



evoqua
WATER TECHNOLOGIES

AFWA– Chlorination Overview

Presented by Ollie Timms

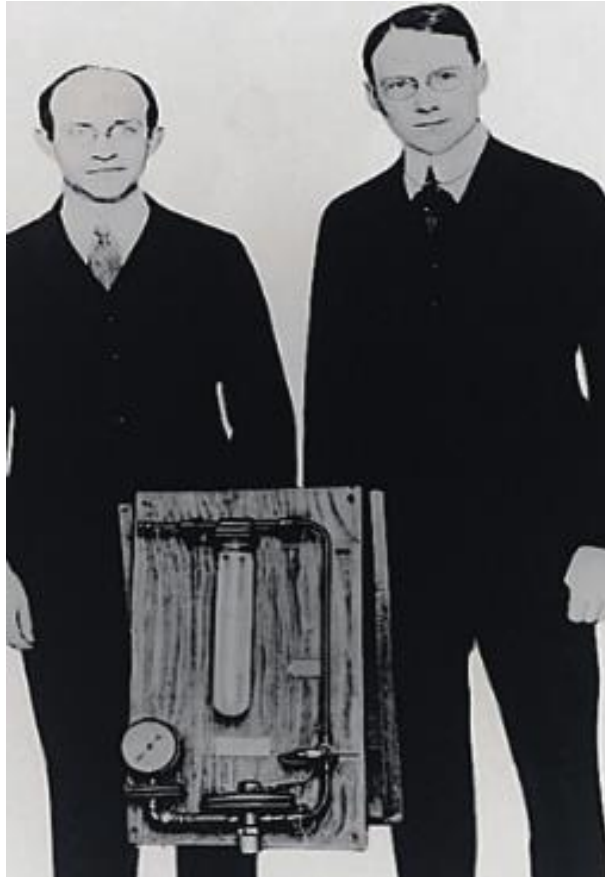
27th July 2016

Overview Scope:

1. Why We Disinfect
2. How Can We Disinfect
3. Gas System & Components
4. Control of Gas Disinfection
5. Gas Safety Equipment



1. DISINFECTION – WHY ?



WATER BORNE DISEASE HAS BEEN A MAJOR GLOBAL KILLER SINCE TIME IN MEMORIAL

MR WALLACE AND TIERNAN IN 1913 DEVELOPED THE FIRST TECHNIQUE FOR DISINFECTION THROUGH THE USE OF CHLORINE GAS.

THIS DEVELOPMENT WAS VOTED BY TIMES MAGAZINE AS THE 7TH MOST INFLUENTIAL ACHIEVEMENTS OF THE 20TH CENTURY

100 YEARS LATER, ACCESS TO BUG FREE POTABLE WATER REMAINS A GLOBAL CHALLENGE

IN 2019 AN ESTIMATED 3.4 MILLION PEOPLE DIED OF PREVENTABLE WATER BORNE INFECTION.

1. FIRST ATTEMPT.



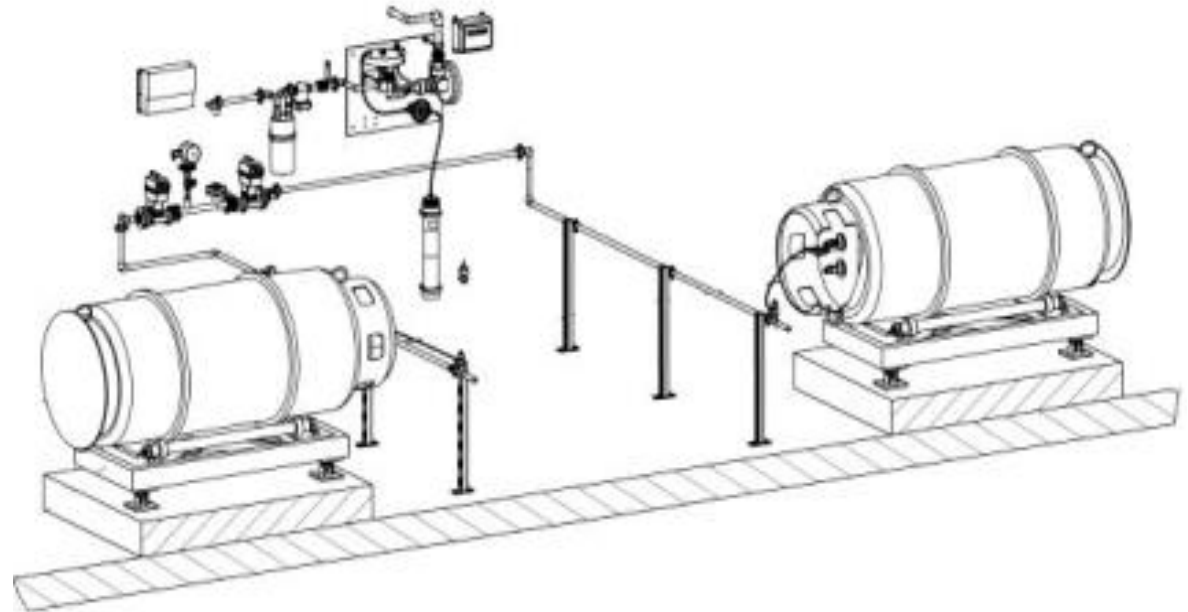
The W&T Chloro-boat was used for disinfecting large reservoirs or sterilizing large outdoor swimming areas.

