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Village of Oswego

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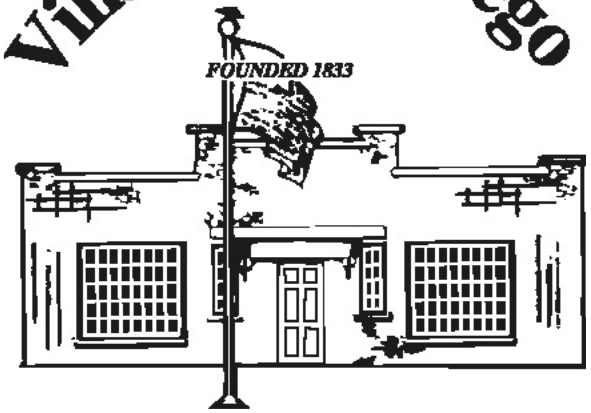

WRT

New Technology for Radium Removal at the Village of Oswego

From Evaluation through Full Scale Installation and Operation

Outline

- Introduction
- Evaluation of Treatment Technologies
- Pilot Study
- Design of Treatment System
- Fabrication and Construction
- Start-Up of Treatment Plants
- Summary

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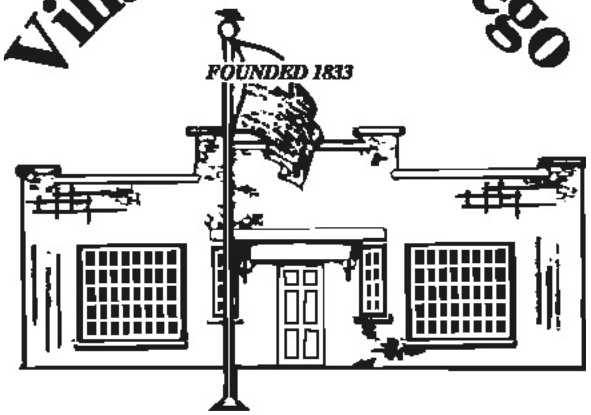

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Introduction

Village of Oswego

- Located approximately 40 miles southwest of Chicago
- Experiencing rapid growth, current population 22,000
- Water supply consists of five deep sandstone wells, plus 2 wells under construction
  - Capacities of 750 to 1,200 gpm
  - Radium levels range from 7 to 18 pCi/L
  - No other treatment, only the addition of chlorine and polyphosphate
- Entered into a compliance agreement with IEPA

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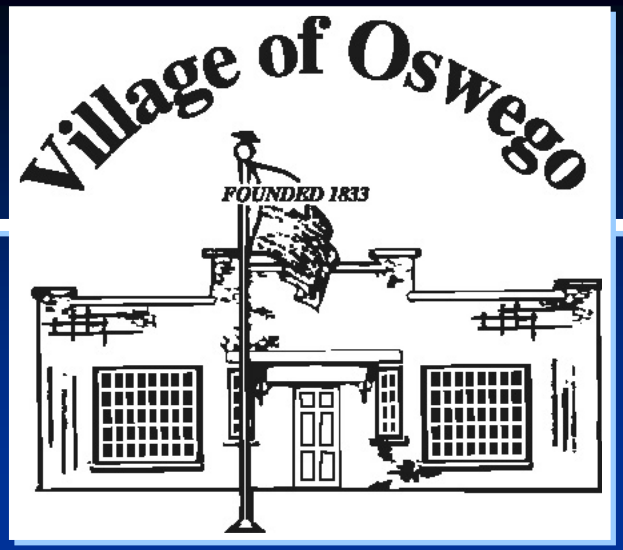

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Evaluation of Treatment Technologies

