Too Much of a Good Thing? Re-evaluating Ozone Needs After 20 Years

2024 IOA-PAG Conference

Presented by
Michael McKie
August 2024

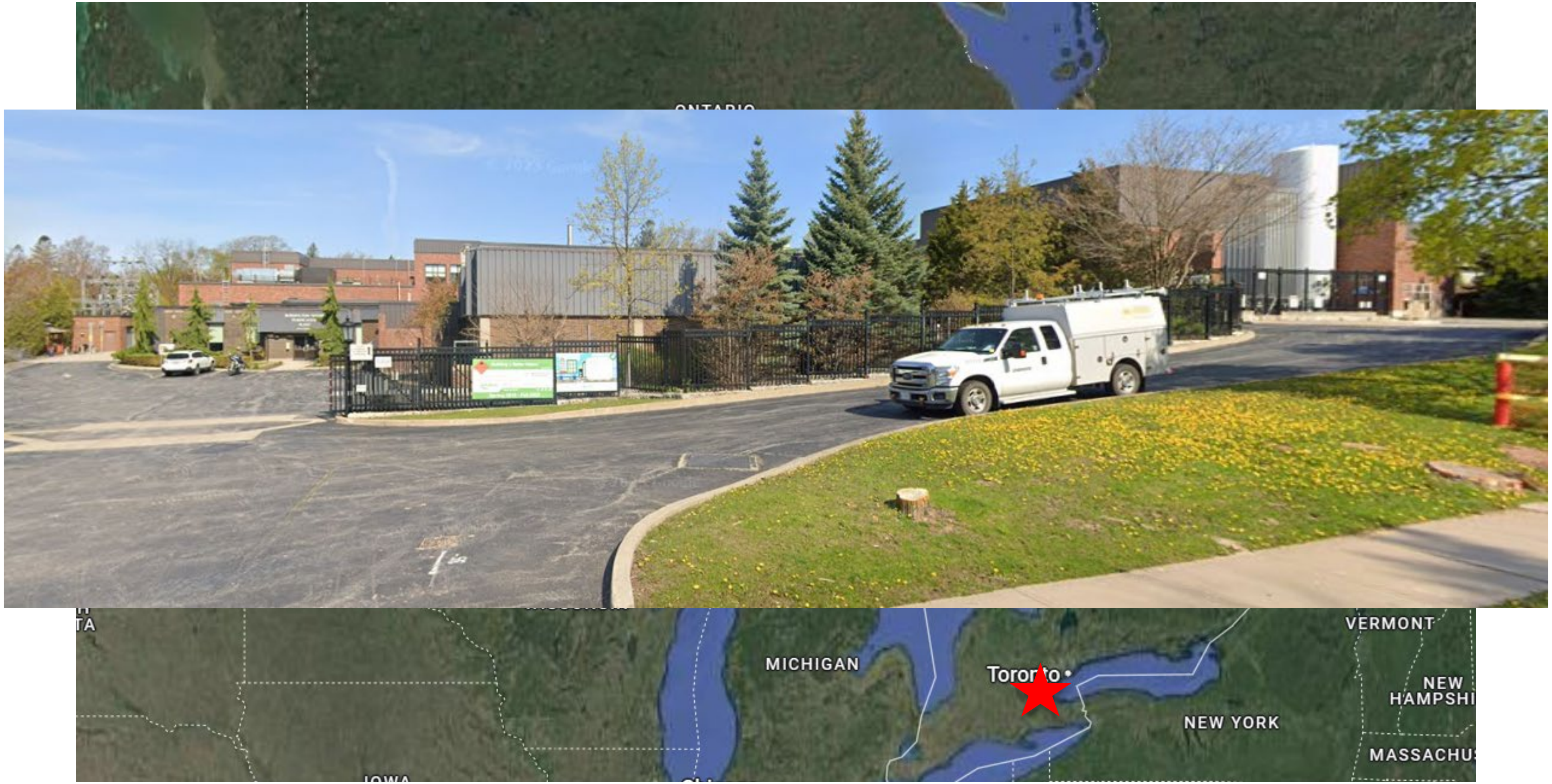
CIMA+ 30+ YEARS

Engineering for **people**

Presentation Outline

- Quick History of Ozone at Burlington
- Design vs Reality
- Re-thinking the Status Quo
- Decision Time
- Path Forward

