Careers in Drinking Water & Wastewater

Martin Allen – Water Research Foundation (retired)

Randall Giffin – Aurora Water Department (retired)

“Faculty”

- Martin Allen, PhD
- Senior research microbiologist – USEPA
- Director of Technology Transfer – Water Research Foundation
- 50+ publications
- VW (bug) enthusiast
- Randall Giffin
- USEPA-Wastewater Disinfection Studies(7 years)
- Aurora Water Quality Lab-32 years
- Colorado Water Utility Council Secretary and Chair

Why Consider Careers in Water?

- **Growing need to replace those retiring – increased demand for staff in decades to come**
- **Every community has a drinking water and wastewater treatment facilities – mobility throughout the country**
- **Different skill sets and levels of education needed – more later**
- **Salaries & Benefits good**
- **Satisfaction in protecting health and the environment**

Overview of Drinking Water

- **Water sources include lakes, rivers, groundwater**
- **Each source has different water quality characteristics requiring different treatment**
- **Drinking water needs to meet U.S. E.P.A criteria- e.g., lead, removal of human pathogens, etc.; Colorado authorized to administer (possible employer)**
- **Reservoirs and underground water mains/pipes convey the water to customers**

Purpose of Drinking Water Treatment

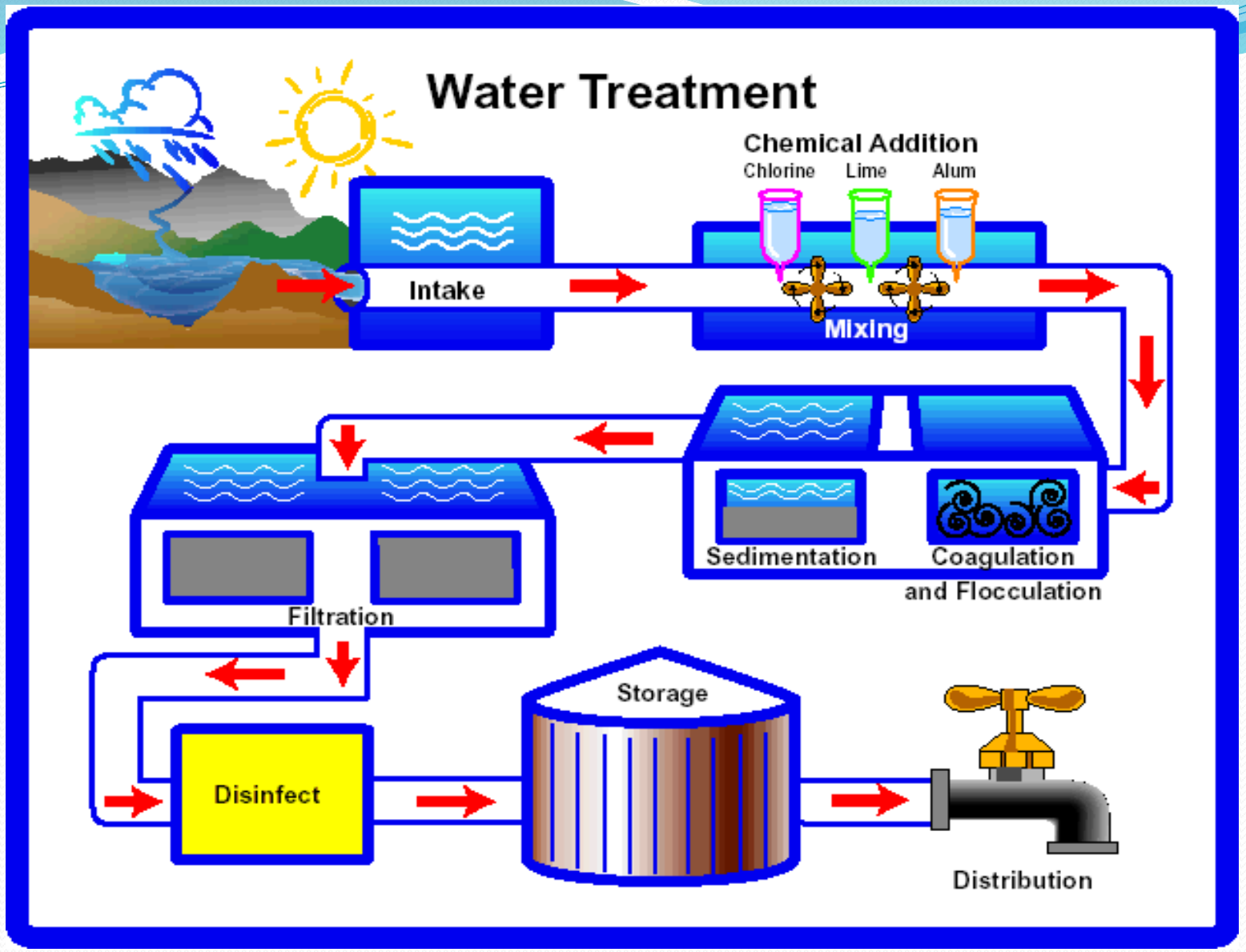
- **Remove or kill all human pathogens (not sterile water)**
- **Remove suspended particulates (turbidity)**
- **Make the water esthetically pleasing in taste and color**
- **Meet all EPA-set regulations**
- **Add disinfectant (chlorine species) to protect water quality from plant to consumer during distribution**