Comparison of Radium Treatment Technologies

	Z-88™ Ion Exchange	Conventional Ion Exchange	HMO	Reverse Osmosis	Lime Softening
NSF Std.61 Certified for use in potable water	Yes	Yes	Yes	Yes	Yes
Chemical Addition	No	Yes	Yes	Yes	Yes
Liquid Waste Generated	No	Yes	Yes	Yes	Yes
Changes in Other Water Quality Parameters	No	Yes	Yes	Yes	Yes
Type of Operation	Passive	Active	Active	Active	Active
Design Scale	Individual Well	Individual Well	Individual Well	Individual Well	Centralized Location
Disposal of Radium	Approved Landfill	Sewer	Sewer	Sewer	Land / Landfill
Combined Radium in Residuals (13 pCi/L in source water)	1,200-2,000 pCi/g	100-2,000 pCi/L	5,000-15,000 pCi/g	25-150 pCi/L	10-20 pCi/g of sludge
Equipment / Media Ownership	WRT	Utility	Utility	Utility	Utility
IDNS License Holder	WRT	?	?	?	?
Guaranteed Performance	Yes	No	No	No	No

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Increase In Radium for Disposal Resulting From New Regulations

- HMO, Conventional Ion Exchange and Reverse Osmosis
  - The summer water production in Oswego was 42% & 59% above the winter average during 2003 & 2004 respectively
  - Under new radium regulations, all water produced must meet the standard
  - For these treatment processes, the additional radium removed from irrigation water and other seasonal uses is discharged to sanitary sewers
  - Results in an increase in the annual amount of radium at the wastewater treatment plant of 18% & 22% for 2003 & 2004 respectively
  - Results in an increase in wastewater radium concentration during the summer months, especially during dry periods
- WRT Process
  - All radium is disposed of in a licensed and permitted LLRW (Low Level Radioactive Waste) facility
  - Results in a reduction in the amount of radium at the wastewater treatment plant

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Evaluation Treatment Technologies

- After an evaluation of alternatives and given the preferences of Oswego, the WRT process utilizing their Z-88 ™ media was selected
- Village preferred the simplicity of the WRT Process
  - Passive treatment system – no additional plant operators
  - No chemical handling, storage or feed systems
  - No liquid waste streams or sludge disposal issues
  - WRT retains ownership of equipment and media; ownership of spent media is transferred to the disposal site
- WRT Process was least expensive
  - No capital costs for equipment - $1.7 million savings over conventional ion exchange
  - Over twenty years; $500,000 savings over conventional ion exchange

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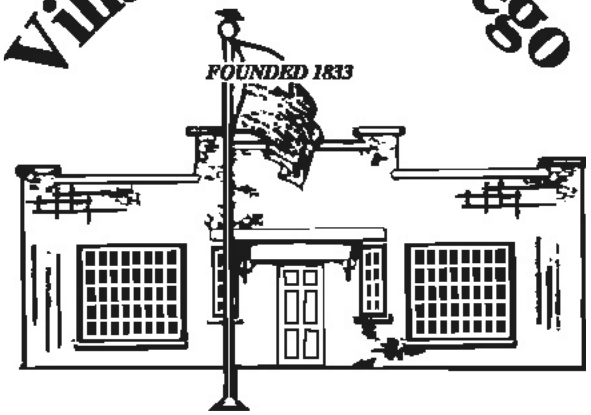

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Pilot Study

Pilot Study Phase

- Self contained pilot system was used for:
  - Demonstrating the technology
  - Determining media life
  - Establishing operating costs
  - Meeting regulatory requirements
- Utility monitored operation and collected samples
- Pilot unit and analytical services were provided by WRT

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Pilot Study Phase

Well capacity:	1,000 GPM
Alkalinity:	295 mg/L
Hardness:	229 mg/L
Iron:	0.28 mg/L
pH:	7.7
Gross alpha:	16.8 pCi/L
Radium 226:	9.1 pCi/L
Radium 228:	8.7 pCi/L
Comb. Ra 226,228:	17.8pCi/L
In Operation:	7/11/02 to 12/2/03

(3 months required by IEPA)

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Pilot Study Report - Oswego

Pilot Study Report

for

Z-88 ™ Radium Treatment Process

conducted at the

Village of Oswego, Illinois

in conjunction with

Smith Engineering Consultants, Inc.

