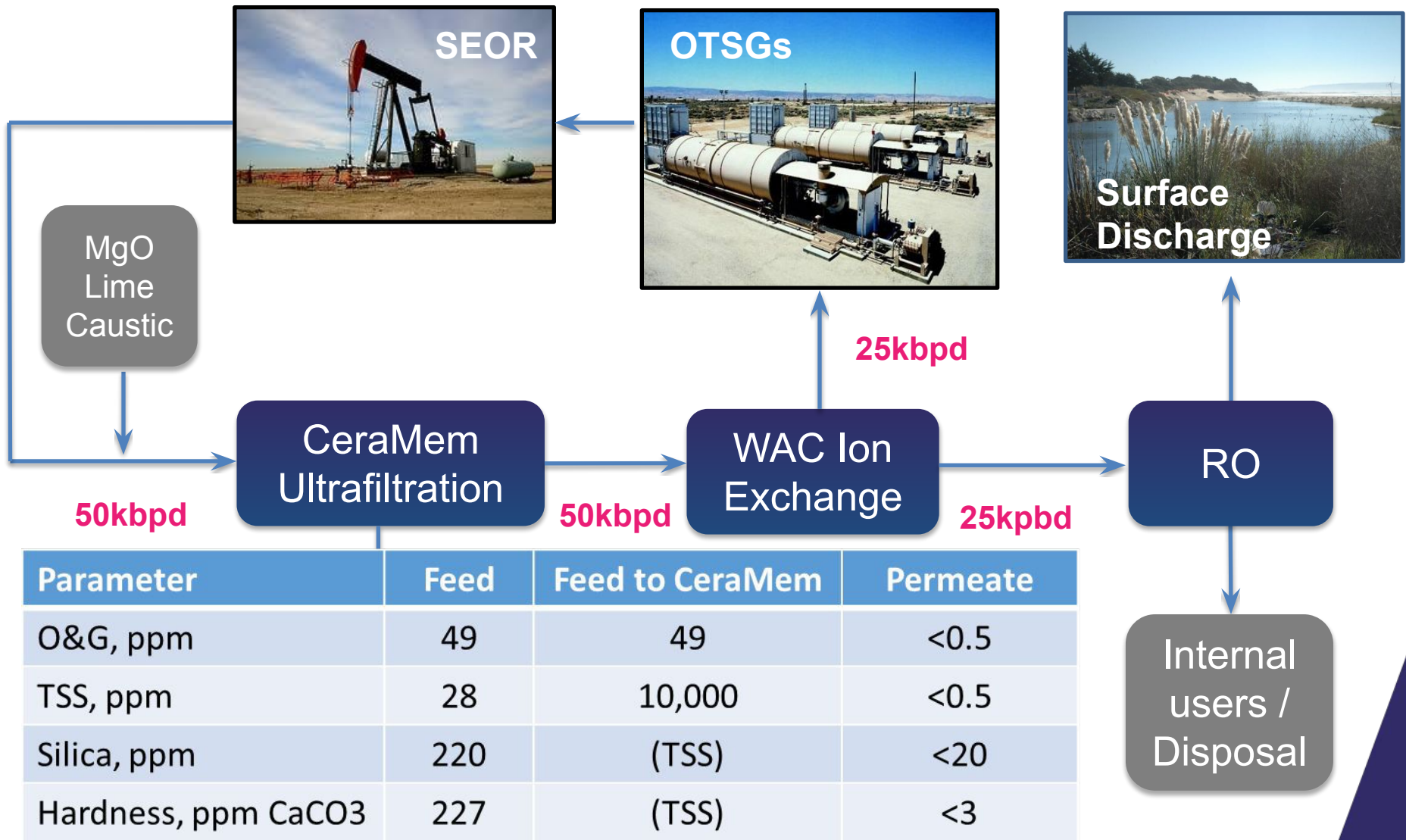


Steam Flood Case Study - California Customer

- **Project Information:**
 - Customer: Confidential
 - Location: California, USA
 - Application: Steam Flood produced water treatment for recycle as OTSG Feed
- **Project Goal**
 - Treat 50,000 bpd of produced water
 - Treat 50% for OTSG Feed
 - Treat 50% for surface discharge (excess produced water)
- **Key Project Drivers**
 - Increase oil production
 - Reduce injection volume
 - Reduce formation pressure

Note: EPC = Veolia. Ceramic UF unit = CeraMem (Alsys)

Steam Flood Case Study – Customized Process





Steam Flood Case Study - California Customer

Unique requirements and challenges

- Softening and Silica removal necessary for OTSG feed specification.
- Minimize injection volume to disposal well
- Limited foot-print
- Save energy re-using produced water at high temperatures
- Highly abrasive feed / high TSS to the membrane

A customized solution

- Lime softening as pre-treatment
- Use of MgO to co-precipitate the Silica
- **30% footprint reduction** with ceramic membranes
- Ceramic membranes operated at 160 °F (70 °C)
- **Abrasive resistant membrane** formulation developed for this application
- Abrasion model developed to estimate membrane lifetime