Software Program to Ascertain Radionuclide Residual Concentrations (SPARRC) Model

SPARRC Model Overview

➤ **Input influent water quality and treatment information to estimate:**

- Quantity & concentrations of radium and uranium in residuals

- Disposal costs
  - Complete for IX, RO, AA, green sand
  - Not complete for coagulation/filtration and lime softening

SPARRC Model Overview, cont.
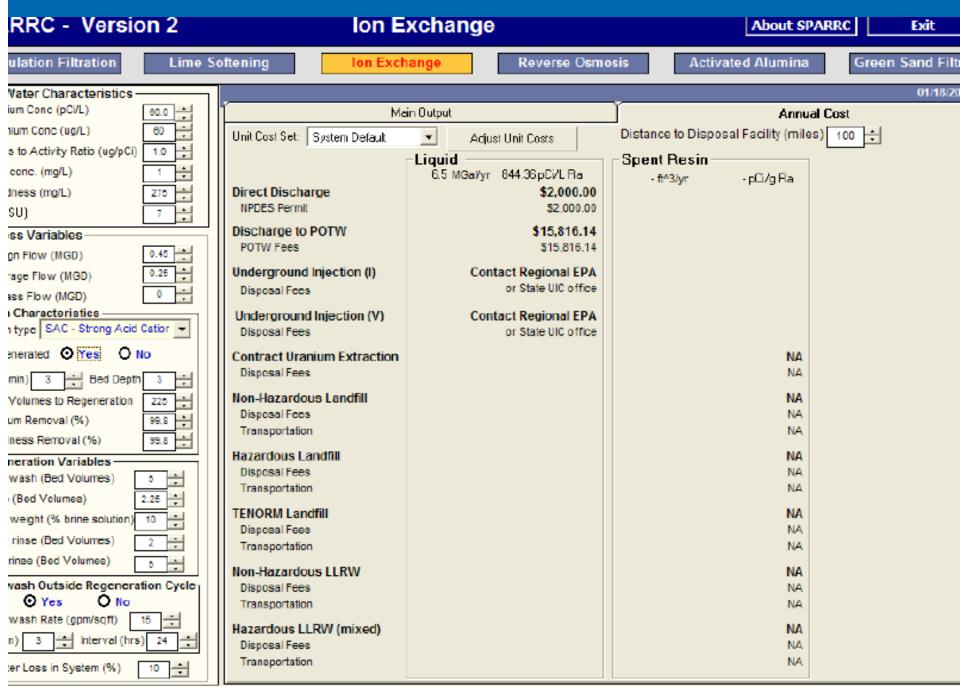
➢ **Version 2 developed in 2006**

- Interim release (no external peer review)

➢ **Model is not intended to:**

- Establish regulatory requirements

- Assist with design of process equipment

- Account for state or local restrictions on disposal

ulation Filtration | Lime Softening | **Ion Exchange** | Reverse Osmosis | Activated Alumina | Green Sand Filt

Water Characteristics

ium Conc (pCi/L)	80.0
nium Conc (ug/L)	60
s to Activity Ratio (ug/pCi)	1.0
conc. (mg/L)	1
ness (mg/L)	275
SU)	7

ss Variables

gn Flow (MGD)	0.45
rage Flow (MGD)	0.25
ss Flow (MGD)	0

Characteristics

n type: SAC - Strong Acid Catior

enerated ⦿ Yes ○ No

min)	3	Bed Depth 3
Volumes to Regeneration	225	
um Removal (%)	99.8	
ness Removal (%)	99.8	

neration Variables

wash (Bed Volumes)	5
(Bed Volumes)	2.25
weight (% brine solution)	10
rinse (Bed Volumes)	2
rinse (Bed Volumes)	5

wash Outside Regeneration Cycle
⦿ Yes ○ No

wash Rate (gpm/sqft)	15
n) 3 Interval (hrs)	24
er Loss in System (%)	10

01/18/20

Main Output | **Annual Cost**

	Treated Water		Finished Water
Flow	0.25	mgd	0.25
Radium removal	99.8	percent	99.8
Uranium removal	0.0	percent	0.0
Hardness removal	99.80	percent	99.80
Radium Concentration	0.1	pCi/L	0.1
Uranium Concentration	60.0	ug/L	60.0
Hardness	0.5	mg/L CaCO3	0.5

