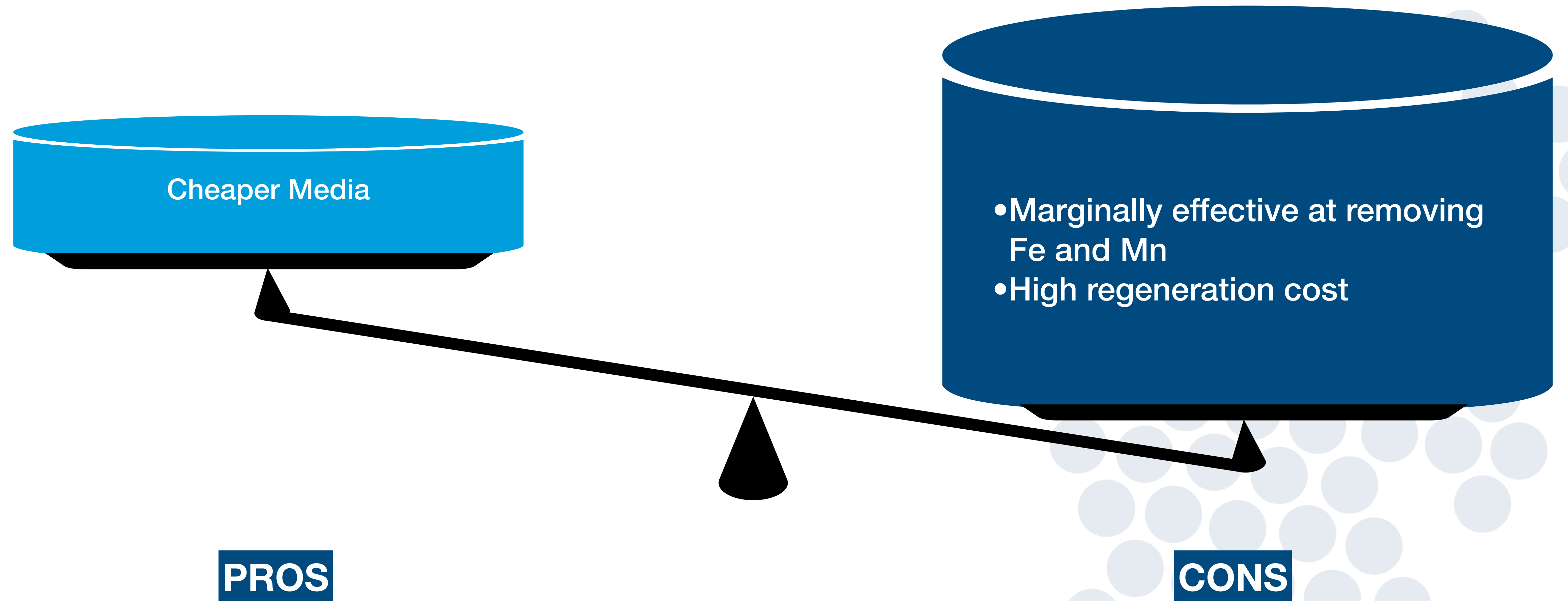
1. Oxidation & Chemical Precipitation Process



2. Greensand



3. Water Softening Resins



4. Reverse Osmosis

Efficient Removal

PROS

- Higher buying cost
- Higher Operating cost
- Increased concentration of ions in reject or concentrate stream as well as feed stream
- Risk of foul membranes due to Mn^{++} oxidation & precipitation

CONS

5. Birm

Effective at removing Fe & Mn

PROS

- Ineffective at removing Arsenic & H₂S
- More costly (since H₂S must be removed first using Birm media)
- Uses 3x more water than SIR-1300

CONS

6. Pyrolox

Removes Fe, Mn, H₂S effectively

PROS

- Does not remove Arsenic
- 3x heavier than SIR-1300
- Uses 6x more water for backwash

CONS

7. Ion Exchange

SIR-1300

- Removes fairly high quantities of Fe, Mn, & Arsenic
- Works well with pH > 6.5
- TDS < 2500 ppm

PROS

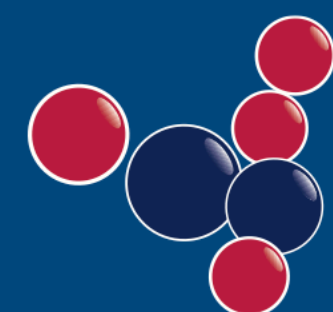
- Suspended solids < 10 ppm
- Alkalinity > 100 ppm to work media more effectively

CONS

THANK YOU

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INNOVATIONS IN ION EXCHANGE