Impossible to monitor for pathogens

Water Treatment Processes*

- **Settling Chambers**
- **Flocculation – settle suspended particles**
- **Filtration – sand**
- **Ozone – remove organics and color**
- **Membranes – higher level of filtration**
- **UV – kills protozoa (*Cryptosporidium)***
- **Disinfection – prior to leaving plant**

*** Not all processes needed**



Additional processes – ozone, UV, membranes

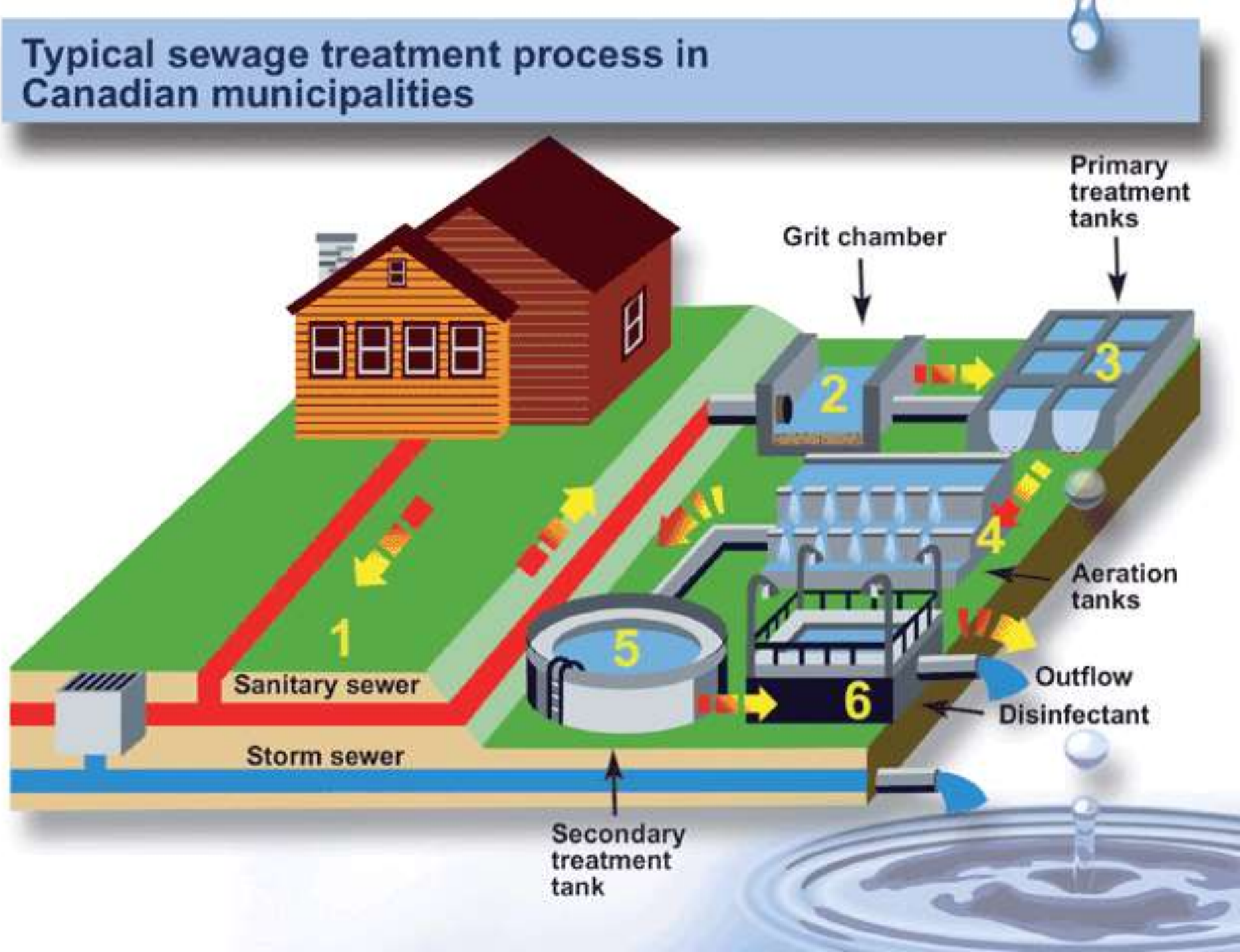
Wastewater Treatment Processes

- **Three wastewater sources**

1. **Domestic –households, schools, etc**
2. **Industrial – pretreated on-site**
3. **Storm water –rain water**

- **Collection system – gravity flow**
- **Processes – grit/solids removal; aeration; disinfection,**
- **Sludge digestion – energy production, solids**

Typical sewage treatment process in Canadian municipalities