2: Types Of Disinfection: CHLORINE GAS

The direct injection of chlorine gas from 1 Ton chlorine drums into a potable water supply.

ADVANTAGES AND DISADVANTAGES

- STABLE AND LONG LASTING
- MOST COMMON METHOD
- CHEAP CAPITAL
- EXTREMELY TOXIC
- SUPPLY IS DIFFICULT.



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2. OSEC – ON SITE ELECTROLYTIC CHLORINATION

OSEC technology uses electro chemistry to convert standard food grade salt into a hypochlorite solution which disinfects water sources.

ADVANTAGES AND DISADVANTAGES

- NO DANGEROUS CHEMICALS
- ON DEMAND GENERATION REMOVES LOGISTICAL CHALLENGES
- INITIAL CAPEX PRICE IS HIGH – THOUGH ROI IS RELATIVELY QUICK



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2. Sodium Hypochlorite 10 to 15%

In occasions where a water treatment works is situated in proximity to a bleach manufacturer it is a simple option to use the manufactured chemical. Commercial hypo's inability to travel makes for Inherent logistical problems otherwise.

ADVANTAGES / DISADVANTAGES

- EASY TO USE.
- LIMITED SHELF LIFE - PRODUCES THMS.
- OFF GASES - DECAYS RAPIDLY ESPECIALLY IN HIGH AMBIENT HEAT.
- HIGH OPEX



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2: Calcium Hypochlorite 65% HTH

Calcium hypochlorite is delivered in a stabilised powder form to site. This reduces the degradation of chlorine with time however the calcified chlorine is extremely expensive and difficult to dilute and dose

ADVANTAGES / DISADVANTAGES

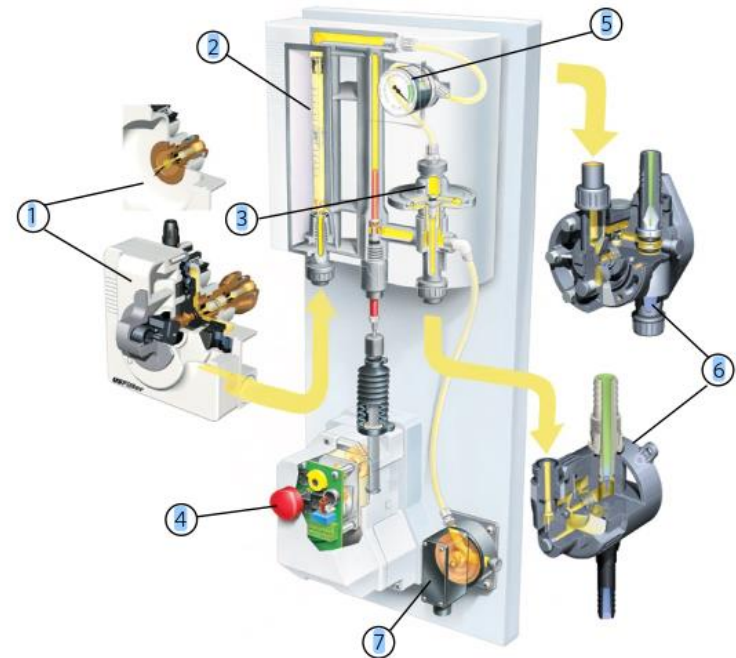
- Longer shelf life
- Can be explosive under certain conditions
- Produces sludge – breaks pumps, blocks lines
- Off Gases & THMs
- pH dependant
- High OPEX



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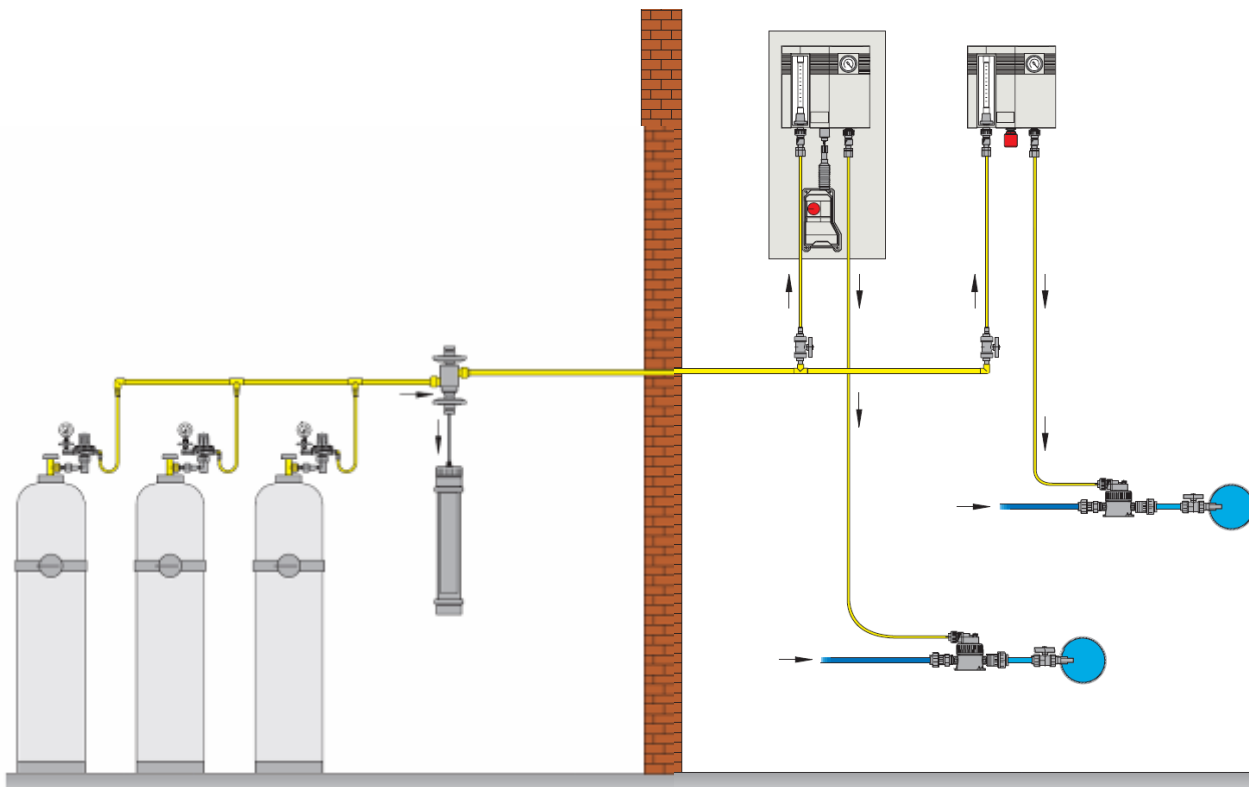
3. GAS DISINFECTION – 70% OF GLOBAL DISINFECTION

