Past and Future Efforts Towards Reducing Selenium in Refinery Wastewater Effluent

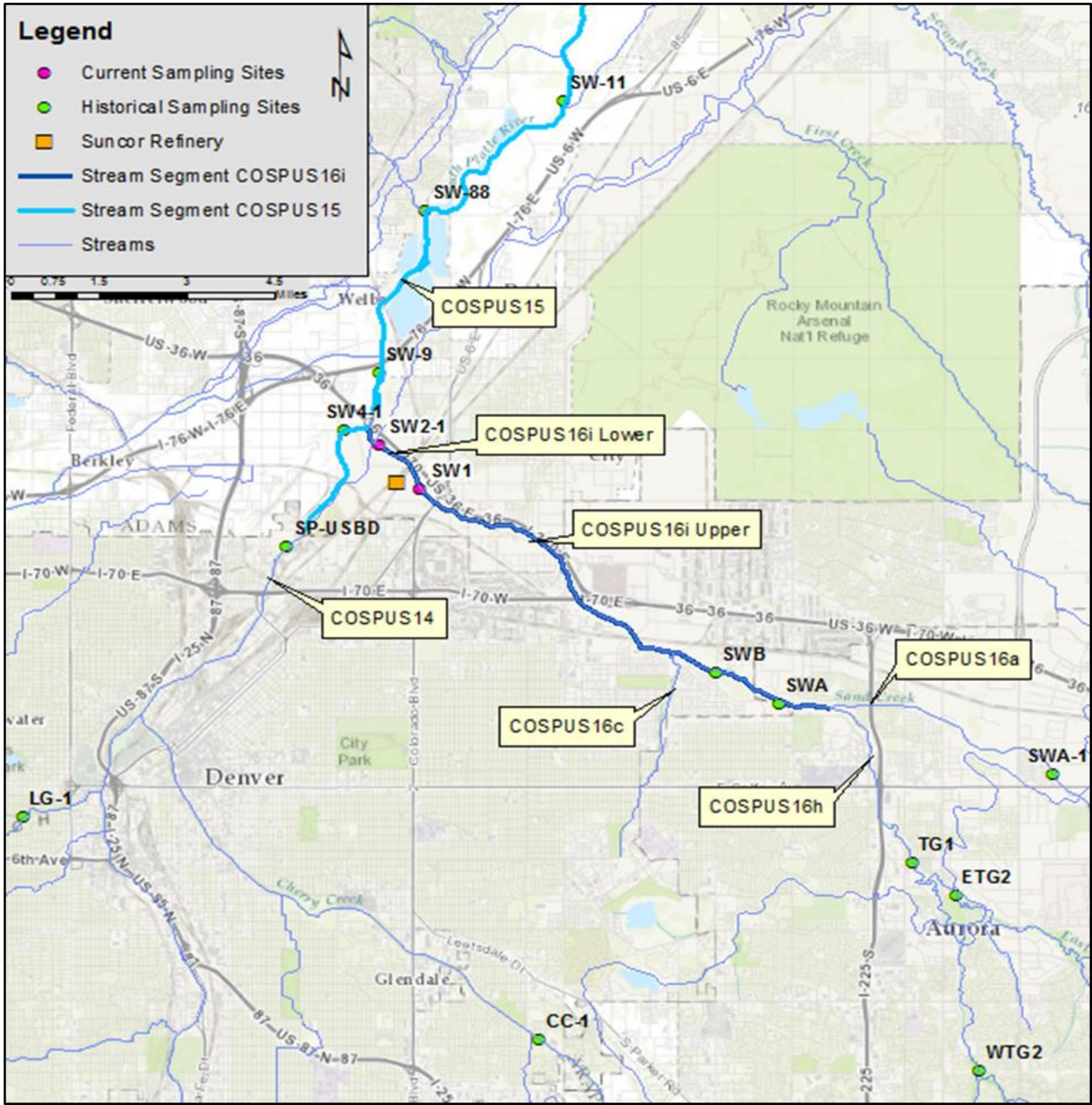
Confluence at the Confluence
October 26, 2016

