

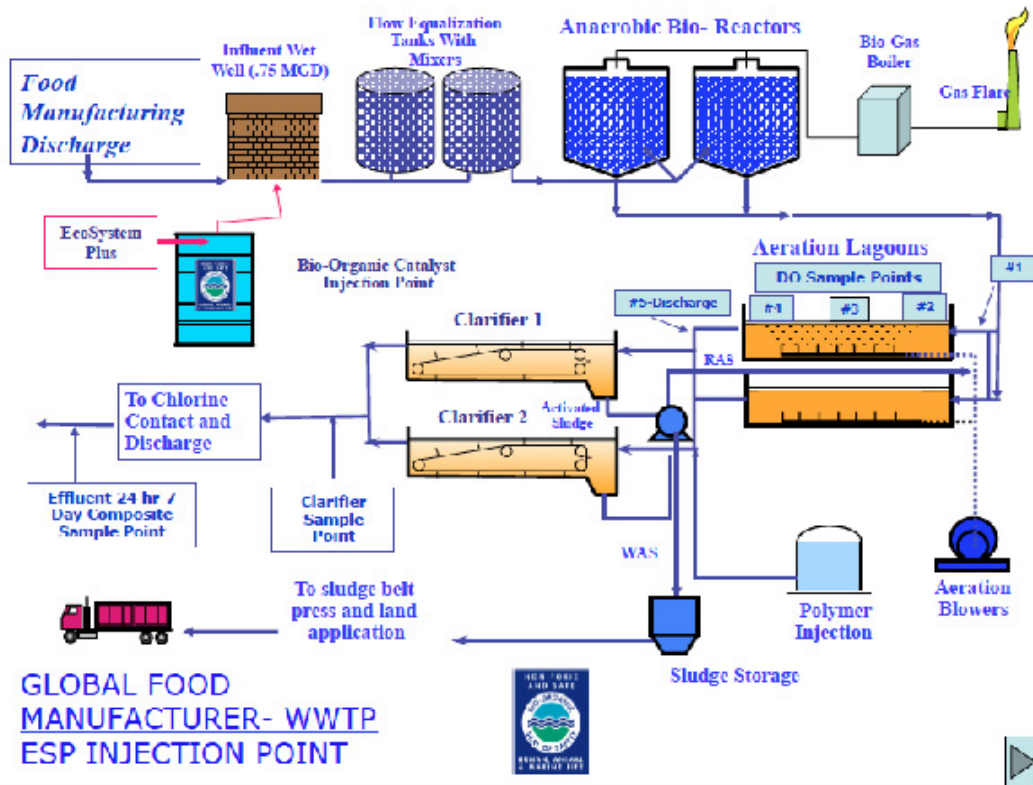


# Results Of Ecosystems Plus® Injection In Secondary Aeration Lagoons

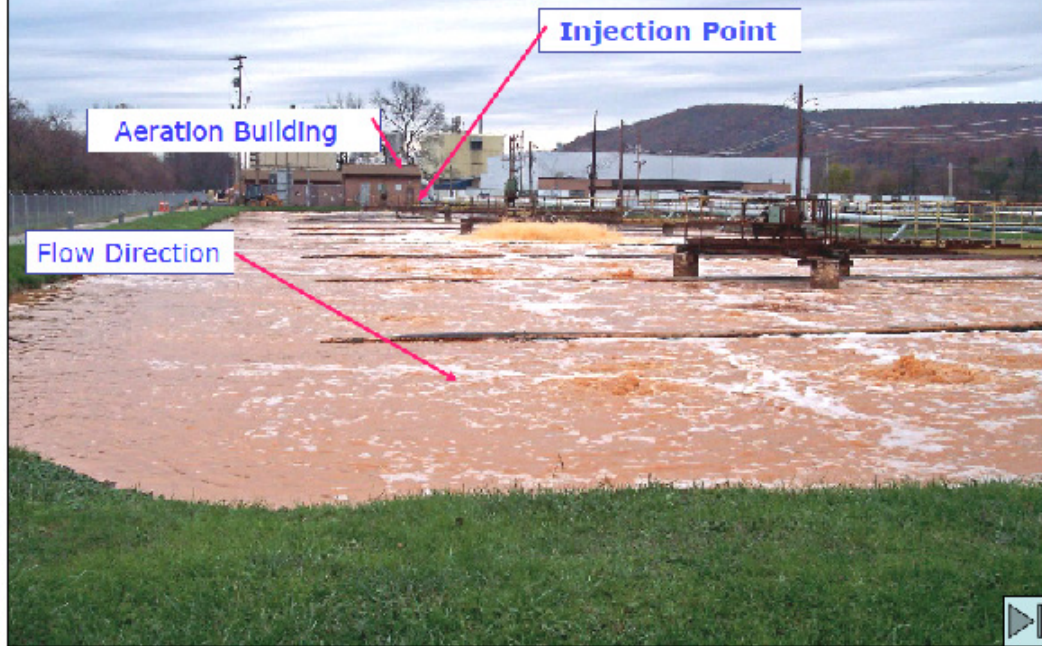
Global Food Manufacturer (September 6-22 2006)

