Case Study # 1

Scenario

Small community comprised of 100 people is served water by 40 taps. The source is a groundwater well with elevated radium and iron.

Current treatment includes chlorine addition and iron filtration; the backwash is discharged to land.

Community is served by a centralized wastewater treatment facility

System is participating in the Arkansas Valley Conduit Project

Step 1 – Define the problem

Issues being faced: radionuclide violation, unpermitted discharge, worker exposure to radiation

Problem Statement: Our community must identify an option that will achieve the following goals

- Compliance with the radionuclide rule
- Eliminate existing waste handling and worker exposure issues
- Provide a reasonable means of managing waste
- Can provide water to meet projected 20 year demands
- Is cost effective and affordable to our community

Step 2 – Identify Driving Issues

The following items are the issues that were of greatest concern to this community:

- Capital and O & M costs, and ultimately the impact to rate payers
- Ability to achieve compliance with the Radionuclide Rule
- Ability to achieve and maintain compliance with applicable waste handling requirements
- Aesthetic quality of finished water
- Ease of operations
- Reliability of treatment processes
- Minimizes system liability
- Worker safety

Step 3 – Identify all possible alternatives and screen for feasibility

Alternatives	Can Achieve Rad Comp?	Acceptable Waste Mngt?	Significant Pros and Cons of Option		Significant Pros and Cons of Option		Evaluate Further?
New well or surface water source	No	No	An alternate source is available	P	Water quality does not meet radionuclide standards and is high in iron	C	No
Consolidation w compliant system (Arkansas Valley Conduit)	Yes	?	System can implement appropriate interim measure	P	Iron filtration can be removed and a sequestering system can be installed, will need further evaluation	P	**Yes**
Proprietary treatment technology 1	Yes	No	Acceptable contract terms, liability, etc.	P	Does not remove Fe, pretreatment will be required and therefore does not resolve waste handling issues	C	No
Proprietary treatment technology 2	Yes	Yes	Acceptable contract terms, liability, etc.	P	Fe and Ra co-removed and waste be can managed acceptably	P	**Yes**
HMO/Filtration/ Evap pond	Yes	Yes	Fe and Ra co-removed and waste can managed acceptably	P	Strategy to minimize radionuclide build-up in filters, will need further evaluation	P	**Yes**
HMO/Filtration/Discharge to WWTF	Yes	Yes	Does the WWTF have the hydraulic capacity to handle this waste stream	P	HMO sludge will accumulate in biosolids at WWTF, system feels it can adequately manage	P	**Yes**
Fe Filtration/IX/Evap pond	Y	Y	Evap pond must be sized to handle IX brine and may also need to handle filtration waste stream	P	Strategy to minimize radionuclide build-up in filters, will need further evaluation	P	**Yes**
Fe Filtration/IX/Discharge to POTW	Y	Y	Does the POTW have the hydraulic capacity to handle this waste stream	P	Rads will be in biosolids and liquid discharge, system not confident that it will meet discharge limits	C	No
RO/Discharge to POTW	Y	Y	System feels it may be possible to operate without iron filtration pretreatment	P	Rads will be in biosolids and liquid discharge, system not confident that it will meet discharge limits	C	No
RO/Discharge to surface water or groundwater	Y	N	System feels it may be possible to operate without iron filtration pretreatment	P	It does not appear that discharge could meet anticipated Preliminary Effluent Limits	C	No
Point-of-use treatment	Y	Y	System can meet all legal requirements	P	Does not eliminate iron filtration residuals	C	No

Step 4 – Develop selection criteria and weighting factors

Capital and O & M costs, and ultimately the impact to rate payers	50 %
Reliability of treatment processes to meet regulatory requirements	25 %
Aesthetic quality of finished water	10 %
Ease of operations	5 %
Minimizes system liability	5 %
Worker safety	5 %

Step 5 – Conduct analysis of potentially feasible solutions

	Arkansas Valley Conduit	Proprietary treatment technology 2	HMO/Filtration/ Evap pond	HMO/Filtration/Discharge to POTW	Fe Filtration/IX/Evap pond
Capital Costs	Annualized in O & M	$150,000	$600,000	$250,000	$700,000
Annual O & M	$15,000	$70,000	$40,000	$25,000	$35,000
Monthly Tap Share*	$30	$173	$190	$100	$200
% of MHI	1.1	6.6	7.3	3.8	7.7

*Tap share does not include potential reductions due to grant money

Step 6 – Select Alternative

It is clear that any of the above compliance options can likely meet the following requirements:

- Compliance with the radionuclide rule
- Eliminate existing waste handling and worker exposure issues
- Provide a reasonable means of managing waste
- Can provide water to meet projected 20 year demands

However, only the Arkansas Valley Conduit option can meet the following requirement:

- Is cost effective and affordable to our community

Therefore, this community would likely select this option as its best compliance strategy. The only drawback to this option is that it will take up to 10 years to be completed.

Please note, if a system can make a case that there is a significant advantage to pursuing a long term project such as the Arkansas Valley Conduit, the Water Quality Control Division is open to negotiating an Enforcement Order on Consent that would include an appropriate compliance schedule to allow for such participation and may include stipulations to implement measures to mitigate consumer risks until the project is complete. In order to begin such negotiation, systems should have their engineer perform an evaluation similar to that shown in this case study. This evaluation should be clearly documented in a Preliminary Engineering Report and submitted to WQCD for review.

