

RECLAMATION

Managing Water in the West

Lower Colorado Dam's Quagga Mussel Assessment and Potential Control/Preventive Program

Leonard Willett, BOR - Hoover Dam Water Treatment Group Manager



U.S. Department of the Interior
Bureau of Reclamation

Agenda

- **BACKGROUND**
- **BUREAU OF RECLAMATION LOWER COLORADO DAMS (LCD) CONTRACTED WITH QUAGGA MUSSEL CONSULTANT – RENATA CLAUDI (RNT CONSULTING)**
- **LESSONS-LEARNED FROM ONTARIO POWER PLANTS**
- **COMPREHENSIVE FACILITY REVIEW OF THE DAMS**
- **FINDINGS & POTENTIAL CONTROL/PREVENTIVE MEASURES**

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Consultant and LCD Quagga Mussel Point of Contact

- Contracted with RNT Consulting Inc.
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Site Visit Experience Ontario Hydro Power Facilities (reactive approach)



Sir Adam Beck #2



Sir Adam Beck #1



DeCew #2



Pump Generating Station

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Nanticoke Coal Fired Facility Ontario (proactive approach)



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Over time if left untreated

- Transformer cooling water piping plugged at Ontario Hydro Power



Water Cooled
Transformer Piping

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Ontario Hydro Plant Unit Coolers



Dead Mussels Found in Unit Coolers

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Quagga Mussel Infestation at Dams; What have we learned and what do we recommend

RNT Consulting Inc.

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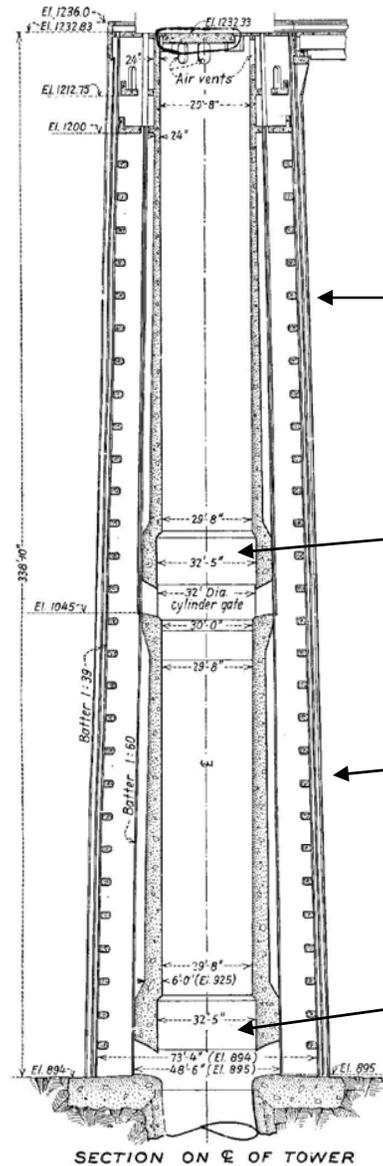


Observations from inspection of external surfaces

- Mussels are present in the lower penstock (Living 200 + psi pressure)



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Elev 1111
Dec 2007 Lake
Mead Level

Elev 1045
66'

Elev 970
141'

Elev 894
217'

Sampling Plates at Parker Dam November 7/07



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Davis Dam Penstock Gate Oct.07



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Proactive vs. Reactive Control Measures

- Proactive

Does not allow growth of mussels in the system or on the surface protected

- Reactive

Does allow mussels to grow in the system or on the surface. Established populations have to be eliminated periodically