- Preferred supplier of gas equipment in the world
- 100+ years as the industry leader in gas disinfection
- Largest global install base
- Largest yearly sales volumes



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3: Types Of Gas Feed System: Smaller Capacity



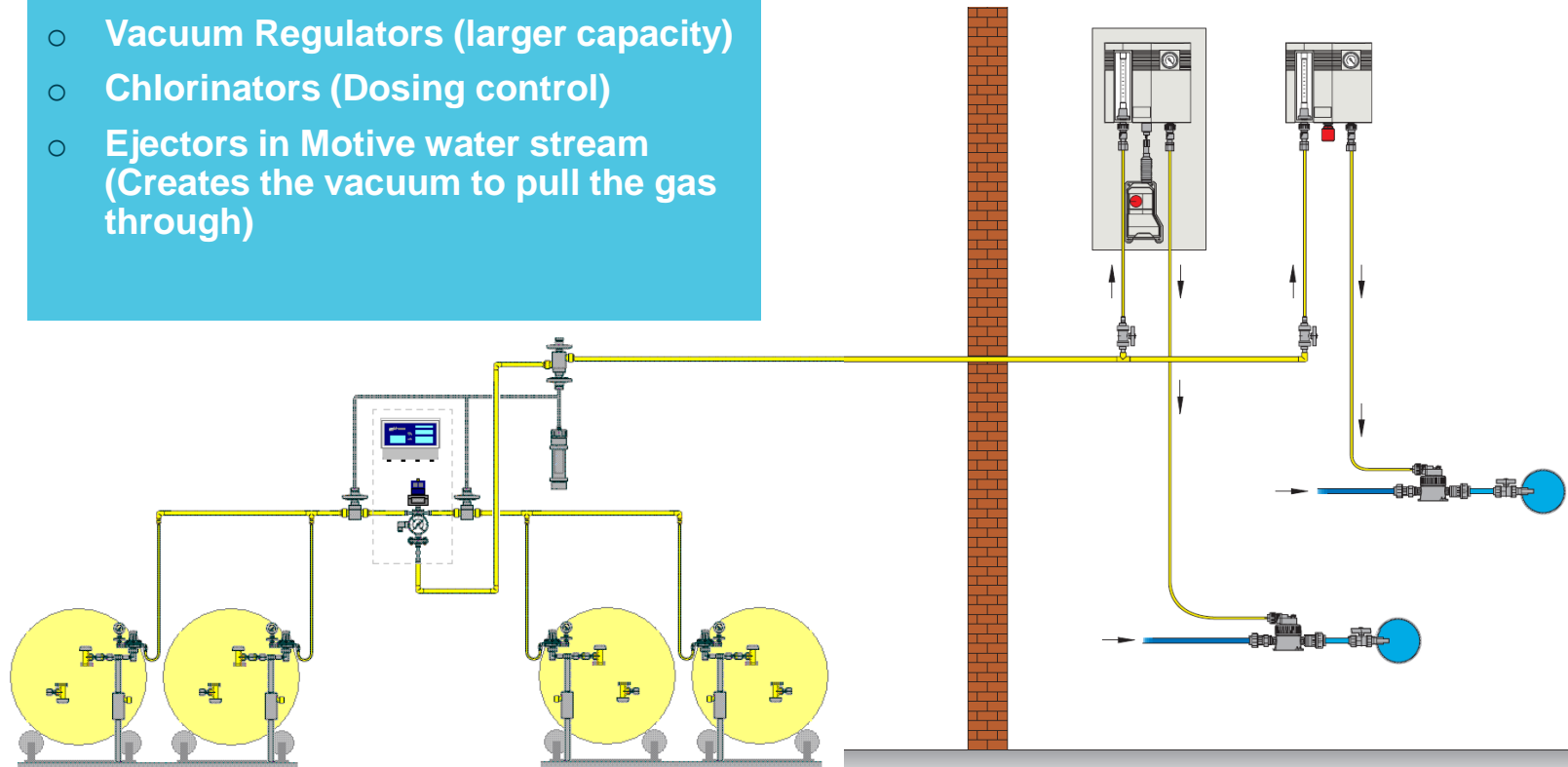
Core Components:

