Mid-West Clarifiers

Project Description:

This municipal plant had three large draft tube clarifiers following a conventional activated sludge facility. These clarifiers were in the process of being "upgraded" with spiral scrapers and a "tangential port" energy-dissipating inlet (EDI) …. and a larger centerwell.

The Problem:

This project was still under construction when we were contacted by the regulatory agency to provide an evaluation. It seems that the two newly-completed clarifiers were performing poorer than the remaining original draft tube clarifier at normal flows. The specifications had called for an "LA-EDI or equal". Although the contractor's submittal of a tangential-port EDI was originally rejected by the Engineer, a subsequent submittal of a CFD model analysis (showing that the "tangential port" EDI was better than the LA-EDI) was accepted as proof of its performance.

Our Findings:

1. The two new clarifiers had their centerwells submerged by about 0.2 ft at normal flow. We had one centerwell raised to prevent flow over the top …. and then tested alongside the second new clarifier with the submerged centerwell. This test showed that the effluent from the clarifier with the raised centerwell was 7 mg/l; the effluent from the modified clarifier with the submerged centerwell was 24 mg/l!
2. The new clarifier with the raised centerwell was then tested side-bv-side against the remaining original draft tube clarifier. The new clarifier (with the raised centerwell) completely lost its blanket at 660 gal/sf/d! Meanwhile, the old clarifier continued to produce an effluent TSS of less than 10 mg/l
3. The new EDI with the tangential ports (facing counterclockwise) caused the entire clarifier contents to rotate counterclockwise, even as far out as the effluent launder. It also caused the blanket to be expanded which, in turn, led to the massive loss of solids in the effluent.

Solutions:

1. The centerwell was raised on all clarifiers, thereby preventing short-circuiting of the MLSS to the effluent.
2. Several modifications were suggested to improve the performance of the tangential port EDI.
    a. in order to eliminate the jetting from the four inlet ports through the tangential ports, a fixed baffle ring was added inside the EDI shell.
    b. In order to reduce the spiraling energy created by the eight tangential ports, each port was made to extend to the full depth of the EDI.

c. In order to further dissipate the spiraling counter-clockwise energy created by the tangential ports, eight 2-ft wide by 5-ft deep baffles were attached to the inside of the centerwell.

The Result:
The extreme modifications to the centerwells and the EDIs have improved the performance of the new clarifiers somewhat, but not up to the level anticipated with the original design.

What Have We Learned (Again??):

A. "You can't make a silk purse out of a sow's ear".
B. Occasionally an "upgrade" is really a "downgrade".
C. Never say "or equal" when it comes to specifying which EDI you want. They're not at all equal ….. and you'll waste your valuable time trying to get past the cheapest submittal to the one that you really want.
D. Good field data ALWAYS trumps the CFD model analysis when it comes to activated sludge clarifiers.