

KAISER **ALUMINUM**

Agreed Order No. 2692 Amendment No. 2



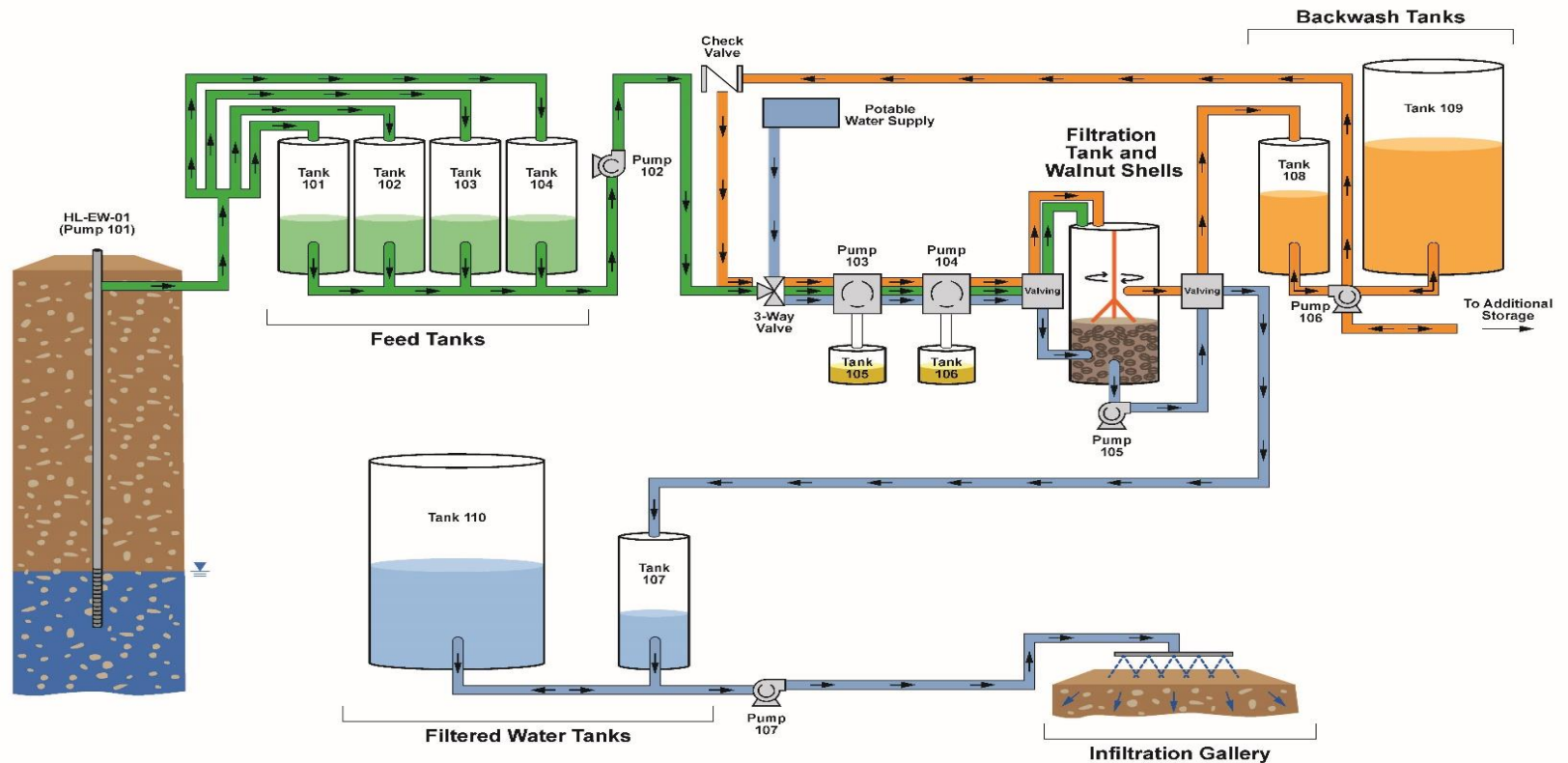
Agreed Order No. 2692 Overview

- Initial Agreement – August 15, 2005
 - Defined the process for the Remedial Investigation/Feasibility Study (RI/FS) scope and schedule
- Amendment No. 1 – September 26, 2012
 - Excavation and off-site disposal of contaminated soil in multiple locations throughout the Site
 - Remedial actions for petroleum in groundwater in applicable areas of the Site
 - Capping of contaminated soil in multiple locations throughout the Site
 - Excavation and off-site disposal of soils contaminated with PCBs and petroleum in the West Discharge Ravine