## Primary Project Objectives::

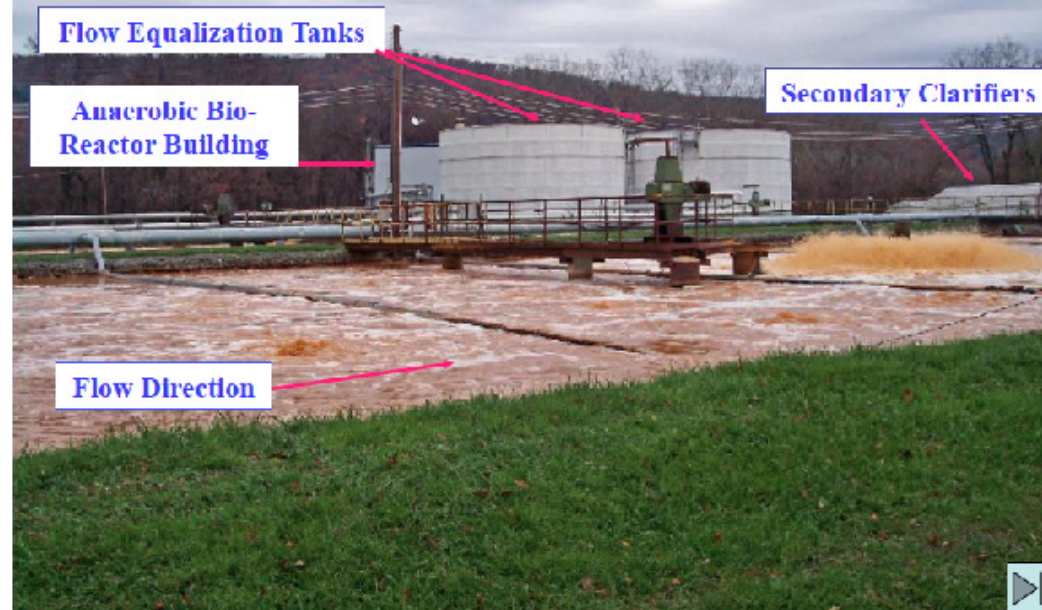
- Demonstrate ESP®'s ability to increase the transfer of dissolved oxygen into the secondary aeration lagoons.
- A baseline of DO measurements was established for the period 8/17-23/06 in both lagoons 2 & 3.
- The levels were measured daily at 5 separate points along the length of each lagoon.
- The points were:
  1. Influent distribution box.
  2. The beginning of lagoon.
  3. Midway point. (Opposite surface aerator #1).
  4. End of the lagoon. (Opposite surface aerator #2).
  5. Effluent discharge box.



## ESP INJECTION POINT INTO LAGOON # 3



## SECONDARY AERATION LAGOON # 3 WITH FINE BUBBLE DIFFUSERS AND SURFACE AERATORS



**Technology breakthrough greater aeration efficiency:**

- Improves oxygen transfer and uptake.
- Reduces energy use, while increasing DO.
- Increases biological activity and biomass.
- Increases treatment plant capacity.
- Reduces volatile organics for odor control.
- Improves nitrification and de-nitrification cycle.

**Technology breakthrough solubilization of lipids:**

- Solubilization of fats, oils, and greases (FOG's).
- This is an accelerated natural catalytic process in which lipid ester bonds are rapidly cleaved, reducing their molecular structure to both glycerol and fatty acids.
- Glycerol and fatty acids are then readily available to wastewater micro-organisms as a high-energy food source of carbon for enhancement of nitrification and de-nitrification reduction processes.

