

Treatment of Underground Water Using Ozonation

Anwar Samhuri – 52645 (ELE)

Lamis Yousif – 41791 (CHE)

Yara Roshdy - 55312 (CVE)

Yousef Shorrab - 57861 (CHE)

Situation

Today, water is being used at a rate twice the rate of the population increase. The sources of water commonly used today is groundwater and seawater. Groundwater is being depleted causing many countries to suffer of high stress levels in groundwater depletion example the UAE, India, and Saudi Arabia.

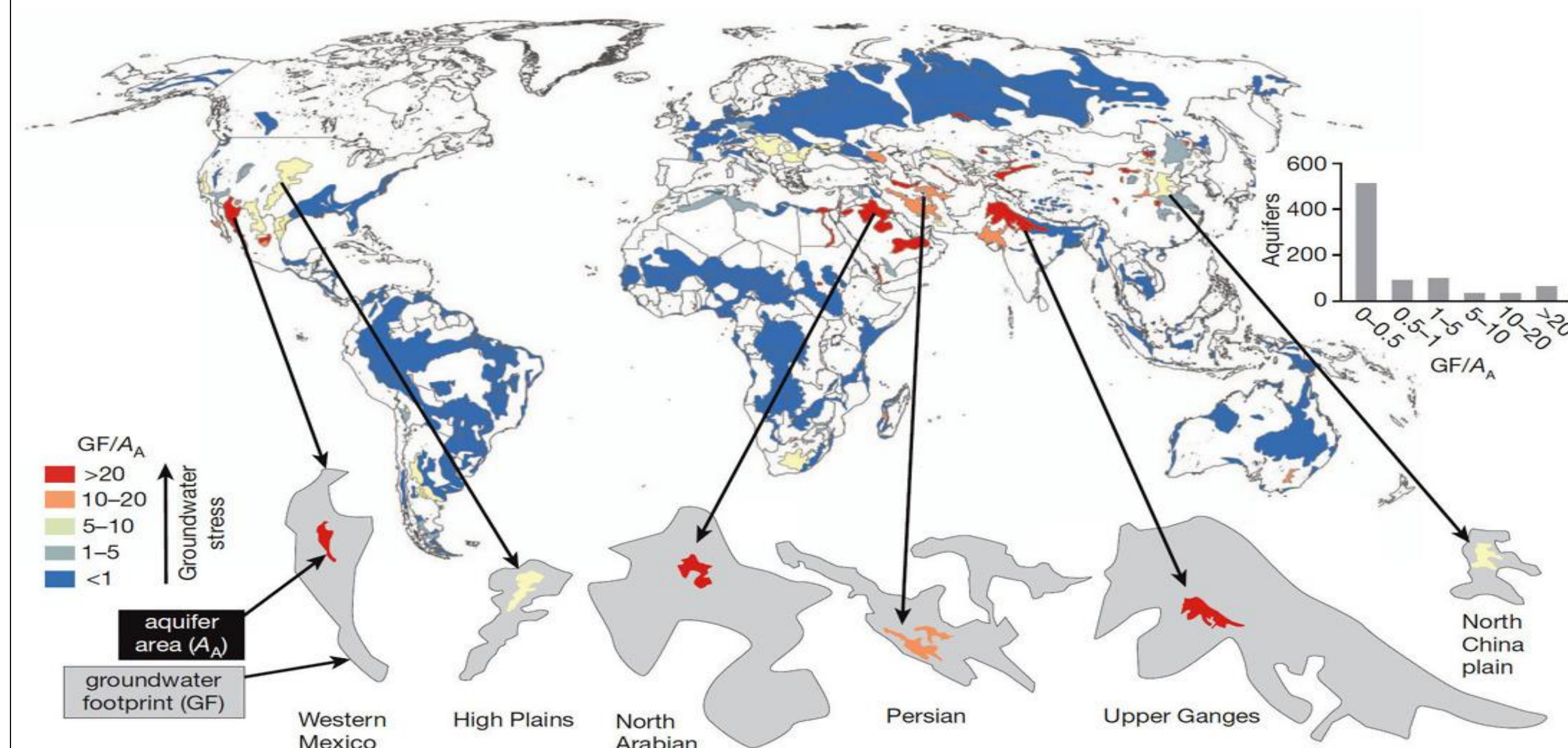


Figure 1: Global Trends in Groundwater Depletion

Problems

- Groundwater is being depleted at a rate faster than it's recharge period which can take infinite number of years.
- Two types of groundwater is there; Surface groundwater which is used because its not very contaminated and Subsurface groundwater
- The subsurface underground water that is left can be severely contaminated with heavy metals, chemical, solids and organic compounds
- This underground water is treated using Chlorination or Ozonation
- Chlorination is an effective way to treat groundwater by it can produce hazardous by-products that can be carcinogenic
- Ozonation is used to treat water used in swimming pools and Aquariums
- It uses Ozone gas generated using UV Lambs which can be bulky, requires maintenance every 9 months

Solutions

Artificial Groundwater Recharge Techniques:

- Direct Subsurface Recharge - percolation
- Direct Surface Recharge – injection wells
- Combinations of Both
- Indirect Methods – underground pumping facilities

