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Speaker

*A New Water Softener Brine
Recovery Innovation*





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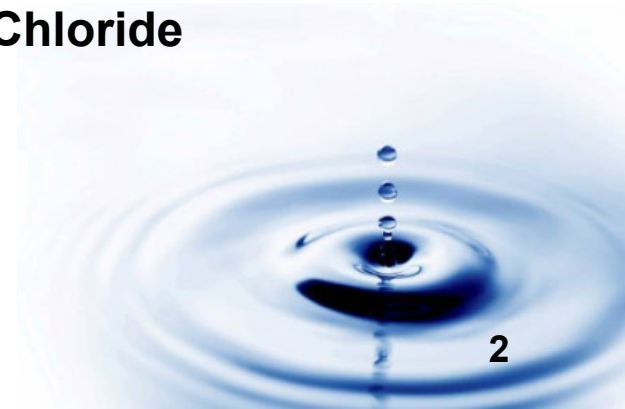
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A New Water Softener Brine Recovery Innovation

**Presented at:
Salt Symposium – New Directions in Chloride**

by
Peter S. Cartwright, PE

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Chloride

- In water, exists as the anion Cl^-
- Essential electrolyte in the human body
- Atomic weight – 35.45
- Almost all chloride compounds very water soluble



- Chloride pollution mainly results from sodium chloride dissolving in water
- It is extremely soluble – 260,000 mg/L in water at ambient temperature

Chlorides are found in

- Road salt applications
- Water softener regenerant discharges
- Agricultural fertilizer
- Manure
- Industrial discharges
- Dirt and gravel road dust suppressants



EPA Chloride Standards

(SDWA Secondary Limit = 250 mg/L)

Chronic exposure (4 day average) 230 mg/L

Acute exposure (1 hour average) 860 mg/L



**U.S. Geological Survey found
that 37% of U.S. watershed
areas show a “significant
increase” in salinity**

***Now known as “Freshwater
Salinization Syndrome”***



**In MN, 50 water bodies
with chloride level above
230 mg/L (39 in TCMA)
27% of monitoring wells
above 230 mg/L**



MN Wastewater Treatment Plant Chloride Contamination (2016)

Source	Chloride Mass (tons)	Percent of Total
Residential Water Softening	113,246	49%
Industry (General)	49,523	21%
Commercial Water Softening	37,807	16%
Drinking Water	10,000	4%
Human Excreta	8,654	4%
Commercial Products	4,621	2%
Household Products	2,759	1%
Drinking Water Chlorination	3,073	1%
Wastewater	1,218	1%
Total	230,901	

Hard water is costly.
In the U.S., hard water
damages total
>\$6 billion/year
(extra soap, detergent,
damaged plumbing, etc.)

USGS Data

Between 1990 and 2010,
softeners in U.S.

used

1,220,000 tons/year
of salt (6,700,000 lb/day)

Residential Water Softeners in Minnesota

- In 72% of households
- Use average of 25 lbs. sodium chloride/month
- Generate >113,000 tons/yr of chloride
- ~74% of units are now demand-based

Effect of Salt Discharge on Water Quality

- DIR Softener, efficiency of 4000 gr hardness/lb salt
- 20 gpg hardness (342 ppm) in water
- Regeneration releases 372 ppm Cl⁻ into water



Residential Softening Alternatives to Ion-Exchange

Type	Technology	Comments
Physical	Template assisted crystallization	Keeps scale in suspension
Physical	Magnetic	Lack of scientifically credible proof of performance
Electrical	Electronic precipitation	Lack of scientifically credible proof of performance
Electrical	Capacitive deionization	Non-competitive in residential applications
Pressure-Driven	Nanofiltration	Non-competitive in residential applications

Brine Recovery – Commercial Practice

- Portion of regenerate with highest concentration of NaCl routed directly back to brine tank
- Brine accumulates hardness – must eventually be discarded
- Recovers 25-35% of salt

