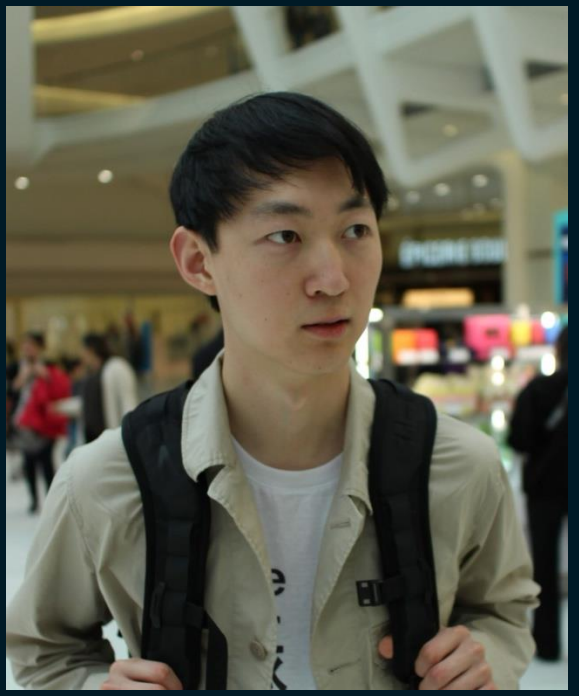

SeeQ
conneqt
PERFORMANCE OPTIMIZATION TRACK

Condition Based Batch Filter Washes and Renewals



Yu “Leon” Liu

Digital Engineer

Solvay Chemicals Inc

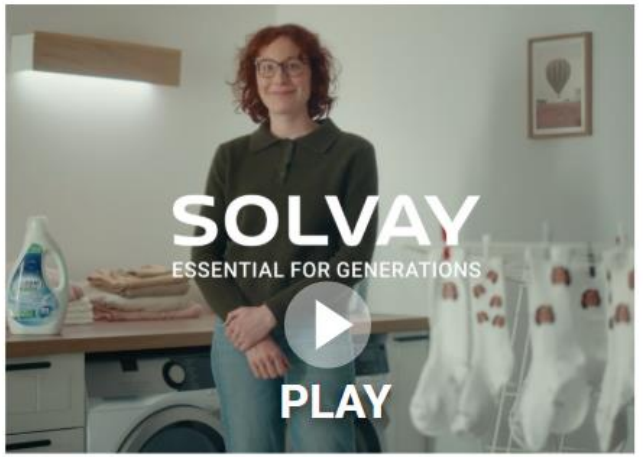
conneqt

We are **Solvay**

We are Solvay, a pioneering chemical company with a legacy rooted in the groundbreaking soda ash process innovation of our founder Ernest Solvay. We are essential chemistry – neither commodity nor specialty… essentials.

Making progress possible has been in our DNA since 1863. We master industrial processes to better manufacture technologies that are essential to multiple markets, just as we commit to social progress for our employees and communities.

Our products are essential to people's daily lives—purifying the air we breathe, conserving food resources, protecting health and well-being, making car tires more sustainable, enabling battery recycling, and high-performance semiconductor chip manufacturing.



A reference player in all our markets, with sustainability and excellence embedded in our operations and values, we are committed to driving the transition toward a carbon-neutral future by 2050, and creating a sustainable impact for generations.

