Table 4-2. Results of Particle Analysis from Full Fare Buffet Style Grease Interceptor (Part 2).

	Particle 1		
Mesh Size	Description	Wet Weight	Settle Rate
		(g)	(ft/s)
Mesh 2			
Mesh 3			
Mesh 4	potato	0.37	0.223
Mesh 5	fish	0.11	0.164
Mesh 6	potato	0.06	0.141
Mesh 7	rice, kernel	0.03	0.168
Mesh 8	meat: chicken	0.02	0.066
Mesh 9	1/4 rice	0.01	0.126
Mesh 10	1/4 rice	0.006	0.1
Mesh 12	? Particle	0.003	0.08

	Particle 2		
Mesh Size	Description	Wet Weight	Settle Rate
		(g)	(ft/s)
Mesh 2			
Mesh 3			
Mesh 4	meat: beef	0.38	0.151
Mesh 5	meat: chicken	0.05	0.076
Mesh 6	rice	0.07	0.196
Mesh 7	1/2 rice	0.01	0.162
Mesh 8	seed, white	0.02	0.106
Mesh 9	seed, tomato	0.01	0.074
Mesh 10	meat: chicken	0.006	0.039
Mesh 12	? Particle	0.001	0.125

	Particle 3		
Mesh Size	Description	Wet Weight	Settle Rate
		(g)	(ft/s)
Mesh 2			
Mesh 3			
Mesh 4	onion	0.17	0.068
Mesh 5	onion	0.06	0.051
Mesh 6	rice	0.05	0.186
Mesh 7	seed, brown	0.03	0.136
Mesh 8	seed, red	0.01	0.103
Mesh 9	corn	0.01	0.062
Mesh 10	? Seed	0.003	0.047
Mesh 12	? Particle	0.002	0.113

Source: Full Fare Buffet Style #2– Full Fare - Wash sinks, dishwasher, pre-rinse sinks, prep sinks, can wash

Solids Collection Span: 1100-11:00 (24hrs)

4.3 Grease Interceptor Influent Fluid Flow Analysis

The research team measured flow at several grease interceptors to provide additional data on the variability of the grease interceptor influent flow field. Analysis of the influent flow field is displayed in Table 4-3 (mean, minimum, and maximum) and Figures 4-2 (frequency and cumulative distributions). Figure 4-3 displays several time history trace of the flow data over a 24 hour period for different food service establishments. In Table 4-3, the total water usage to the grease interceptors ranged between 1,700 to 6,300 gallons. These values are consistent with those measured by Nashville Metro Water Services, where their GI water usage displayed values between 1,140 and 6,660 gallons. These total water usage were within the range found by Garza (2005) that also characterized the wastewater stream of several types of food service establishments. Grease interceptor sizes at these measurement sites ranged from 1,000 to 1,500 gallons.

In Table 4-3 as well as Figure 4-2, the flow data clearly shows that a large percentage of the flows (90-95%) falls below 10 gpm with 85-90% falling below 5 gpm. The time history data shows that the grease interceptor flow is highly intermittent with peak values that are 3-7 times the average occurring several times over the 24 hour period. The results show that, at the 90% mark in the cumulative distribution function (Figure 4-2b), most (75%) of the fluid flow from the food service establishments were 1/3 of the recorded peak flow. Clearly, the peak flows are associated with high FSE operation periods such as cleanup and preparation for major meals (i.e., breakfast, lunch, and dinner). Nashville Metro Water Services determined an average water flow over discrete 2-4 hr periods based on the water usage during that period and found values between 1 and 6.5 gpm. Although they did not perform actual flow measurements, the recorded total daily water usage performed by Garza (2005) showed that variability exists on different days of the week. However, Garza's recorded water usage values were determined from daily water meter readings and may include flow variability due to non-food service related activities.

