Treatment Designs to Meet Regulation Deadlines, Planning and Scheduling

WPCA – First Energy

February 19, 2020

TRANSFORMING WATER. ENRICHING LIFE.

About Our Presenters

Max Swoboda
Business Developer – Power Market

- 27 years of experience providing technical and water treatment solutions to power plants
- Has developed water solutions for many industries from ultrapure water production to fossil and nuclear facilities
- Focused on the wastewater needs of coal-fired plants needing to stay in compliance with CCR and ELG regulations
- Bachelor of Science in Civil Engineering from the Virginia Military Institute

Agenda

New Rule Highlights

Compliance Paths

- High Flow
- Early Retirement
- Low Utilization
- Voluntary Incentive Program
- Non-Categorized

Choose Your Own Adventure

High FGD Flow Subcategory Factors

- Greater than 4 million gallons per day, after recycle to the limits of the FGD system materials of construction.
- This subcategory appears to apply to a single plant.
- The compliance limits were developed to prevent a disparately higher cost to consumers.

Constituent[1]	Daily Max	Monthly Avg
Arsenic, ppb	18	9
Mercury, ppt	85	31
Nitrate, ppm	N/A	N/A
Selenium, ppb	N/A	N/A

Expected Treatment Requirement is Physical/Chemical

Early Retirement Subcategory Factors

- After the 2015 Rule release, 107 plants announced retirements, 33 listed environmental regulations as reason.
- Stranded asset cost of equipment installed near the end of useful life of plant.
- North American Electric Reliability Corp (NERC) stress test concerns
- Time to allow replacement generation to come on line for grid stability.

Repower might be included in final rule[1]

When will your plant retire?

Before 12/31/2028

After 12/31/2028

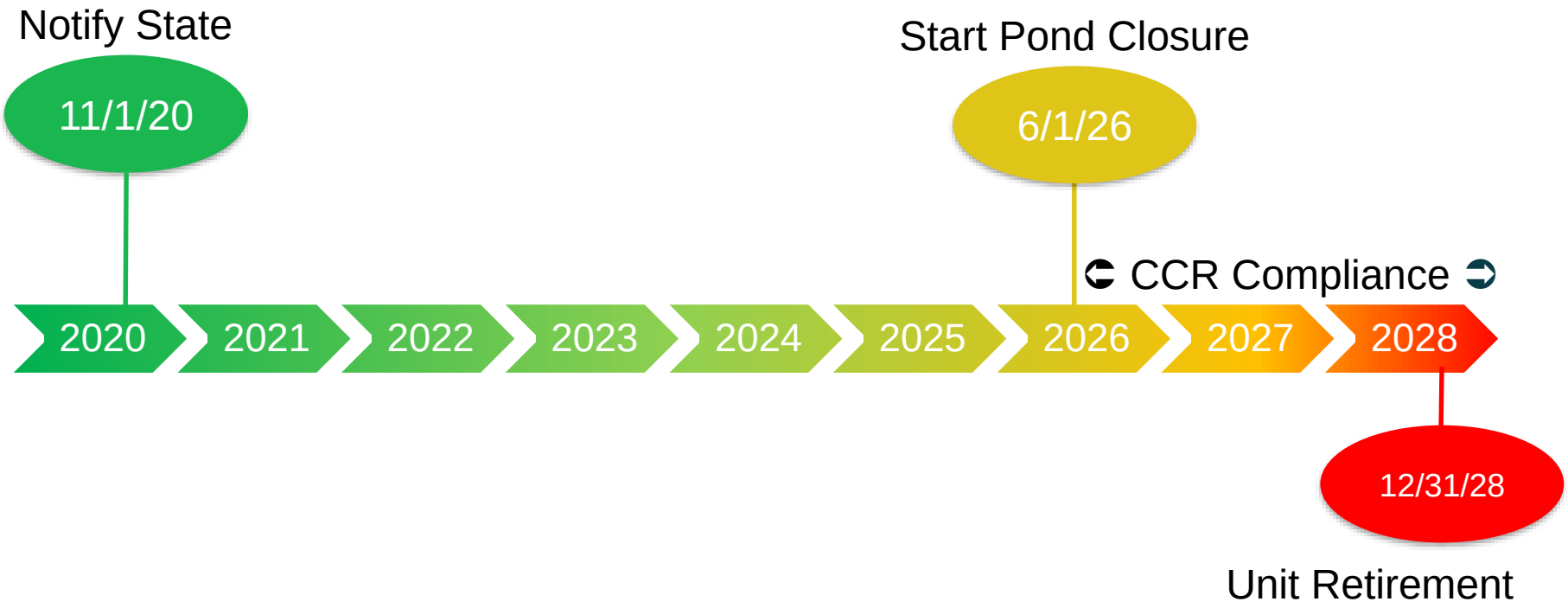
Choose your path by clicking the arrow

Retirement before 12/31/2028

- Notify the permitting authority before 11/1/2020.[1]
- Complete Certification Statement with estimated retirement date.[2]
- BAT Limits become equal to BPT limits for TSS based on surface impoundments.[3]
- Rule change does not require an implementation period because the BAT limitations are equal to the previously promulgated BPT limits.[4]
- Complete impoundment closure by 2028.[5]

