

From: Eva Steinle-Darling
Sent: Tue, 22 Apr 2014 09:50:50 -0700
To: daniel.nix@wichitafallstx.gov
Subject: Texas Water DPR monitoring presentation follow-up
Attachments: 2014_TX-Water_ESD.pdf

Hello Daniel,

It was very nice to talk with you at the Awards Breakfast at Texas Water last week. I was very interested to hear about the progress of your emergency water supply project. I bet you didn't realize that your outreach video had made you a recognizable celebrity in certain circles!

We discussed your current monitoring requirements, which was also the subject of my presentation later that day and I recalled you expressing some interest in the content of the presentation. I didn't see you in the audience (I apologize if I missed you!), so I thought I would pass along my slides in case you'd like to look over them. I would also be happy to answer any questions you might have about our research work at the CRMWD at Big Spring or at the national level with the WaterReuse Research Foundation.

Also, the National Water Research Institute and the National Science Foundation are co-sponsoring a workshop in Austin in a few weeks that I am helping organize. The workshop will bring together a small number of experts in treatment and public health to answer the question of what wastewater effluent quality should be to be considered an acceptable source water for potable use. This would be in a very informal setting focused on open discussion between the participants. The exact date is still to be determined, but we are currently planning to meet during one day in the first week of June.

We would be delighted if you or someone else from Wichita Falls were able to make it and share your perspective with our experts. Please let me know if you would be interested and I will keep you in the loop as planning for the workshop progresses.