~9,000
Employees

€4.7bn
Underlying net sales

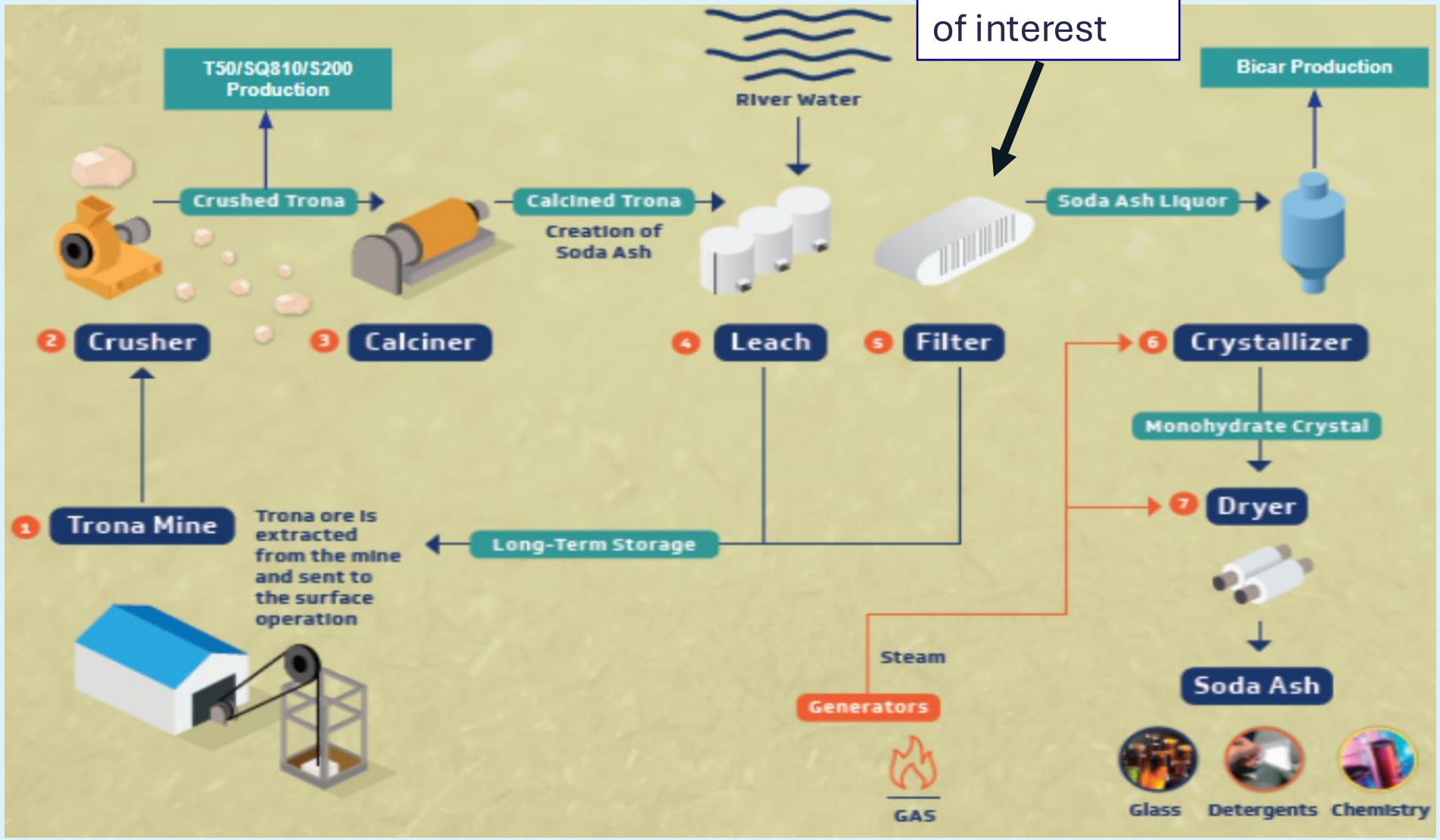
€1.05bn
Underlying EBITDA

44
Production sites

41
Countries

2024 figures

Process Overview



-two stages of filtration

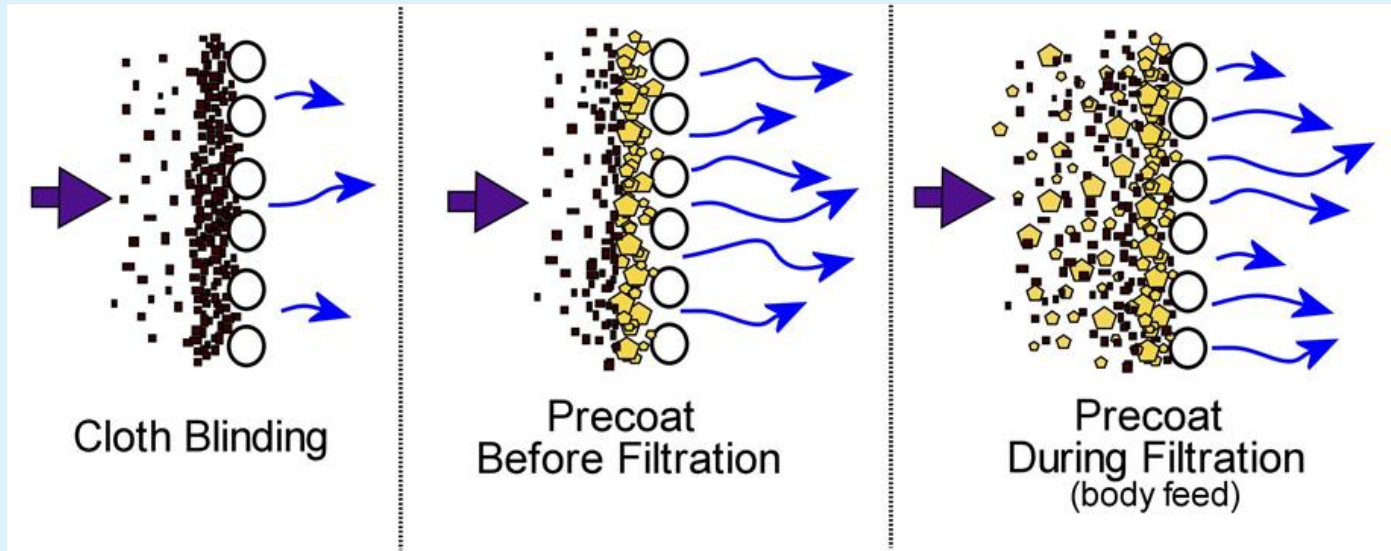
-15 primary filters in parallel with 8 secondary filters

Filters Batch Overview

1.Wash: Nozzles spray condensate at filter leaves to clean dirt and precoat

2.Precoat: Cycle filteraid through filter to coat bags

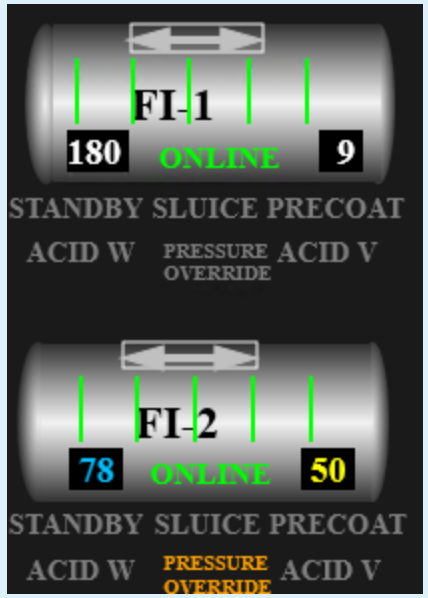
3. Filter: Constant flow until reaches max pressure, then constant pressure - limited to washing two filters at a time



Previous method of washing

1. Continuously wash filters back to back
2. Aim for each filter to be washed once a shift
3. Monitor pressure to not hit pressure limit

Some filters have more chronic problems
ie: Scaling, bag ripped, or cloth binding



Filter #	Online Hours	(MAX Hours)	Filter #	Online Hours	(MAX Hours)
FI-1	6	(24)	FI-9	3	(22)
FI-2	18	(24)	FI-10	2	(22)
FI-3	15	(24)	FI-11	0	(22)
FI-4	12	(24)	FI-14	14	(22)
FI-5	10	(24)	FI-15	4	(22)
FI-6	19	(24)	FI-31	8	(22)
FI-7	7	(24)	FI-32	10	(22)
FI-8	9	(24)	FI-37	11	(22)
FI-26	6	(24)			
FI-27	0	(24)			
FI-28	1	(24)			
FI-29	4	(24)			
FI-30	20	(24)			
FI-38	22	(24)			
FI-39	21	(24)			
FI-40	0	(24)			
FI-41	0	(24)			

Previous method of renewal

Each filter was scheduled for a full renewal once a year
with acid washing per operator judgement or during outages

Problems with washing method

1. Washing some filters that did not need washing
   (~30% more precoat usage)
2. Waiting to wash some filters that needed immediate washing
   (10% OEE Loss reduction)
3. No forecasting for operators to plan which filters need washing
4. No standard method among shifts

