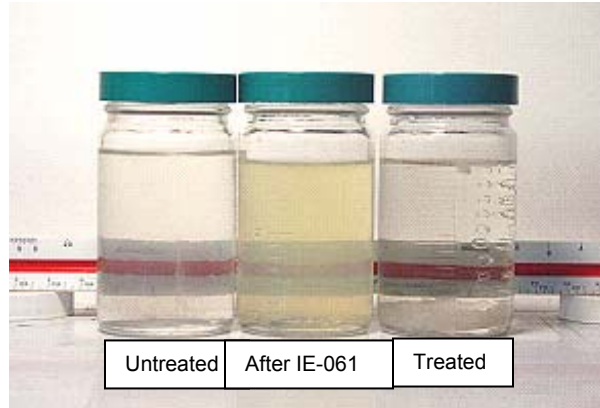




Selenium Removal

The oil refinery was in search of a feasible solution for the removal of selenium. Discharge permit changes by the EPA require a reduction of 50% from current levels.

Integrated Engineers, Inc. was given an opportunity to perform a feasibility test to determine a treatment process as well as estimated operational costs. The best process was to adjust the pH from 7.0 to 10.0 using caustic, utilization of a metal precipitant (IE-061) with ORP (oxidation reduction potential) control, followed by addition of Floccin-D to encapsulate the selenium. ORP data points are listed below:



IE-061 (ppm)	ORP (mV)
0	-74
20	-223
40	-258
60	-283
80	-296
100	-303
120	-312

The ORP was stable at -312 mV so no additional IE-061 was added. Floccin-D was added at a dosage of 800 ppm (which might be reduced as the water clarity was excellent). The settled water was decanted and tested for Selenium using EPA Method 200.8. The resulting Selenium levels are shown below and are in units of parts per billion (ppb):

Untreated	530 ppb
Treated	180 ppb
% Reduction	66%

Estimated cost of treatment based on this treatability is \$9.04/1,000 gallons including the caustic, IE-061 and Floccin-D.