Best,
Eva

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WATER IS OUR FOCUS, OUR BUSINESS, AND OUR PASSION

Monitoring Framework for Direct Potable Reuse

April 16, 2014
Texas Water in Dallas, TX

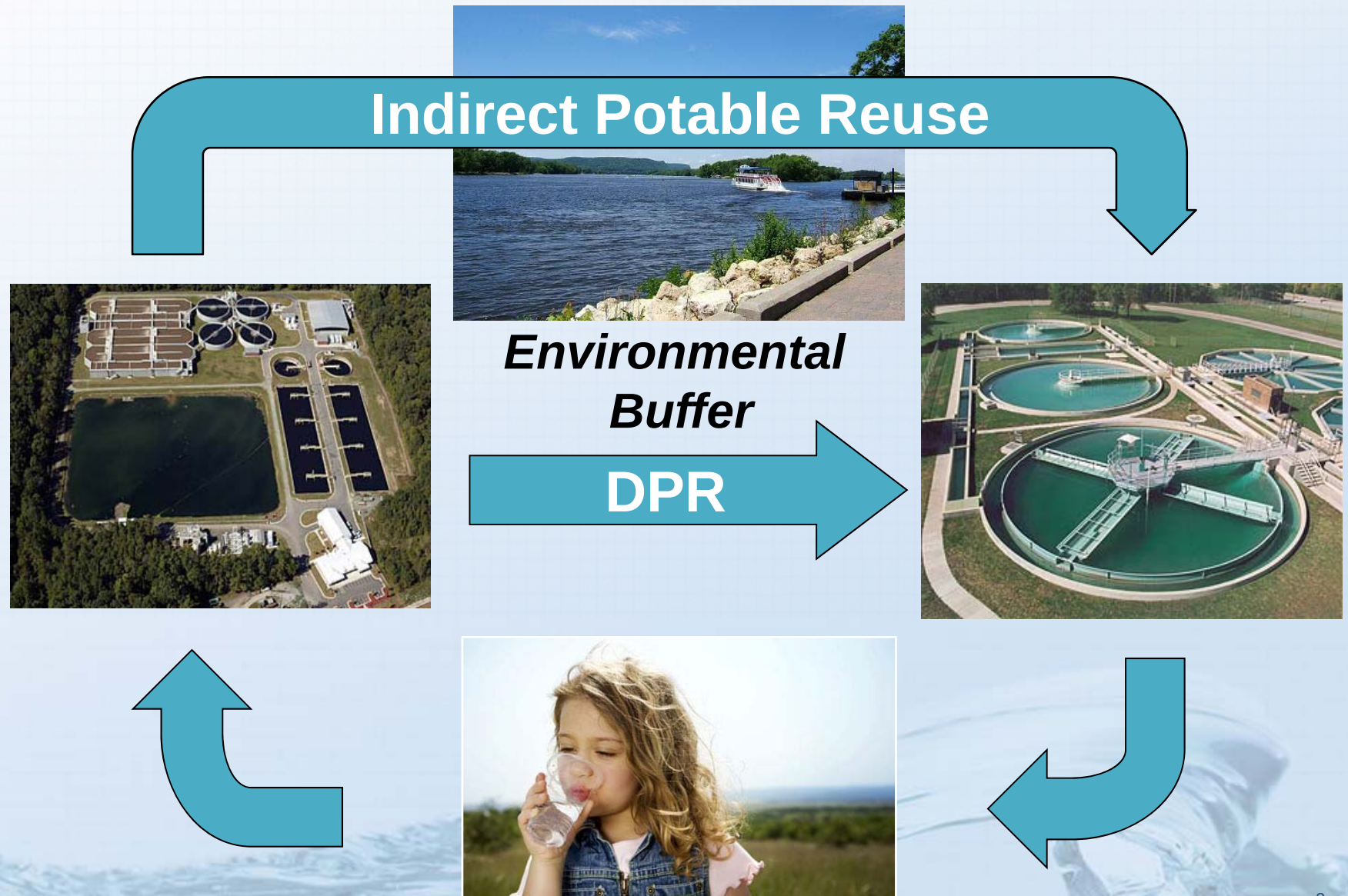
Agenda

- Definitions
- Public Health Goals
- Value of the Environmental Buffer
- Monitoring for DPR

Funding Acknowledgements



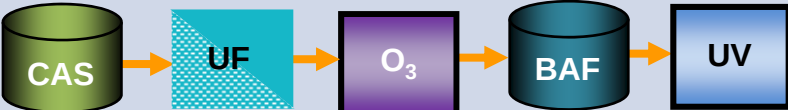
Potable Reuse



Treatment Goals for DPR

- California Department of Public Health:
 - 12-log virus
 - 10-log *Giardia*
 - 10-log *Crypto*
- WateReuse Research Foundation:
 - 12-log enteric virus
 - 10-log *Crypto* (*Giardia* implied)
 - 9-log bacteria
- Texas: **case-by-case**

Treatment Trains meet Goals

Treatment Train	Virus	Crypto	Total Coliform
	15	12	18
	15	13	18
	14	11	16
GOALS	12	10	9

But what if a Process Fails?

Treatment Train	Virus	Crypto	Total Coliform
	~~15~~ 9	~~13~~ 6	~~18~~ 12
	15	13	18
	14	11	16
GOALS	12	10	9

In IPR, the Environmental Buffer Provides...

1. Response Retention Time (RRT)
2. Attenuation:
 - Filtration
 - Photolysis
 - Die-off
 - Sorption
3. Positive Perception



Natural vs. Engineered Buffers



Storage Time

Long RRTs
possible
(months)



Monitoring

Shorter RRTs
required
(hours – days)

DPR Failure Mitigation Alternatives

1. Diversion of off-spec water
 - Monitoring & failure response is critical
2. “Stand-by” process redundancy
 - Monitoring & failure response critical
3. “Duty” process redundancy
 - Monitoring & failure response still important but less central