Examples of Skills Needed at Water Utilities

- Control room operators
- Process maintenance
- Water sample collection
- Water analysis
- Accountants
- Customer service reps
- Water main repairs
- Tradesmen/women
- Motor fleet
- Legislative liaison
- Security
- IT functions
- Surveyors
- Planners
- Managers
- Engineers
- Designers
- Regulatory liaison
- Public relations
- Human resources
- Trainers

Water Utility Concerns

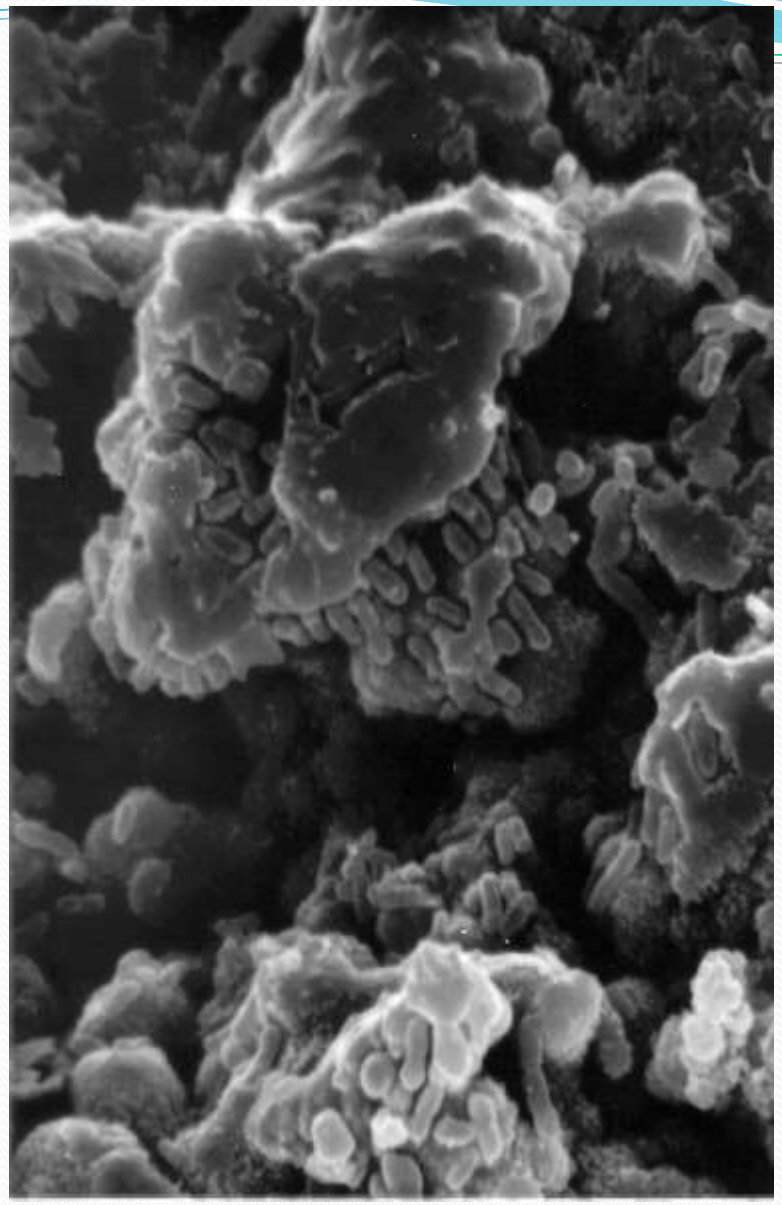
Knowledge Areas	Total Rank
Asset Management	1
Utility Finance	2
Distribution System Integrity	3
Energy Management	4
Water Resources	5
Chemicals of Emerging Concern	6
Water Efficiency	7
Disinfection By-Products	8
Customer Service	9
Communication	10
Climate Change	**11**
Advanced Treatment	12
Desalination and Reuse	13
Microbials	14