Halton Region – Burlington Water Treatment Plant



Ozone at the Burlington WTP

- Installed in 2005
- Design dose 2.6 mg/L
  - 1-log *Crypto* inactivation in cold weather limiting
- Capacity 750 kg/d @ 6%; 550 kg/d @ 10%
- Duty/stand-by configuration
- Drinking water licence requires 0.5-log *Giardia* inactivation
  - 48 times less than design CT

Obsolescence of Critical Components Drives Upgrade

Aging Equipment Concerns

Key findings

- Stock additional spares for obsolete components
- Replace PSUs
- Generator replacement anticipated 2030

Project to replace PSUs initiated in 2023

C3 WATER

TECHNICAL REPORT

To:	**Bill Mundy, C.E.T** **Optimization Specialist**	Company:	**The Regional Municipality of Halton**
From:	**Dennis Mutti, M.A.Sc., P.Eng.** c. 226-338-3893	Project Ref.#:	**75-41-201433**
Copy:		Date:	**November 9, 2020**
Subject:	**Final Report, Long Term Ozone Asset Management Strategy**		

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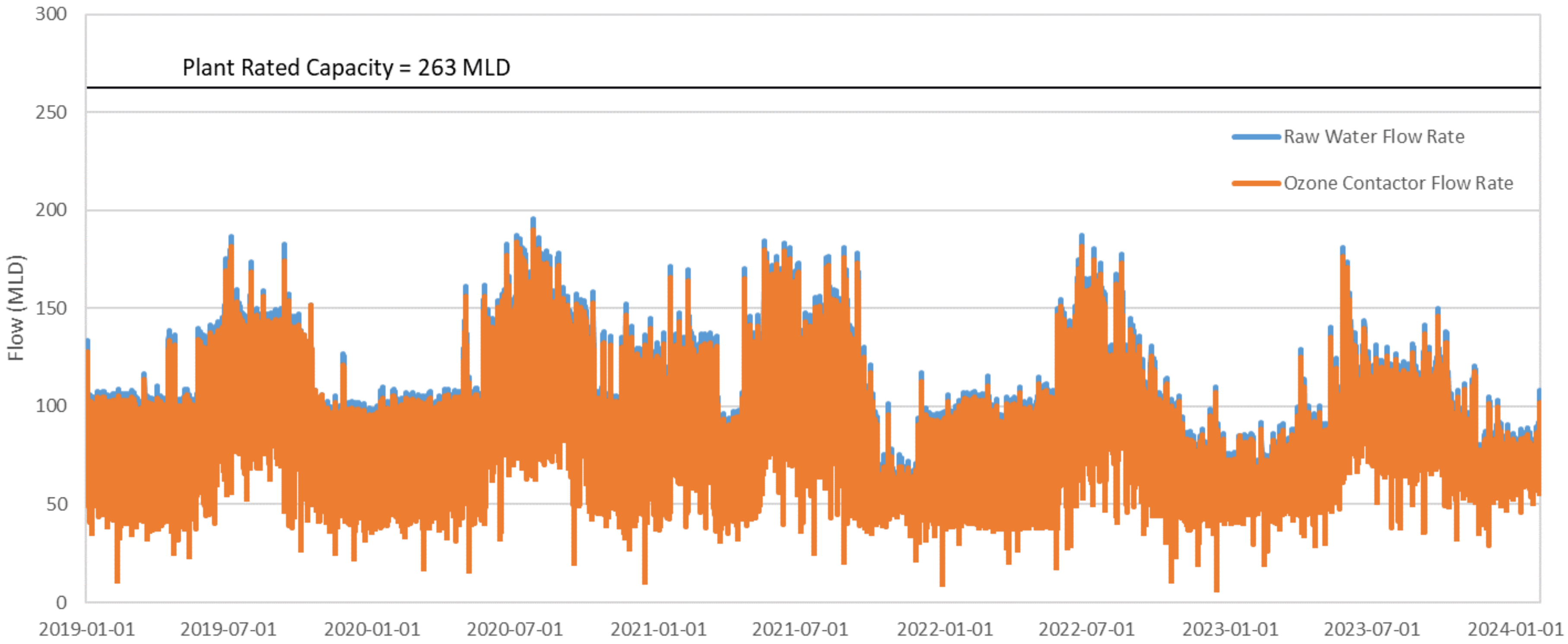
The Regional Municipality of Halton