Monitoring is the Key to Determine Response Retention Time

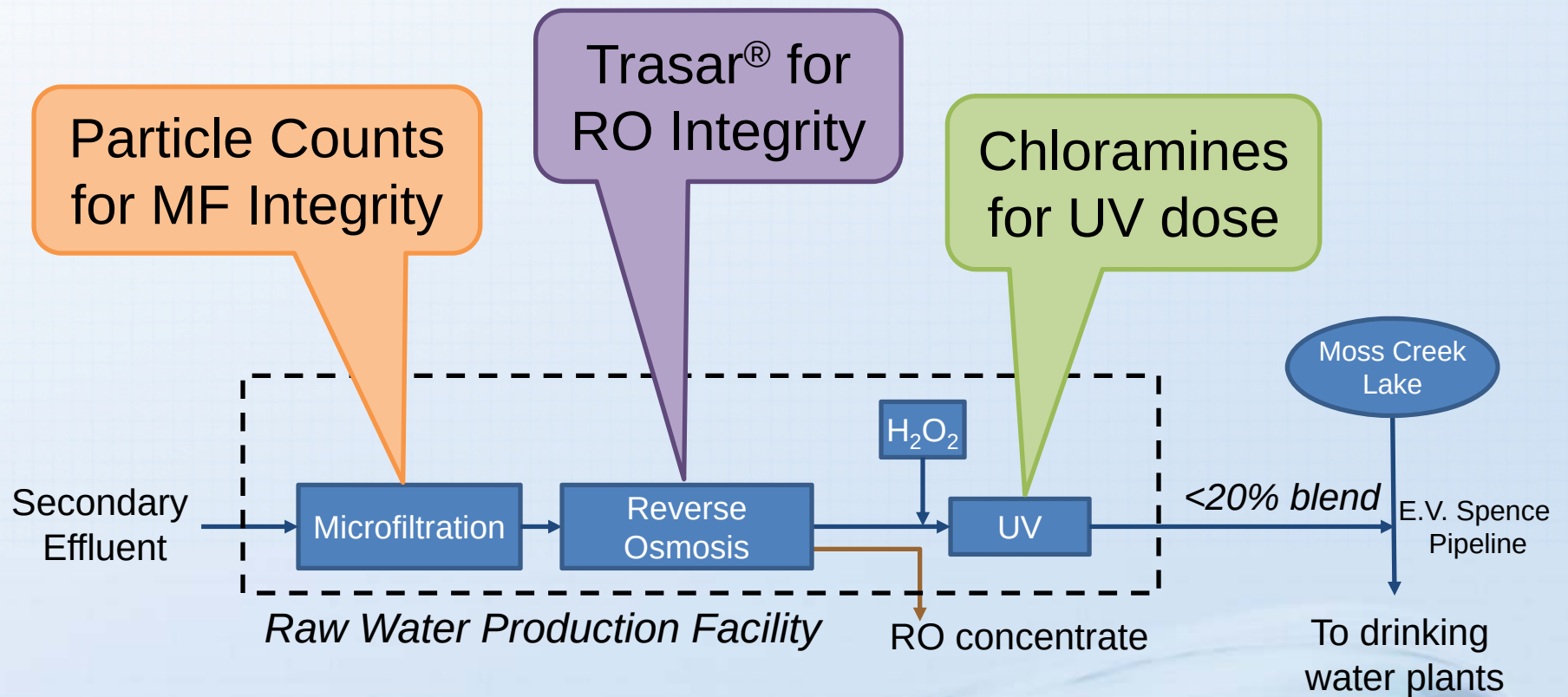
Critical Characteristics:

1. Sensitivity so we can identify failures
2. Time to:
 - Identify failure (monitoring)
 - Take corrective action (response)
3. Independence from other measurements and processes

Monitoring Technology Limits Options



Monitoring Study at Big Spring will Develop DPR Monitoring Tools



How to award log removal credits?

- Recall our goals:
 - 12-log enteric virus
 - 10-log *Crypto* (*Giardia* implied)
 - 9-log bacteria

Awarding Log Removal Credits:

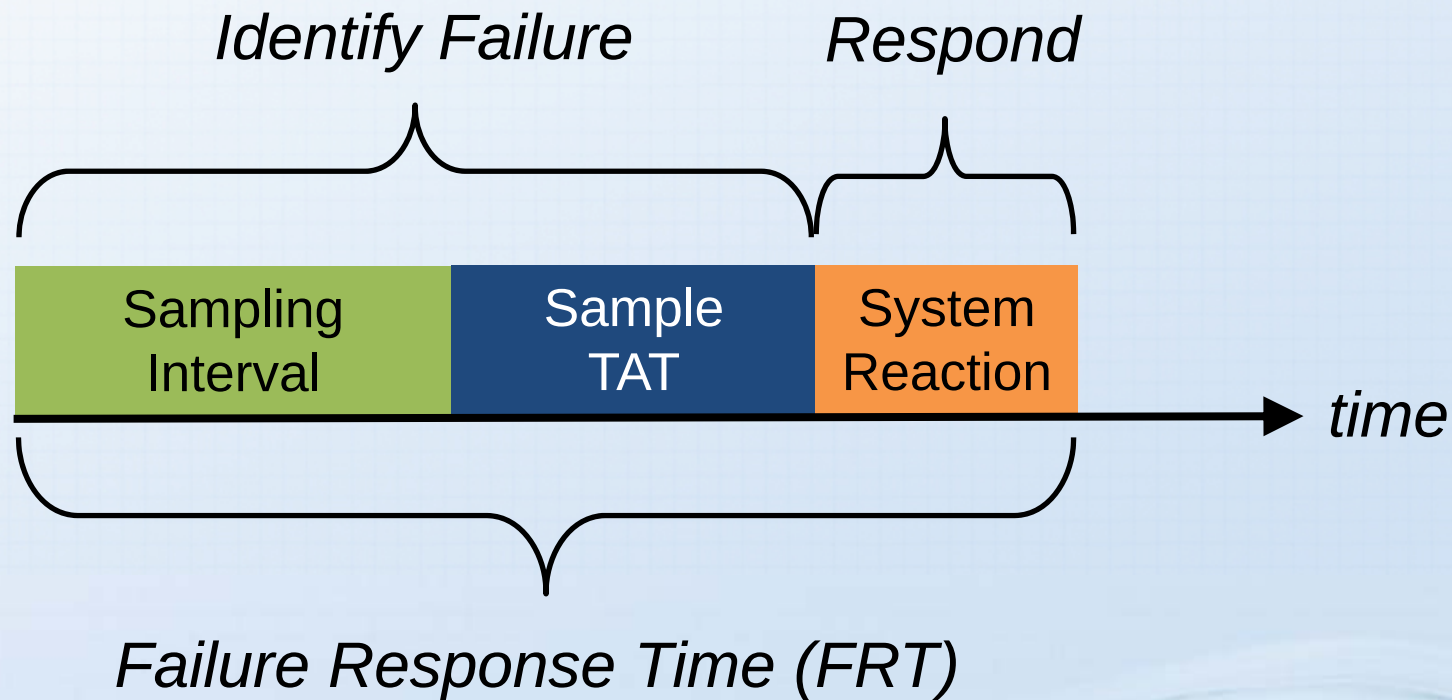
Concept #1 - Failure Response Time

- $FRT < RRT$
 - FRT = Failure Response Time
 - RRT = Response Retention Time
- In words:
The time it takes to respond to a failure must be LESS than the total response retention time (RRT) provided by an engineered storage system *after* treatment



Awarding Log Removal Credits:

Concept #1 - Failure Response Time

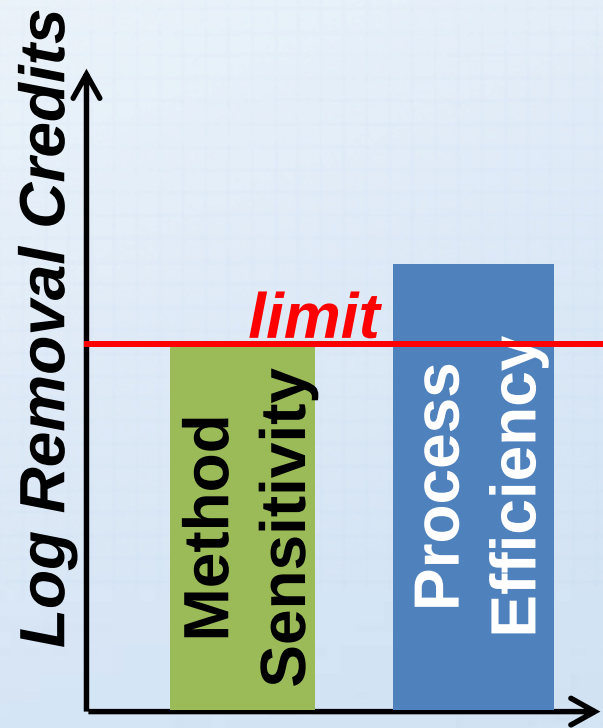


*This analysis is done for each combination of:
(1) process, (2) pathogen, and (3) monitoring method*