November 13, 2002
www.wrtnet.com

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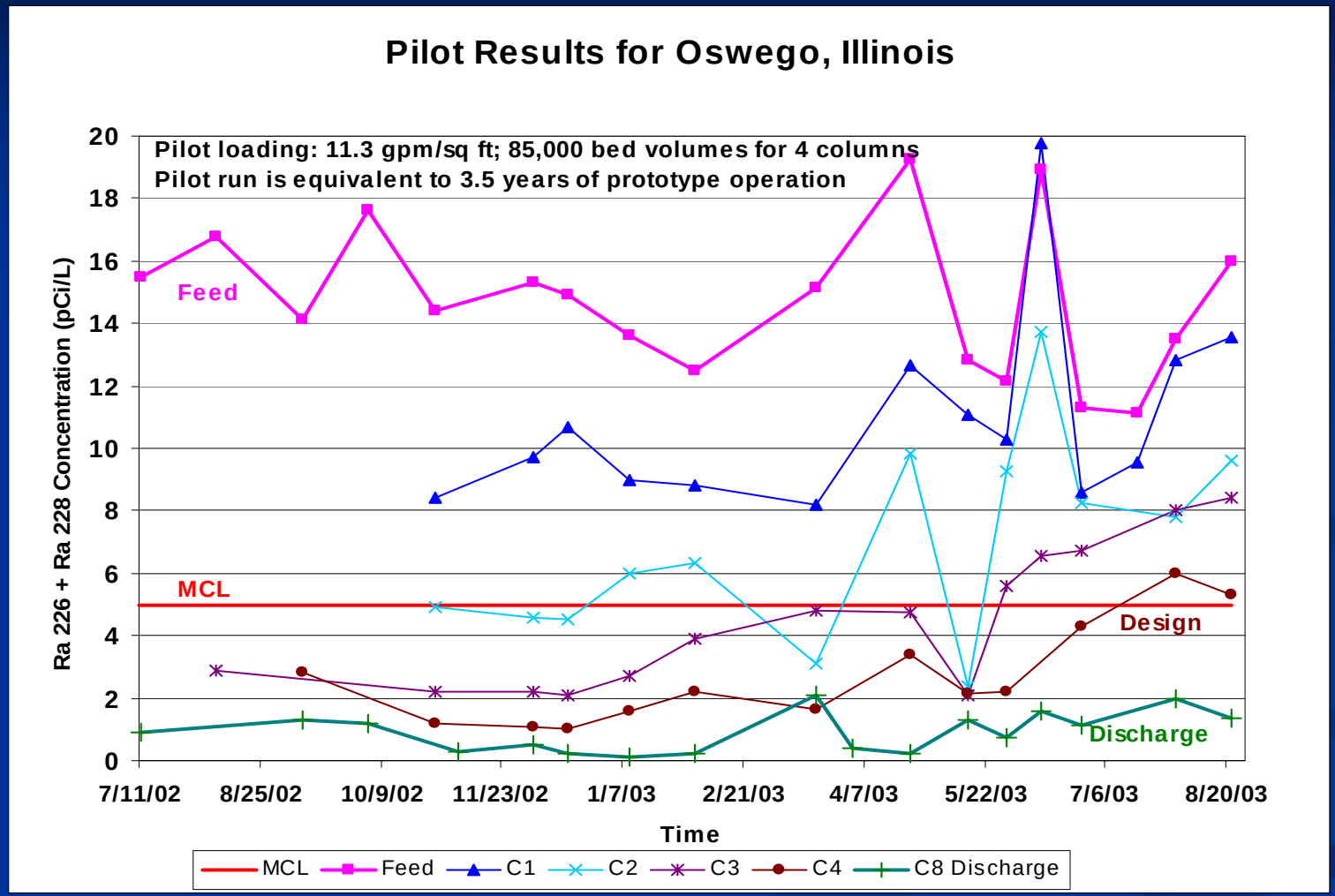
Pilot Study Report - Oswego