 - Evaluation of the practicability of PCB removal from extracted groundwater using an ex-situ Walnut Shell Filtration treatment system

Walnut Shell Filtration

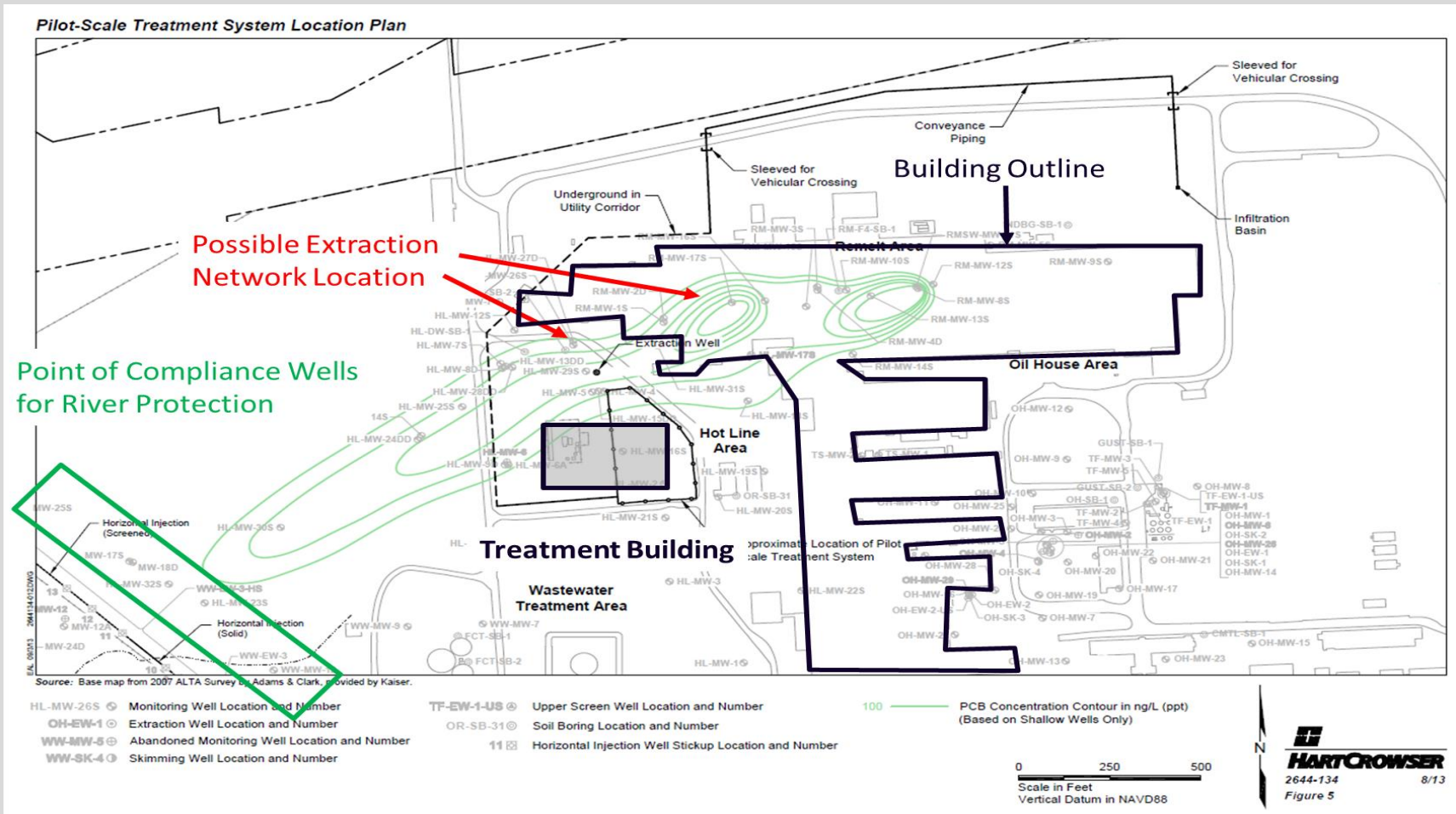
- **Walnut Shell Filtration**
 - Walnut shell in conjunction with castor oil capture PCBs from extracted groundwater
 - Walnut shells are periodically backwashed to remove castor oil
- **Kaiser System**
 - 282 gallon unit purchased from Filtra Systems
 - Commissioned in October 2015
 - 24 Test Runs Completed
 - 20,687,099 gallons treated
 - ~20 grams of PCBs captured
 - 21 – 32 gpm process rate
 - Approximately -70% capture efficiency
 - Operational capacity limited by discharge pipe to infiltration gallery