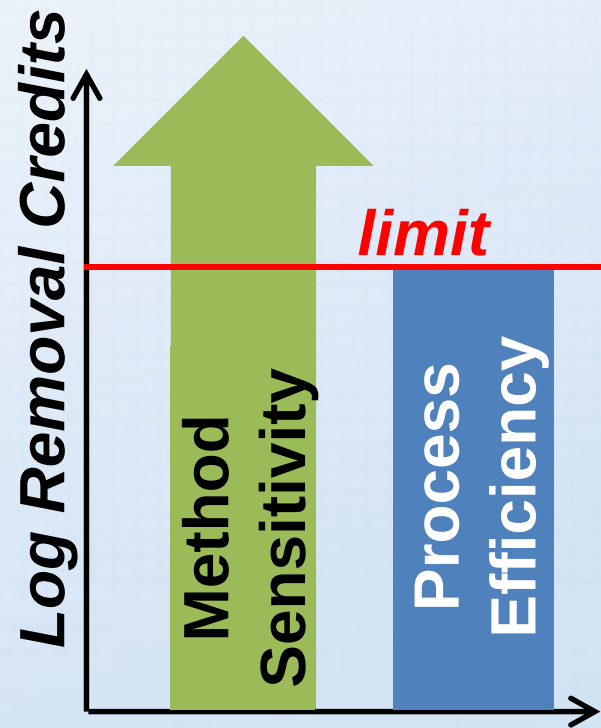
Process Example #1: Microfiltration Removal of Protozoa

	Standard	“Advanced”
1. Process	Microfiltration	
2. Pathogen	Protozoa (Cryptosporidium)	
3. Monitoring Approach	Pressure Decay	Particle Counts
Log Removal Credit	4-log protozoa	
Monitoring Interval	24 hours	instant / hourly
Sample TAT	minutes	minutes
Response time (valve & pumps)	minutes	minutes
Failure Response Time	24+ hours	1-2 hours

Awarding Log Removal Credits: Concept #2 – Sensitivity



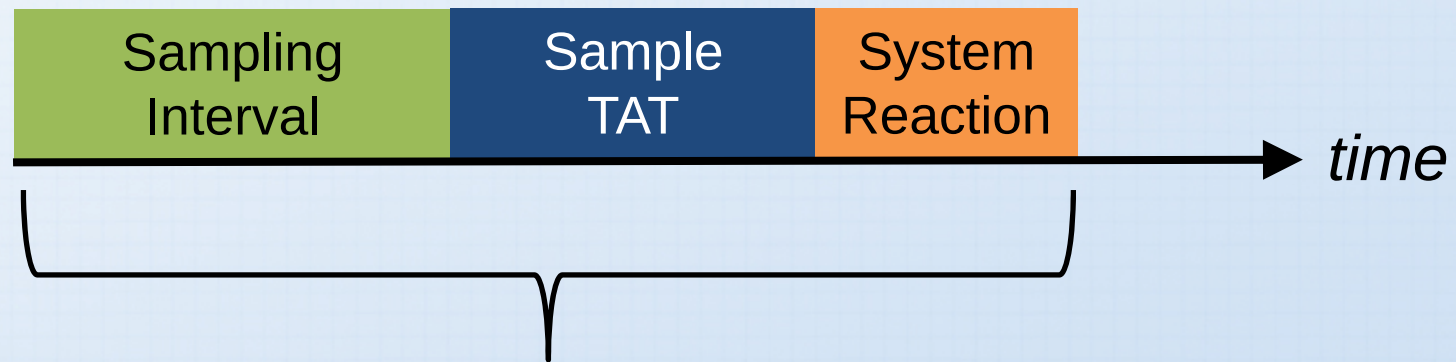
Awarding Log Removal Credits: Concept #2 – Sensitivity