Oswego – Water Quality Data

Item	Pre WRT Process	Units	Post WRT Process
Alkalinity	361	mg/L	356
Antimony	< 0.006	mg/L	< 0.006
Arsenic	< 0.05	mg/L	< 0.05
Barium	< 1	mg/L	< 1
Beryllium	< 0.004	mg/L	< 0.004
Cadmium	< 0.005	mg/L	< 0.005
Calcium	56.9	mg/L	56.3
Chromium	< 0.05	mg/L	< 0.05
Copper	< 0.2	mg/L	< 0.2
Cyanide	< 0.007	mg/L	< 0.007
Fluoride	0.92	mg/L	0.93
Hardness	240	mg/L	260

Oswego – Water Quality Data

Item	Pre WRT Process	Units	Post WRT Process
Iron	0.3	mg/L	0.19
Lead	< 0.005	mg/L	< 0.005
Magnesium	22.4	mg/L	22.3
Mercury	< 0.2	µg/L	< 0.2
Nickel	< 0.1	mg/L	< 0.1
Nitrate + Nitrite as N	< 0.06	mg/L	< 0.06
Nitrite	< 0.06	mg/L	< 0.06
pH	6.84		6.74
Selenium	< 0.05	mg/L	< 0.05
Sodium	25.3	mg/L	24
Sulfate	13.2	mg/L	15.6
Total Dissolved Solids	318	mg/L	316

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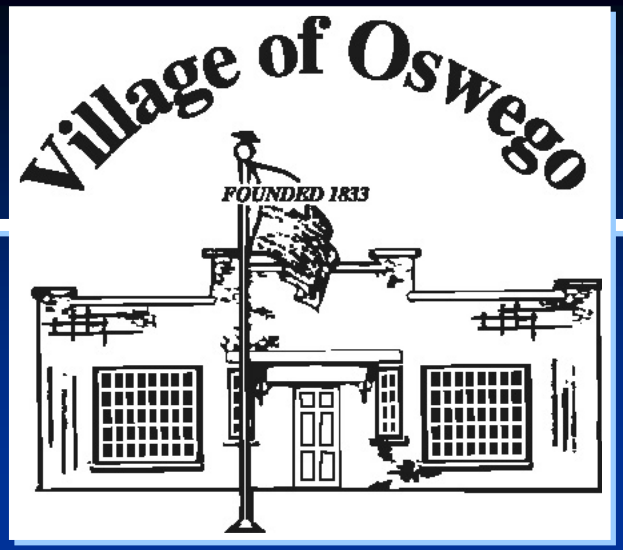

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Design of Treatment System

Design of Treatment System

- Design flow: 1,000 gpm
- Upflow, fluidized bed
- Single vessel with two stages
  - 11.0 ft. diameter
  - 22.0 ft. overall height
  - 5.25 ft. media per stage
- Total pressure drop <10psi
- Loading: 10.5 gpm/ft²
- Media life: 2 – 4+ years, varies with well site
- Post-treatment addition of polyphosphate and chlorine