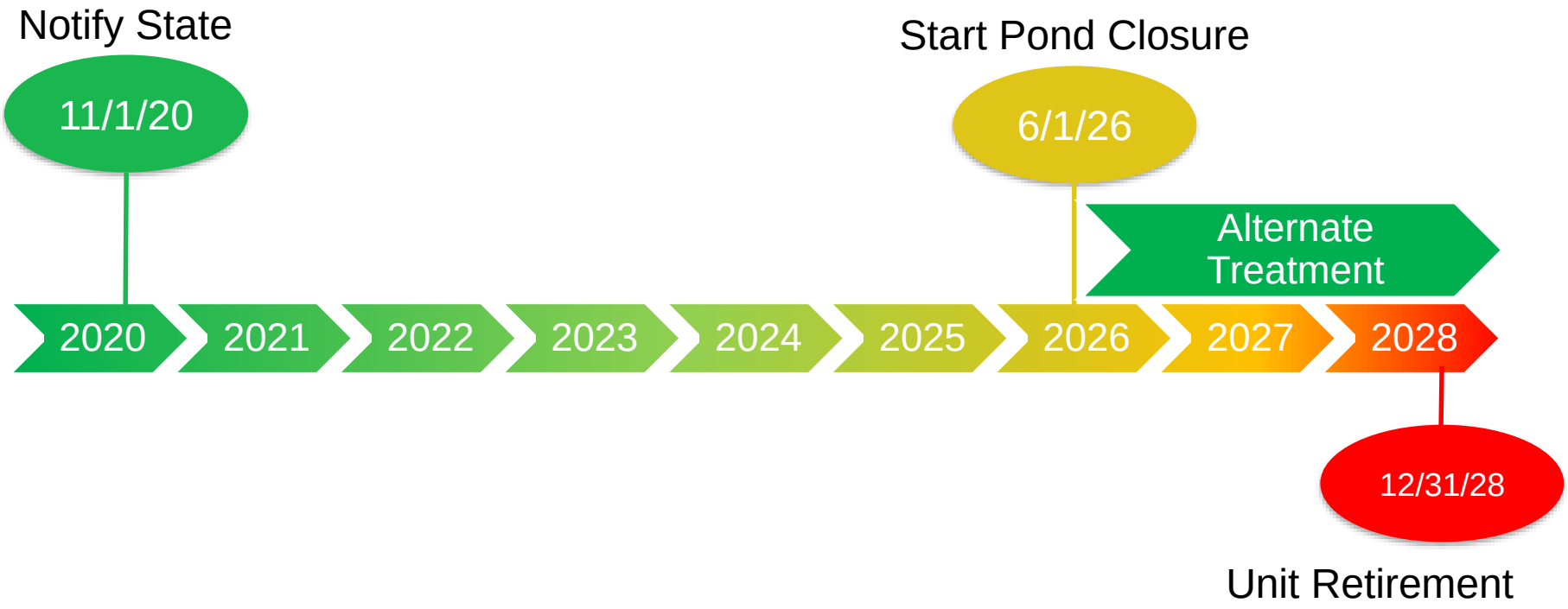
No New Limits are imposed by the Rule

Compliance Timeline for Early Retirement



Pond Closure Creates an "Early" Early Retirement

Compliance Timeline for Early Retirement



Use Alternate Treatment to Extend Generation

CASE STUDY

Temporary Ash Pond Replacement Wastewater Treatment System

Project Overview

- Southeast USA, Coal Fired Plant >2,000 MW
- Year Executed: 2019-2020
- Solution Type: Temporary Equipment to Replace Ash Pond
- Capacity: 10,000 gpm

Customer Challenge

NPDES compliance deadline force early closure of the ash pond, leaving the plant without a means to operate for 6-9 months. A treatment system was needed to provide uninterrupted operation until a permeant solution was constructed.

Solution

Modular skidded CoMag clarifiers were used for TSS and metals reduction. An effluent clearwell of 1+M gallons ensured compliance before discharge. Solids generated by the clarification were dewatered and disposed of in onsite landfill. Complete operation is provided.