Walnut Shell Filtration



Groundwater Treatment System Flow Diagram

Walnut Shell Filtration



Walnut Shell Filtration



Walnut Shell Filtration



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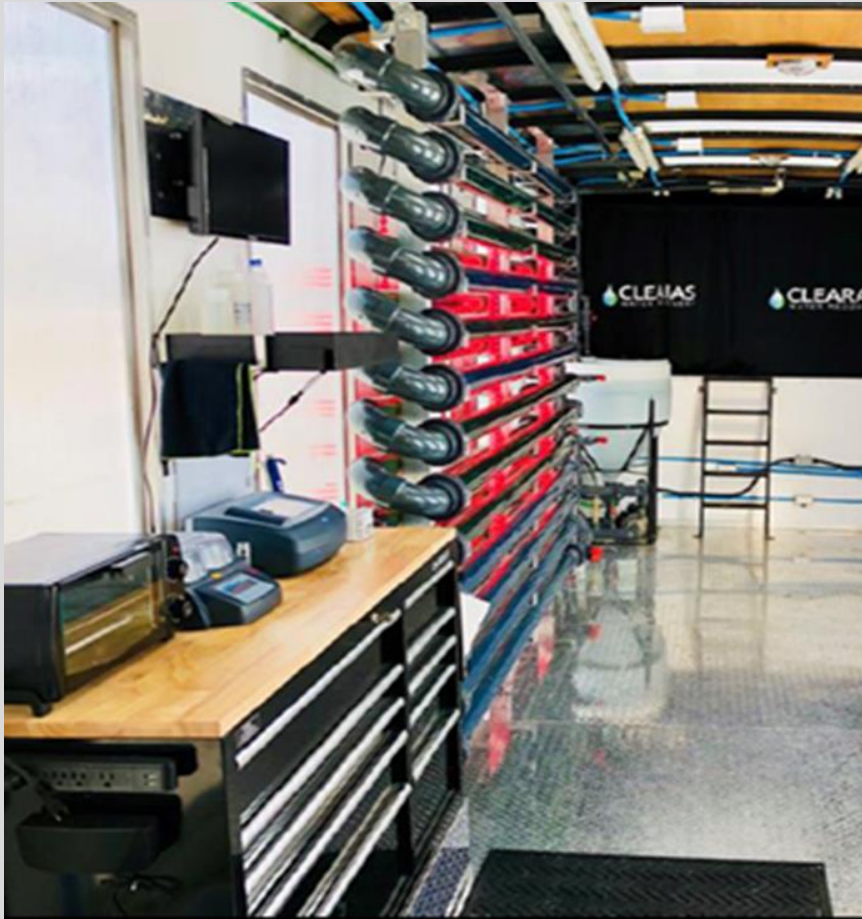
Walnut Shell Filtration