Findings & Potential Control Measures

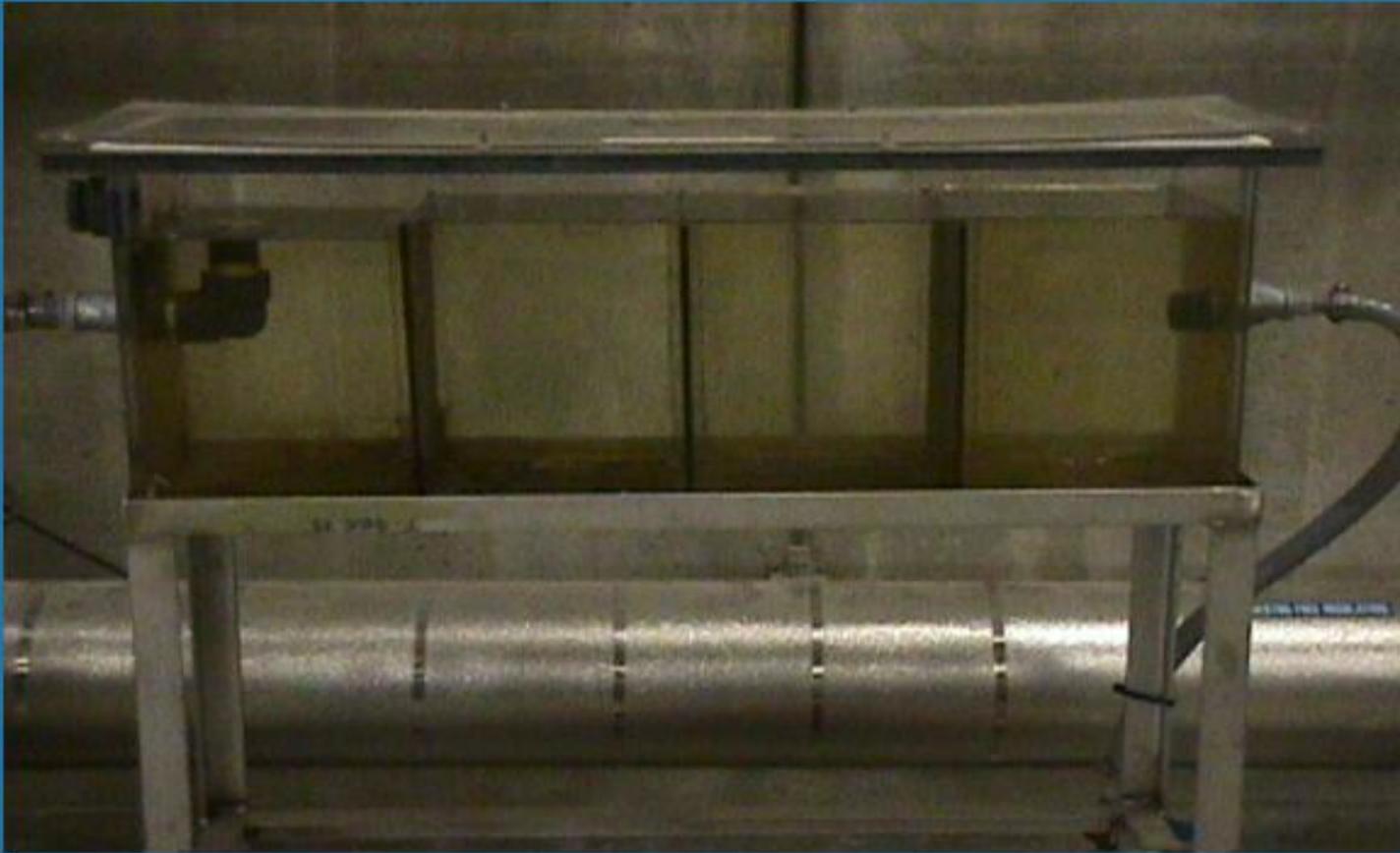
- All three dams use the same settlement substrate on the sampling plates
- Same dimensions
- At the same depth (10ft, 20....down to maximum depth)
- Examine the plates at the same time interval and in the same manner
- Multiple strings of sampling plates lakeside and in the tailbay



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Install Side stream sampler
for plant monitoring

Bio-box



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Options for External Structures*

***Structures That Are in Direct Contact With
the External Environment; No Isolation Is
Possible**

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Reactive Options for External Structures

Mechanical Cleaning



- de-water and use powerwash
- underwater, scrape and vacuum or powerwash

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Proactive Options for External Structures