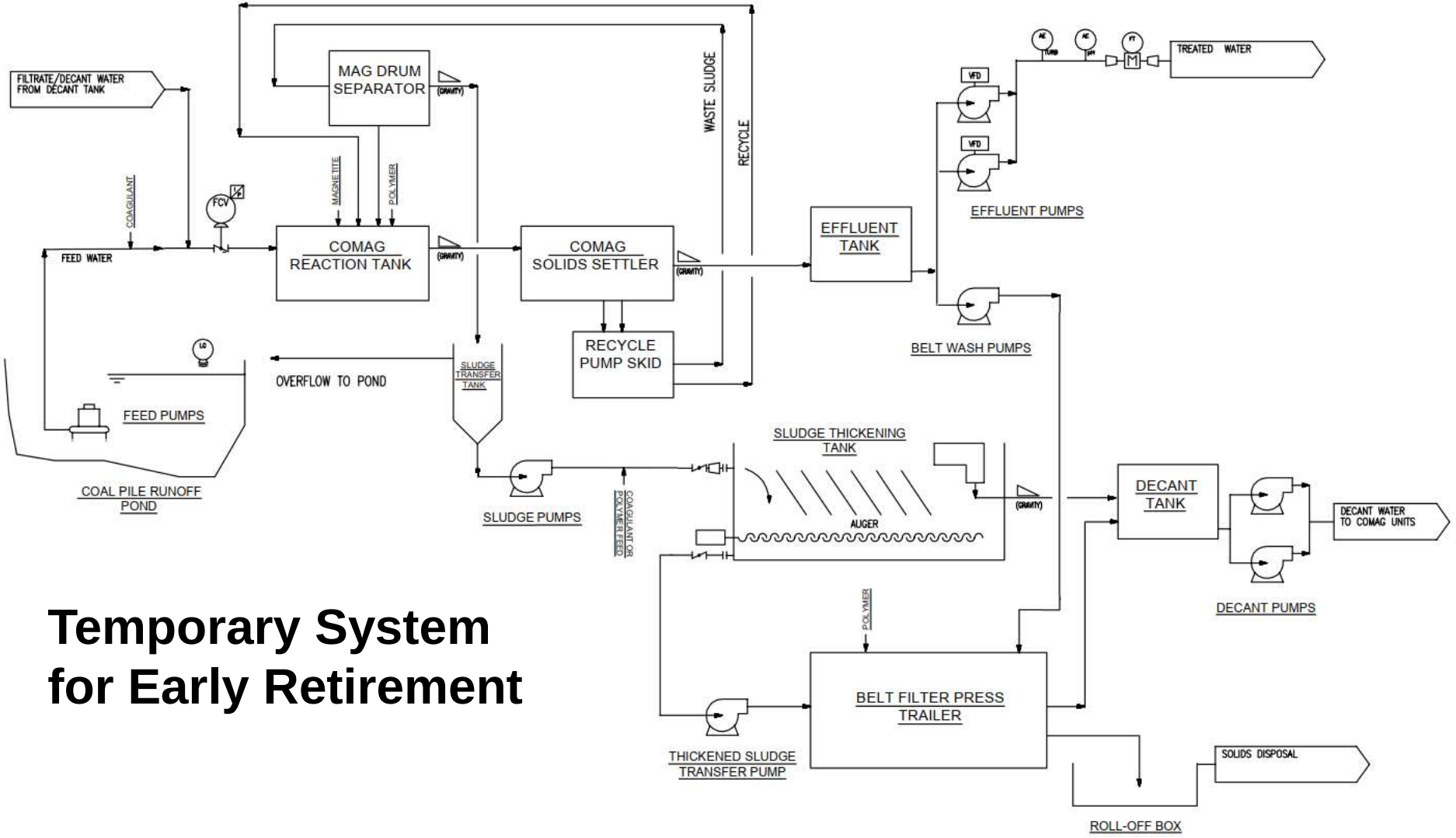
Results

NPDES permit limitations were consistently met with TSS well below 30 ppm with an inlet design TSS of 400 ppm.

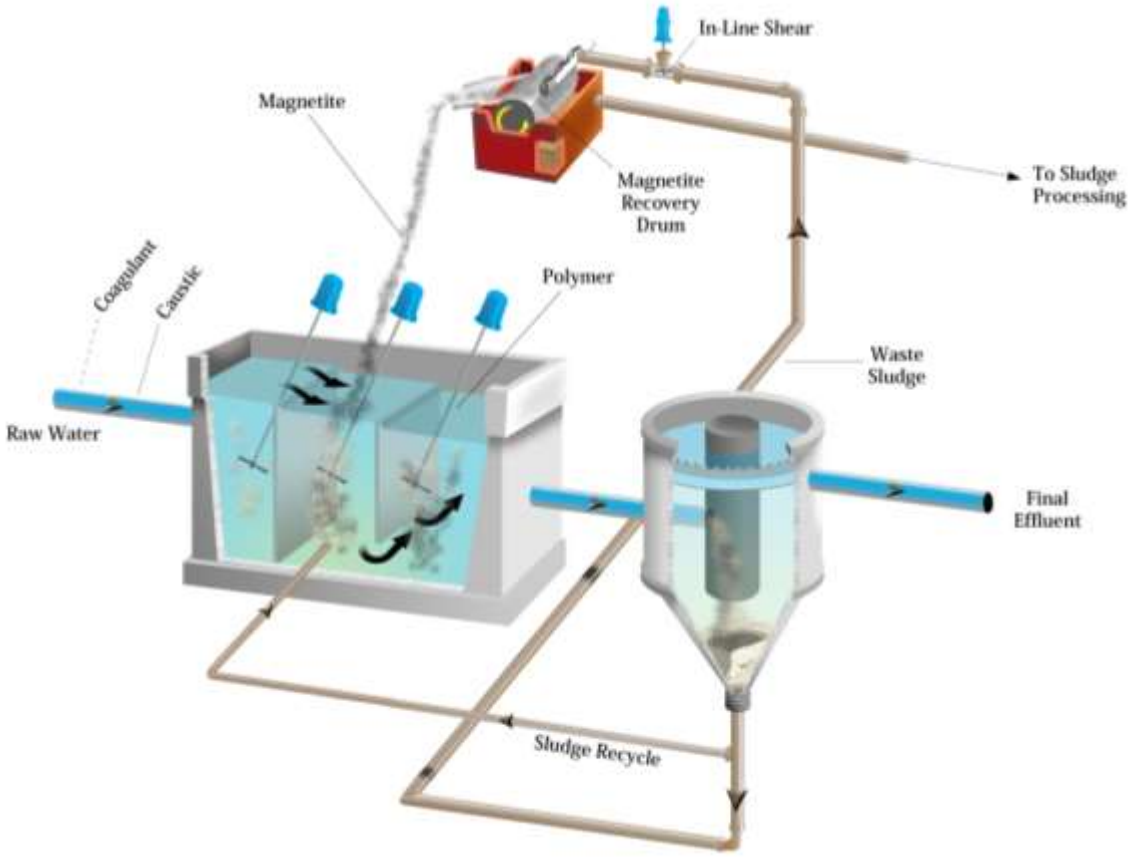
Scope of work

- Total process design
- Design & engineering
- Equipment supply
- Project management
- Installation
- Reagents and supplies
- Startup & commissioning
- Operation & maintenance