The researchers did not find any strong correlation between the total water usage, average flow, or peak flow relative to the number of seats at the food service establishment. This lack of correlation between flow measurements and number of seats at a food service establishment suggest that another indicator for the flow of the waste stream derived from kitchen activities should be used, such as the quantity, size, and types of sinks, pipe size and configuration to the grease interceptor, and process equipment discharge flow rates (i.e., condensate, dishwasher, grinder).

The results in Table 4-3 and Figures 4-2 and 4-3 suggest long average residence times exceeding 2 hours under highly intermittent influent flow conditions exists for most food service establishment grease interceptors. While the FOG released from the interceptor effluent has not been measured, it is possible for excessive release of FOG in the grease interceptor effluent during peak operation under three conditions: a) when the influent water temperature is significantly higher than the GI water temperature; b) when excessive use of detergents/emulsifying agents are used; and/or c) when excessive amount of solids or a liquid stream containing a highly concentrated substance is discharged. In case (a), high temperature influent water could displace already separated FOG at the surface of the GI. However, laboratory tests of high temperature influent into a colder bulk temperature GI has shown little impact on the effluent FOG concentration with existing GI designs. As will be discussed in the next chapter, the low impact of temperature-driven density flows on grease interceptor performance is likely due to the deep location of the effluent pipe.

In case (b), the detergent/emulsifying agent may not allow time for or prevent adequate coalescing for proper separation of the influent FOG. Finally, in case (c), the high solids concentration may also cause short circuiting due to a density outfall. This may lead to an increase in the effluent FOG concentration due to the shorter path taken by the influent water through the GI. All these scenarios, however, will strongly depend on the geometric configuration of the GI (i.e., inlet/outlet piping, internal baffles, unit shape).