Suncor Commerce City Refinery

- ~100,000 bpd petroleum refinery – only one in Colorado
  - Supply ~35% of Colorado’s gasoline and ~55% of Colorado’s diesel fuel
  - Supply ~1/3 of Denver International Airport’s jet fuel
  - Large supplier of paving grade asphalt used for roads in Colorado

Sand Creek Selenium Standard

- Treated Refinery Wastewater Discharged to Sand Creek
  - Segment 16i, Lower
  - Ambient standards adopted in 2013
    - 9.0 µg/L (ch)
    - 18.4 (ac)
    - Ambient standard reflected in permit limit effective 1/1/2018

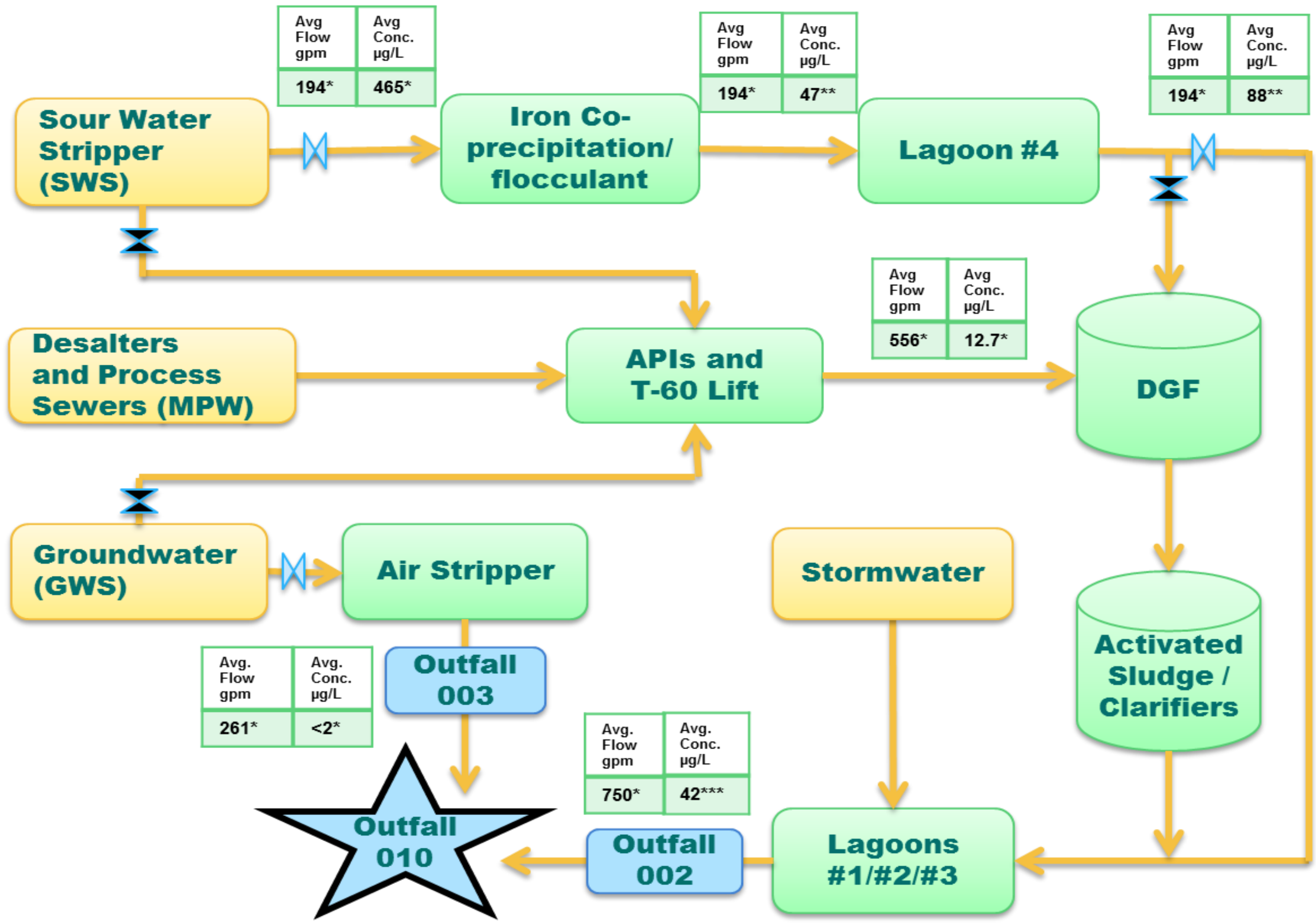


Past Efforts to Reduce Selenium

- Selenium (Se) levels in the refinery discharge above the ambient standard
  - Crude oil contains selenium
  - Removal of sulfur compounds for fuel (EPA requirement) also removes selenium, increasing the levels of selenium in the discharge

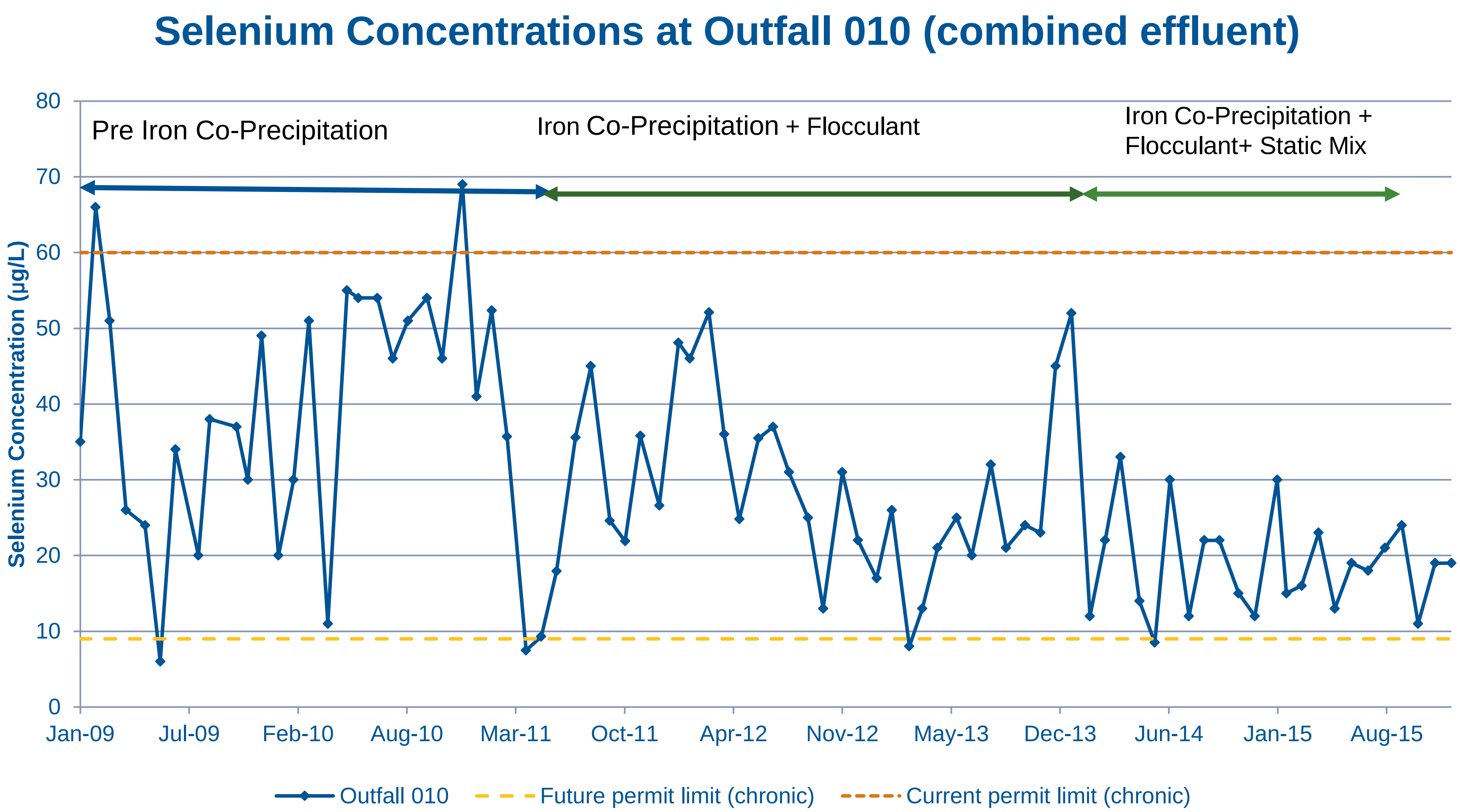
- Over 20 years of effort has been invested into selenium reduction studies at the Commerce City refinery
  - >20 pilot and bench tests exploring chemical, physical, and biological treatment technologies