Temporary System for Early Retirement

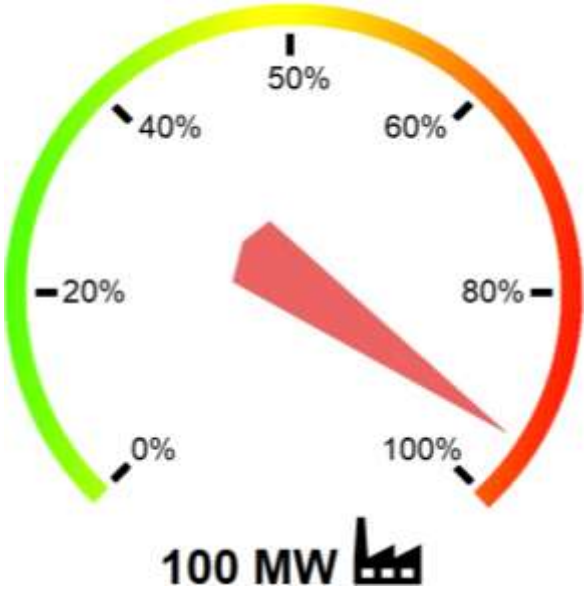


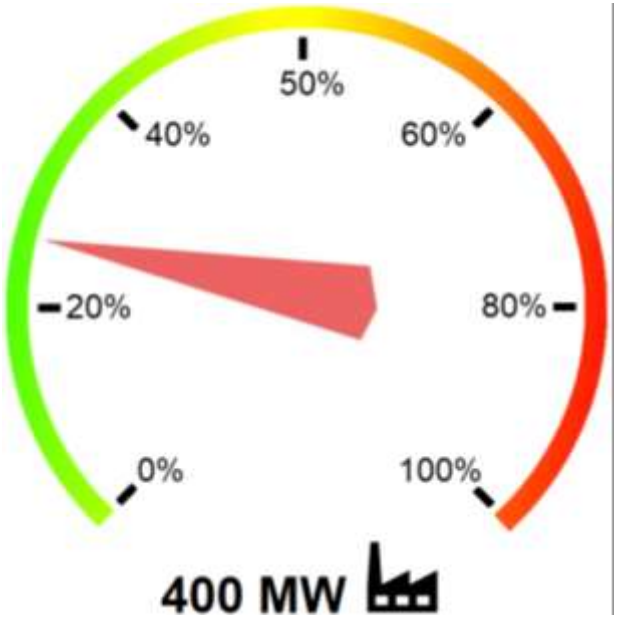
CoMag® Ballasted Clarifier



Low Utilization Subcategory

Annual Net Generation must be less than 876,000 MWh per unit for 2 year average



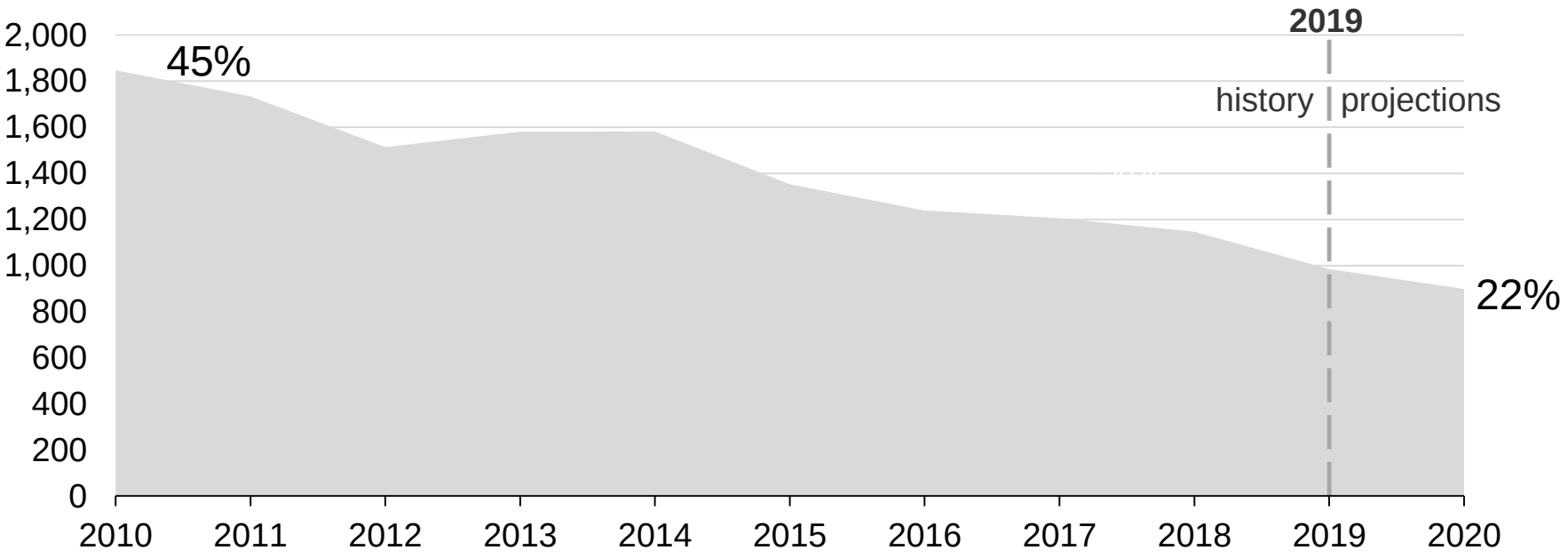


100% or 25%
876,000 MWh per year = 876,000 MWh per year

Low Utilization Subcategory Factors

- Low Natural Gas Prices
- Higher Cost per MWh of smaller generating units
- Allow operation for peak loading to increased electricity reliability

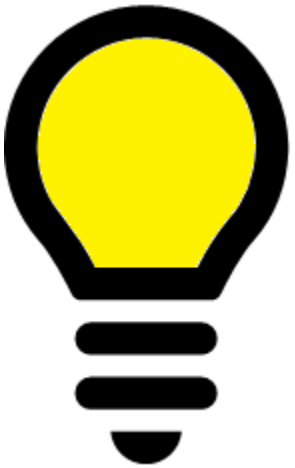
EIA Data on Electricity generation from coal – (AEO2020 Reference case)
billion kilowatthours



Will your unit produce less than 876,000 MWh per year?