Case Study # 2

Scenario

Small community comprised of 100 people is served water by 40 taps. The source is a groundwater well with elevated radium and iron.

Current treatment includes chlorine addition and iron filtration; the backwash is discharged to land.

Community is served by a centralized wastewater treatment facility

System is **not** participating in the Arkansas Valley Conduit Project

Step 1 – Define the problem

Issues being faced: radionuclide violation, unpermitted discharge, worker exposure to radiation

Problem Statement: Our community must identify an option that will achieve the following goals

- Compliance with the radionuclide rule
- Eliminate existing waste handling and worker exposure issues
- Provide a reasonable means of managing waste
- Can provide water to meet projected 20 year demands
- Is cost effective and affordable to our community

Step 2 – Identify Driving Issues

The following items are the issues that were of greatest concern to this community:

- Capital and O & M costs, and ultimately the impact to rate payers
- Ability to achieve compliance with the Radionuclide Rule
- Ability to achieve and maintain compliance with applicable waste handling requirements
- Aesthetic quality of finished water
- Ease of operations
- Reliability of treatment processes
- Minimizes system liability
- Worker safety

Step 3 – Identify all possible alternatives and screen for feasibility

Alternatives	Can Achieve Rad Comp?	Acceptable Waste Mngt?	Significant Pros and Cons of Option		Significant Pros and Cons of Option		Evaluate Further?
New well or surface water source	No	No	An alternate source is available	P	Water quality does not meet radionuclide standards and is high in iron	C	No
Consolidation w compliant system	Yes	?	No nearby systems available	C			No
Proprietary treatment technology 1	Yes	No	Acceptable contract terms, liability, etc.	P	Does not remove Fe, pretreatment will be required and therefore does not resolve waste handling issues	C	No
Proprietary treatment technology 2	Yes	Yes	Acceptable contract terms, liability, etc.	P	Fe and Ra co-removed and waste be can managed acceptably	P	**Yes**
HMO/Filtration/ Evap pond	Yes	Yes	Fe and Ra co-removed and waste can managed acceptably	P	Strategy to minimize radionuclide build-up in filters, will need further evaluation	P	**Yes**
HMO/Filtration/Discharge to WWTF	Yes	Yes	Does the WWTF have the hydraulic capacity to handle this waste stream	P	HMO sludge will accumulate in biosolids at WWTF, system feels it can adequately manage	P	**Yes**
Fe Filtration/IX/Evap pond	Y	Y	Evap pond must be sized to handle IX brine and may also need to handle filtration waste stream	P	Strategy to minimize radionuclide build-up in filters, will need further evaluation	P	**Yes**
Fe Filtration/IX/Discharge to POTW	Y	Y	Does the POTW have the hydraulic capacity to handle this waste stream	P	Rads will be in biosolids and liquid discharge, system not confident that it will meet discharge limits	C	No
RO/Discharge to POTW	Y	Y	System feels it may be possible to operate without iron filtration pretreatment	P	Rads will be in biosolids and liquid discharge, system not confident that it will meet discharge limits	C	No
RO/Discharge to surface water or groundwater	Y	N	System feels it may be possible to operate without iron filtration pretreatment	P	It does not appear that discharge could meet anticipated Preliminary Effluent Limits	C	No
Point-of-use treatment	Y	Y	System can meet all legal requirements	P	Does not eliminate iron filtration residuals	C	No

Step 4 – Develop selection criteria and weighting factors

Capital and O & M costs, and ultimately the impact to rate payers	50 %
Reliability of treatment processes to meet regulatory requirements	25 %
Aesthetic quality of finished water	10 %
Ease of operations	5 %
Minimizes system liability	5 %
Worker safety	5 %

Step 5 – Conduct analysis of potentially feasible solutions

	Proprietary treatment technology 2	HMO/Filtration/ Evap pond	HMO/Filtration/Discharge to POTW	Fe Filtration/IX/Evap pond
Capital Costs	$150,000	$600,000	$250,000	$700,000
Annual O & M	$70,000	$40,000	$25,000	$35,000
Monthly Tap Share*	$173	$190	$100	$200
% of MHI	6.6	7.3	3.8	7.7

*Tap share does not include potential reductions due to grant money

Step 6 – Select Alternative

It is clear that any of the above compliance options can likely meet the following requirements:

- Compliance with the radionuclide rule
- Eliminate existing waste handling and worker exposure issues
- Provide a reasonable means of managing waste
- Can provide water to meet projected 20 year demands

However, none of these options can meet this requirement:

- Is cost effective and affordable to our community

Therefore, this community is in a difficult position. The HMO/Filtration/Discharge to POTW is the cheapest option, but would either require significant grant funds and/or additional time to procure funds.

If a system is in this position, the Water Quality Control Division is open to negotiating an Enforcement Order on Consent that would include an extended enforcement order that would likely include stipulations requiring systems to implement measures to mitigate consumer risks and also require systems to take actions to improve its financial capacity and build capital reserve funds so that eventually the cheapest alternative could be implemented. In order to begin such negotiation, systems should have their engineer perform an evaluation similar to that shown in this case study. This evaluation should be clearly documented in a Preliminary Engineering Report and submitted to WQCD for review.