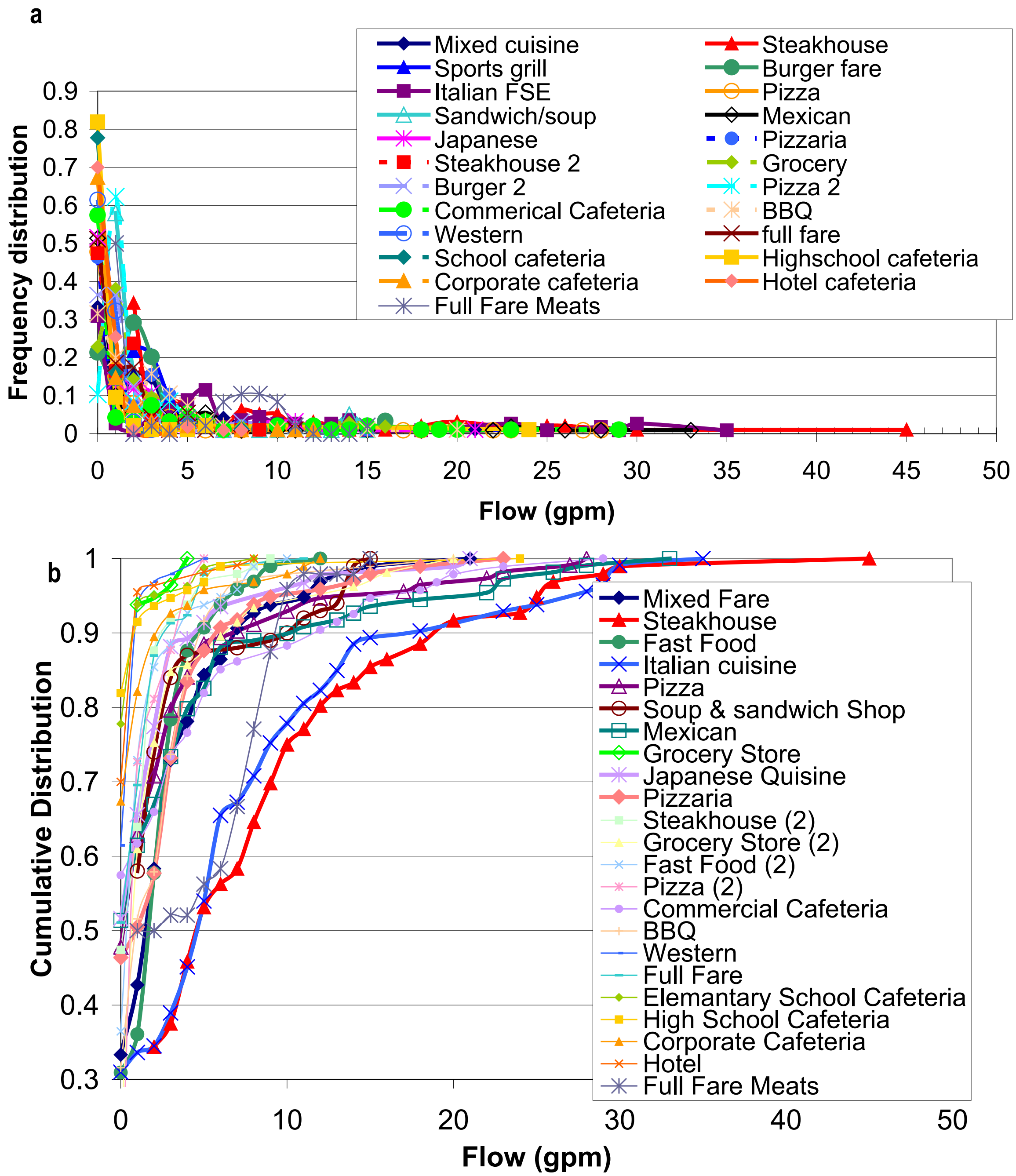

Figure 4-2. Distribution of Flow Data from Sampled Grease Interceptor Influent: a) Frequency, b) Cumulative.

Table 4-3. Flow Data from Grease Interceptor Influent from Different Restaurant Types.

FSE NAME	Total Flow to GI gpd	Max Flow gpm	Avg Flow gpm	Std. Dev gpm	GI Size market	Min HRT minute	Avg HRT hr	Seating #
full fare steakhouse	2,512	9	1.2	1.8	1000	111	14	250
grocery store	2,078	20	2.6	4.1	1200	60	7.8	5
fast food - burgers	1,421	10	1.4	2.0	1000	100	11.9	85
full service pizza	1,599	5	1.5	1.3	1000	200	11.1	90
full service - mixed cuisine	1,650	21	3.8	4.0	1000	48	4.4	320
full service steak house	6,326	45	9.8	8.4	1500	33	2.5	365
full service - mixed cuisine	1,643	12	3.0	2.3	1000	83	5.6	345
fast food - burgers	951	16	3.2	3.8	1000	63	5.2	84
full fare - Italian	4,310	35	9.4	8.0	1500	43	2.7	300
full service cafeteria	2,944	29	3.2	5.8	2000	69	10.4	300
full service pizzeria	1,235	28	4.2	6.3	1500	54	5.9	156
Single service - sandwiches	995	15	3.0	3.7	1000	67	5.6	140
full service - Mexican	1,810	33	5.0	7.4	1000	30	3.3	200
full service - meats featured	2,657	20	2.3	3.1	1000	50	7.2	172
grocery store	389	4	1.2	0.8	1000	250	13.6	1
Single service - Japanese	654	21	2.6	4.2	1000	48	6.5	44
Single service - mixed cuisine	629	5	0.5	0.9	1000	200	32	117
full service pizzeria	1,423	23	3.9	4.3	1000	44	4.3	82
full service - mixed cuisine	1,213	11	1.1	1.8	1000	91	14.7	142
elementary school cafeteria	339	8	0.5	1.3	1500	188	55.6	300
high school cafeteria	677	24	0.6	2.7	1500	63	39	450
cafeteria, corporate office	1,113	12	1.0	2.2	1500	125	26	530
full service restaurant, hotel	1,244	8	0.5	1.2	1500	188	50	101
full service meats	2,769	15	2.8	3.8	1500	100	8.9	276