Under

Over



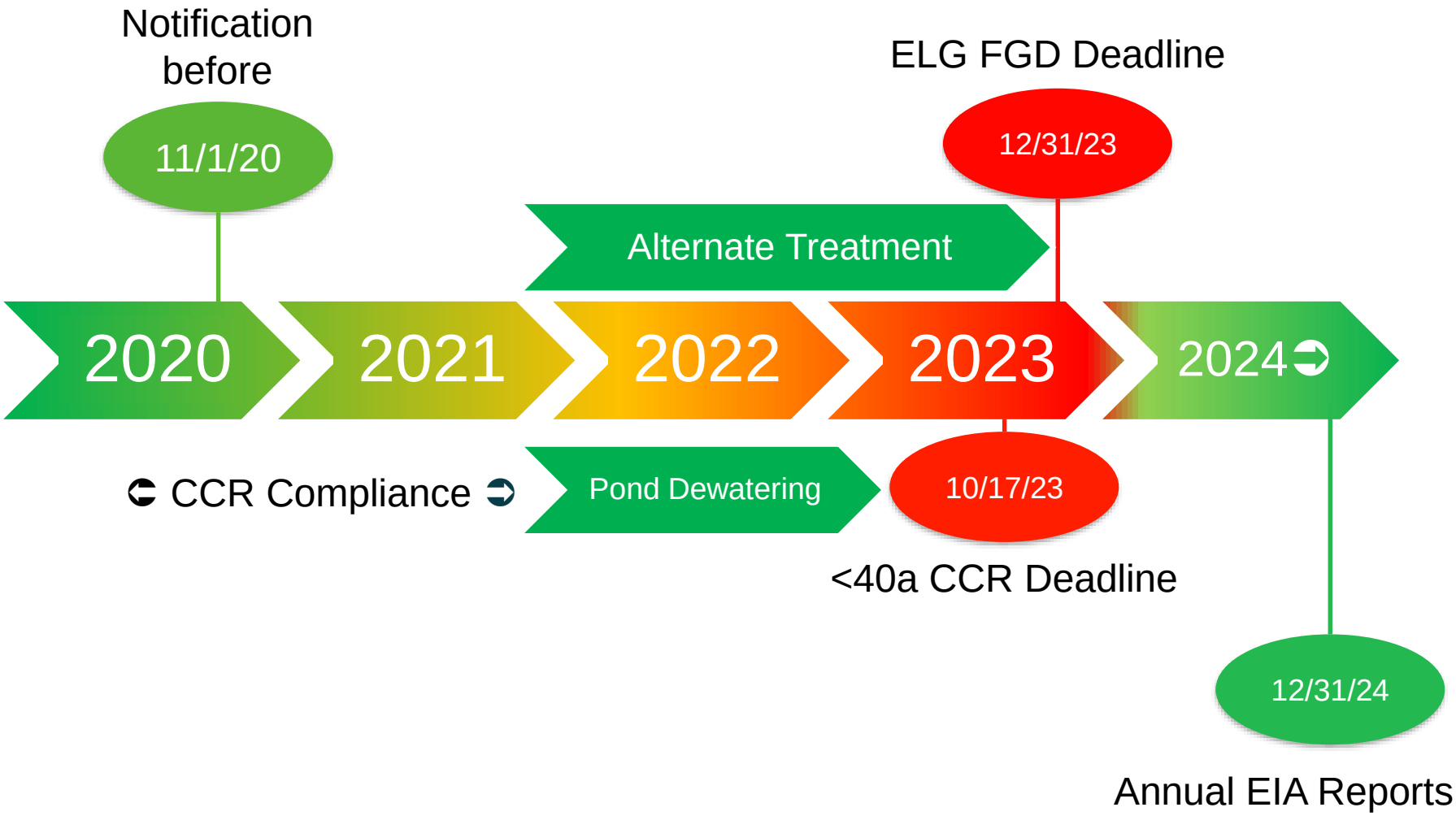
Click a bulb.

Low Utilization Unit Compliance Steps

- Must operate below the production threshold before implementation date.
- Utilization is Per Boiler Net Generation and must be less than 876,000 MWh for 2 year average
- Using data reported to Energy Information Administration (EIA)
- Annual certification is required
- Exceeding the Utilization limit triggers a two year compliance window opens and it cannot return to the low utilization subcategory.

Savings Clause for Involuntary Orders[1]