- Header
- Changeover
- Vacuum Regulators
- Chlorinators (Dosing control)
- Ejectors in Motive water stream (Creates the vacuum to pull the gas through)

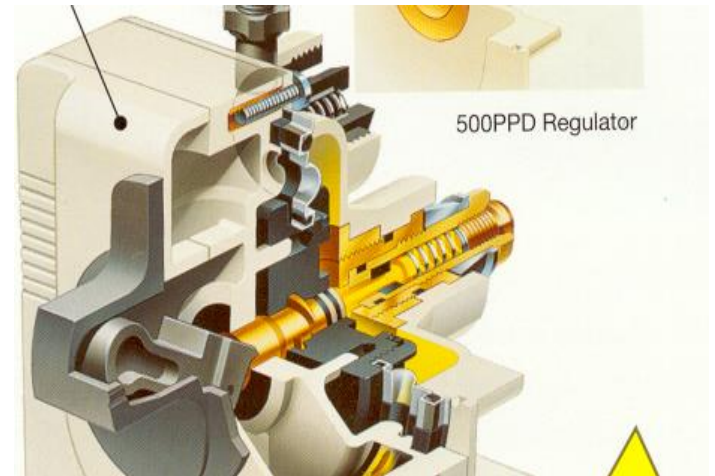
3: Types Of Gas System: Larger Capacity

Core Components:

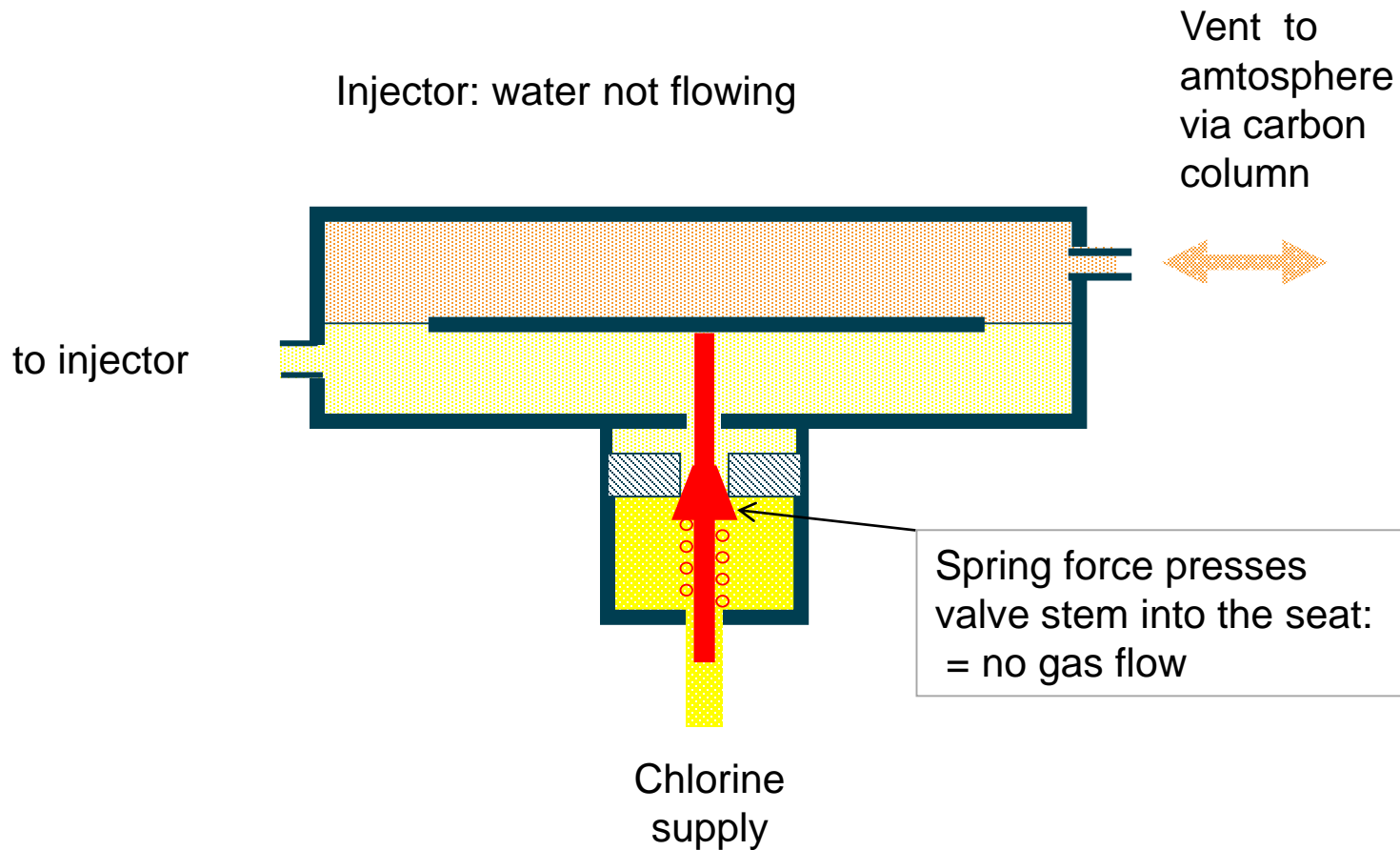
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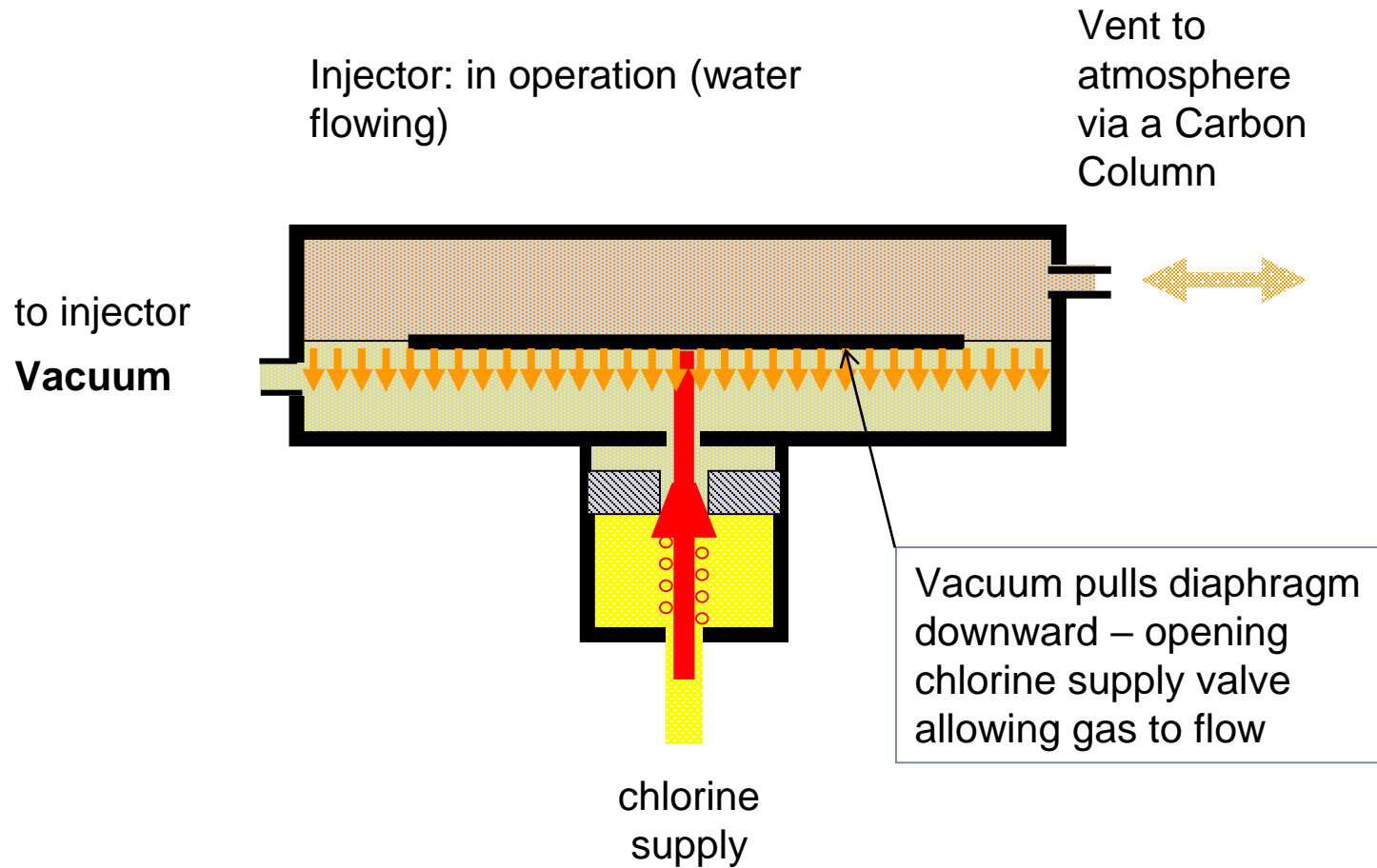
3: Components - Vacuum Regulators



3: Vacuum Regulators - Using Vacuum To Control



3: Vacuum Regulators - Using Vacuum To Control



2: Components: Chlorinators

V10K –15kg/hr



Kent V2000 – 60kg/hr



V2030 –200 kg/hr



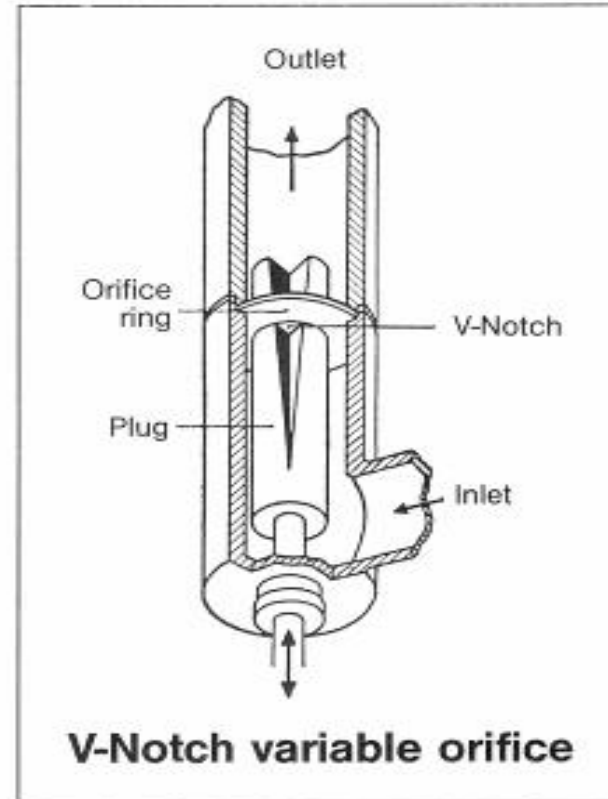
2: Components - How the Chlorinator Works

All Chlorinators use the V- Notch principle – gives a linear variable flow rate across the opening range.