Problems with renewal method

1. Some filters will be scaled or the cloth will be bound for many months before renewal
2. Some filters will be renewed when it is not necessary

Need a good way to move from time-based to condition-based

Filter Washing

Balancing 3 KPIs

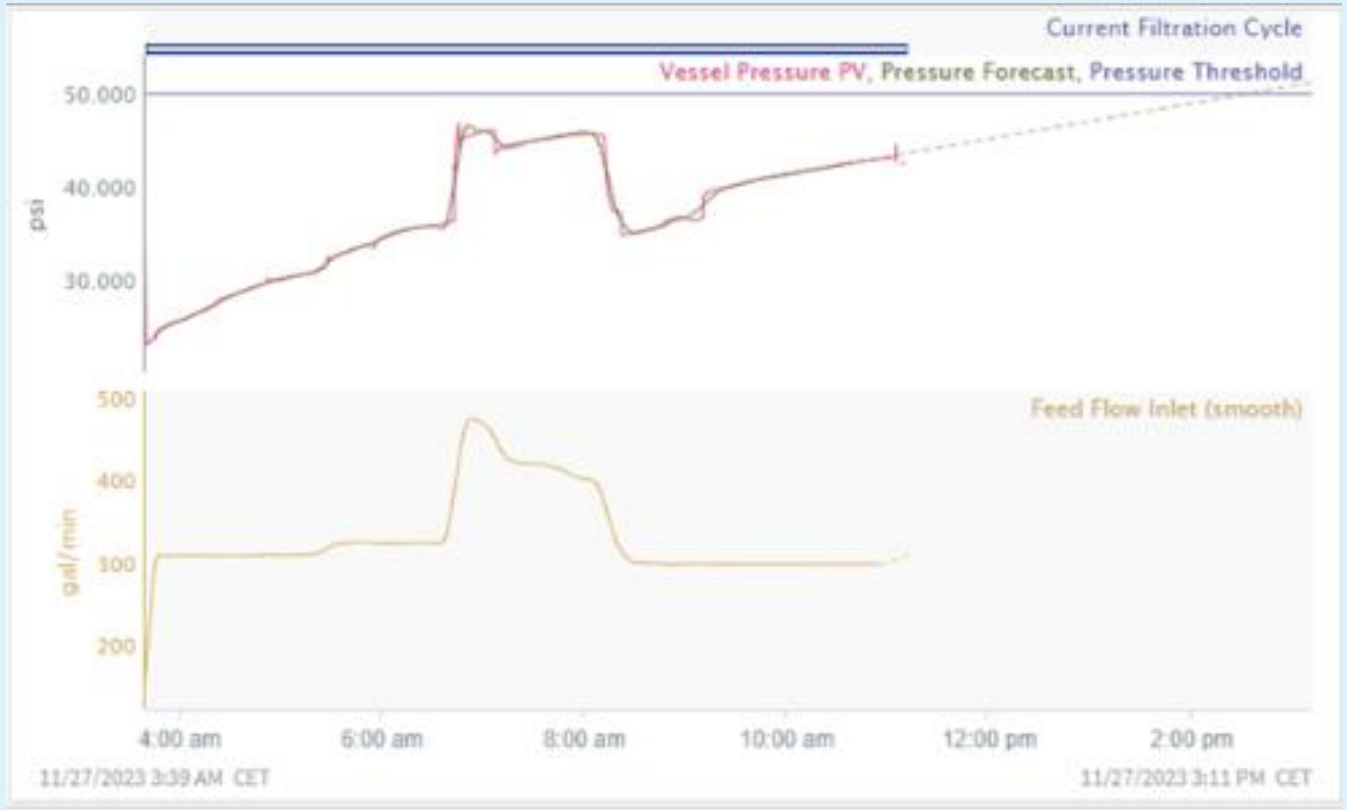
1) Pressure Forecast
2) Space between Filter Leaf
3) Time since last wash