Climate Change

Suddenly, Bob realizes that he's "part of the problem".

Water Quality Monitoring

- **Source waters**
- **Within water treatment plant**
- **Leaving water treatment plant**
- **Within reservoirs and distribution system**



Bacteria in water main tubercles- New Haven, CT; M.Allen,1977

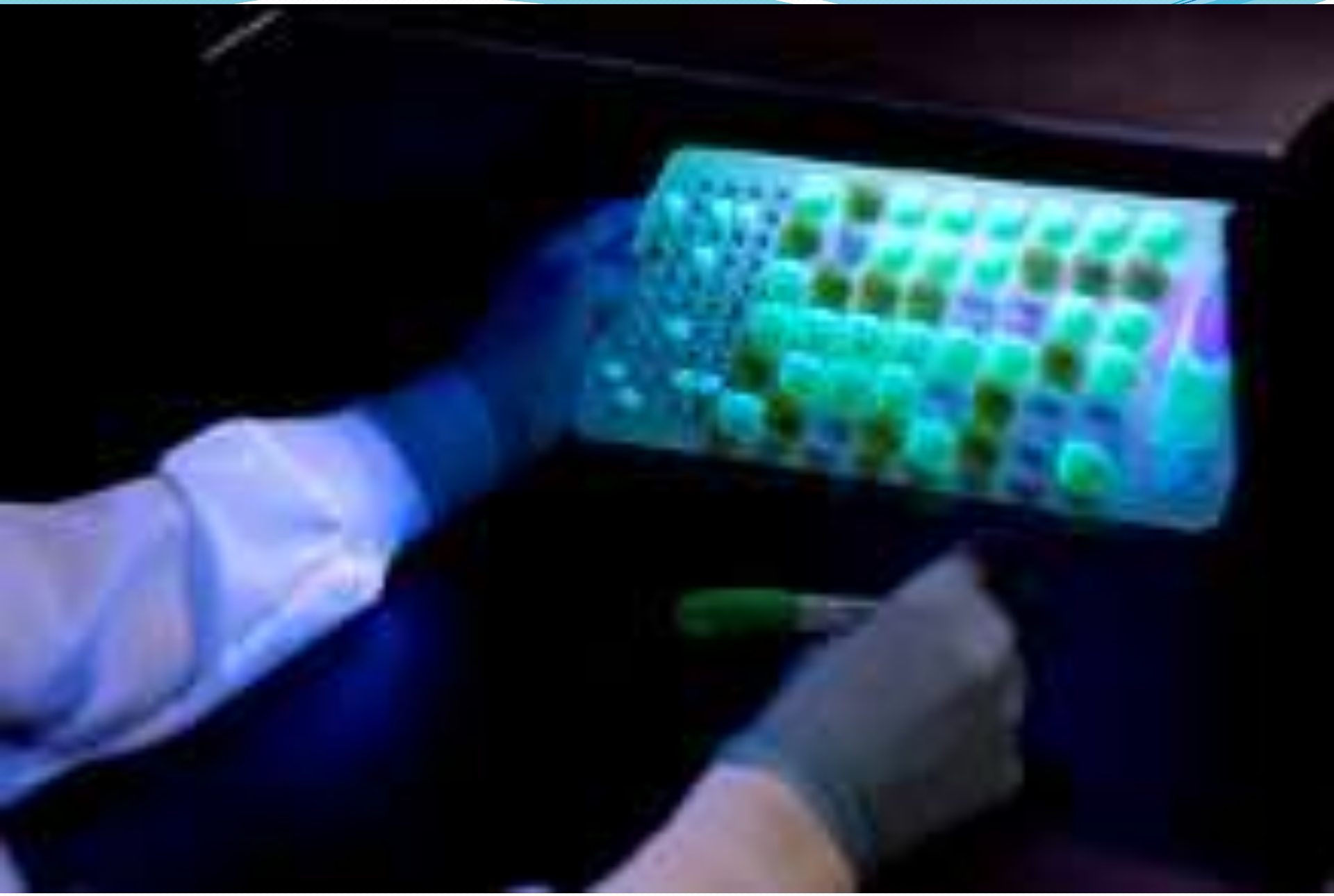
Example of water testing

- **Source water for drinking water**
- **Influent at wastewater facility**
- **Treated water leaving drinking water and waste water treatment facilities**
- **Target organisms – Total Coliforms, *E. coli***

Common Drinking Water Tests (demonstrations)

- **pH – how acid or basic the water is (neutral is 7.0 pH)**
- **Alkalinity - how well buffered the water is (quantity of treatment chemicals to add)**
- **Hardness – amount of calcium/magnesium (water will leave lime deposits)**
- **Total coliforms – general bacterial quality**
- ***E. coli* - best indicator of possible human pathogens**

Colilert – center (clear-negative), right-(positive for coliforms), left –(positive for *E.coli)*



Drinking Water "Issues"

- Sustainability (enough supply)
- Lead
- Fluoride
- Chlorine
- Disinfection Biproducts
- Pharmaceuticals
- Trace organics
- Heavy metals
- Bottled water
- Point-of-Use Devices
- Water main breaks
- Zebra mussels
- Algae

Types of Education Required

- Most utility jobs require at least high school degree
- Many positions require mechanical aptitude
- Many positions require an Associate Degree or a Bachelor Degree (engineering, chemistry, biology, administration, communication, customer service).
- In general the skill sets are the same for drinking water and wastewater utilities, except for the "yuk" factor