These are used in conjunction with glass flow meters on Chlorinators to adjust the flow of gas. This gives indication of actual feed quantity

Automatic units use increase/decrease or 4-20mA signals to control the flow rate. All units have Manual adjustment options

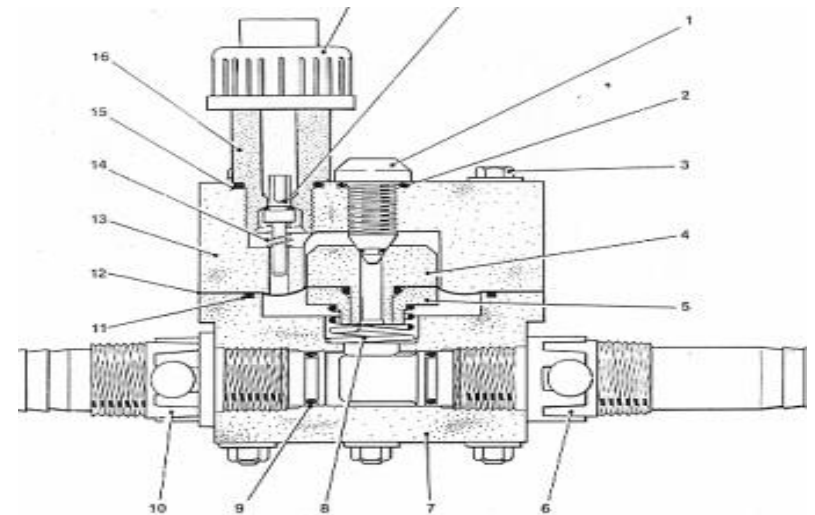
Gas is pulled through via vacuum created by the Eductor/Ejectors.



2: Components - Ejectors



All capacities available, injectors perform the crucial function of providing the vacuum pressure required to operate the chlorine gas system whilst also mixing the chlorine gas into the water supply



2: Components – Ejectors

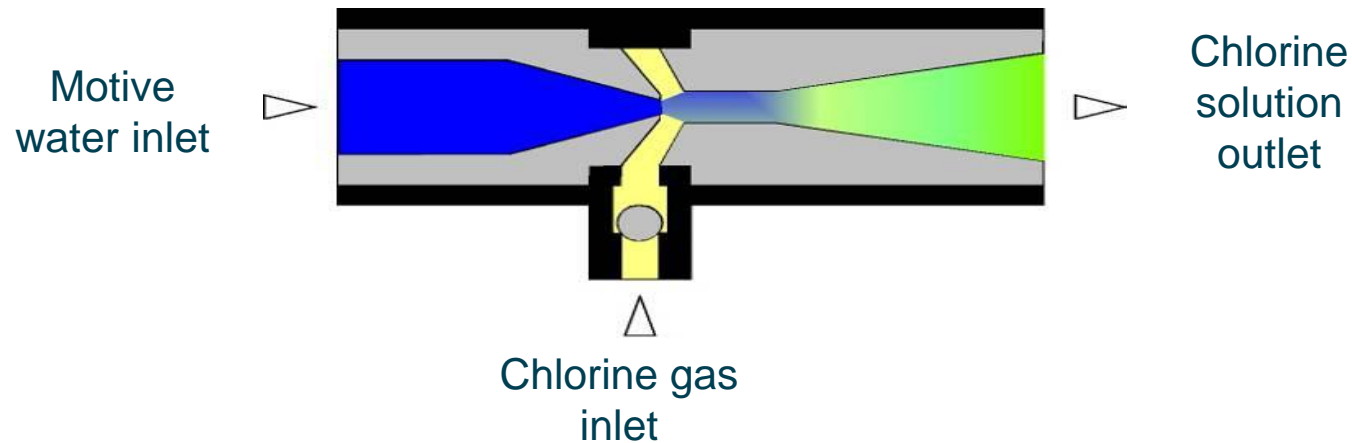
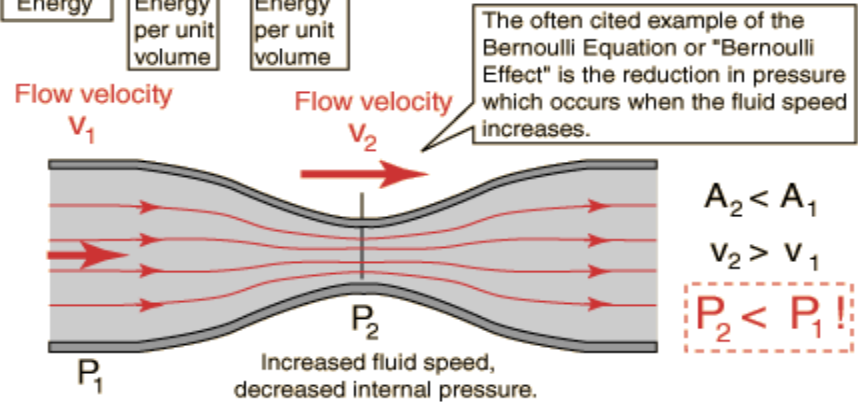
Energy per unit volume before = Energy per unit volume after

$$P_1 + \frac{1}{2}\rho v_1^2 + \rho gh_1 = P_2 + \frac{1}{2}\rho v_2^2 + \rho gh_2$$