1) Pressure Forecast

Hours until filter reaches max psi

Take slope and multiply by last recorded flow

- Use growing window or fixed window?
- Fixed 1 hour window



Filter Washing

Balancing 3 KPIs

1) Pressure Forecast
2) Space between Filter Leaf
3) Time since last wash

2) Space between Filter Leaf

Hours until cake starts to bridge

Precoat + Admix + Solids

Due to lack of instrumentation, we assume constant solids loading

Calculated by feed flow integral, predicted by feed flow rate

Criteria 2: Space Left Between Filter Leaves Forecast

Asset	Current Step Last	Perlite from Precoat	Perlite Accumulation from Admix	Solids Accumulation	Space Left Between Leaves
FI29 Expansion Primary Filter	Filtration	0.1793 in	3.1018 in	0.0211 in	-2.279 in
FI10 Old Side 2nd Filter	Filtration	0.1051 in	0 in	0.0007 in	1.4513 in
FI32 Expansion 2nd Filter	Filtration	0.091 in	0 in	0.0018 in	1.4771 in
FI15 Old Side 2nd Filter	Filtration	0.0872 in	0 in	0.0012 in	1.486 in
FI37 Expansion 2nd Filter	Filtration	0.0761 in	0 in	0.0011 in	1.5084 in
FI9 Old Side Primary/2nd Filter	Filtration	0.1236 in	0 in	0.0016 in	1.9117 in