Treatment Technologies Evaluated

- **Algae**
 - Removed approximately 89% of PCBs from Backwash Water
 - Media transfer technology – not destructive
 - Algae/PCB generated waste management – landfill/incineration
- **Solvent Exchange Extraction and Zero Valent Metal Destruction**
 - Removed approximately 80% of PCBs from Backwash Water
 - Destroyed approximately 90% of captured PCBs

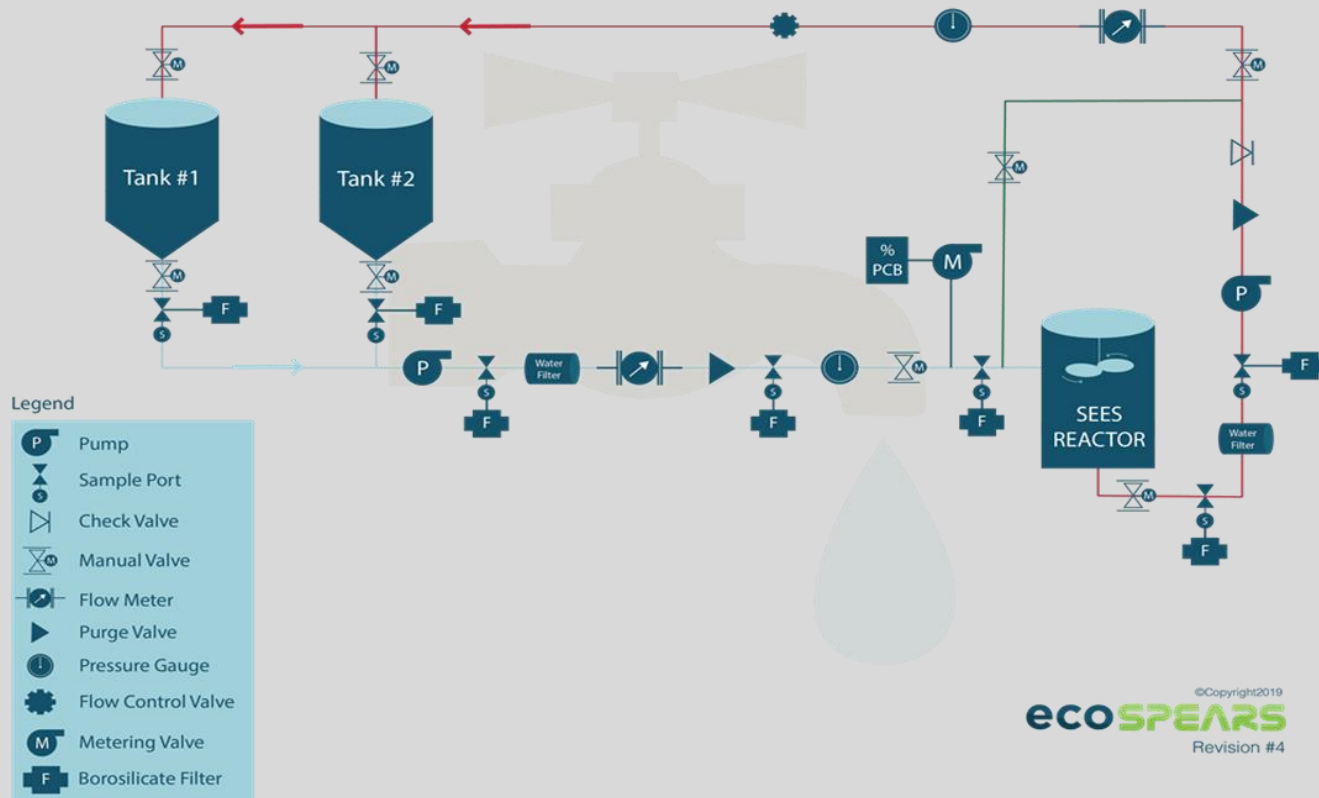
Algae Based System



Solvent Exchange Extraction System

Solvent Exchange Extraction System (SEES)