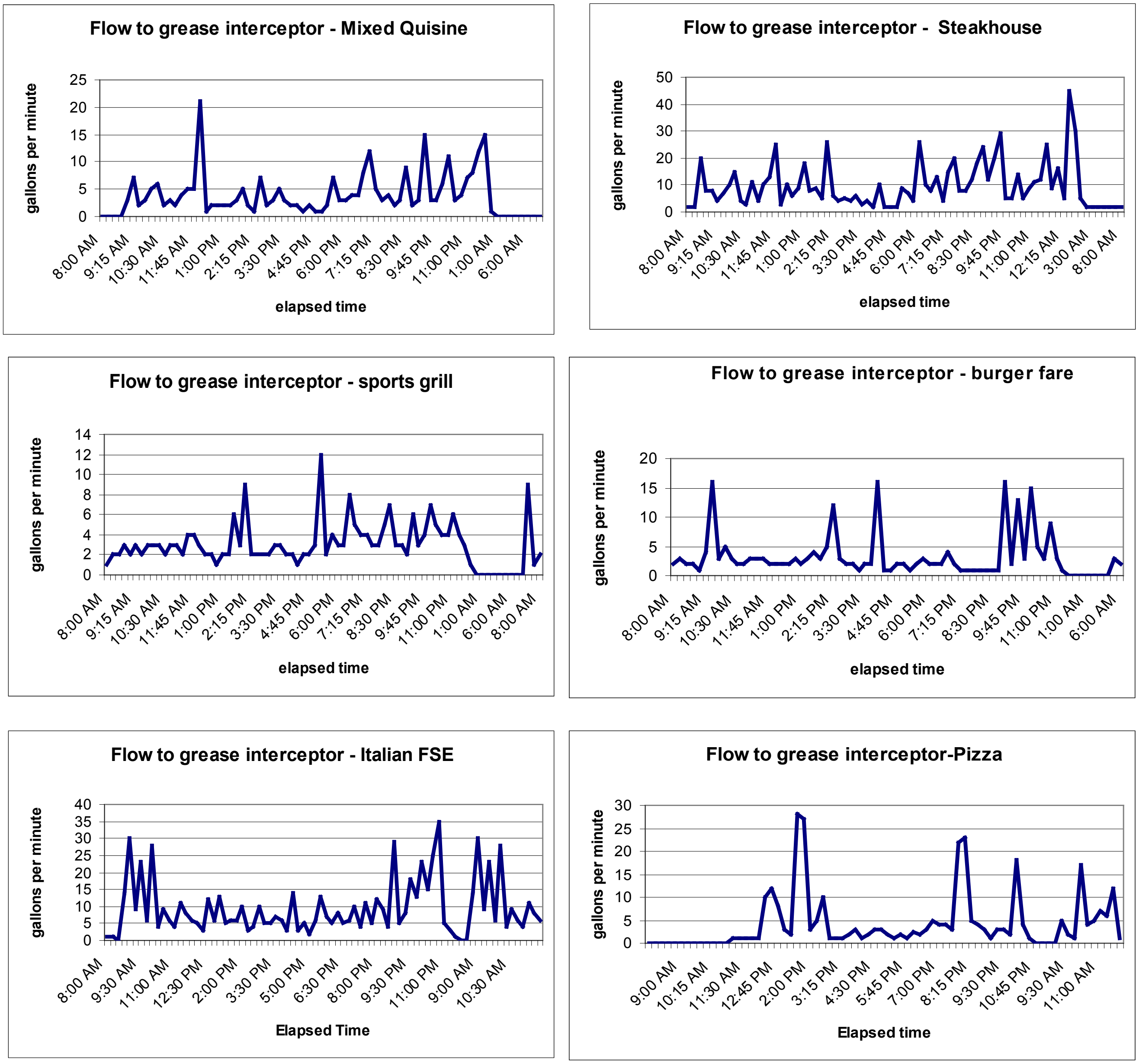

Figure 4-3a. Analysis of Flow Data from Sampled Grease Interceptor Influent from Several Restaurants.