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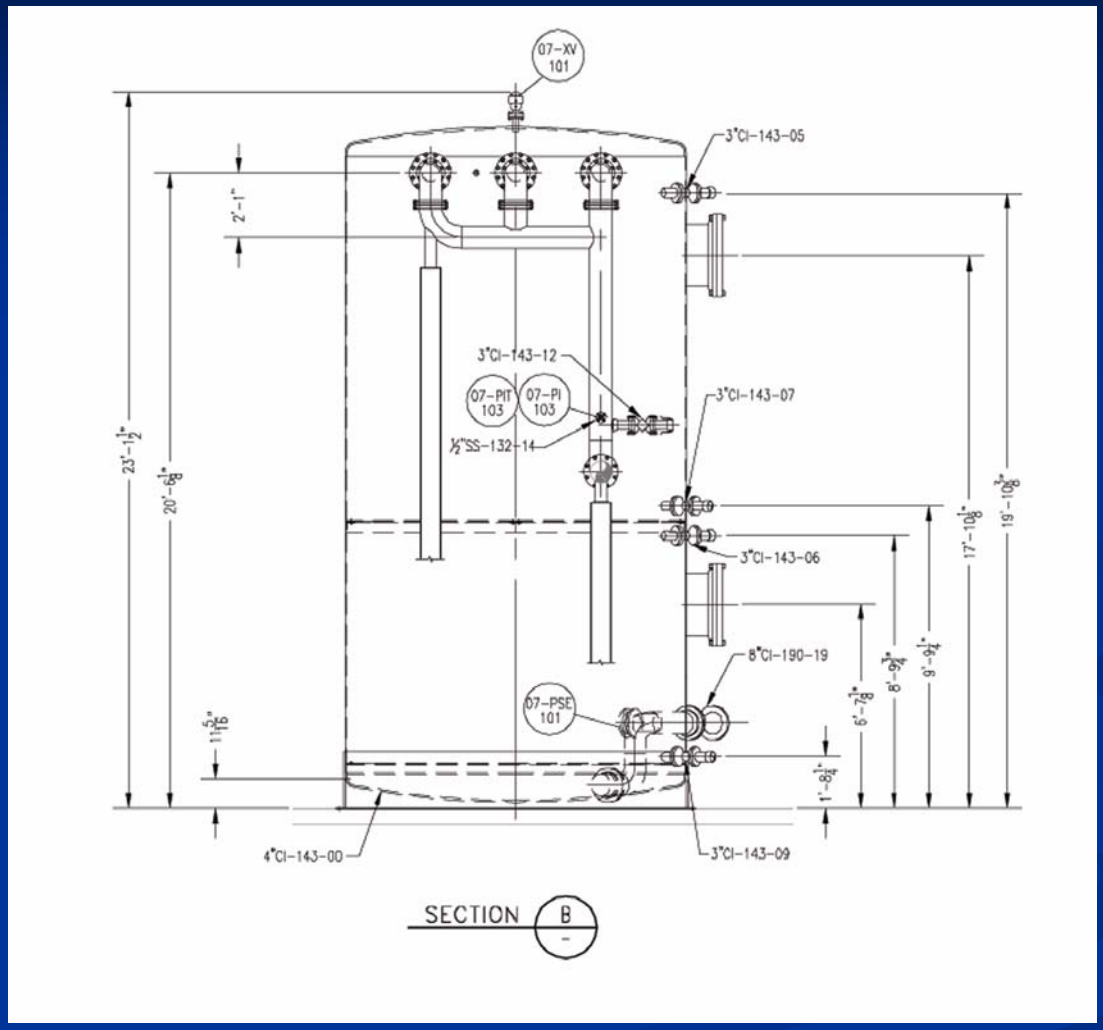