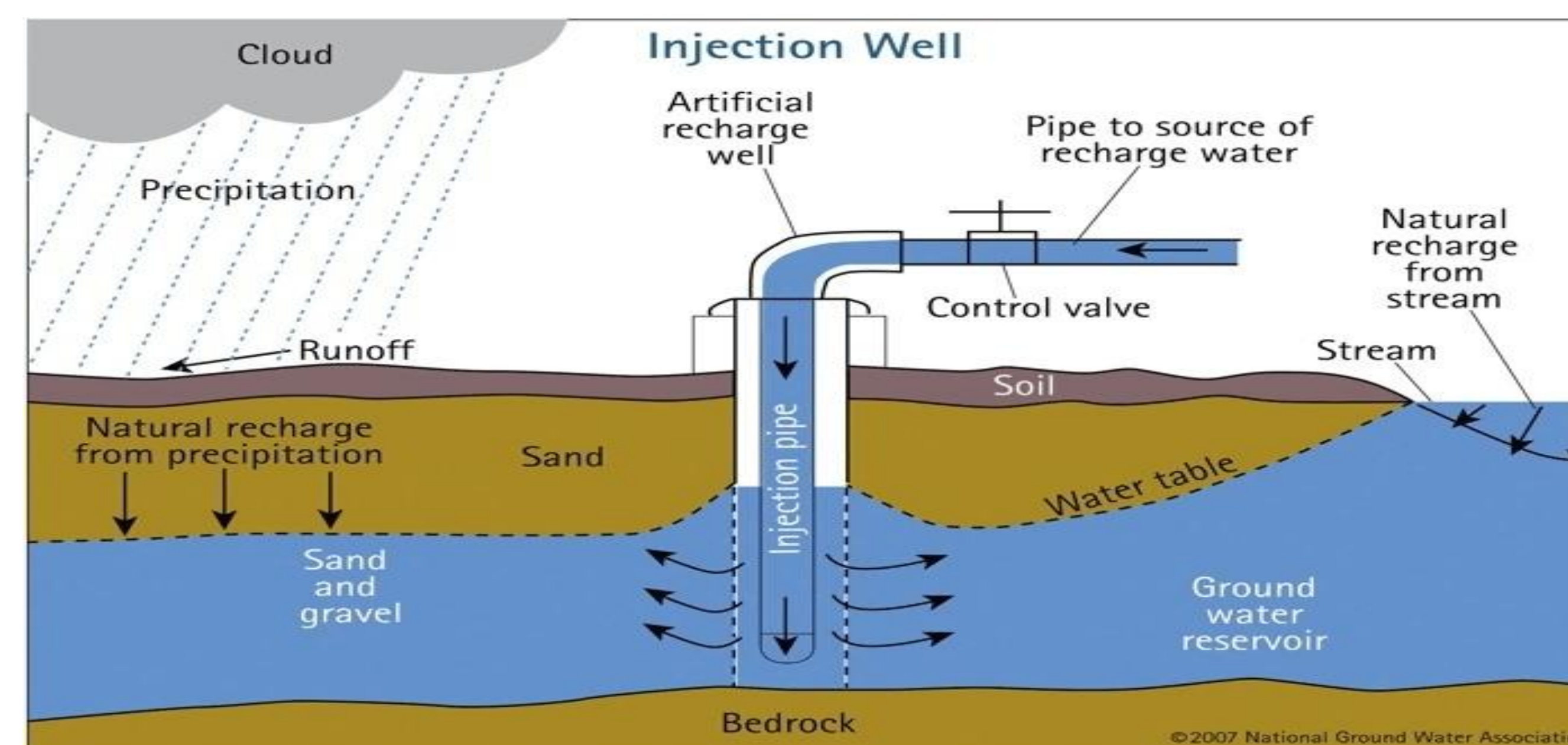


Figure 2: Artificial Groundwater Recharge using Injection wells

Ozone Generator using Corona Discharge:

- 1) Air pump supplies air into the air dryer
- 2) Air dryer gets rid of humidity
- 3) The dried air enters the ozone generator
- 4) Oxygen gas (O_2) is transformed into Ozone Gas (O_3)

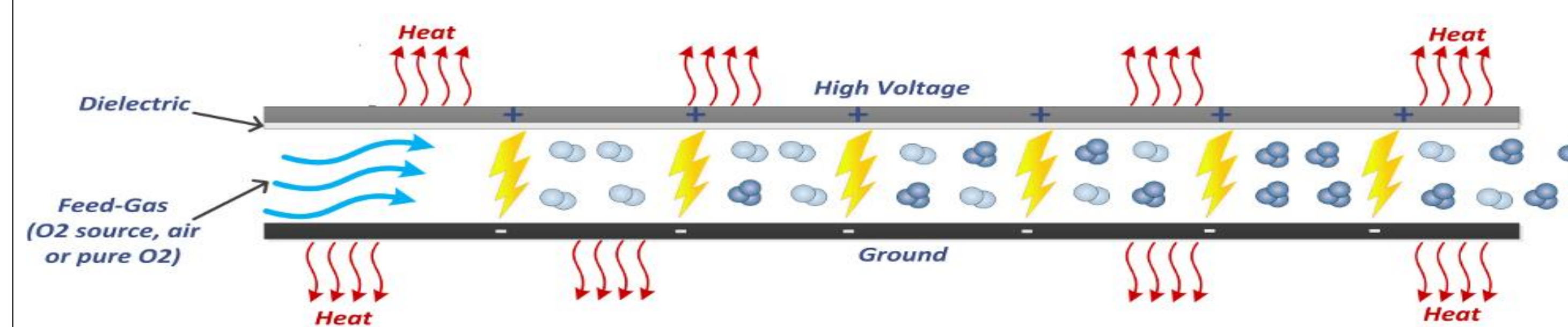


Figure 3: A schematic of the internal workings of a Corona Discharge Ozone Generator.

The process Ozonation treatment of contaminated underground water:

- 1) Ozone is applied to water and forms oxygen radicals
- 2) Oxygen radicals react with soluble metals and organic compounds to form precipitate
- 3) Pathogens are destroyed
- 4) Precipitate is filtered out
- 5) Excess ozone degrades in 30 minutes maximum
- 6) PVC is used as an ozone resistant material for the reactor