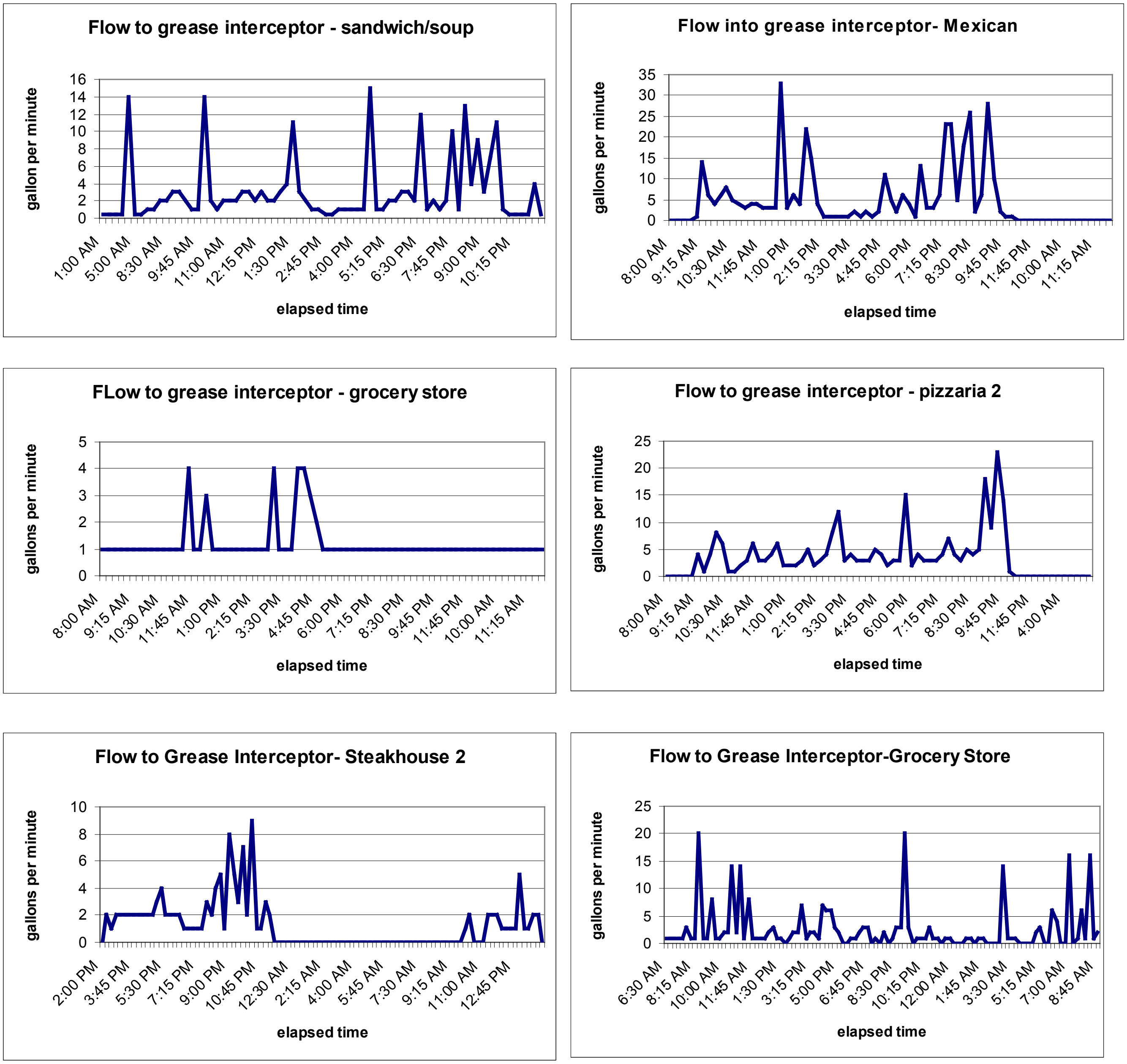

Figure 4-3b. Analysis of Flow Data from Sampled Grease Interceptor Influent from Several Restaurants.