NEW

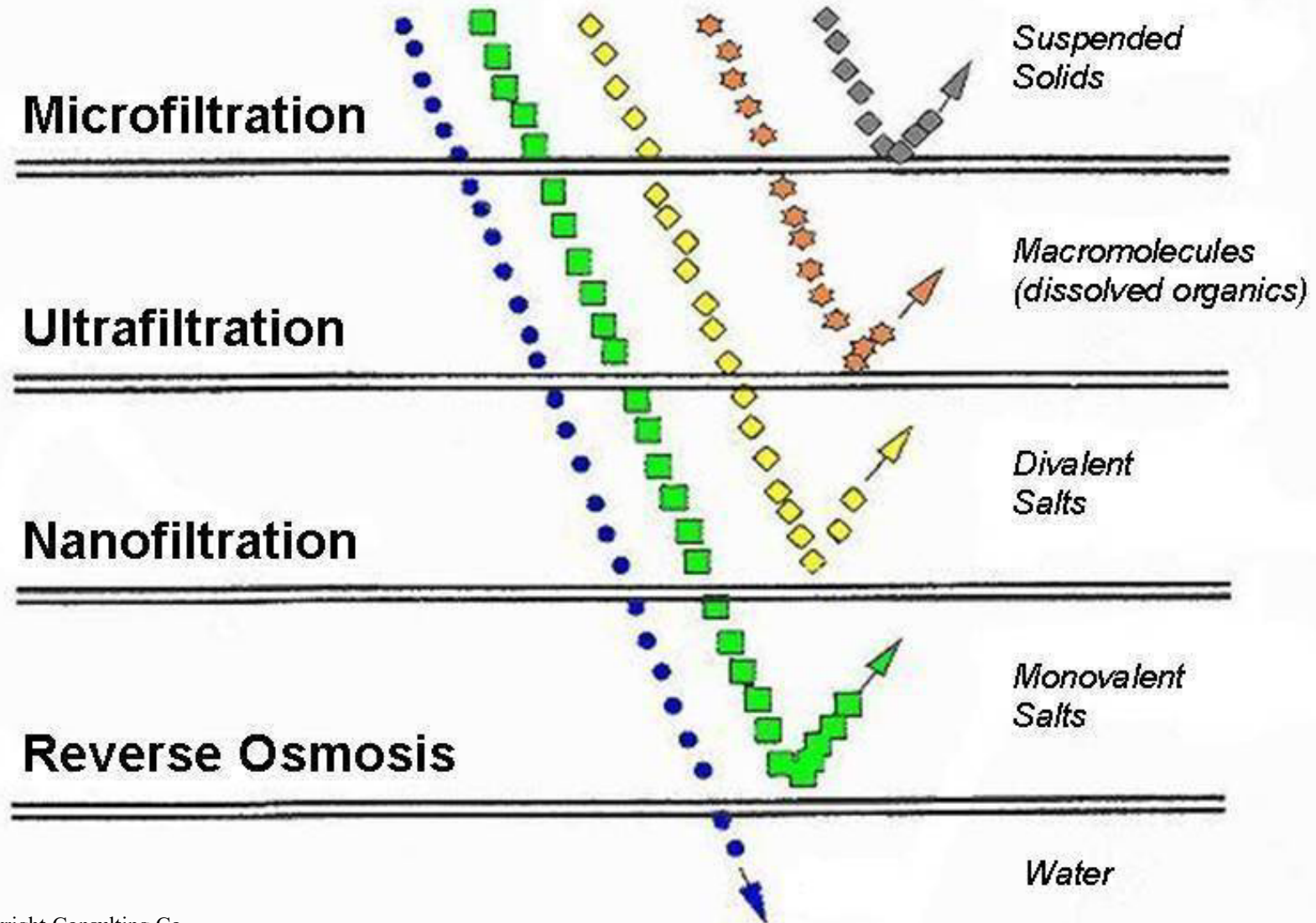
Brine Reclaim Technology



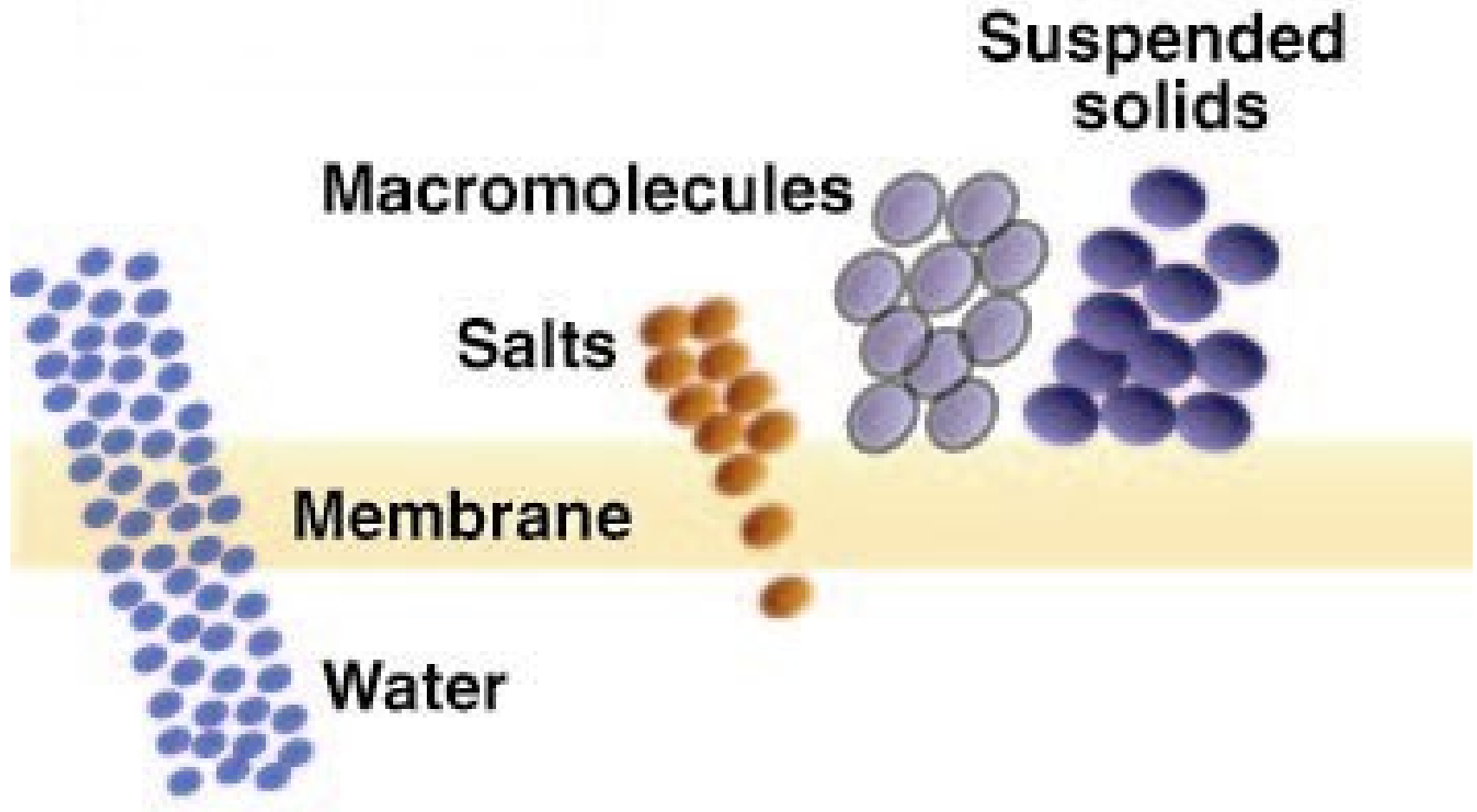
- New technology to separate hardness ions from regenerant stream, discard them and recycle the brine
- Uses nanofiltration (NF)
- Patented
- In final phases of commercialization