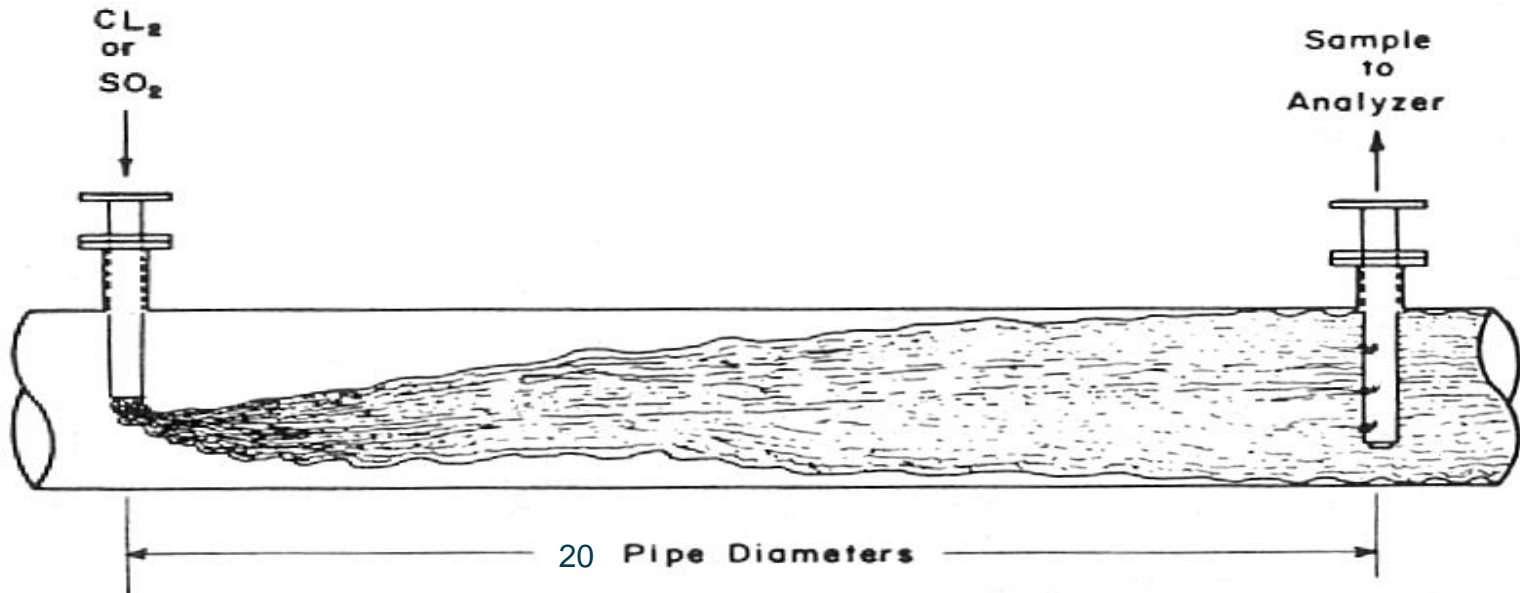
Pressure
Energy

Kinetic
Energy
per unit
volume

Potential
Energy
per unit
volume



4: Measuring Residual - Chlorine Solution Mixing



- In a straight run of pipe carrying water with reasonable turbulence, a chlorine solution will be fully mixed with 20 pipe Diameters without some form of mixing device before an accurate sample can be withdrawn

4: Analysers

W&T manufacture a variety of Analysers to both monitor and control your chlorine dose on site.



