**From:** "Joby Adams" <joby@cgrs.com>
**To:** "Gary Beers" <gbeers@smtpgate.dphe.state.co.us>
**Date:** 4/30/2010 3:32 PM
**Subject:** FW: Message from KMBS_C450
**Attachments:** SKMBS_C45010043014180.pdf

RO analysis by Remco.

Joby Adams, P.G.

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-----Original Message-----
From: minolta@cgrs.com [mailto:minolta@cgrs.com]
Sent: Friday, April 30, 2010 4:18 PM
To: Joby Adams
Subject: Message from KMBS_C450

Scanned 13:06:12 03/25/2014



Hydranautics Membrane Solutions Design Software, v. 2006 10/12/2006

BASIC DESIGN

| | | | | | |
|---|---|---|---|---|---|
| RO program licensed to: | | | | | |
| Calculation created by: | REM | | | | |
| Project name: | Conquest Oil C-3 | | Permeate flow: | 75.00 | gpm |
| HP Pump flow: | 125.0 | gpm | Raw water flow: | 125.0 | gpm |
| Recommended pump press.: | 362.4 | psi | | | |
| Feed pressure: | 333.4 | psi | Permeate recovery: | 60.0 | % |
| Feedwater Temperature: | 20.0 | C(68F) | | | |
| Feed water pH: | 7.7 | | Element age: | 0.0 | years |
| Chem dose, ppm (100%): | 0.0 | H2SO4 | Flux decline % per year: | 7.0 | |
| Acidified feed CO2: | 15.61 | | Salt passage increase, %/yr: | 10.0 | |
| Average flux rate: | 15.0 | gfd | Feed type: | Well Water | |

| Stage | Perm. Flow | Flow/Vessel Feed | Flow/Vessel Conc | Flux | Beta | Conc.&Throt. Pressures | | Element Type | Elem. No. | Array |
|---|---|---|---|---|---|---|---|---|---|---|
| | gpm | gpm | gpm | gfd | | psi | psi | | | |
| 1-1 | 75.0 | 41.7 | 16.7 | 15.0 | 1.07 | 318.1 | 0.0 | ESPA2 | 18 | 3x6 |

| | Raw water | | Feed water | | Permeate | | Concentrate | |
|---|---|---|---|---|---|---|---|---|
| Ion | mg/l | CaCO3 | mg/l | CaCO3 | mg/l | CaCO3 | mg/l | CaCO3 |
| Ca | 5.0 | 12.5 | 5.0 | 12.5 | 0.018 | 0.0 | 12.5 | 31.1 |
| Mg | 5.0 | 20.6 | 5.0 | 20.6 | 0.018 | 0.1 | 12.5 | 51.3 |
| Na | 3649.6 | 7933.9 | 3649.6 | 7933.9 | 63.111 | 137.2 | 9029.3 | 19629.0 |
| K | 707.0 | 906.4 | 707.0 | 906.4 | 15.253 | 19.6 | 1744.6 | 2236.7 |
| NH4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.000 | 0.0 | 0.0 | 0.0 |
| Ba | 0.000 | 0.0 | 0.000 | 0.0 | 0.000 | 0.0 | 0.000 | 0.0 |
| Sr | 26.900 | 30.7 | 26.900 | 30.7 | 0.097 | 0.1 | 67.104 | 76.6 |
| CO3 | 3.6 | 6.0 | 3.6 | 6.0 | 0.006 | 0.0 | 9.0 | 15.0 |
| HCO3 | 512.0 | 419.7 | 512.0 | 419.7 | 14.853 | 12.2 | 1257.7 | 1030.9 |
| SO4 | 252.0 | 262.5 | 252.0 | 262.5 | 1.025 | 1.1 | 628.5 | 654.6 |
| Cl | 5730.4 | 8082.4 | 5730.4 | 8082.4 | 92.825 | 130.9 | 14186.8 | 20009.5 |
| F | 12.4 | 32.6 | 12.4 | 32.6 | 0.399 | 1.1 | 30.4 | 80.0 |
| NO3 | 125.0 | 100.8 | 125.0 | 100.8 | 14.581 | 11.8 | 290.6 | 234.4 |
| B | 7.95 | | 7.95 | | 5.011 | | 12.36 | |
| SiO2 | 0.0 | | 0.0 | | 0.00 | | 0.0 | |
| TDS | 11036.9 | | 11036.9 | | 207.2 | | 27281.3 | |
| pH | 7.7 | | 7.7 | | 6.2 | | 8.0 | |

| | Raw water | Feed water | Concentrate |
|---|---|---|---|
| CaSO4 / Ksp * 100: | 0% | 0% | 0% |
| SrSO4 / Ksp * 100: | 23% | 23% | 72% |
| BaSO4 / Ksp * 100: | 0% | 0% | 0% |
| SiO2 saturation: | 0% | 0% | 0% |
| Langelier Saturation Index | -0.73 | -0.73 | 0.38 |
| Stiff & Davis Saturation Index | -1.14 | -1.14 | -0.39 |
| Ionic strength | 0.18 | 0.18 | 0.45 |
| Osmotic pressure | 117.4 psi | 117.4 psi | 290.4 psi |

These calculations are based on nominal element performance when operated on a feed water of acceptable quality. No guarantee of system performance is expressed or implied unless provided in writing by Hydranautics.
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