Process Example #2: Reverse Osmosis Removal of Virus

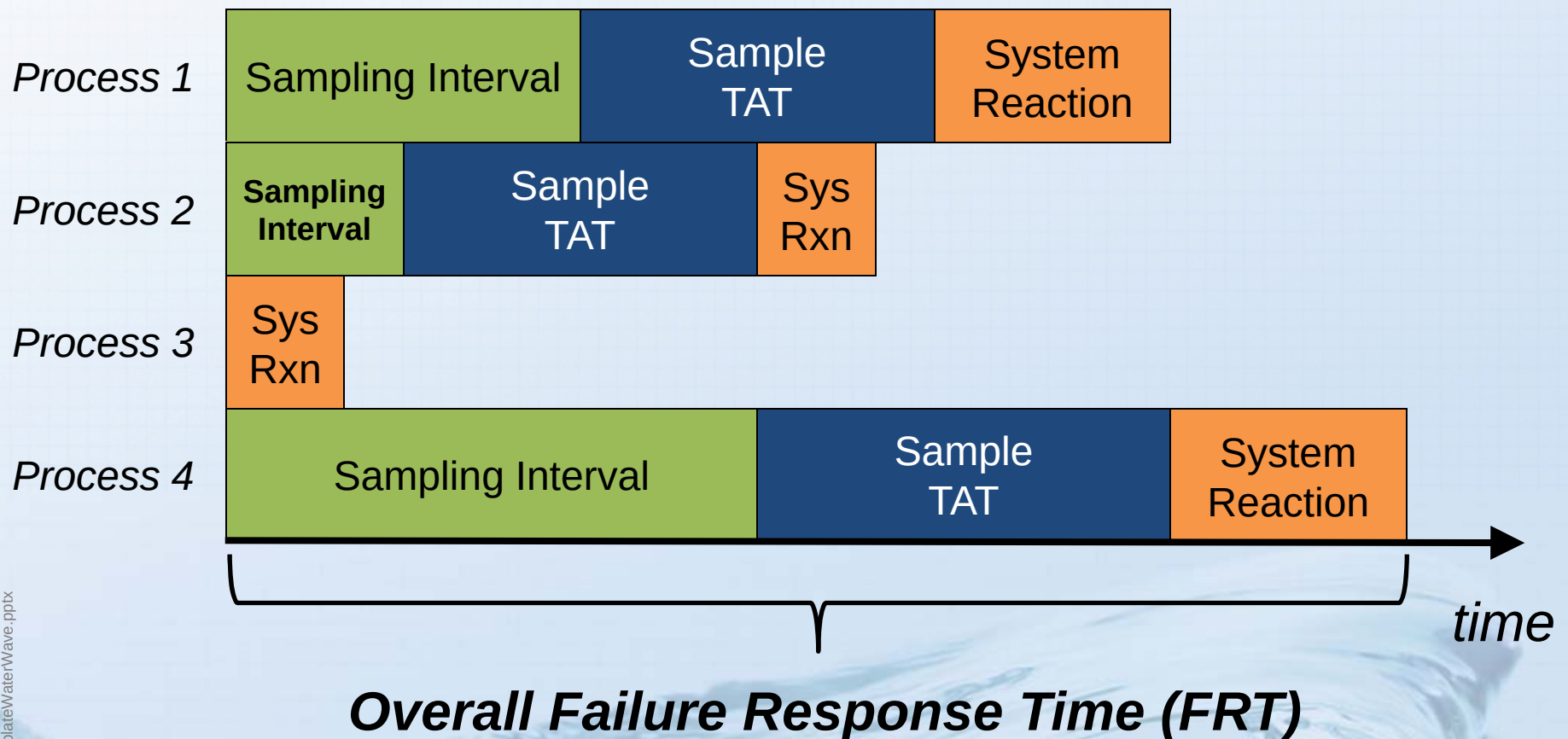
	Standard	“Advanced”
1. Process	Reverse Osmosis	
2. Pathogen	Virus	
3. Monitoring Approach	EC monitoring	Trasar®
Log Removal Credit	< 2-log	<i>potentially 4 to 6-log</i>
Monitoring Interval	instant	instant
Sample TAT	instant	instant
Response time (valve & pumps)	minutes	minutes
Failure Response Time	minutes	minutes

