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# *TEXAS RESTAURANT WASTEWATER ANALYSIS*

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# TEXAS RESTAURANT WASTEWATER ANALYSIS

The Texas Onsite Wastewater Research Council funded a study to sample restaurant wastewater strengths. The sampling was conducted in 2002 by the San Antonio River Authority, the City of Austin and the Lower Colorado River Authority. The council felt this data was necessary due to the wide variety of results previously reported by various entities and the emerging reliance on onsite systems to serve restaurants. A by-product of this research is valuable data for utility districts and cities that allow restaurants to hook up to their sewer lines.

The principal constituents of concern for restaurant wastewater are its organic strength (BOD, COD), particulate loading (TSS), and oils (FOG). These all have a direct affect on the performance of an onsite system. The organic loading must be reduced to acceptable levels in order to use off the shelf aerobic treatment units or dispose of wastewater in conventional trenches. High organic loading will cause the soil interface to clog resulting in slow permeability and a failing system. If using off the shelf NSF Standard 40 units, high organic influent will cause odors and effluent that cannot be disinfected properly using normal equipment. The same consequences occur with high solids loading. Fats oils and greases contribute to organic loading as well as cause clogging of soil interface surface and of equipment.

It was assumed that several factors affected the strength of the wastewater. The factors evaluated were type of food served, water use, type of service, sanitation procedures, and grease trap criteria. Table "A" shows the specific data collected.

Specific comparisons were made of the data. The comparisons are shown as follow:

Table B Waste Water Strength by Testing Entity
Table C Wastewater Strength by Restaurant Type
Table D Wastewater Strength by Method of Wash
Table E Wastewater Strength by Type of Fixtures

One restaurant's results were so non-typical it was considered an "outlier" and its data was not used in these comparisons except for Table "B."

The trends that appeared when looking at this data are what would be expected in some cases and surprising in others. When looking at use of low flow fixtures the average

BOD is 34% greater in restaurants with low flow fixtures than those without these fixtures. This would be expected due to the elimination of carriage water. Additionally, when looking at hand vs. machine washing, hand washing produces a BOD mg/L strength 152% greater than machine washing. This would also be due to carriage water.

When evaluating types of restaurants, one would expect that typical restaurants serving a greasy cheese enchilada plate would have a FOG level greater than a restaurant serving light Chinese food; however, that was not the case. On the average, Chinese food restaurants FOG was 26% greater than Mexican food restaurants. This was attributed to such factors as the type of oils used in preparation.

When comparing this data to domestic waste you can see a substantial increase. Typical domestic waste BOD averaged between 100-400 where here we averaged 1202. Domestic TSS ranged between 100 to 350 where our average was 318. FOG levels in domestic waste ranged between 16-65 where our average was 131.

It should be noted that studies conducted by the universities of Washington and Wisconsin in the 1980's showed that even with septic tank treatment, wastewater BOD was 120% greater than domestic waste. FOG was elevated above domestic waste even with grease traps, and only TSS was lowered to domestic raw wastewater levels by using septic tanks and grease traps.

This indicates that in no case should restaurant waste be simply treated through traditional septic tanks and grease traps prior to being disposed of in absorption trenches or to a NSF Standard 40 Treatment Plant. Immediate or early failure will result if a pretreatment strategy is not developed to adequately address these issues.

Numerous failures of onsite systems occur due to designers and regulators not fully understanding hydraulic vs. organic loading. "Table III-Wastewater Usage Rate" that appears in the Texas State Standards only applies to hydraulic loading.

If we consider a fast food restaurant with 33 seats and a loading factor of 15 gpd per seat, from the State Standards it might be assumed a 500 treatment plant would suffice. (15x33=495). The reality is this would require a 2500 gpd plant if you look at it on an organic loading basis. Since Standard 40 Treatment Plants assume 240 BOD and our

average was 1202 BOD, a plant five times bigger would be required. This is based on an average and could be subject to failure a portion of the time due to high loading.

These issues must be evaluated when designing for a restaurant:

- waste strength BOD, TSS, FOG
- grease trap size
- buffering peak organic and hydraulic loading
- low flow fixtures impact

These type designs are the most complex and expensive type of onsite systems typically installed. A properly installed system for less than 1000 gpd flow will exceed $50,000.