Low Utilization Unit Timeline



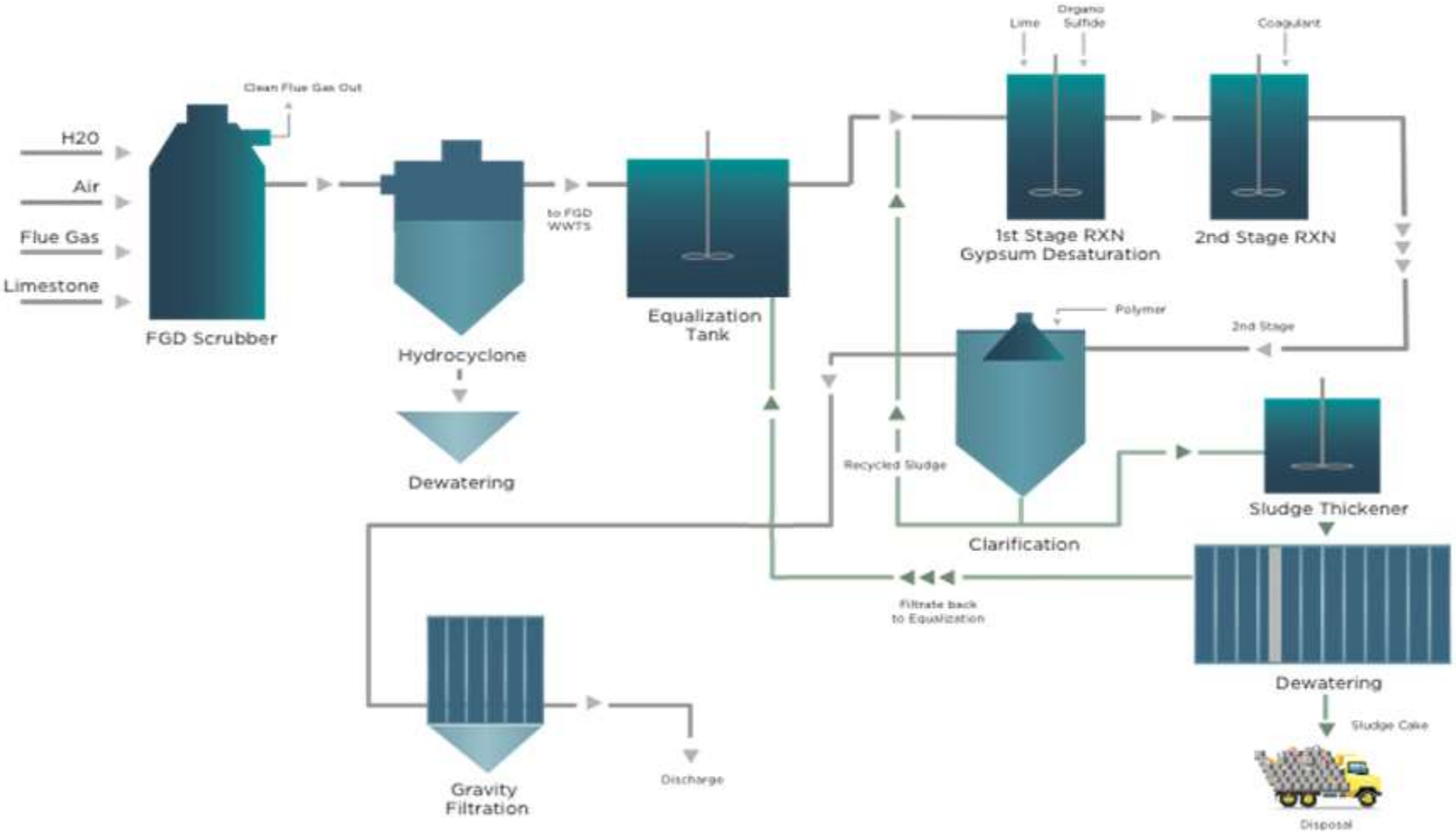
Low Utilization Subcategory Limits

Constituent[1]	Daily Max	Monthly Avg
Arsenic, ppb	11	8
Mercury, ppt	778	356
Nitrate, ppm	N/A	N/A
Selenium, ppb	N/A	N/A

Expected Treatment Requirement is Physical/Chemical

FGD Wastewater System

Simplified Treatment Schematic



CASE STUDY

FGD Wastewater Treatment

Project Overview

- USA, Coal Fired Plant with FGD, >2,000 MW
- Solution Type: FGD wastewater treatment application
- Year of Completion: 2019
- Capacity: 600 gpm

Customer Challenge

Use of wet LFSO scrubbers in FGD systems to meet emission standards results in a purge stream that is acidic, supersaturated with gypsum, contains high TDS and TSS, heavy metals, chlorides and magnesium.

Solution

A physical/chemical treatment with multimedia filters and media based lead lag mercury polishing and plate and frame filter press for solids dewatering.

Results

A system providing 600 gpm of treated FGD wastewater with <50 ppt of mercury and <8 ppb arsenic.

Scope of work

- Total process design
- General engineering
- Equipment supply
- Project management
- Supply of initial reagents and supplies
- Startup & commissioning
- Supervised Operation & maintenance

Consider the Voluntary Incentives Program (VIP)

- Extended Compliance date of December 31, 2028.
- Tighter effluent limits including dissolved solids.