**Study parameters (dissolved oxygen testing):**

- Since the RAS could not be separated, it was not possible to isolate Lagoon #3 and #2.
- Increases in DO were examined and compared as a combined total for lagoons #2 and #3.
- The ON and OFF time periods are both compared against the baseline.

**Secondary channel flows:**

- The average daily influent flow from the anaerobic bio-reactor is .75 MGD, and this flow is split into two (2) influent flows of .365 MGD to the aerobic lagoons #2 and #3.
- These secondary aeration lagoons have a volume of 1.5 million gallons each.
- Each aeration lagoon has two (2) surface aerators, along with six 6 sub-surface, finebubble, air diffusers.

**Secondary channel loading:**

- Average return activated sludge (RAS) flow, per-lagoon, is .144 MGD.
- Baseline average daily loading was 10,677 lbs. TCOD.
- Average daily loading during study (9/6-22/06) was 14,818 lbs. TCOD.

**Study Start-up:**

- EcoSystems Plus® was injected into the #3 lagoon influent distribution box: 9/6-22/06 @ 3.6 GPD.
- The results of increased DO levels (9/6-22/06) are compared against various baselines.

**Study testing:**

- NH<sub>3</sub>-N and TCOD levels, sampled at the clarifier discharge point, were compared against historic baselines.
- Final sludge volumes from dewatering were compared against a baseline.
- PO<sub>4</sub>-P Removal Rates were compared as well.

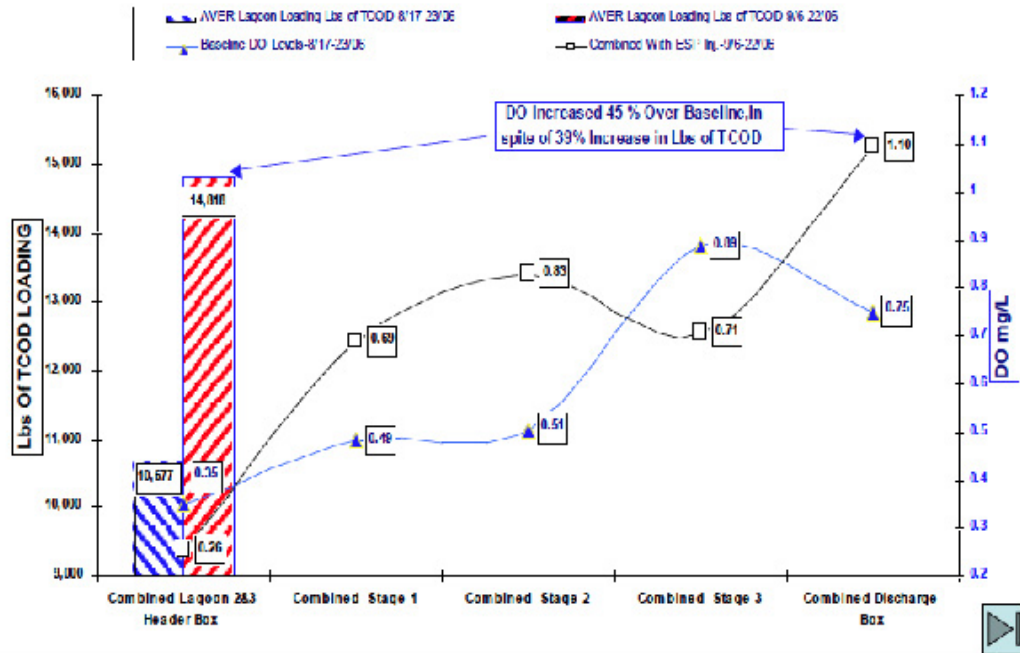
**Results in secondary aeration lagoons (dissolved oxygen)**

- 45% increase in DO measured at the lagoon discharge point: study period 9/6-22/06, against baseline period 8/17-23/06.
- Surface aerators both on and off.
- Concurrent with 39% increase in TCOD loading, over baselines.