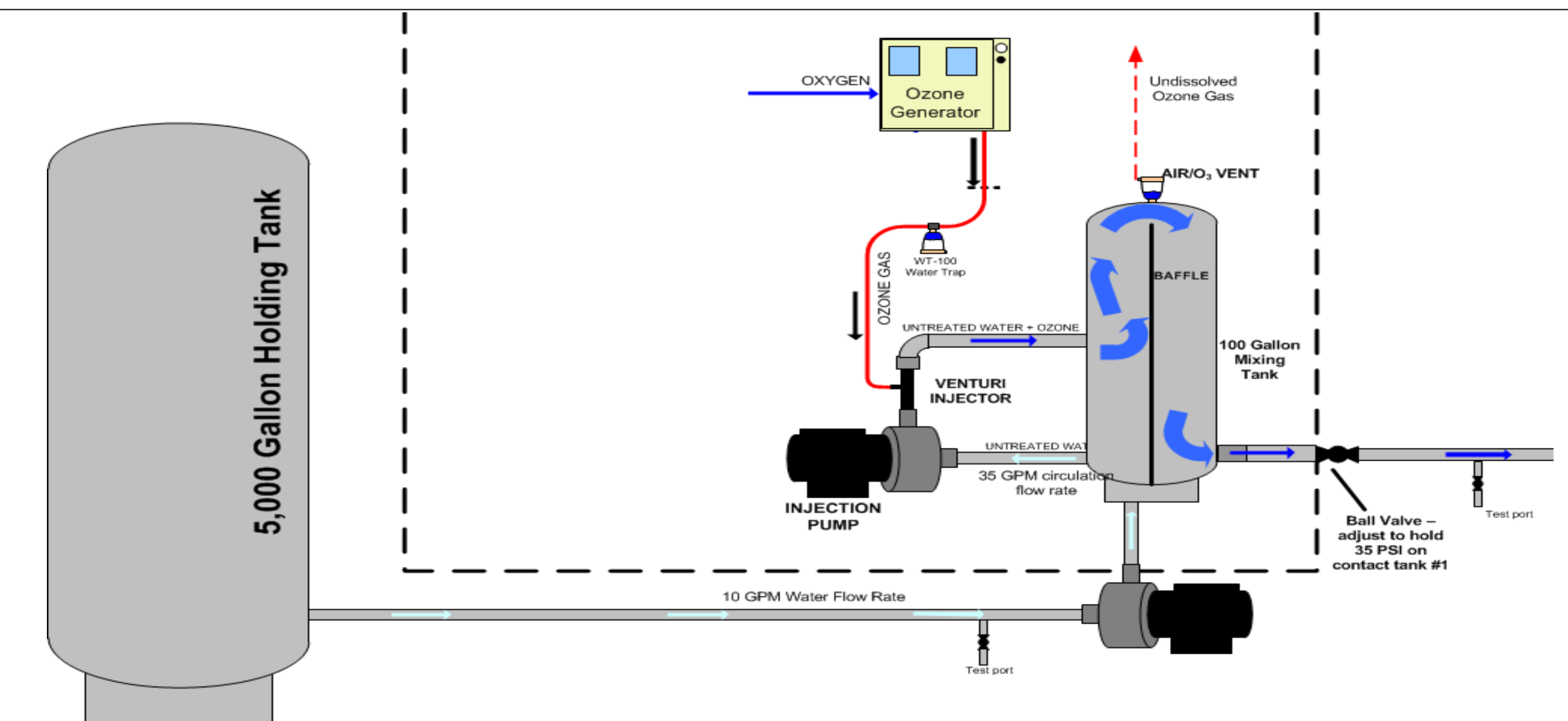


Figure 4: Treatment of underground water process overview

Evaluation

- **Cost** – Depends on the manufacturer, site, capacity of the plant and the characteristics of the wastewater to be disinfected.
- **Operation and maintenance** – reliable and low maintenance
- **Efficiency**
 - Ozonation removes color, odor, and taste
 - Corona discharge produces high quantities of ozone gas
 - Ozone is 35 times faster than chlorine
 - Corona discharge uses less energy
 - Artificial recharge removes bacteria through natural filtration
- **Disadvantage:**
 - Corona discharge cannot be used in humid atmosphere
 - High startup price
 - Artificial Recharge is a experimental method the requires more research

References

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