Long-Term Ozone Asset Management Strategy
Final Report

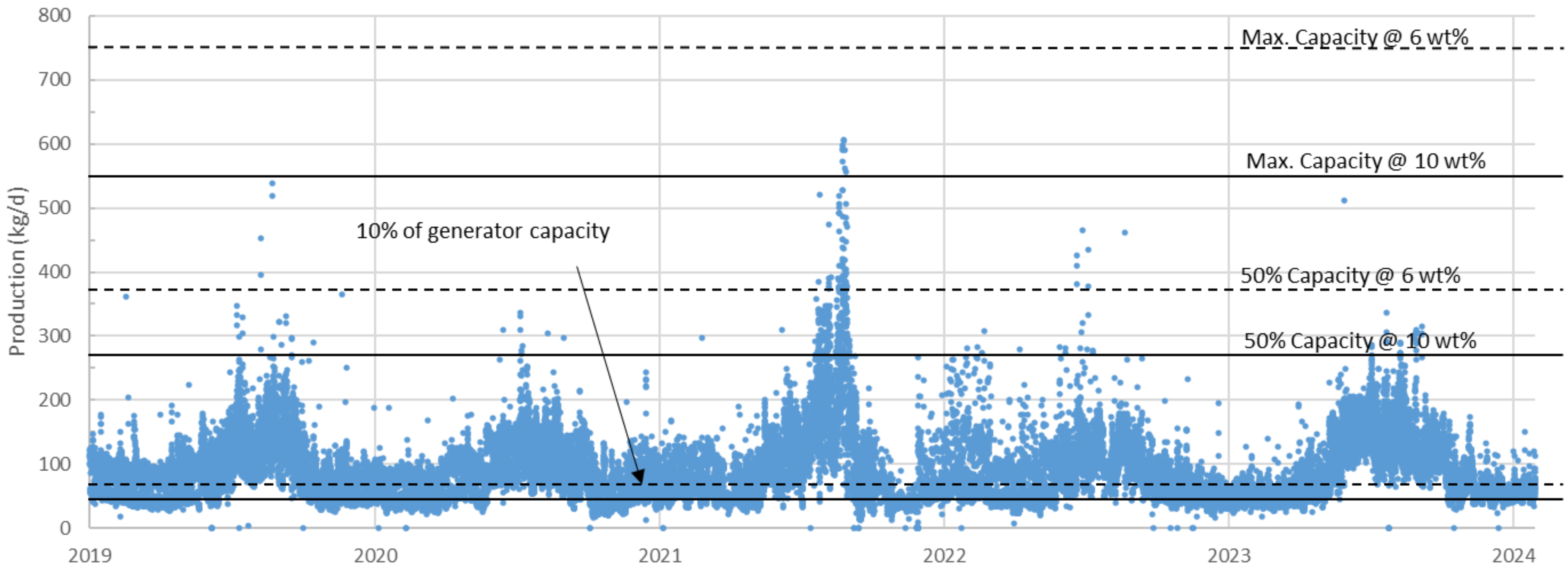
C3 WATER INC.