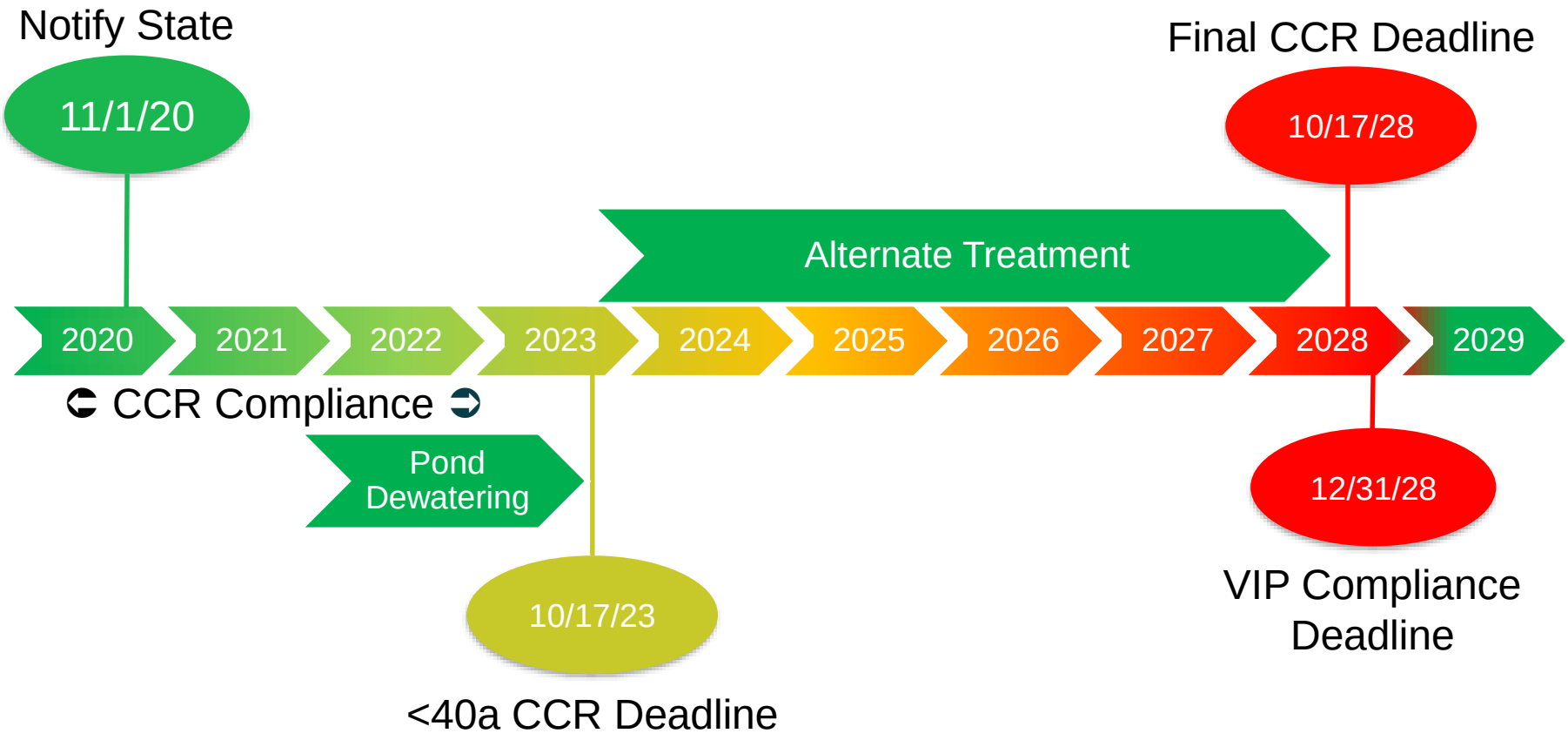
VIP ***or*** ***Not***

VIP Factors

- New consideration of BAT for VIP, Membrane over Thermal
- Delayed implementation date to improve membrane system availability
- Extra time also allows development of fly ash paste for brine disposal
- Additional consideration for limitations on Bromides based on comments from drinking water plants.[1]
- The Rule now considers membrane filtration as BAT based on cost.
- EPA expects paste technology to develop before the compliance dates, further reducing cost.[2]

EPA suggest up to 23 plants are candidates for VIP[3]

Compliance Timeline for VIP



VIP Limits

Constituent[1]	Daily Max	Monthly Avg
Arsenic, ppb	5	-
Mercury, ppt	21	9
Nitrate, ppm	1.1	0.6
Selenium, ppb	21	11
Total Dissolved Solids, ppm	351	156
Bromide, ppm	0.6	0.3

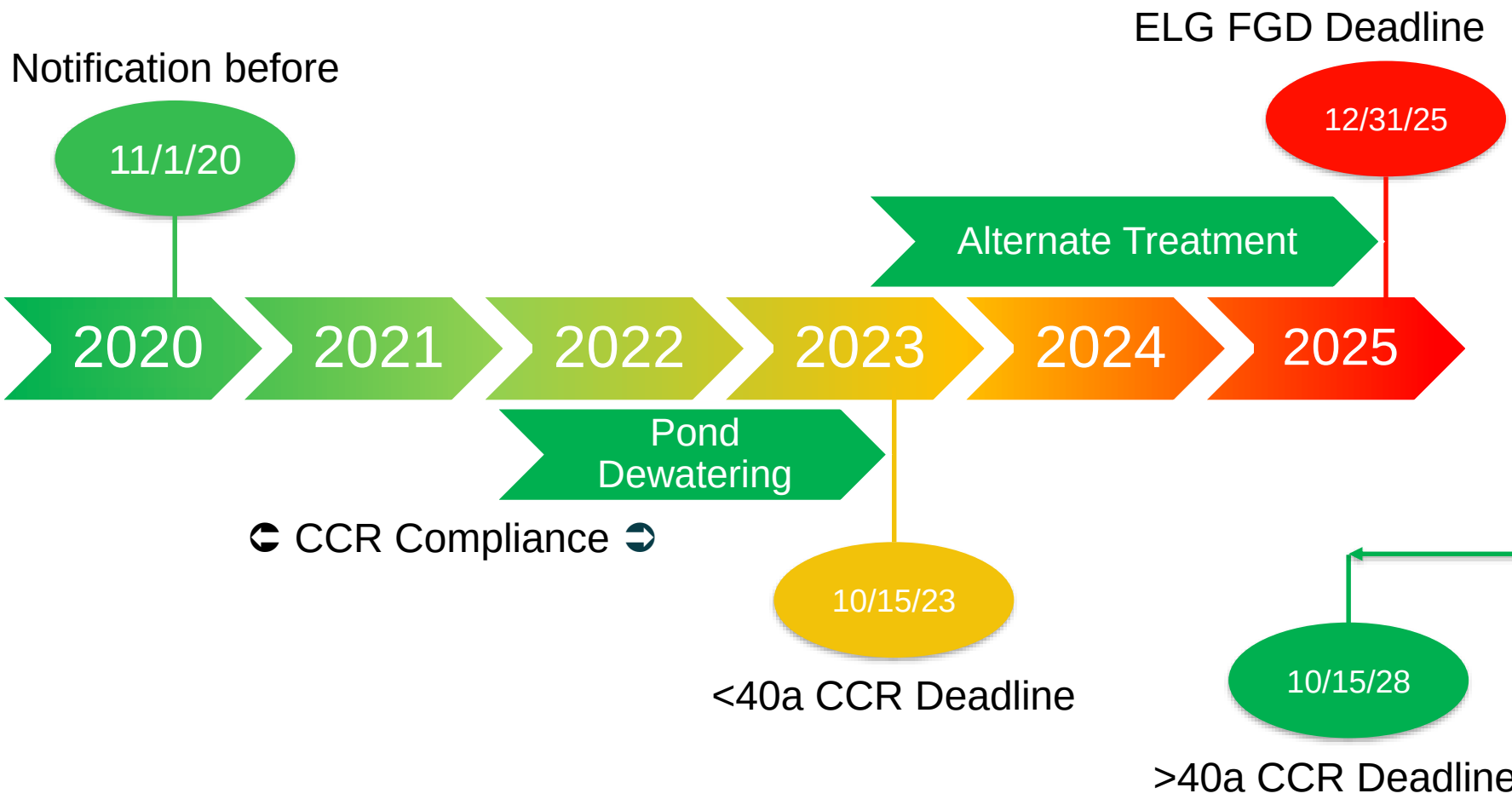
Limestone in – Limestone out

Non-Categorized Plants

Normally operating Flagship plants checklist

- ✓ Non Compliant CCR Pond stop sluicing by August 31, 2020
- ✓ Compliant CCR Pond <40 acres complete closure by October 17, 2023
- ✓ Bottom Ash Compliance November 1, 2020 or December 31, 2023
- ✓ FGD Compliance by December 31, 2025
- ✓ Compliant CCR Pond >40 acres complete closure by October 17, 2028