Aqueous Ex-Situ Technology

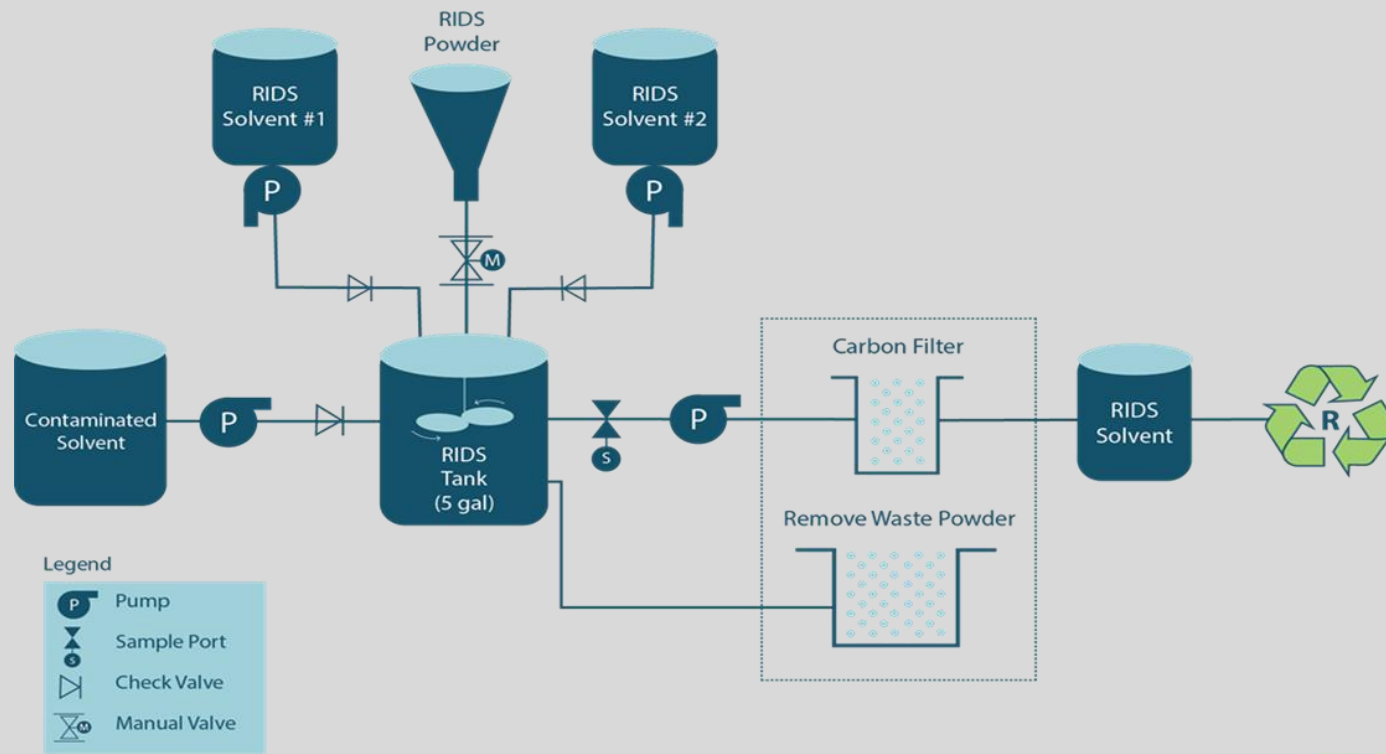


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Zero Valent Metal Destruction