November 9, 2020

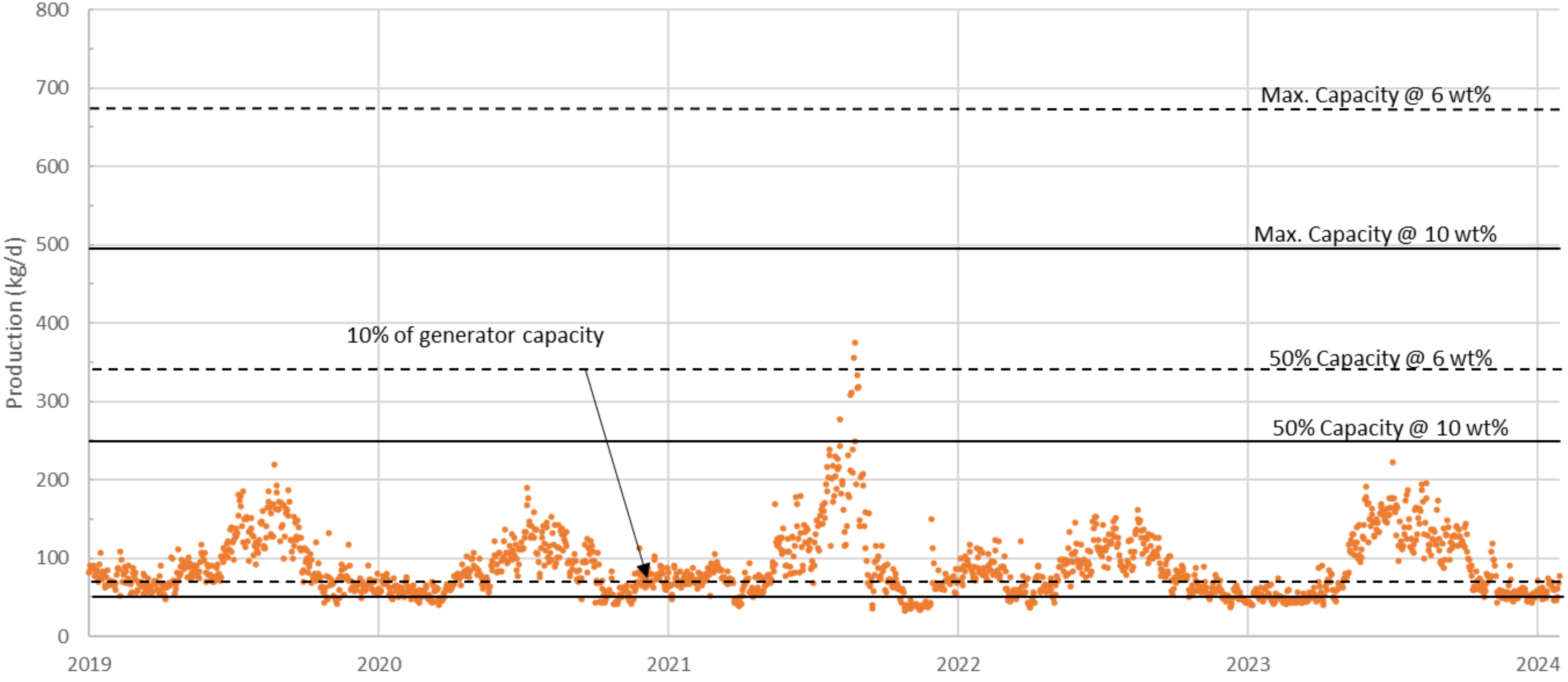
Reviewing System Operation – System Flow