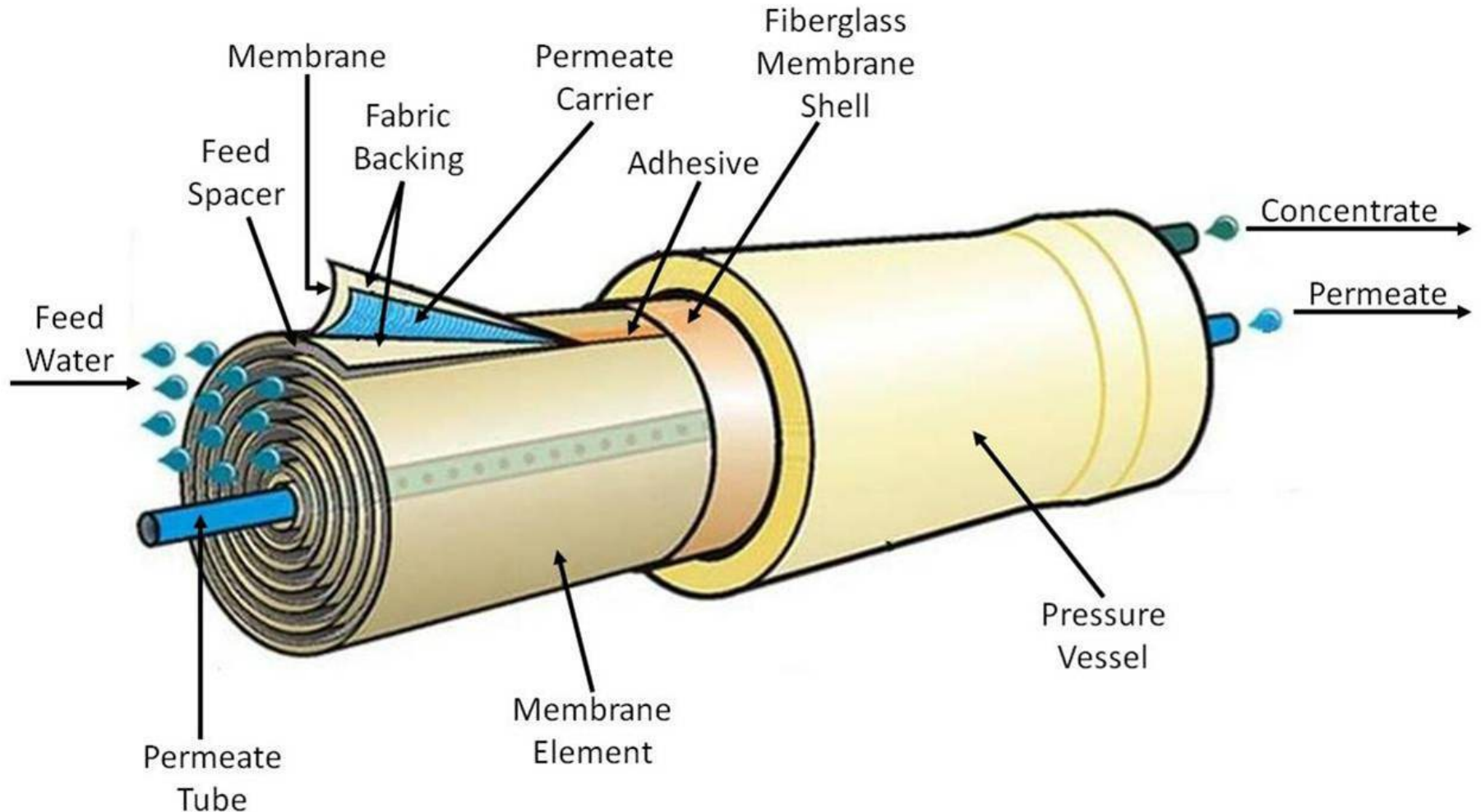
Membrane Technologies



Nanofiltration

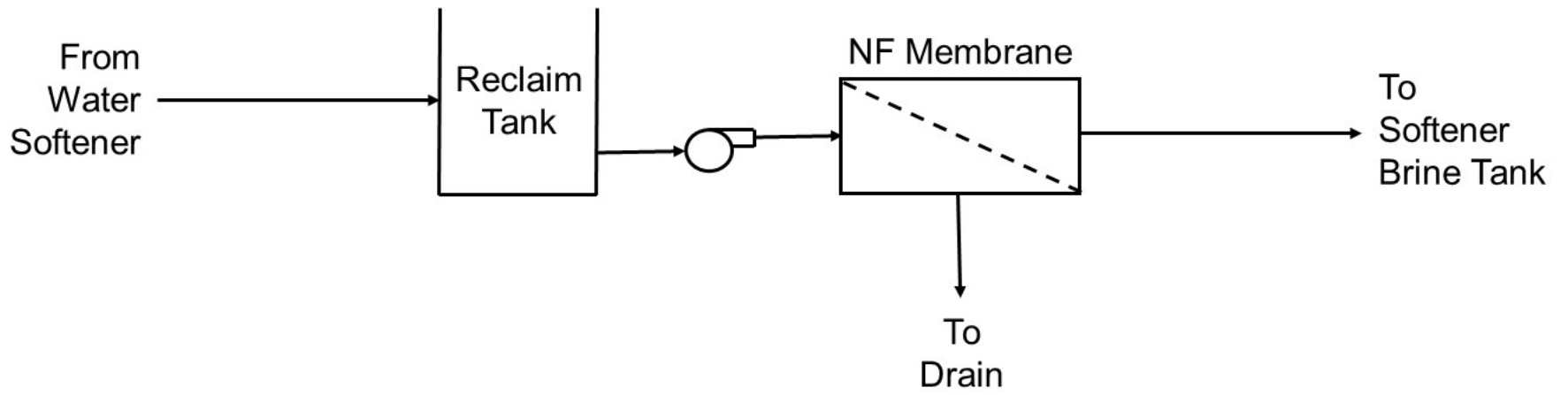


Spiral Element

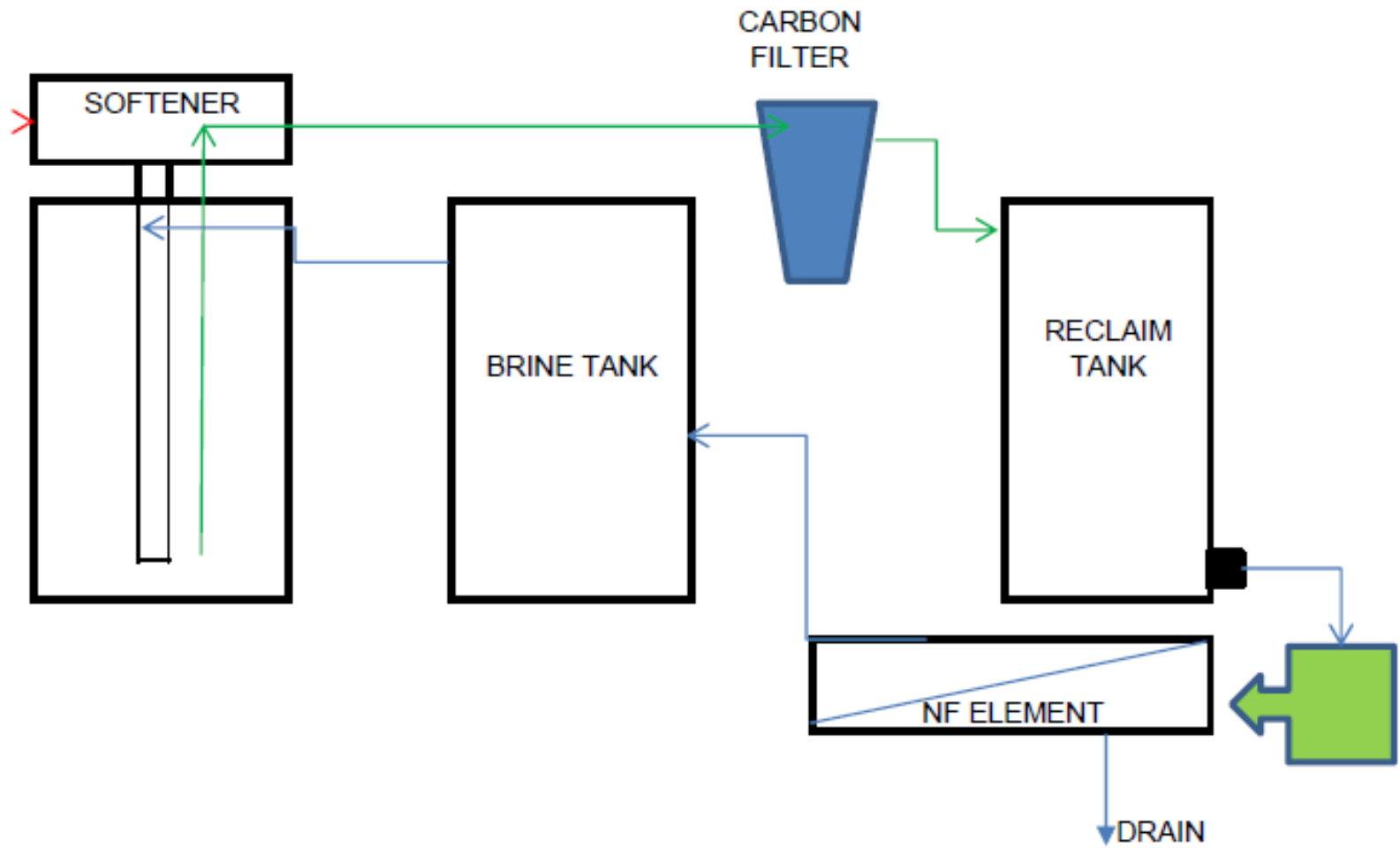


- New brine reclaim standard ASSE-1088
- Test/performance standard
- Specifies minimum of 75% recovery of chloride (NaCl)





BRINE RECLAIM SCHEMATIC



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