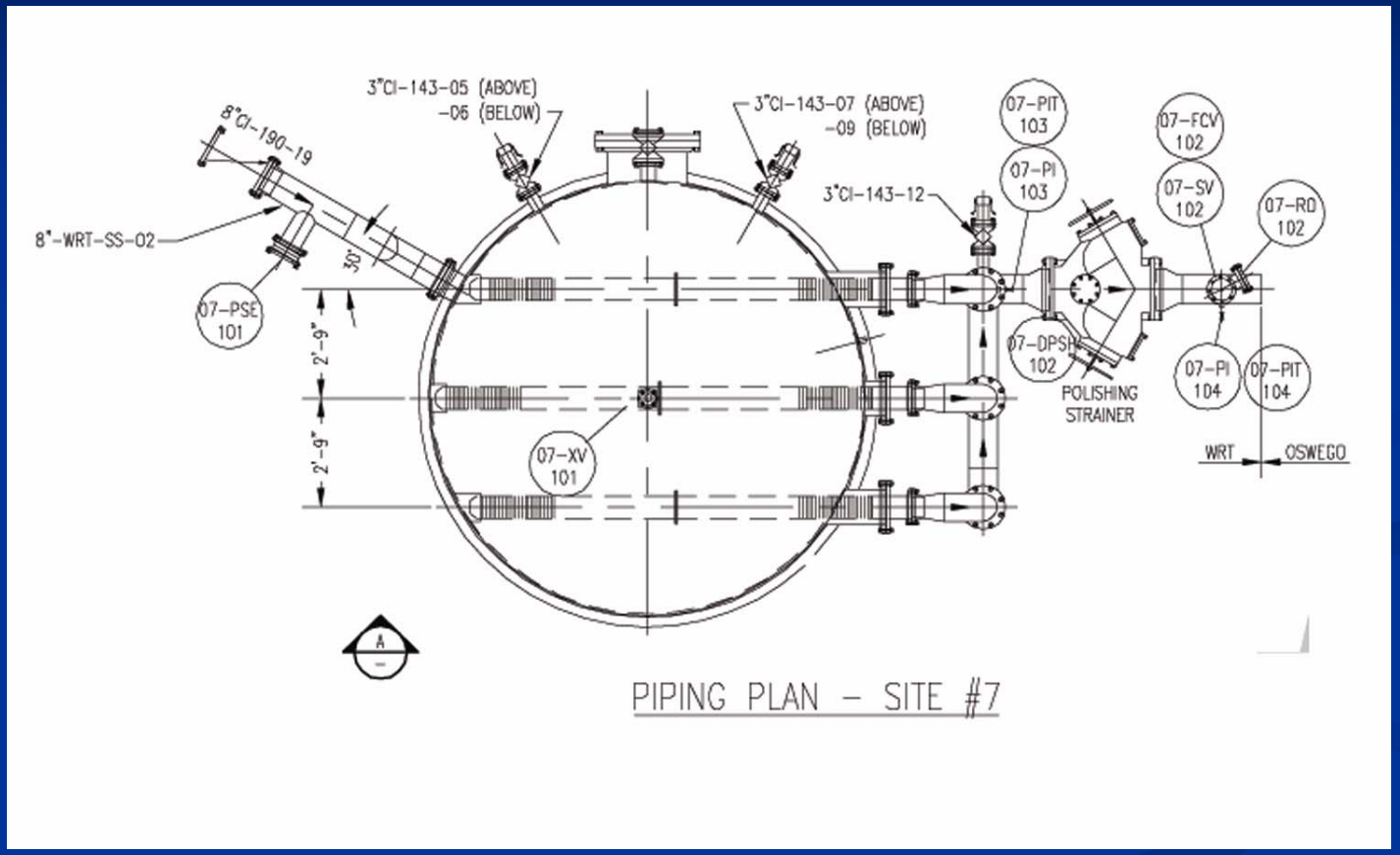
Design of Treatment System