ADVANTAGES

- 24/7 MONITORING
- INCREASED ACCURACY
- DECREASED CHEMICAL COSTS
- INCREASED QUALITY
- REDUCTION OF LABOUR COSTS



4: Control Modes

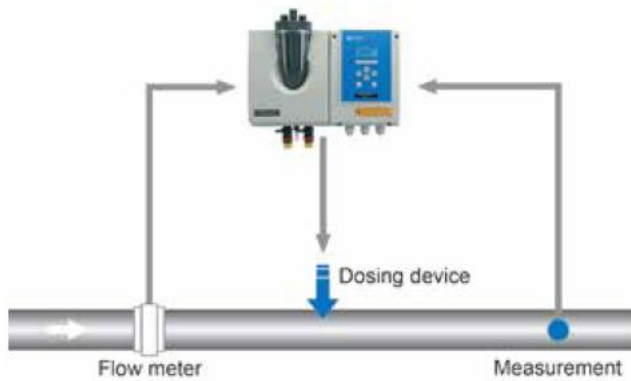
Flow proportional control



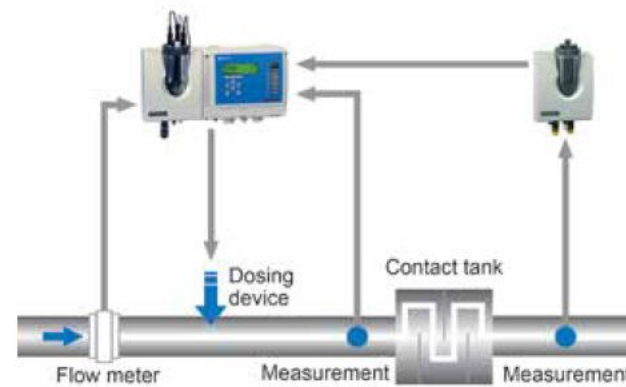
Closed loop control



Compound Loop Control



Setpoint Trim Control



3: Safety Equipment : Principle options

Gas Detection

Automatic Closing Systems

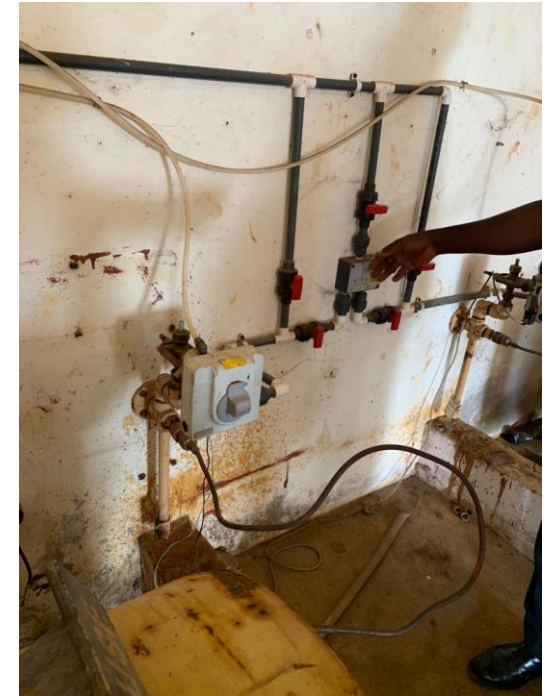
1 Ton Chlorine scrubbers



4: After sales support



Local training, support
Remote Troubleshooting
ON site service
Maintenance plan, list of components



5: References List

Just for chlorine gas we have supplied nearabout 150 major installations in Africa from North to South.



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THANK YOU FOR YOUR ATTENTION
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2. CHLORINE DIOXIDE

Chlorine dioxide generators reacts relatively stable precursor chemicals on site to produce chlorine dioxide on demand.

ADVANTAGES / DISADVANTAGES

- **EFFECTIVE LONG LASTING RESIDUAL, NO THMS* NOR PH DEPENDANT**

- **SODIUM CHLORITE & HYDROCHLORIC ACID BASE CHEMICALS ARE NEEDED**

- **CAN ONLY BE MADE ON SITE, LIMITED STORAGE**

- * **TRIALOMETHANES – HAZARDOUS CHEMICAL FORMED WITH BIO-ORGANICS IN WATER DURING THE CHLORINATION PROCESS.**



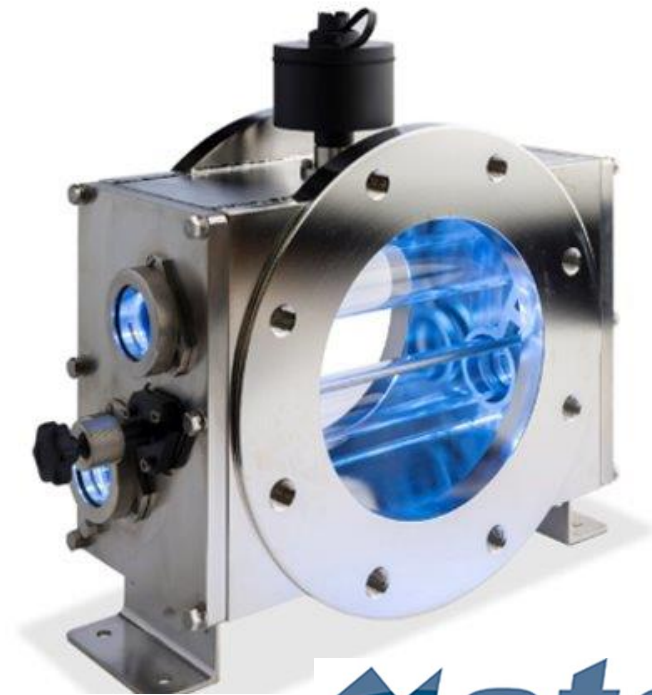
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2: Ultra Violet Disinfection

Ultraviolet disinfection is the only truly non-chemical means of disinfection. The UV system converts electric energy into low wave length light energy which alters the DNA of bacteria rendering them inert or 'unable to reproduce'

ADVANTAGES / DISADVANTAGES

- EFFECTIVE AGAINST CRYPTO & GIARDIA
- NO CHEMICAL REQUIREMENT
- HIGH POWER CONSUMPTION
- NO LASTING RESIDUAL IN WATER



2. OZONE DISINFECTION

Ozone is an exciting technology which converts atmospheric air into tri-atomic oxygen, or ozone, which is a powerful 'chemical free' disinfectant

ADVANTAGES / DISADVANTAGES

- REQUIRES ONLY AIR AND ELECTRICITY
- MOST POWERFUL DISINFECTANT
- OZONE GAS REQUIRES CAREFUL MANAGEMENT
- NO LONG TERM RESIDUAL



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