Failure Response Time of the Treatment Train is the Longest Individual FRT

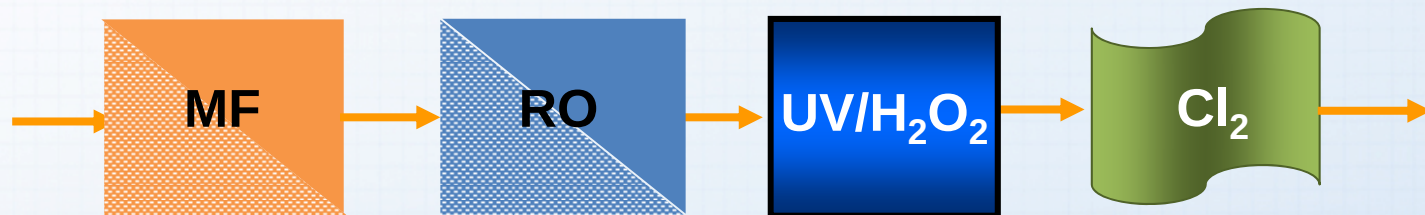


*Failure Response Time (FRT)
for one process*

Failure Response Time of the Treatment Train is the Longest Individual FRT

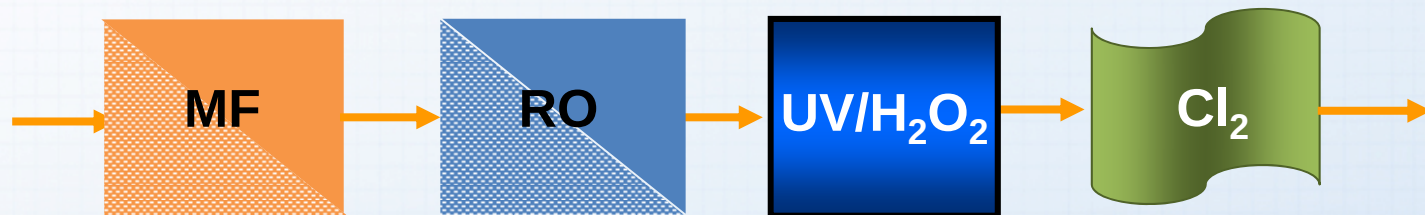


Train Example:



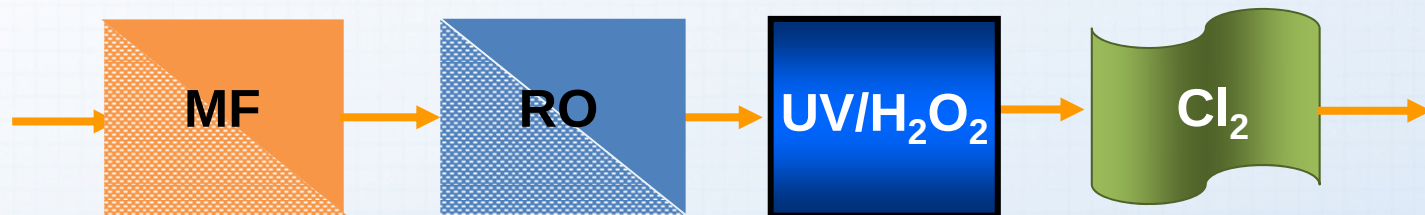
Process	Monitoring Method	Credits Awarded			Failure Response Time
		V	P	B	
MF	Pressure decay	--	4	3	24+ hours
RO	EC	2	2	2	minutes
UV/H ₂ O ₂	sensors	6	6	6	minutes
Cl ₂	Online residual	6	0	6	minutes
 Totals		14	12	17	24+ hours
Goals		12	10	9	

Train Example:



Process	Monitoring Method	Credits Awarded			Failure Response Time
		V	P	B	
~~MF~~	~~Pressure decay~~		~~4~~	~~3~~	~~24+ hours~~
RO	EC	2	2	2	minutes
UV/H ₂ O ₂	sensors	6	6	6	minutes
Cl ₂	Online residual	6	0	6	minutes
X Totals		14	8	14	minutes
Goals		12	10	9	

Train Example:



Process	Monitoring Method	Credits Awarded			Failure Response Time
		V	P	B	
~~MF~~	~~Pressure decay~~	<del></del>	~~4~~	~~3~~	~~24+ hours~~
RO	Trasar[®]	4	4	4	minutes
UV/H ₂ O ₂	UV sensors	6	6	6	minutes
Cl ₂	Online residual	6	0	6	minutes
 Totals		16	10	17	minutes
Goals		12	10	9	

The Range of Potential RRTs is *HUGE*

Monitoring
Complexity

“Monitoring Focused”