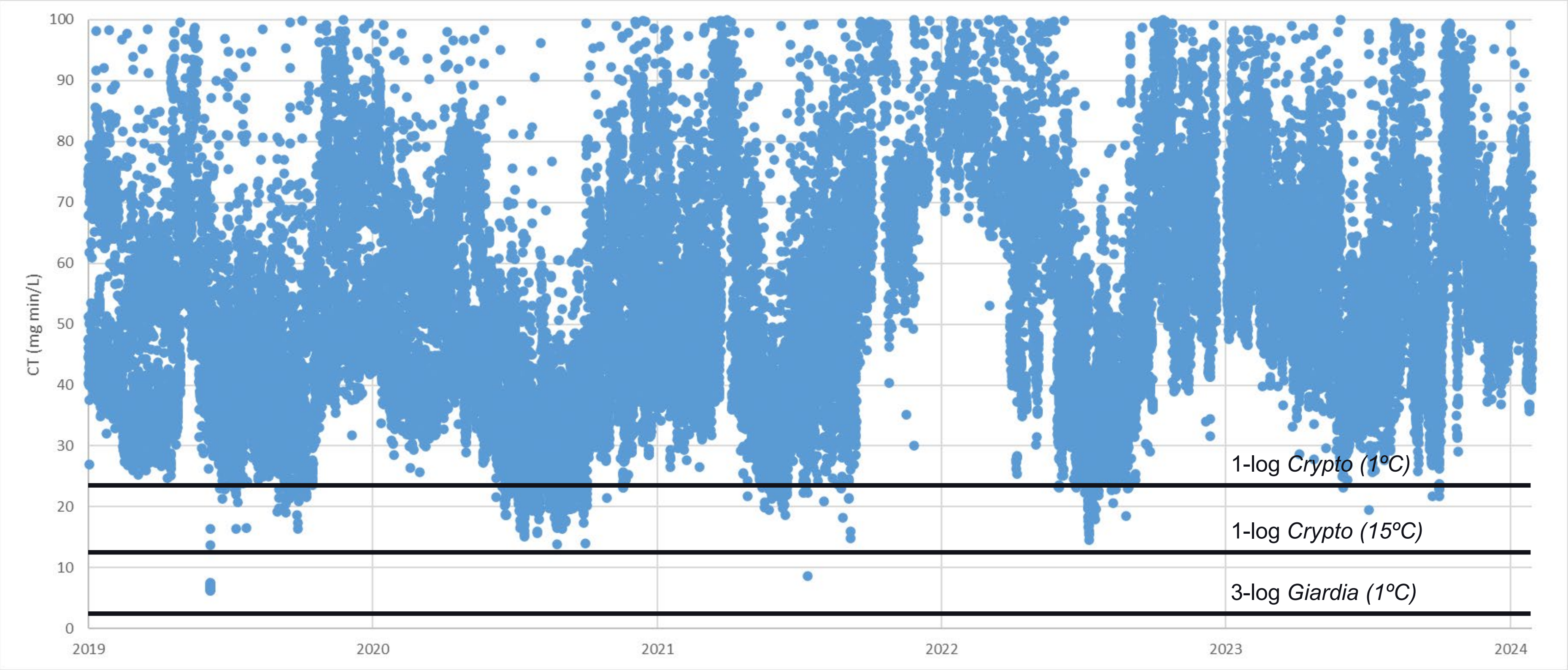
Reviewing System Operation – Hourly Production



Reviewing System Operation – Daily Production



Reviewing System Operation - Disinfection



Summary of System Operation

- Aging system facing continued O&M concerns
- System capacity >> production requirements
- Opportunity to chart short- and long-term ozone plan

Plotting the Future of Ozone at Burlington

- Design alternative considerations
  - Ozone production range: 32 to 684 kg/d
  - Operational redundancy and improved maintainability
- Alternatives considered
  - Do nothing
  - Like-for-like PSU Replacement
  - Reduce generator capacity by 50% and replace PSUs
  - Replace existing generators with smaller generators
  - Add a third, smaller generator
  - Retrofit existing generators with lead-free dielectrics

Detailing Key Alternatives

- Reduce Generator Capacity by 50%
  - Operational range becomes 27.5 to 375 kg/d for each generator
  - No redundancy available when required dose >375 kg/d
  - Addresses concern with continued maintenance
  - Construction process similar to generator refurbishment
  - Lead time ~18 months (PSU replacement is limiting step)
  - Higher capital cost than a like-for-like PSU replacement
- 3 new, smaller generators
  - Propose three (3) generators sized from 25 to 340 kg/d
  - Two (2) duty, one (1) standby configuration for high production periods
  - Addresses concern with continued maintenance