- Water treament more of a chemical process, wastewater more of a biological process
- Your HS advisor can help decide the type of courses needed for your career

Sources of Information

- http://workforwater.com/highschoolvotech/page.aspx?id=304
- http://workforwater.com/highschoolvotech/page_int.aspx?id=44
- http:/workforwater.com/page.aspx?id=281
- http://workforwater.com/resource water professional/page_int.aspx?id+2147483651

Dateline: Charleston, WV, Jan 8, 2014

- Massive chemical spill upstream from intake of drinking water plant serving 300, 000 customers
- Chemical – 4-Methylcyclohexane Methanol (MCHM)
- All residents advised not to drink , bathe, wash clothes, cook with water
- Schools, restaurants, hotels, businesses –all closed
- Water plant process not designed for such an event
- After chemical moved downstream, treatment plant began operations and the entire distribution system flushed

Freedom Chemicals Site


WEST VIRGINIA
Charleston
CNN

Lessons Learned –Not Learned

- **Such events can happen again**
- **West Virginia lax in inspecting chemical facilities (1994 last inspected)**
- **Physical defects in storage tank known but not repaired**
- **Company failed to notify State as required**
- **Maybe the state needs to consider public health over company profits and new laws enacted**

Are you interested in being involved in such events?

- Such events will continue to occur
- Responders from water utilities, local, state, and federal agencies
- Requires the expertise of many disciplines (scientists, health personnel, water analysts, communicators, utility operators, etc.)
- Challenging but rewarding