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## An Evaluation of Energy-Dissipating Inlets

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There are four different types of energy-dissipating inlets (EDI's) currently available:

- the gated-opening type,
- the "scooped opening"/ "tangential port opening" type,
- the multiple plate type, and
- the opposing-jet type

The first two types, gated-opening and "scooped" or tangential port opening, are in general use and are available from most manufacturers of clarifier equipment. Proponents of the gated EDI mention the flexibility of the gate positioning as an operability advantage. Although I have seen one operation that has changed several of its gates to the fully-open position to encourage the scum to be shunted to the peripheral scum relief slots on the centerwell, virtually every other gated EDI that I've seen has probably never been adjusted since start-up.

The "scooped" EDI is becoming much more prevalent. The scoop/tangential port is supposed to be designed with certain dimensions that are supposed to impart just the right amount of tangential energy to the MLSS to enhance flocculation.

One of the questions facing a designer of either of these first two types of EDI's is "which direction should they be facing? ..... with the rotation of the collector mechanism? ..... or counter to its rotation? Although I used to feel that these inlets should be facing counter to the rotation, I now believe that there probably isn't "a dime's worth of difference".

We have evaluated several clarifier systems with these two types of EDI's. Our evaluations have led me to believe that they may not provide any benefit to a clarifier. Worse than that, we have found, in a well-controlled side-by-side full scale evaluation at the LA-Hyperion plant, that the addition of a "scooped" EDI clearly made that clarifier work **worse** than the control clarifier that had no EDI. (ref. WEFTEC '99 presentation)

Prior to the Hyperion project, some of our other field evaluations had shown us that:

- at Orlando's Conserv II plant, the clarifiers with EDI's had the same types of currents that we would have expected to see in any clarifier without an EDI.
- at Cedar Rapids, the new clarifiers with EDI's performed no better than the clarifiers without EDI's. Our measurements also showed that the clarifiers with an EDI (a) did not promote mixing within the centerwell and (b) had slightly faster density currents than the clarifiers without an EDI.
- at the Atlantic County (Atlantic City, NJ) plant, the new plow-type scraper clarifier with an EDI .... and a larger centerwell ..... and a horizontal peripheral baffle, performed worse under all conditions of flow than the original scraper clarifiers did without any of these appurtenances. (Note: In a recent upgrade, Atlantic County removed their EDI.

One of the major flaws that I see with these conventional scooped EDI's is that they often slow the inlet flow so much that there is not enough mixing intensity remaining within the centerwell. Since the flow exiting the scoops or gates has so little energy, it tends to "droop" directly downward into the clarifier, forming a more intense density current than would have been formed if the MLSS had been dispersed through out the centerwell. Under high flow regimes, they tend to increase the velocity at the scoops as a "sheet" flow along the periphery of the curved vanes. This condition greatly increases the rotational currents in the clarifier, adding to the chaos within the inlet zone.

Considering these experiences and observations, along with our knowledge of the poor performance in clarifier modification projects such as Phoenix 91<sup>st</sup> Avenue, Dallas (TX), Central Weber (UT) and South Valley (UT), and the Santa Rosa (CA) project (ref. WEFTEC '02 presentation), I cannot recommend the installation of either of these first two types of EDI's.

The third type of EDI, made up of multiple plates, is a proprietary device of US Filter's, called the FEDWA. I have not seen one of these in action, and do not know of any installations of these on clarifiers in the 100' diameter range. I have information from a larger installation on the East Coast .... and a smaller installation in the West .... where it didn't perform as expected. The device is supposed to enhance flocculation by providing for multiple changes in direction of the MLSS. My main concern would be with the hydraulic regime created in the centerwell area. I see nothing in this design that leads me to believe that it would encourage good blanket formation within the centerwell area. An additional concern would be the absence of test data at flow rates greater than 900 gal/sf/d. We should be looking for better performance at much higher flow rates.

The fourth type of inlet, which makes use of opposing jets to enhance flocculation and reduce any spiraling motion within a clarifier, is also a patented device<sup>2</sup> This inlet device was demonstrated in extensive field testing at the Los Angeles-Hyperion plant to increase the capacity of the existing clarifiers by more than 50 percent. It did this by responding to the problem of poor blanket formation within the centerwell area and by reducing the intensity of the density currents.

With respect to the clarifier project under design, information from the vertical solids profiling indicates that there is poor formation of the sludge blanket in the center of these clarifiers. This is the kind of condition that moves the settled sludge deposits further out in a clarifier and eventually leads to clarifier failure. Often mistaken as a "thickening" failure, this is really problem of turbulence. In order to address this condition, and provide other benefits such as enhanced flocculation and better flow distribution, I recommend the use of the opposing-jet "LA-EDI" inlet.

1. [WWW.CLARIFIERS.COM](http://WWW.CLARIFIERS.COM) or eslercpe @ aol.com
2. Patent holders are John Esler, Roger Haug, and William Hartnett.

*April 2007: This was written in 2004 for the Grand Rapids (MI) project. The LA-EDI inlet was successfully installed as a part of a subsequent retrofit in their six 100-ft clarifiers, and has been shown to provide improved performance for these clarifiers.*