Filter Washing

Balancing 3 KPIs

1) Pressure Forecast
2) Space between Filter Leaf
3) Time since last wash

3) Time since last wash

If it has been washed already, delay recommending again

If it has not been washed for a long time, recommend a wash

Seeq Dashboard – Filter Washing

Old Side Filters to Sluice

1 2 3

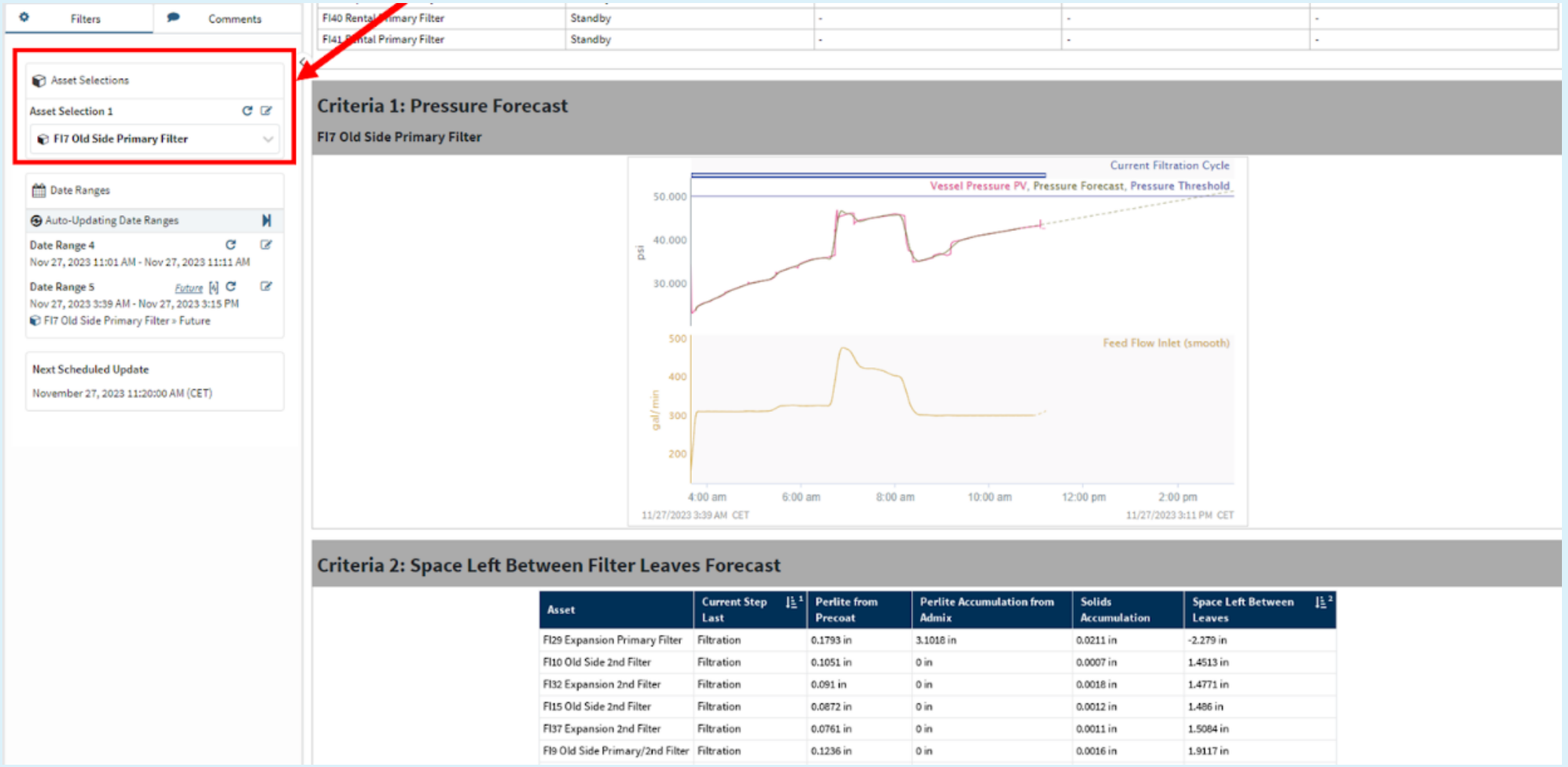
Asset	Current Step	Time until Sluice Needed	Time until Cake Bridges	Time until Pressure Limit	Time until Time Limit
FI10 Old Side 2nd Filter	Filtration	-9.4 h	-9.4 h	-	12.4 h
FI39 Old Side Primary Filter	Filtration	-8.8 h	24.1 h	19.9 h	-8.8 h
FI15 Old Side 2nd Filter	Filtration	2.0 h	2.0 h	-	16.6 h
FI9 Old Side Primary/2nd Filter	Filtration	7.2 h	7.2 h	-	11.2 h
FI6 Old Side Primary Filter	Filtration	9.0 h	43.6 h	28.7 h	9.0 h
FI14 Old Side 2nd Filter	Filtration	9.1 h	9.1 h	-	14.8 h
FI11 Old Side 2nd Filter	Filtration	9.5 h	9.5 h	-	13.5 h
FI4 Old Side Primary Filter	Filtration	17.9 h	60.3 h	-	17.9 h
FI1 Old Side Primary Filter	Filtration	19.2 h	64.6 h	-	19.2 h
FI3 Old Side Primary Filter	Filtration	19.9 h	64.1 h	19.9 h	22.2 h
FI2 Old Side Primary Filter	Filtration	20.2 h	53.5 h	-	20.2 h
FI5 Old Side Primary Filter	Filtration	21.2 h	55.2 h	-	21.2 h
FI7 Old Side Primary Filter	Standby	-	-	-	-
FI8 Old Side Primary Filter	Standby	-	-	-	-

Optimized, condition based, and standard with forecasting

conneqt

Seeq Dashboard – Filter Washing

Can leverage Asset Selection in Seeq so don't need to duplicate work for each filter.