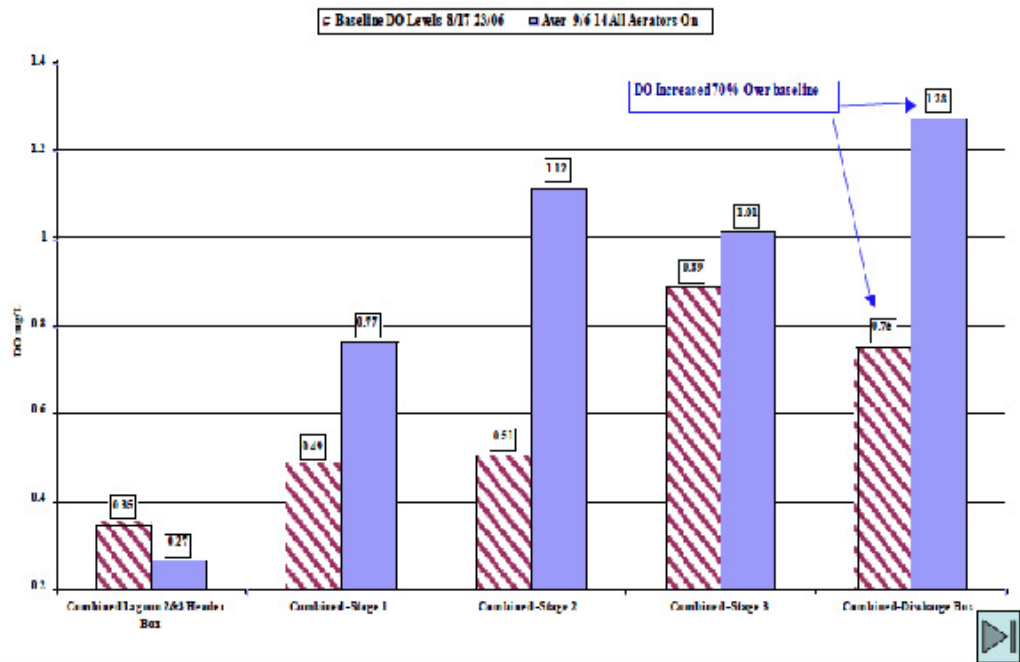
**Results in secondary aeration lagoons (dissolved oxygen):**

- 70% increase in DO measured at the lagoon discharge point with ESP injection, against the baseline period.
- Surface aerators continually on.
- Concurrent with 39% increase in TCOD loading.

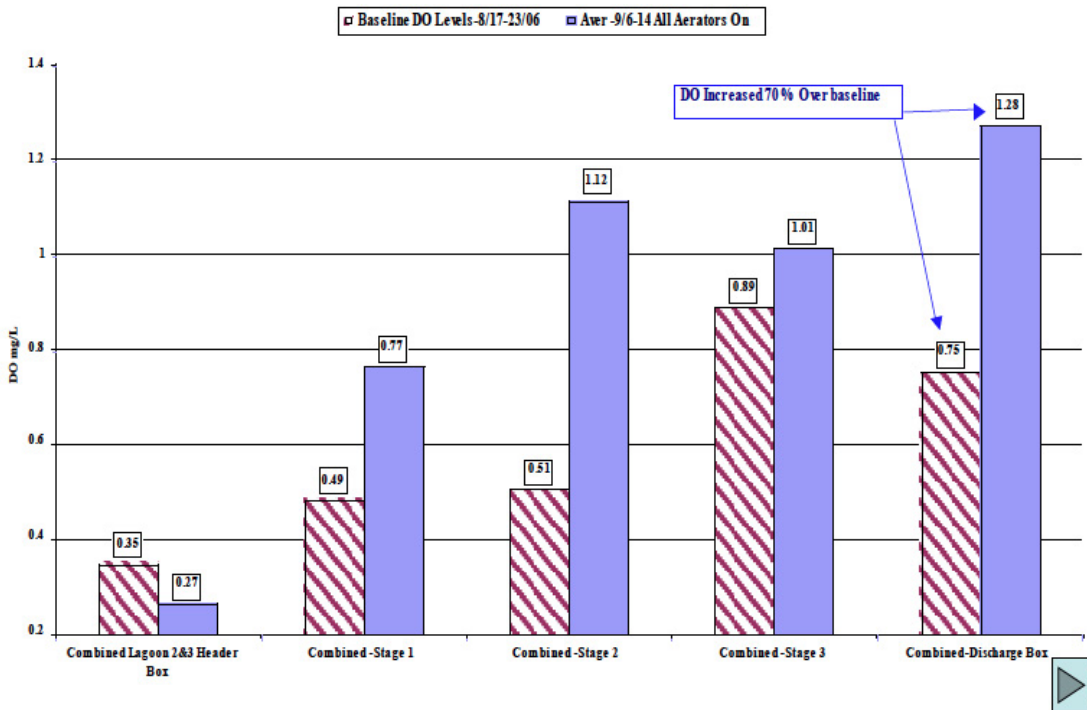
## Comparison of total (DO) increases in secondary aerators:



## Comparison of (DO) increases with all surface aerators on:



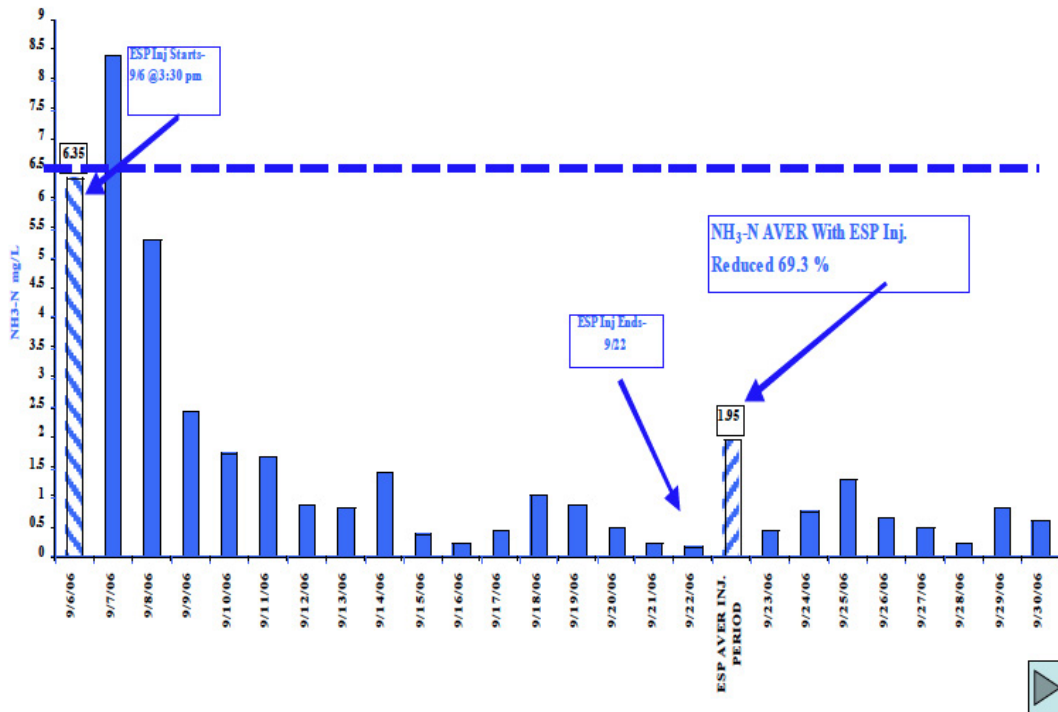
## Comparison of (DO) increases with all surface aerators on:



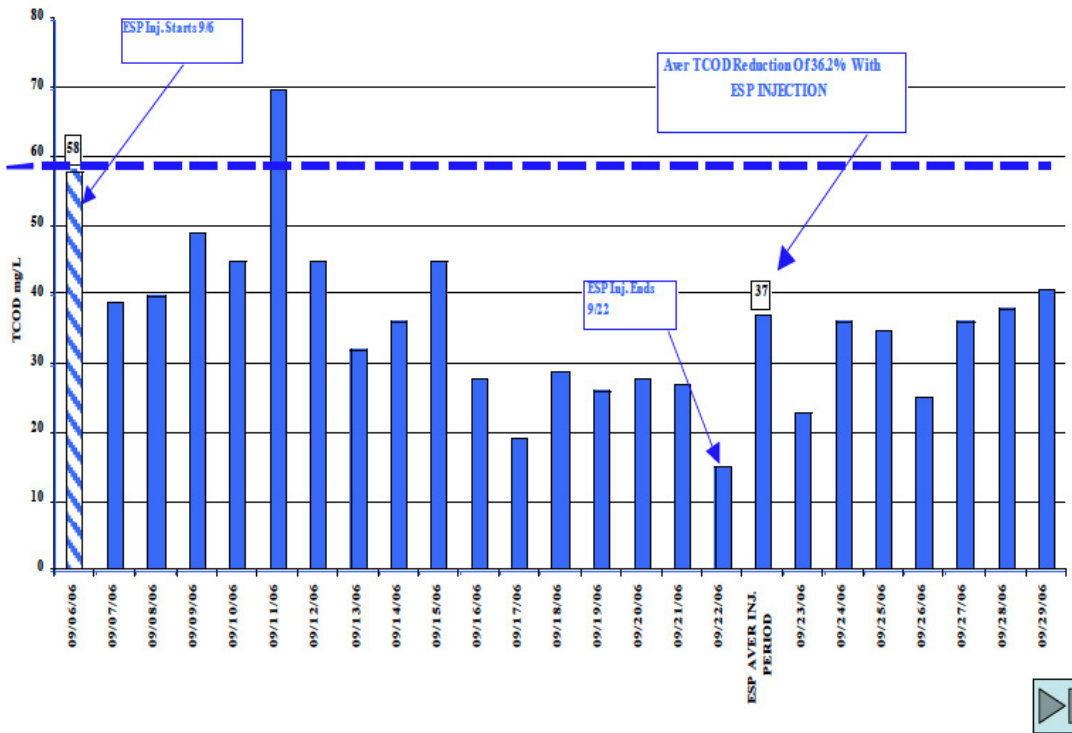
## Secondary aeration Lagoons (NH<sub>3</sub>, TKN & TCOD Reductions):

- 69.3 % reduction in NH<sub>3</sub> & TKN- (mg/l) @ clarifier discharge.
- 36.2% reduction in TCOD -(mg/l) @ clarifier discharge.

## Reductions of NH<sub>3</sub> - N at clarifier:



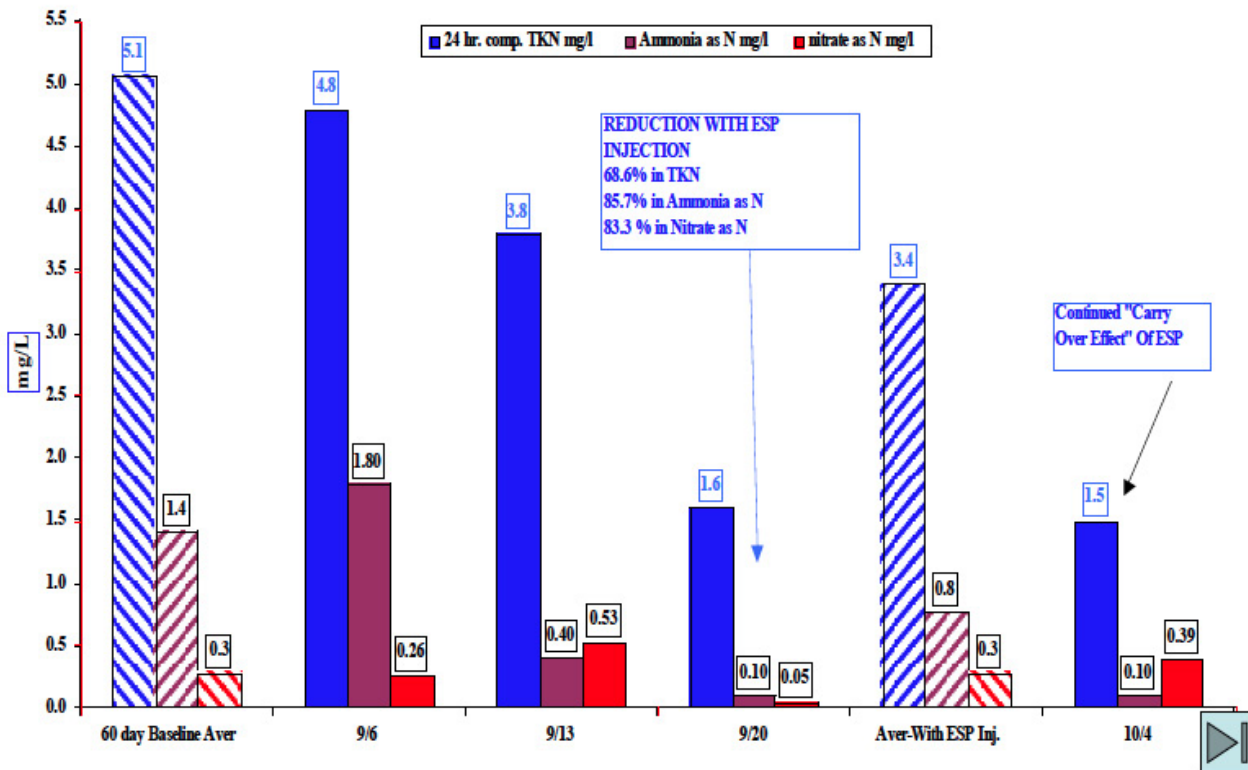
## Reductions in TCOD at clarifier:



## Secondary aeration lagoons (TKN, NH<sub>3</sub>-N & nitrates) reductions in final discharge levels:

- 68.6% in TKN mg/l @ Effluent discharge
- 85.7% in Ammonia as NH<sub>3</sub> mg/l @ Effluent discharge
- 83.3 % in Nitrate as N mg/l @ Effluent discharge

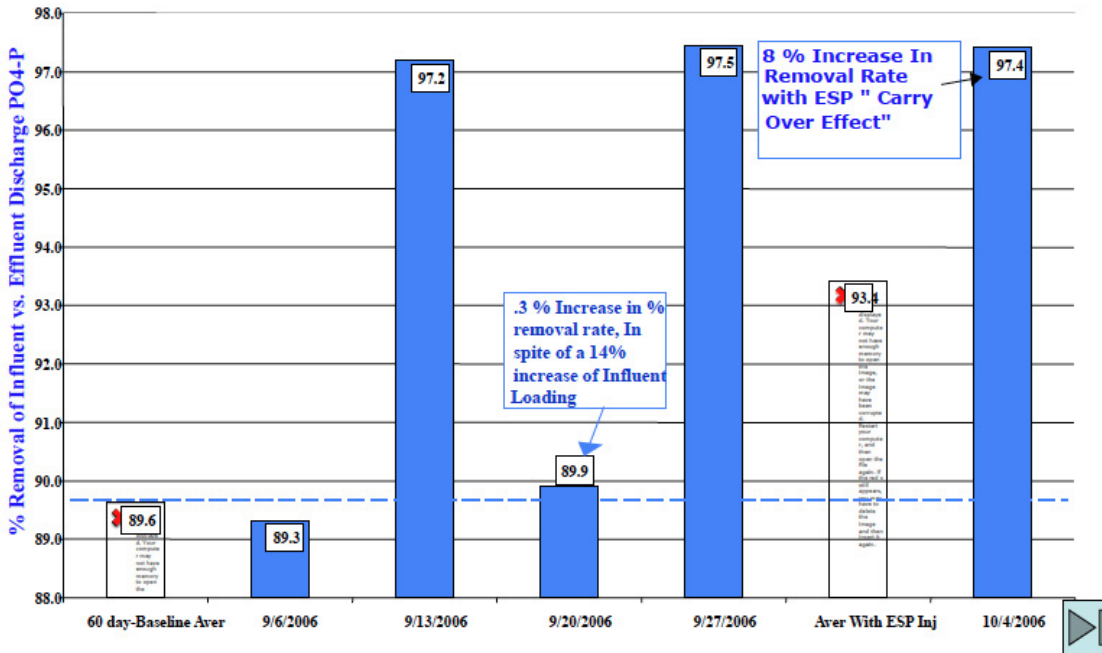
## Improved final effluent discharges:



### Improvements in PO<sub>4</sub>-P discharges:

- Baseline PO<sub>4</sub>-P % removal was 89.6 %
- Removal rates improved to 97.3 % for three weeks.
- One week (9/20/06) only improved by .3 %, however the influent load increased by 14% during that week.

### Improved removal of PO<sub>4</sub>-P discharges (influent vs effluent):



### Reductions in sludge volumes:

- 28.3 % Sludge reduction
- Baseline level of sludge pressed: daily average of 57,065 Lbs.
- Study period sludge pressed: daily average of 40,892 Lbs.
- Concurrent during study period there was a 39% increase in Lbs. of TCOD influent loading.