The results of this study indicate a design manual for restaurants needs to be published so that failures can be greatly reduced.

# TABLE "A"

| RESTAURANT DATA EVALUATED | |
|---|---|
| Water Use | Type of Dishwashing |
| Type of Food | Dishwashing Temperature |
| Free Salad Dressing | Detergent Type |
| Buffet Service | Use of Public Restrooms |
| Specialty Meals | Use of Low Flow Fixtures |
| Ice Cream/Yogurt Machine Use | Automatic Shut Off Fixtures |
| Self Serve Drinks | Ice Machine Discharge Type |
| Type of Plates | Air Conditioning Condensate |
| Type of Service Available | Discharge Type |
| Type of Cooking Oil | Floor Drain Discharge |
| Use of Preservative | Use of Wash-Down Water |
| Defrosting by Use of Running Water | Type of Wash-Dow Chemical |
| Number of Seats | Use of Kitchen Landry |
| Size of Restaurant | Cleaning Water Destination |
| Meals Served Per Day | Mop Water Destination |
| Hours at Operation | Grease Trap Size |
| Days of Operation | Grease Trap Pumping Schedule |
| Use of Garbage Disposal | Location of Sampling Port |
| Were Plates Scraped | |

# TABLE "B"

| AVERAGE WASTEWATER STRENGTH BY TESTING ENTITY | | | | | |
|---|---|---|---|---|---|
| | **BOD mg/l** | **TSS mg/l** | **COD mg/l** | **FOG mg/l** | **BOD lbs/day** |
| San Antonio River Authority | 3029 | 2706 | 4587 | 4105 | 56 |
| Austin | 945 | 325 | 1746 | 120 | 51 |
| Lower Colorado River Authority | 818 | 219 | 1252 | 148 | 17 |

# TABLE “C”

| WASTEWATER STRENGTH BY RESTAURANT TYPE | | | | | |
|---|---|---|---|---|---|
| No in Group | Type Restaurant | BOD mg/L Avg/High/Low | TSS mg/L Avg/High/Low | COD mg/L Avg/High/Low | FOG mg/L Avg/High/Low |
| 6 | Fast Food/Burgers | 2137/974/176 | 233/1107/25 | 2164/6290/367 | 102/207/13 |
| 1 | Pizza | 1856/3220/1270 | 321/1100/63 | 2762/4320/2330 | 183/539/85 |
| 4 | Chinese | 1364/4100/626 | 448/2840/232 | 2430/7540/1258 | 241/2026/30 |
| 9 | Mexican | 1254/18,800/44 | 668/15100/15 | 2425/11,700/152 | 190/1430/37 |
| 1 | American | 1063/1600/536 | 297/585/120 | 1647/2340/837 | 147/280/9 |
| 1 | American Buffet | 792/1385/300 | 195/308/62 | 1311/1948/668 | 63/98/42 |
| 2 | Steakhouse | 601/1160/433 | 160/310/134 | 99/1942/950 | 77/249/14 |
| 3 | Seafood | 555/1180/55 | 229/2118/20 | 901/1630/185 | 47/109/12 |

# TABLE “D”

| WASTEWATER STRENGTH BY METHOD OF WASH | | | | | |
|---|---|---|---|---|---|
| | | | | | |
| **HAND WASH** | | | | | |
| Number Evaluated | BOD mg/L Average | TSS mg/L Average | COD mg/L Average | FOG mg/L Average | BOD lbs/day Average |
| 5 | 2617 | 366 | 2575 | 120 | 30.51 |
| | | | | | |
| **COMMERCIAL DISHWASHER** | | | | | |
| Number Evaluated | BOD mg/L Average | TSS mg/L Average | COD mg/L Average | FOG mg/L Average | BOD lbs/Day Average |
| 22 | 1037 | 418 | 1912 | 153 | 36.92 |

# TABLE “E”

| WASTEWATER STRENGTH BY TYPE OF FIXTURES | |
|---|---|
| NO LOW FLOW FIXTURES | |
| BOD mg/L | BOD lbs/day |
| 973 | 22 |
| LOW FLOW FIXTURES | |
| BOD mg/L | BOD lbs/day |
| 1309 | 36 |