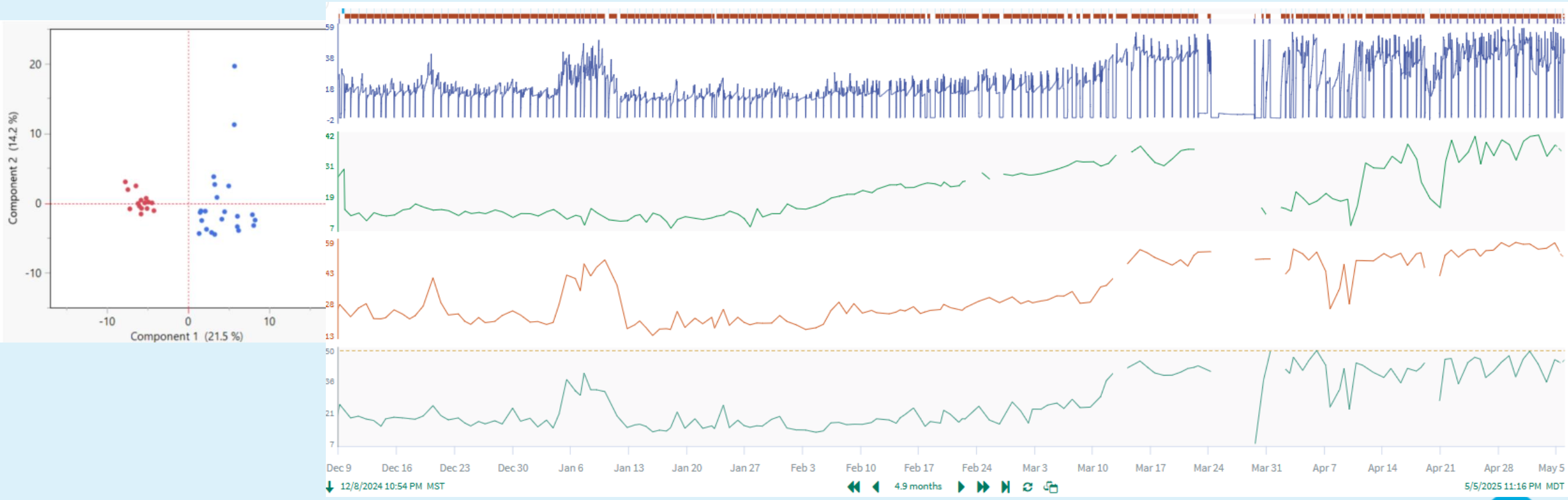
Asset	Current Step Last	Perlite from Precoat	Perlite Accumulation from Admix	Solids Accumulation	Space Left Between Leaves
FI29 Expansion Primary Filter	Filtration	0.1793 in	3.1018 in	0.0211 in	-2.279 in
FI10 Old Side 2nd Filter	Filtration	0.1051 in	0 in	0.0007 in	1.4513 in
FI32 Expansion 2nd Filter	Filtration	0.091 in	0 in	0.0018 in	1.4771 in
FI15 Old Side 2nd Filter	Filtration	0.0872 in	0 in	0.0012 in	1.486 in
FI37 Expansion 2nd Filter	Filtration	0.0761 in	0 in	0.0011 in	1.5084 in
FI9 Old Side Primary/2nd Filter	Filtration	0.1236 in	0 in	0.0016 in	1.9117 in

Filter Renewal

How to know when to renew a filter?

Used Principal Component Analysis in JMP to find correct KPI “max precoating pressure”

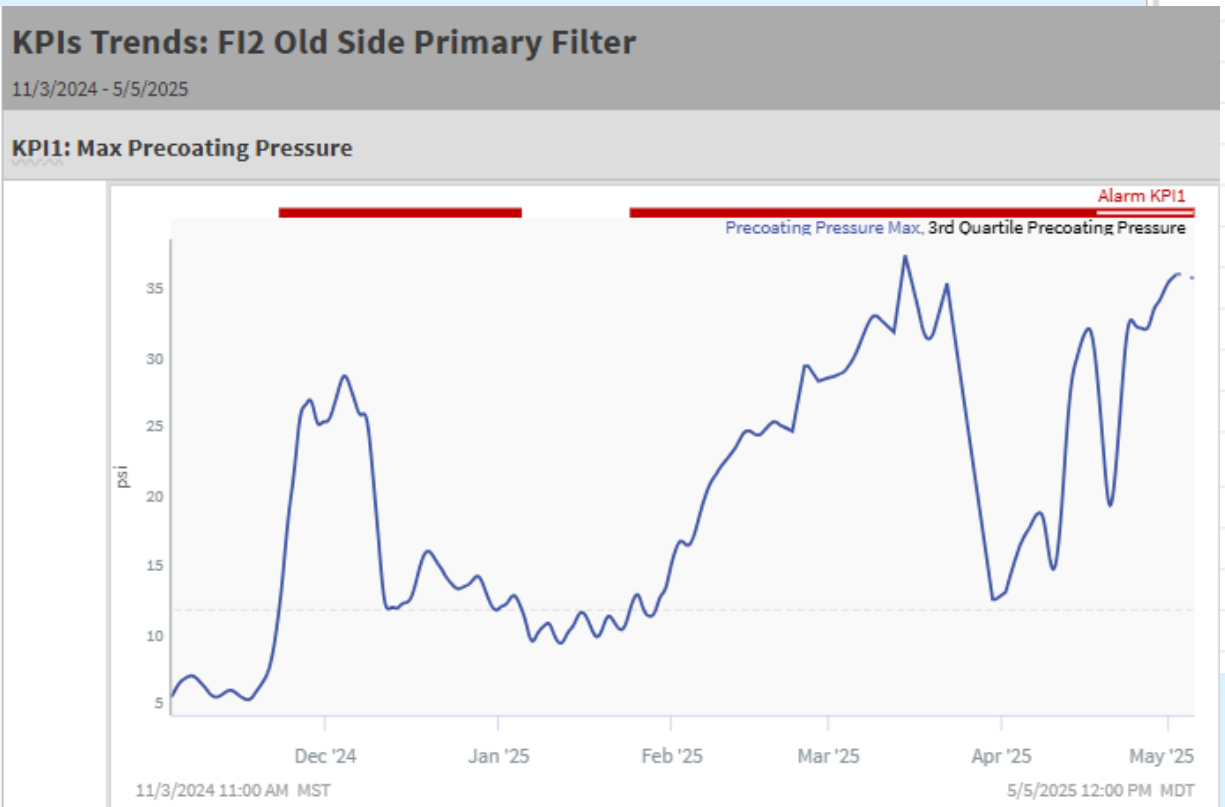
Extract the max pressure during precoating step using Seeq