Resin Volume 125.3 ft3   Regeneration Level 15.17 lb NaCl/ft3 resin   NaCl Applied 4.16 eq NaCl /L
Weight 5264.0 lb   Hardness Capacity 1.24 eq CaCO3 / L   Regeneration Efficiency 3.37 eq NaCl/eq C

Regeneration Waste (brine + slow rinse)
Volume 3984 gal/event   Hardness Concentration 14529.7 mg CaCO3 / L   Time to Breakthrough 20.25
Flow 4722 gal/day   Excess NaCl 40313.4 mg NaCl / L   Total Dissolved Solids 32190.0

Radium
Concentration 3170.12 pCi/L

Uranium
SAC may be applicable to the removal of uranium at pH < 6

Additional Regeneration Waste Volume (fast rinse + backwash) 9375 gal/event 11111 gal/day 4055556 ga
Backwash Waste Volume Outside Regeneration Cycle 1880 gal/event 1880 gal/day 680205 ga

Total Waste (brine + slow rinse + fast rinse + backwash + backwash outside regeneration cycle)
Volume 17713 gal/d   Solid 2.09 lb/d

Radium

Concentration	844.36	pCi/L
Wet Basis	0.84	pCi/g
Dry Basis	59832.13	pCi/g
Removal	5.66E+07 pCi/day	0.020654 Ci/year
POTW Concentration	61.7	pCi/L

Uranium
Strong Acid Cation (SAC) might be applicable for the removal of uranium at pH less then 6, however, it might not be practical

4

ulation Filtration   Lime Softening   **Ion Exchange**   Reverse Osmosis   Activated Alumina   Green Sand Filt

01/18/20

Water Characteristics

ium Conc (pCi/L)	80.0
nium Conc (ug/L)	60
s to Activity Ratio (ug/pCi)	1.0
conc. (mg/L)	1
dness (mg/L)	275
SU)	7

ss Variables

gn Flow (MGD)	0.45
rage Flow (MGD)	0.25
ass Flow (MGD)	0

Characteristics

n type SAC - Strong Acid Cation

enerated ⊙ Yes   ○ No

min) 3   Bed Depth 3

Volumes to Regeneration 225

um Removal (%) 99.8

ness Removal (%) 99.8

neration Variables

wash (Bed Volumes)	5
(Bed Volumes)	2.25
weight (% brine solution)	10
rinse (Bed Volumes)	2
rinse (Bed Volumes)	5

wash Outside Regeneration Cycle
⊙ Yes   ○ No

wash Rate (gpm/sqft) 15

n) 3   Interval (hrs) 24

er Loss in System (%) 10

Main Output   **Annual Cost**

Unit Cost Set: System Default ▼   Adjust Unit Costs   Distance to Disposal Facility (miles) 100

Liquid
6.5 MGal/yr   844.36 pCi/L Ra

Spent Resin
- ft^3/yr   - pCi/g Ra

	Liquid	Spent Resin
Direct Discharge	**$2,000.00**	
NPDES Permit	$2,000.00	
Discharge to POTW	**$15,816.14**	
POTW Fees	$15,816.14	
Underground Injection (I)	Contact Regional EPA	
Disposal Fees	or State UIC office	
Underground Injection (V)	Contact Regional EPA	
Disposal Fees	or State UIC office	
Contract Uranium Extraction		NA
Disposal Fees		NA
Non-Hazardous Landfill		NA
Disposal Fees		NA
Transportation		NA
Hazardous Landfill		NA
Disposal Fees		NA
Transportation		NA
TENORM Landfill		NA
Disposal Fees		NA
Transportation		NA
Non-Hazardous LLRW		NA
Disposal Fees		NA
Transportation		NA
Hazardous LLRW (mixed)		NA
Disposal Fees		NA
Transportation		NA

For More Information

➢ Model and user's guide available at:

- http://www.npdespermits.com/sparrc/

➢ Contact EPA