Reductive Integrated Destruction System (RIDS)

for Contaminated Soil and Groundwater



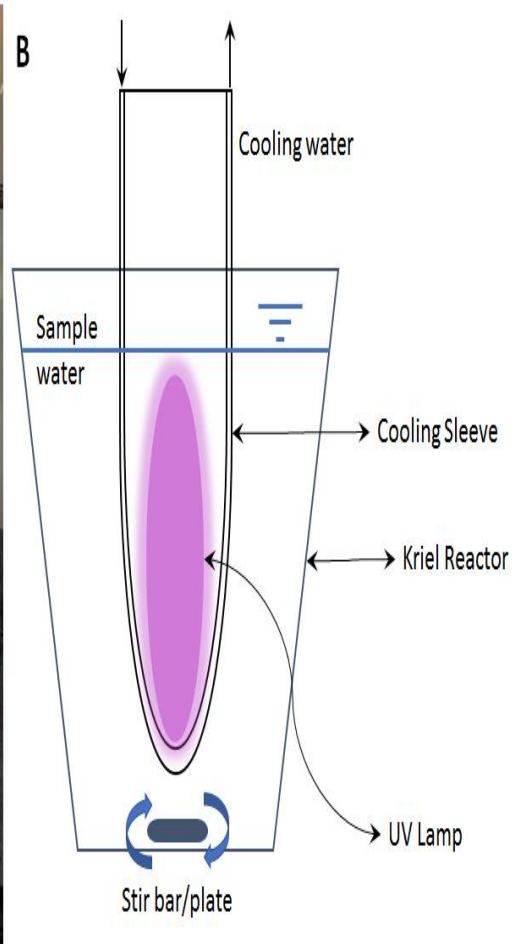
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Treatment Technologies Evaluated

- Ultraviolet/Advanced Oxidation Process (UV/AOP)
 - UV utilized in WWTPs for disinfection activities
 - High flow capability
 - Advanced Oxidation – Hydrogen Peroxide
 - Literature study indicated greater than 95% destruction of PCBs (high concentrations)
 - Had not been proven at any scale only literature
 - CDM Smith performed lab scale batch testing in 2019 on site groundwater (5 L batch)
 - Results consistent with literature
 - Pilot scale testing in development
 - New Build
 - Modification of disinfection unit
 - Continuous flow

Ultra Violet/Advanced Oxidation Process



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■ Phase 1 Interim Actions

- Model and install final groundwater extraction network capable of cutting off the plume and achieving river protection
- Increase size of treated water discharge pipe
- Continue operation of existing Walnut Shell Filtration Pilot Plant
 - Increase to 50+ gpm processing rate
- Continue pilot testing other technologies, as appropriate
- Increase size of treatment building to pilot test UV/AOP on extracted groundwater

■ Phase 2 Interim Actions

- Complete full scale implementation of the most successful technology
- Extraction rates would be required to achieve river protection
- Evaluation of performance

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- Benefits of Interim Action Process
 - Shorter timeframe to begin full-scale remedy
 - More flexibility in technology application at both full-scale implementation and full-scale remedy evaluation (Cleanup Action Plan)
 - UV/AOP offers a potential pathway for PCB destruction vs media transfer

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- Estimated Schedule of Proposal
 - Implement Phase 1 Interim Actions
 - Approximately 18 months from the effective date of Amendment to complete
 - Implement Phase 2 Interim Action – Full Scale Cleanup
 - Approximately 12 months after completion of Phase 1 until full scale implementation

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- **Public Review Period**
 - Amended Agreed Order, Scope of Work, and SEPA documents
 - February 24 to March 24, 2020
 - Fact Sheet includes information on making comments
 - Once public review period is complete, Ecology will:
 - Respond to all comments via published Response to Comments
 - If necessary, modify the documents based on public input and initiate second public review period
 - Finalize the documents if public comments do not necessitate changes to the documents

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Questions/Discussion