- Antifouling Coatings - for both steel and concrete
- Non-toxic, silicone based
- Toxic, copper based coatings
- Life-span 5-7 years before topcoat needs to be refreshed

Reactive Options for Internal Piping Systems

- **Thermal Wash** - 32°C for 48 hours (90° F)
40°C for 1 hour (104° F)
- **Mechanical Cleaning** such as
 - scrape large diameter pipes
 - use remote vehicle tools on difficult areas
- **Flushing with weak acids**
- **Oxygen Deprivation**

Reactive Options for Internal Piping Systems

- **Periodic (once or twice/year) application of**
 - **Non-oxidizing chemicals**
 - **Oxidizing chemical**

Oxidizing Chemical Treatment

- Chlorine
- Bromine
- Chlorine dioxide
- Chloramines
- Ozone
- Potassium permanganate



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Emerging Options

- Bacterial product, zebra mussel specific chemical....being tested on Quagga now
- Bio-Bullets

Proactive Options for Internal Piping Systems

- Sand/media filtration - has to remove all particles greater than 40 micron
- Mechanical filtration - has to remove all particles greater than 40 micron

Example of 40 micron self cleaning filters

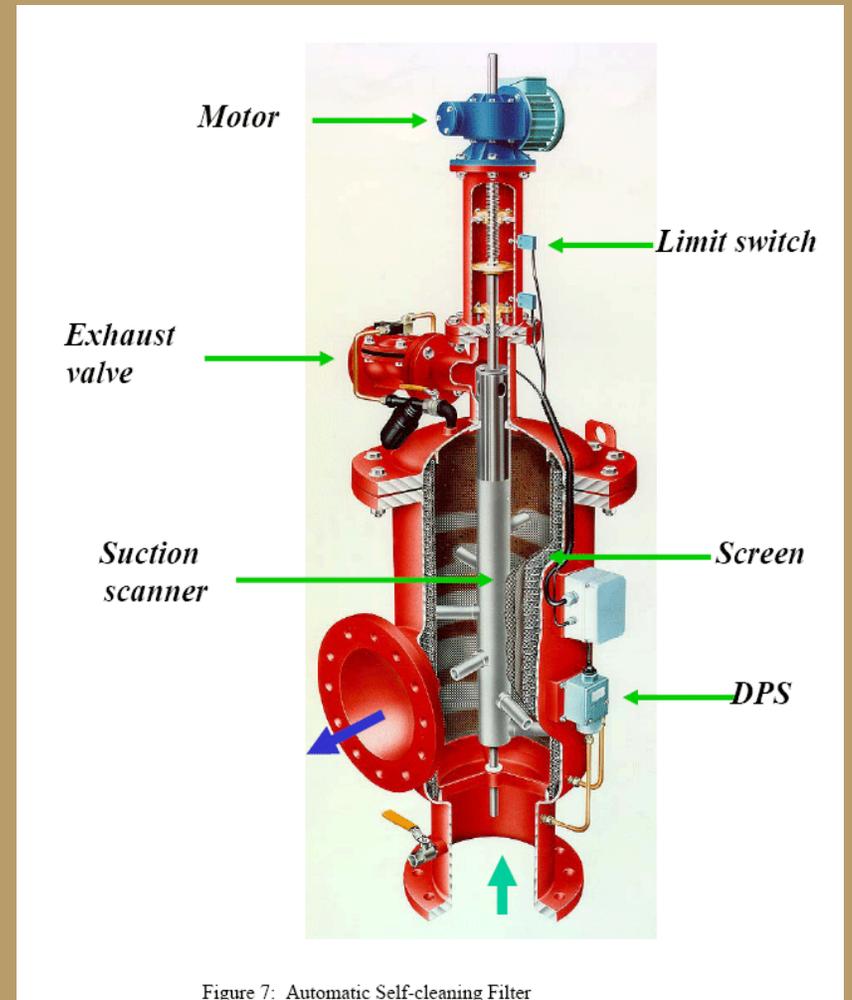
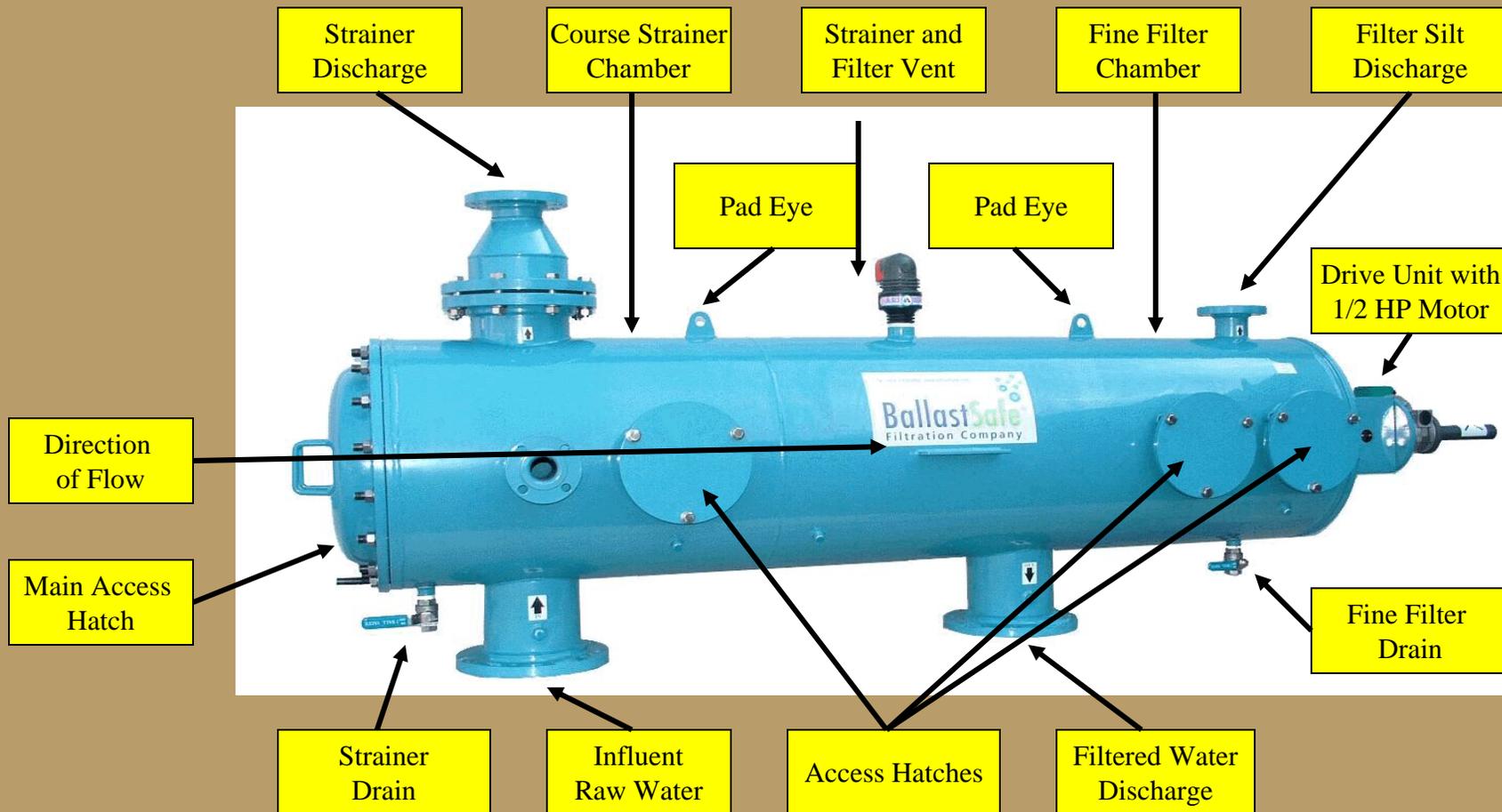


Figure 7: Automatic Self-cleaning Filter

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40 MICRON SELF CLEANING FILTER