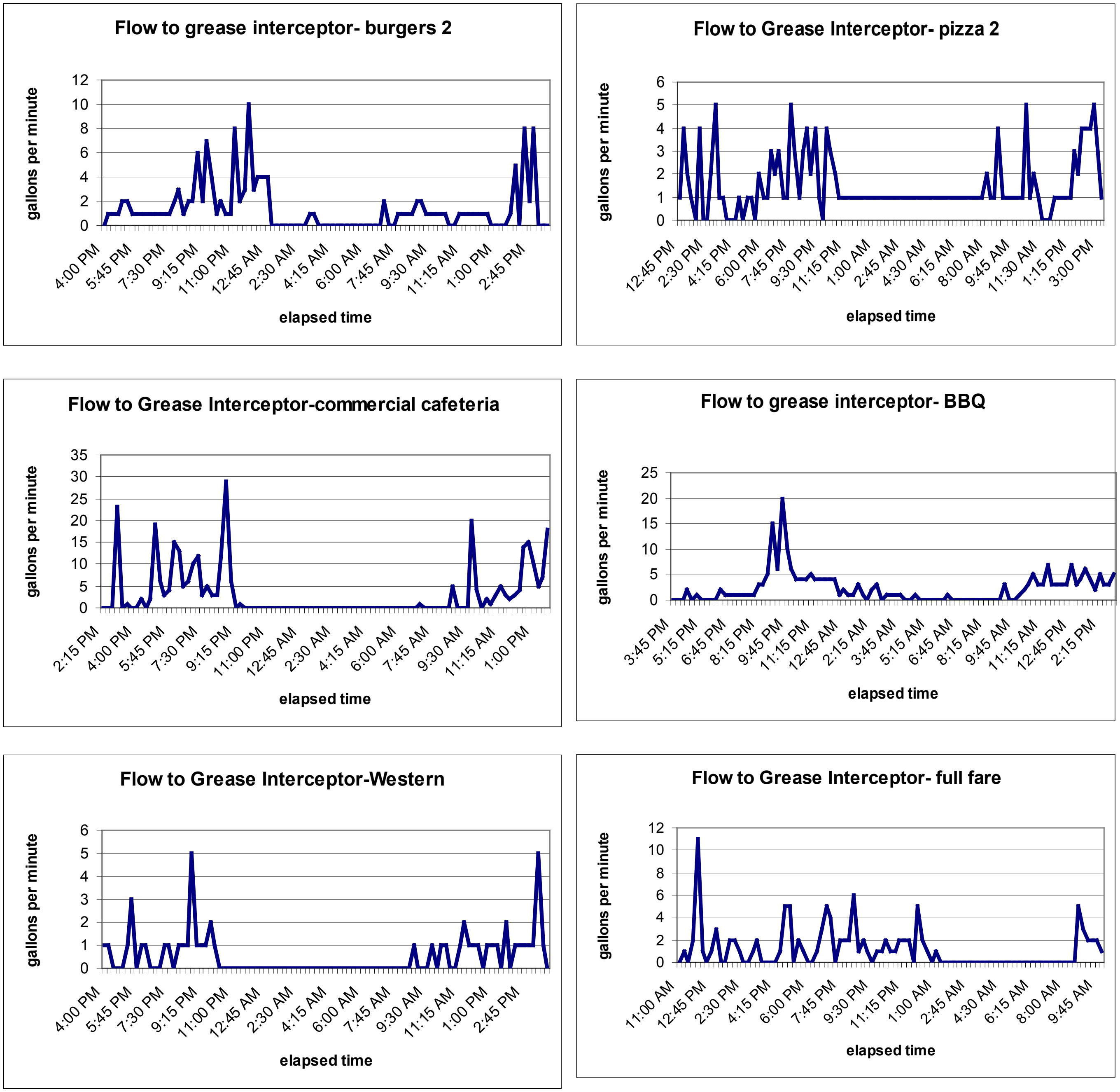

Figure 4-3c. Analysis of Flow Data from Sampled Grease Interceptor Influent from Several Restaurants.