Current Treatment Regime



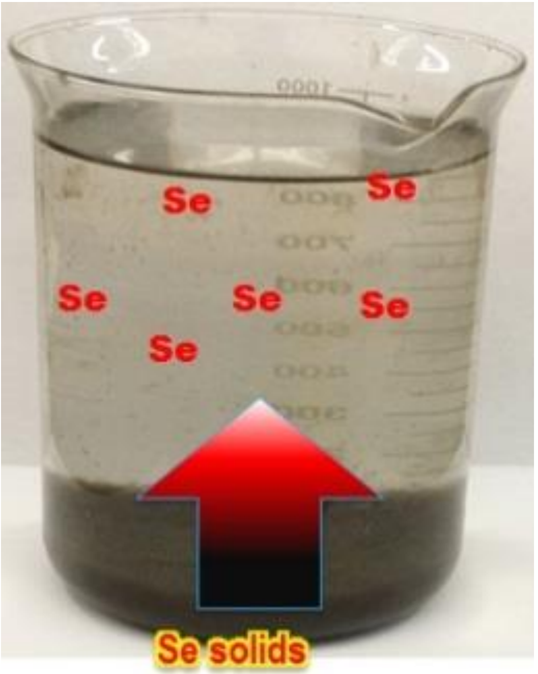
- Three treatment streams contribute to regulatory Outfall 010
- The majority of Se derives from the sour water stripper

Current Treatment Regime



Dissolved Air Flotation (DAF) Pilot Study

- Permit Limit Infeasible to Meet
  - Se-bearing solids release into wastewater if not removed
  - Influent variability



- DAF Solution
  - Rapid solids removal
  - Less variability

Summary of Discharger Specific Variance (DSV) Package

- DSV Approved by the WQCC
  - Selenium DSV for USP Segments 15 and 16i
  - Alternative Effluent Limit (AEL) is 24 µg/L (30-day avg) based on DAF
  - Expires 12/31/2023, Commission review 6/2020
  - Proposed compliance schedule to meet AEL by 10/1/2020
  - DSV meets all state and federal requirements
  - WQCD, EPA, and CPW have helped frame Suncor’s DSV development

Summary of the Alternatives Analysis

- DAF Provides best water quality feasible
  - Rapid removal of selenium bearing solids (clarification) was evaluated
  - Conditions provide test bed for future improvement
- Alternate Effluent Limit (AEL) of 24 µg/L (30-day)
  - Accounts for uncertainty in final effluent conditions
  - Statistically-derived safety factor
  - Results in a significant reduction in permit limits

Comparison of Current and DSV Limits and Loadings		
	Effluent limit	Permitted Load
Current permit (through 12/31/2017)	60 µg/L (30-day average)	1.83 lbs/day
DSV	24 µg/L (30-day average)	0.73 lbs/day

Next Steps for Implementation and Optimization

- Oct 2018 Install DAF
- Apr 2019 Clean Lagoon
- Apr 2020 Fine tuning
- Jun 2020 WQCC Review
- Apr 2021 Treatment studies
- Dec 2023 DSV Expires

Conclusion

Answers to the 3 stages of removal of selenium from refinery wastewater

- How to precipitate selenium?
  - Iron Coprecipitation + Flocculant (current treatment)

- How to remove solids to optimize precipitation?
  - Dissolved Air Filtration Unit (future treatment under DSV)

- What step to follow solids removal?
  - Process optimization (example: re-routing centrate)
  - Evaluate options for process polishing (pilot studies)

SUNCOR

Questions