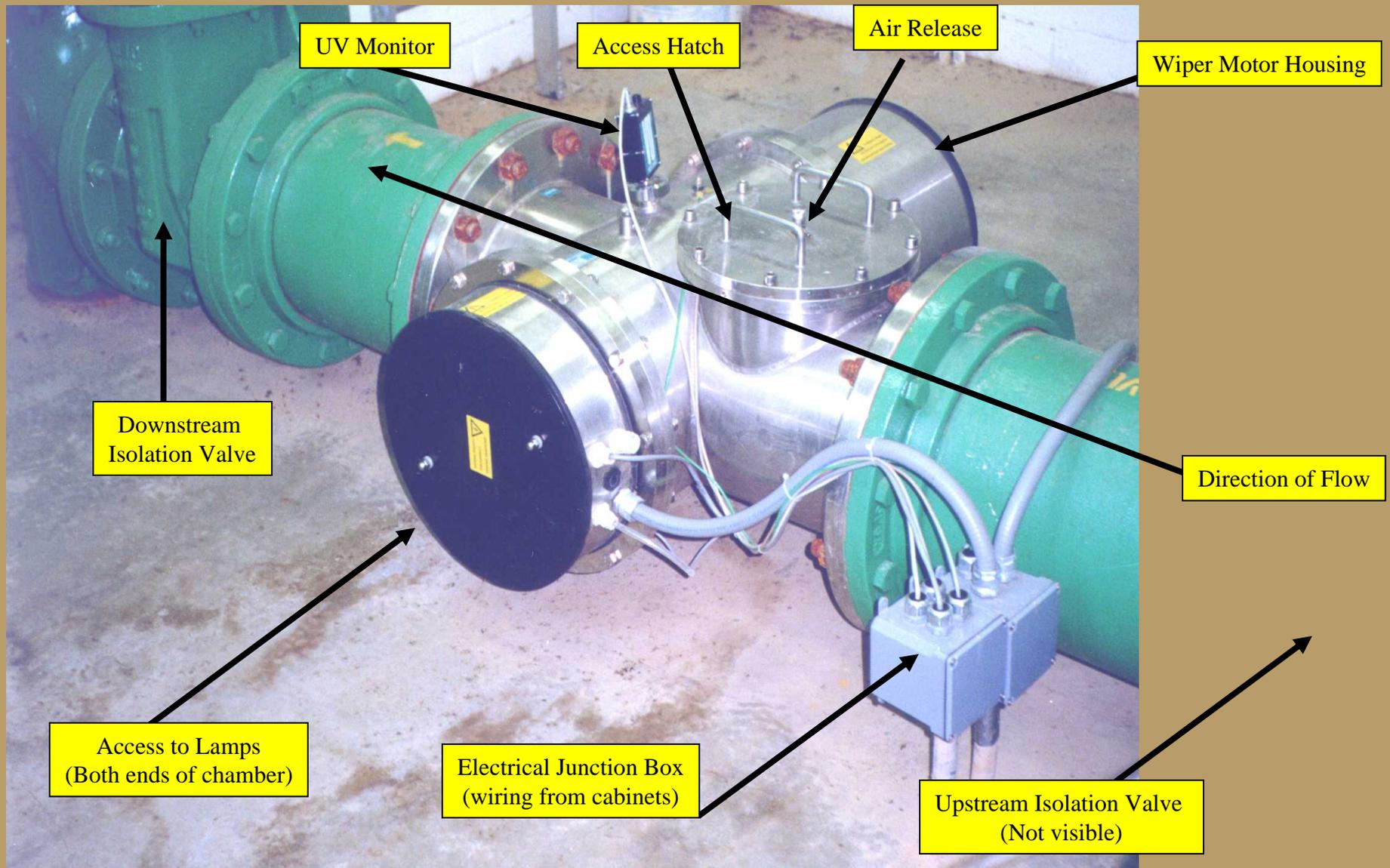


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Additional Proactive Options for Internal Piping Systems