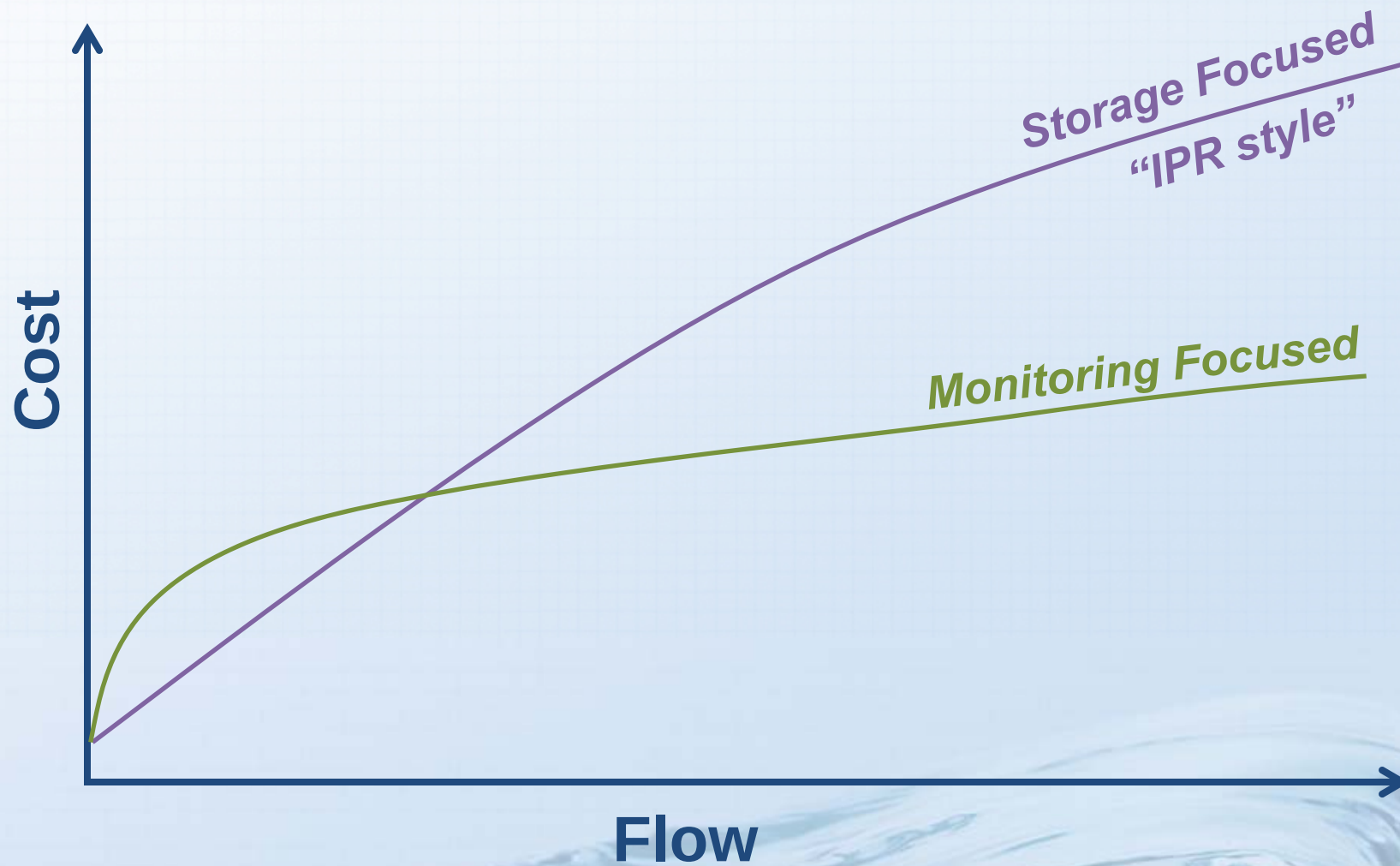
- FRTs in minutes
- RRT < 1 hour
- Online sensors for monitoring

“Storage Focused”

- RRT in months
- FRTs not critical
- Conventional monitoring

Response Retention Time (= Storage Volume)

Cost Curves for DPR



Please contact me with questions!

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