Seeq Dashboard – Filter Renewal

Keep track of number of days in alarm and sort by maximum days in alarm.

Recommendation	Asset	Alarm KPI1: Max Precoating Pressure	Alarm KPI2: Transition Pressure Drop	Alarm KPI3: Early Pressure Limit Reached	Alarm KPI4: Avg Flow PV-SP
Warning	FI2 Old Side Primary Filter	89 d	3 d	15 d	8 d
Warning	FI1 Old Side Primary Filter	32 d	11 d	8 d	-
Warning	FI6 Old Side Primary Filter	26 d	3 d	-	-
Warning	FI37 Expansion 2nd Filter	18 d	-	-	-
Warning	FI4 Old Side Primary Filter	13 d	-	-	-
Warning	FI3 Old Side Primary Filter	12 d	11 d	-	-
Warning	FI29 Expansion Primary Filter	0 d	12 d	-	5 d
Warning	FI27 Expansion Primary Filter	0 d	11 d	-	5 d
-	FI32 Expansion 2nd Filter	0 d	-	-	-
	FI40 Rental Primary Filter	0 d	-	-	-
	FI41 Rental Primary Filter	0 d	-	-	-
	FI7 Old Side Primary Filter	0 d	-	-	-
	FI8 Old Side Primary Filter	0 d	-	-	-
	FI26 Expansion Primary Filter	0 d	-	-	6 d
	FI31 Expansion 2nd Filter	0 d	-	-	6 d
	FI39 Old Side Primary Filter	0 d	-	-	5 d
	FI28 Expansion Primary Filter	0 d	9 d	-	6 d
	FI10 Old Side 2nd Filter	0 d	6 d	-	6 d
	FI30 Expansion Primary Filter	0 d	5 d	-	5 d
	FI9 Old Side Primary/2nd Filter	0 d	5 d	-	4 d
	FI14 Old Side 2nd Filter	0 d	4 d	-	-
	FI38 Expansion Primary Filter	0 d	4 d	-	7 d
	FI15 Old Side 2nd Filter	0 d	4 d	-	4 d
	FI11 Old Side 2nd Filter	0 d	3 d	-	-
	FI5 Old Side Primary Filter	0 d	-	8 d	3 d



Next Steps

- Continue change management on filter dashboard
- IoT for live suspended solids measurement
- Upload all of our data into the cloud for use in Seeq
- Train every engineer in Seeq before end of year

Summary

CHALLENGE

Difficult to develop condition based standard method of batch filter washing and renewal

SOLUTION

By using Seeq dashboard, it is much easier to empower operators with an optimized, condition based, and standard method

RESULTS

10% OEE loss mitigation, which results in ~$400k/yr in OEE gain


SeeQ
conneqt
THANK YOU!