Compliance Timeline for Non-Categorized Plants



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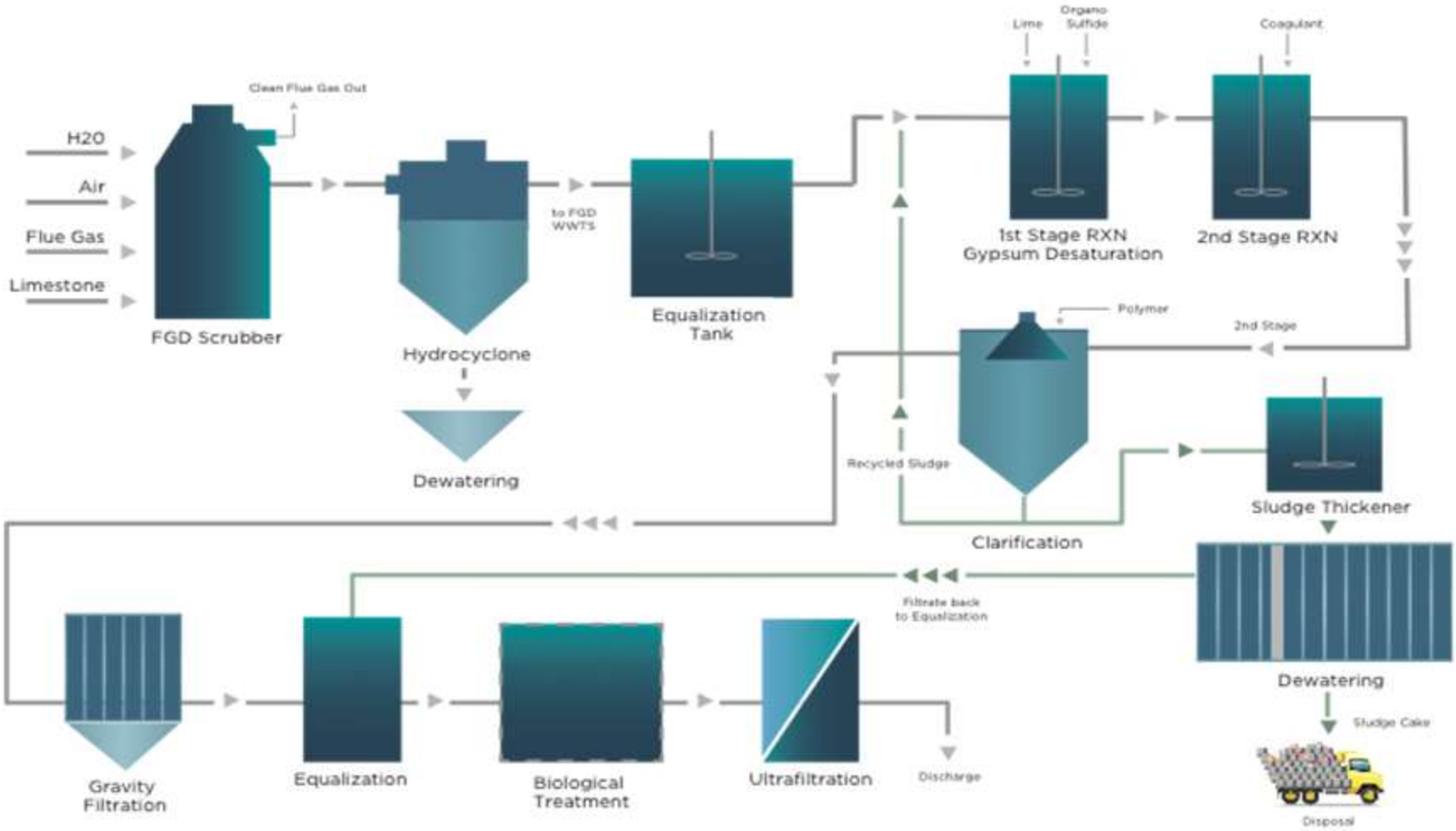
Existing Source Limits

Constituent[1]	Daily Max	Monthly Avg
Arsenic, ppb	18	9
Mercury, ppt	85	31
Nitrate, ppm	4.6	3.2
Selenium, ppb	76	31

Low Hydraulic Residence Time Biological Reduction with Ultrafiltration

FGD Wastewater System

Advanced Treatment Schematic



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Solution

A physical/chemical treatment combined with a **LRTR** biological process that utilizes selected strains of bacteria residing in a series of granular activated carbon-filled bioreactors for the selenium reduction.

Results

A system providing 600 gpm of treated FGD wastewater with < 30 ppt of mercury and < 12 ppb of selenium, <8 ppb arsenic, <4 ppm nitrate

Scope of work

- Total process design
- General engineering
- Equipment supply
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- Startup & commissioning
- Supervised Operation & maintenance

EVOQUA WATER TECHNOLOGIES

For your CCR and ELG water treatment needs.

Please Contact:

Max Swoboda

max.swoboda@evoqua.com

(205) 266-8491

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