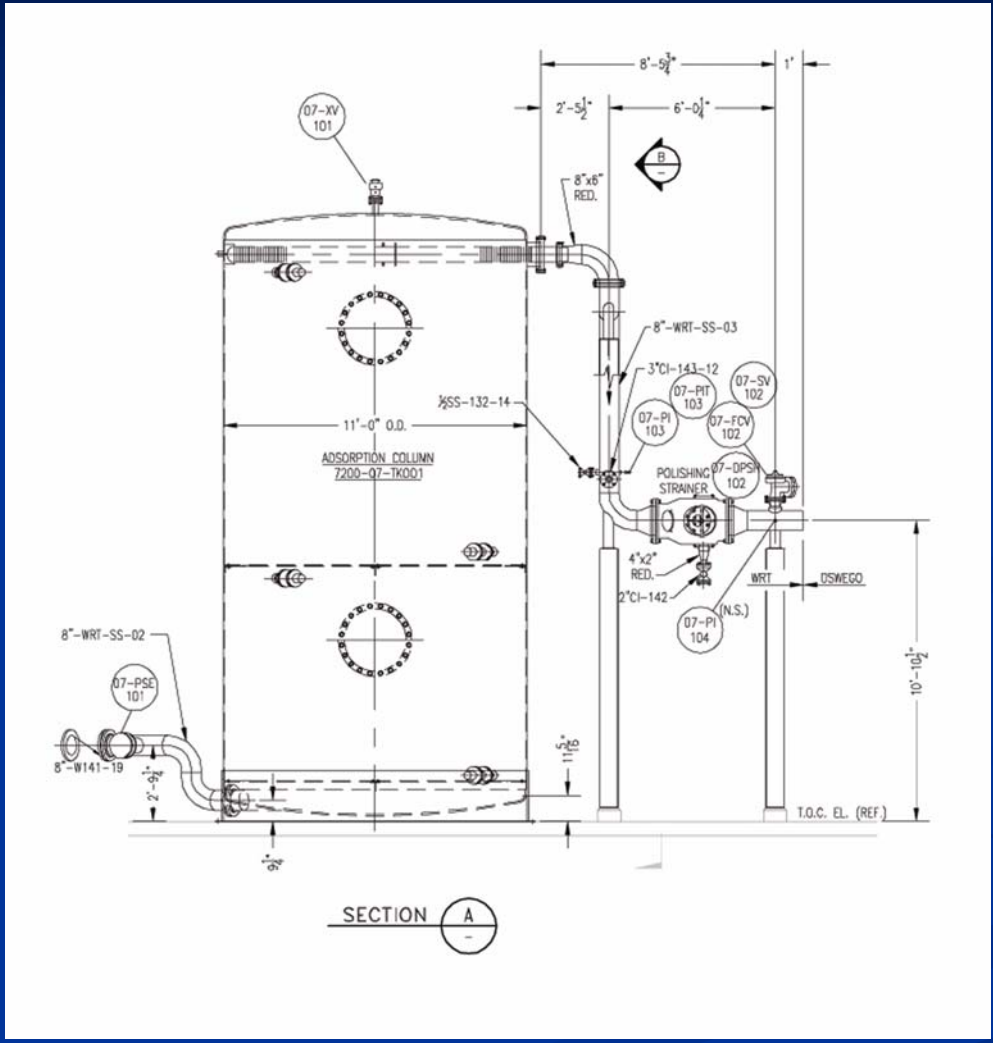


Design of Treatment System



Space required: 25 ft. x 25 ft.

Design of Treatment System



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Fabrication and Construction

Vessel Fabrication

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Construction Project

- Well House Additions – Radionuclide Compliance
  - Five Treatment Plants
    - Design flows: Four @ 1,000 gpm
One @ 750 gpm
    - Construction cost: $3.0 Million
    - Construction complete
- Well House/Treatment Buildings – New wells
  - Two Treatment Plants
    - Design flow: Two @ 1,200 gpm
    - Construction cost: $2.6 Million
    - Under construction
- Well house additions and new buildings designed by PHN Architects

Construction

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Installation

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Installation

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Installation

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Media Installation

Smith Engineering

Village of Oswego

WRT

Completed Installation

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Village of Oswego

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Completed Installation

Smith Engineering

Village of Oswego

WRT

Completed Construction

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Village of Oswego

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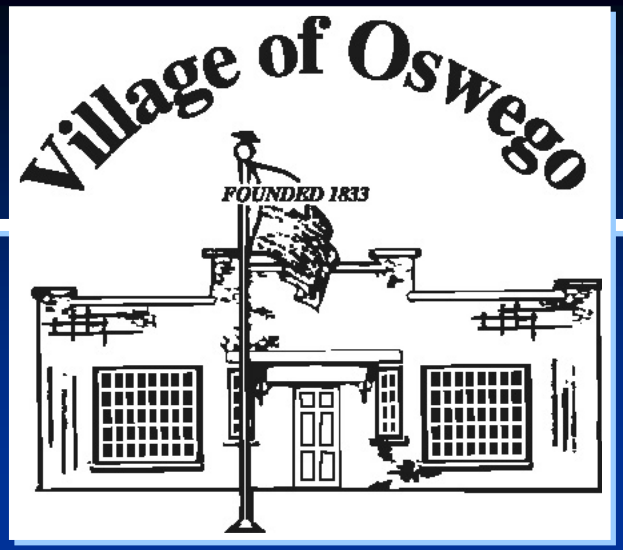