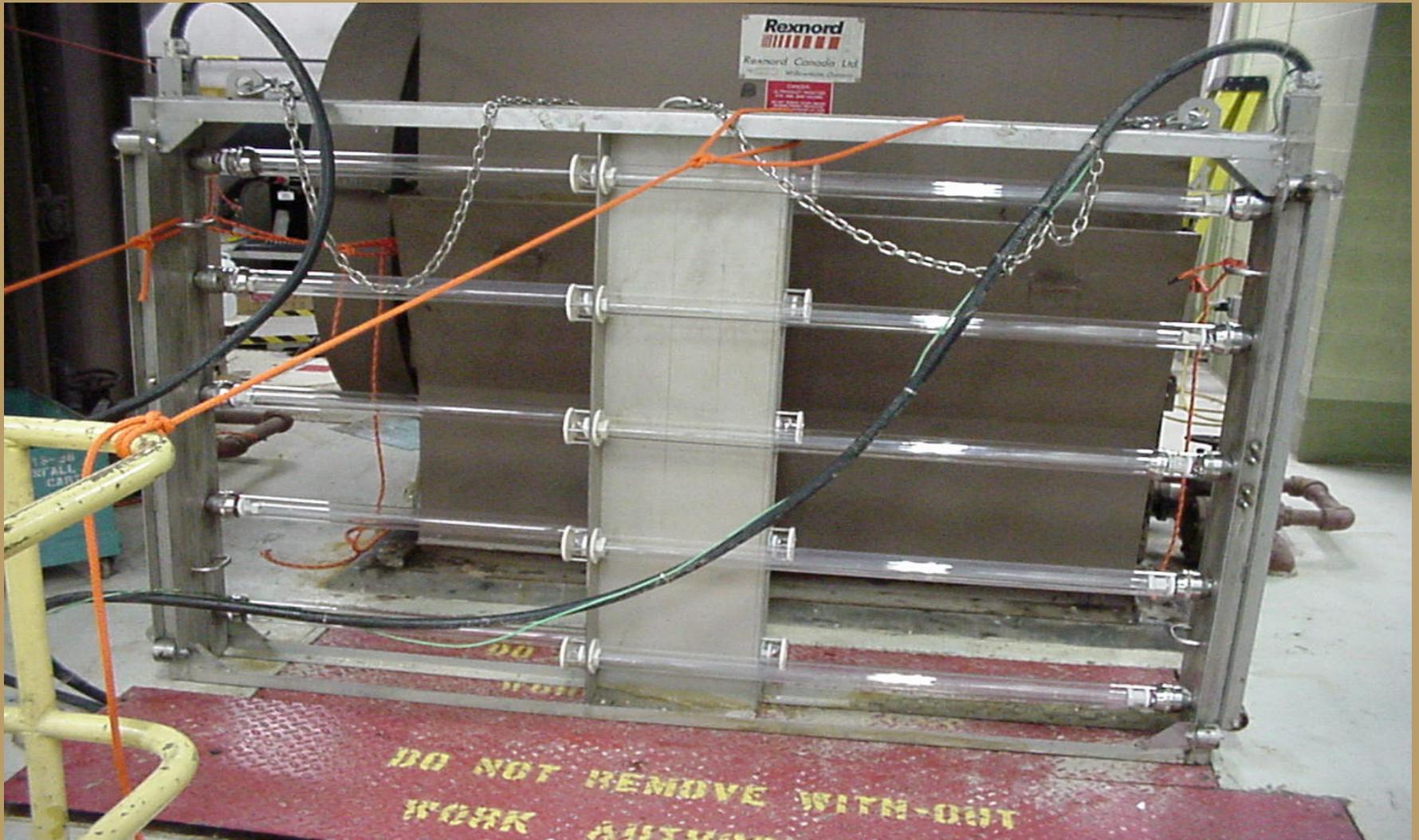
- UV systems
- Closed Loop Cooling
- Oxidizing chemicals
- Non-Oxidizing chemicals

In Line Pipeline UV Installation



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UV Light Bank for Open Channel



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QUESTIONS

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