Detailing Key Alternatives

	Capacity (kg/d)
Generator 1 (Existing)	55 to 750
Generator 2 (Existing)	27.5 to 375
Generator 3 (New)	27.5 to 375

- Add a third, smaller generator
    - Downsize one(1) existing generator by 50%
    - Add a third generator sized from 27.5 to 375 kg/d
    - Redundancy always available
        - Smaller generators when production <375 kg/d
        - One (1) high capacity or two (2) smaller generators used when production >375 kg/d
    - Addresses concern with continued maintenance
        - No obsolete parts with new system; existing components reused at other facilities
    - Competitive bid for third generator may be required
    - AASI delivery estimated to be limited by PSUs (~18 months)
    - Additional design required; may not be sufficient space with existing layout
    - Higher capital cost than downsizing the existing PSUs

Alternative Evaluation

Evaluation Criteria

- Cost
  - Relative estimated 30-year life-cycle cost (incl. capital and O&M)
- Robustness
  - Process' ability to handle variable ozone production requirements with redundancy
- O&M
  - Ability to meet operational needs and level of maintenance effort required for continued operation
- Construction
  - Minimize construction risk and maintain plant operation during upgrade
- Process resiliency
  - Upgraded system minimizes potential impacts to plant operation
- Procurement
  - Level of effort, complexity and competitive bid requirements

Pair-wise Comparison – Baseline Condition

Criteria	Cost	Robustness	O&M	Construction	Resiliency	Procurement	Relative Score (/25)	Weighting (%)
Cost		2	2	3	2	4	13	14
Robustness	4		3	4	2	5	18	20
O&M	4	3		4	3	4	18	20
Construction	3	2	2		2	4	13	14
Resiliency	4	4	3	4		5	20	22
Procurement	2	1	2	2	1		8	9

- Determine Relative weighting
  - A score of 5 means that the y-axis criteria is much more important than the x-axis criteria
  - A score of 3 means that the y-axis criteria is as important as the x-axis criteria
  - A score of 1 means that the y-axis criteria is much less important than the x-axis criteria
  - Table is a mirror when criteria are reversed (5/1, 4/2, 3/3, 2/4, 1/5)

Sensitivity Analysis

Weighting	Baseline	Cost-centric	O&M-centric	Process-centric
Cost	14	23	14	12
Robustness	20	18	19	26
O&M	20	18	24	16
Construction	14	13	13	12
Resiliency	22	20	21	26
Procurement	9	8	8	9

Alternative Scoring

Criteria	Do Nothing	Like-for-like PSUs	50% Capacity	3 New Gens	3rd Small Gen	Dielectric Retrofit
Cost (30 yr)	5	4	4	1	2	3
Robustness	1	1	3	5	5	3
O&M	1	2	5	5	3	4
Construction	5	4	3	2	2	1
Resiliency	1	2	3	5	5	3
Procurement	5	5	5	1	1	5

- Scores assigned are relative
  - A score of 5 means that this option ranks the “best” for the given criteria
  - A score of 1 means that this option ranks the “worst” for the given criteria

Sensitivity Analysis Summary

Evaluation Focus	Primary Alternative (score/100)	Secondary Alternative (score/100)
Balanced	50% Capacity Reduction (74)	3 New Generators (73)
Cost	50% Capacity Reduction (75)	3 New Generators (67)
O&M	50% Capacity Reduction (76)	3 New Generators (74)
Process Operation	3 New Generators (76)	50% Capacity Reduction (72)

Decision and Next Steps

- Preferred alternative: Install a 3rd generator; no upgrades to existing
- Benefits:
  - Improved redundancy and control, long-term O&M flexibility
  - Maximize life cycle of existing equipment
  - Set direction for future upgrades
- Limitations:
  - Does not address obsolescence issues or sizing of existing generators
- Next steps:
  - Detailed design
  - Equipment selection

Acknowledgements

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We'd like to tell you more…

Come talk to us here at the conference or get in touch:

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