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Start-up of Treatment Plants

Start-up of Treatment Plants

- Start-up
  - Media rinsing and disinfection is required prior to on-line operation
  - Media rinsing equipment and procedure required modifications based on the experience with the first vessel
- Operating results

	Oswego Well No. 7		Oswego Well No. 6	
	Feed (pCi/L)	Discharge (pCi/L)	Feed (pCi/L)	Discharge (pCi/L)
Combined Radium	16.5	1.1	5.3	1.0

Start-up of Treatment Plants

- IEPA operating permit has been issued for one well site
- Ready for on-line operation pending formal approval of IDNS licensing agreement with WRT
- Media needs to be loaded and disinfected at three sites

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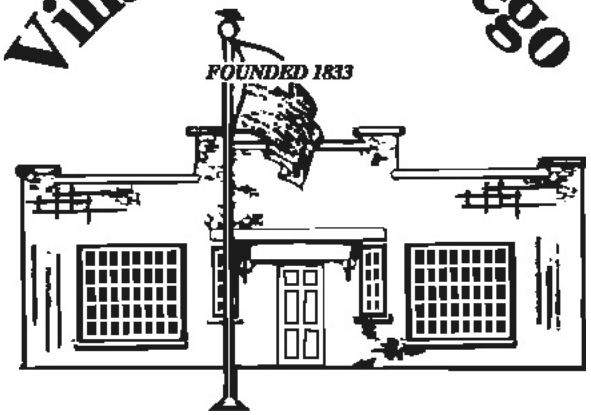

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Summary

Summary

- Pilot studies of WRT process have shown very good results
- Initial testing has confirmed performance of pilot unit
- Media life will exceed two years – depends on radium levels and volume treated
- Oswego selected the WRT Process for the following reasons:
  - Passive treatment system – no additional plant operators
  - No chemical handling, storage or feed systems
  - No liquid waste streams or sludge disposal issues
  - No change in other water quality parameters
  - Produces water with low average radium levels ~ 2.5 pCi/L avg.
  - Least expensive process over a twenty year period
  - Equipment is owned by WRT, ownership of spent media is transferred to disposal site

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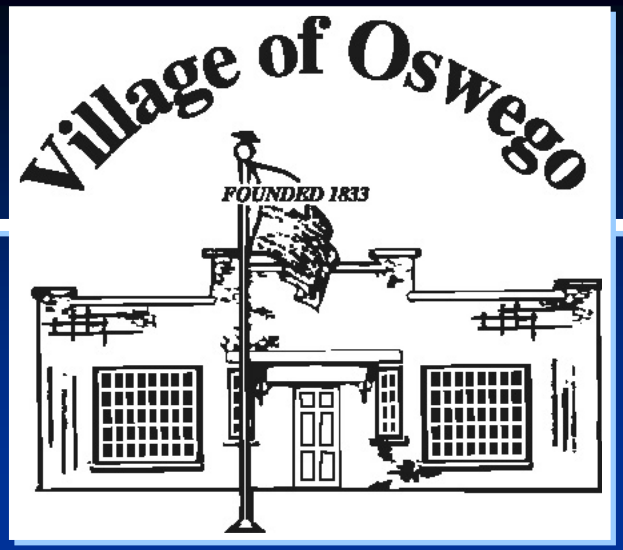
Village of Oswego

WRT

Summary

- Oswego radionuclide project was a cooperative effort between the Village of Oswego, Smith Engineering Consultants, WRT, and the IEPA
- Designing and building five “first of their kind” treatment systems using a new technology was both challenging and rewarding



Questions?

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