PROGRESS REPORT
SVE PILOT TEST AT PARCEL C INSTALLATION RESTORATION SITES
HUNTERS POINT NAVAL SHIPYARD
SAN FRANCISCO, CALIFORNIA

Contract No. N67474-98-D-2076
Contract Task Order 0033

Document Control Number 1532
Revision 0

June 5, 2001

Submitted to:

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Acronyms and Abbreviations

cfm	cubic feet per minute
DCE	dichloroethene
EPA	U.S. Environmental Protection Agency
Hg	mercury
HPNS	Hunters Point Naval Shipyard
IR	Installation Restoration
IT	IT Corporation
lb.	pound
lb./hr.	pound(s) per hour
PCE	tetrachloroethene
PID	photoionization detector
ppmv	parts per million by volume
ROI	radius of influence
scfm	standard cubic feet per minute
SVE	soil vapor extraction
TCE	trichloroethene
TS	treatability study
TtEMI	Tetra Tech EM, Inc.
VOC	volatile organic compound
VM	vapor monitoring
wc	water column

1.0 Introduction

This field activity report is prepared to provide information to the U.S. Department of the Navy, Southwest Division, concerning the progress of the soil vapor extraction (SVE) treatability testing being conducted at various installation restoration (IR) sites in Parcel C, within the Hunters Point Naval Shipyard (HPNS), San Francisco, California. The treatability pilot testing is currently being performed by IT Corporation (IT) under the Remedial Action Contract No. N62474-98-D-2076, Contract Task Order 0033.

This report covers the period from March to April 2001. Areas addressed are the IR sites at Buildings 134, 211/253, 231, 251 and 272. Field activities performed are summarized in Section 2.0. Test data collected were reduced and are presented in Section 3.0. Subsequent activities to be covered in the next reporting period are highlighted in Section 4.0. Data summary tables and figures showing trend plots are included in the appendices.

2.0 Activities Completed During Reporting Period

Activities completed as of the beginning of March were (1) completion of the SVE pilot-scale systems at Buildings 231 and 272 and (2) continuous performance of constant rate testing at Buildings 134, 211/253, and 251. By mid-March, constant rate testing of the SVE systems at Buildings 231 and 272 also began. Constant rate testing of all five SVE systems continued through April.

For Buildings 231 and 272, construction of the pilot-scale system included the installation of SVE and vapor monitoring (VM) wells and SVE equipment. Following system construction were baseline wellhead vapor sampling, step testing, and constant rate testing. The nature and sequence of these activities conducted were similar for all IR sites. Therefore, general descriptions of the activities are presented herein in the following subsections. Site-specific details are provided where referenced. Sections 2.1 through 2.3 are applicable to the activities conducted at Buildings 231 and 272, whereas Section 2.4 covers all building sites.

2.1 Pilot-Scale System Installation

SVE pilot test systems were completed in two more sites in Parcel C at Buildings 231 and 272, respectively. As part of the pilot test system, IT installed a number of SVE and VM wells inside each of the buildings. Some of the wells are located in concrete sumps. The SVE wells are screened from near floor (or ground surface) to the lowest depths above groundwater tables. The VM wells are screened in two depths where practicable—from near floor (or ground surface) to the lowest depths above groundwater tables. Most of the VM wells installed in the concrete sumps are screened across the lower depths only because of limited screened interval in the vadose zone beneath the sumps. The shallow and deep VM wells are located adjacent to one another in separate boreholes. The location and identification of the SVE and VM wells are in general accordance with the *Phase II Soil Vapor Extraction Treatability Study Work Plan* prepared by Tetra Tech EM, Inc. (TtEMI), for HPNS, dated July 28, 2000 (TtEMI, 2000). The physical locations of the wells were adjusted in the field to accommodate actual site conditions. Attachment 1 of Appendix A contains a summary of the as-built well construction details.

In addition to well construction, a pilot-scale SVE blower system was installed at each site. Each system consisted of a skid-mounted blower unit (equipped with a liquid-vapor separator, a condensate discharge pump, air filters, and silencers) and vapor-phase carbon vessels connected in series. Blower capacities and carbon quantities for the two SVE systems are summarized in Table 1, "Soil Vapor Extraction Blower Capacity and Carbon Quantity for Each Installation Restoration Treatability Study Site," as follows:

Table 1
Soil Vapor Extraction Blower Capacity and Carbon Quantity for Each Installation Restoration Treatability Study Site

IR Site	Building Number	Blower Capacity	Carbon Quantity
28	231	400 cfm at 8 inches Hg	2000 pounds
28	272	250 cfm at 8 inches Hg	400 pounds

Hg denotes mercury

2.2 Baseline Wellhead Vapor Sampling

Prior to starting the pilot test at each site, wellhead vapor samples from the SVE wells were collected. Samples were contained in SUMMA™ canisters and shipped to Smart Chemistry (formerly JPB Corporation) of Sacramento, California for analysis using U.S. Environmental Protection Agency (EPA) Method TO-14. Photoionization detector (PID) readings were also taken at the wellheads during vapor sampling. Analytical data and PID readings for each site are presented in Attachment 2, "Baseline Wellhead Vapor Sample Results," in Appendix A.

2.3 Step Testing

Step testing was conducted at each site after the completion of equipment installation inspection. Each SVE system was tested at 2.5 inches mercury (Hg), 5 inches Hg, 7.5 inches Hg, and up to 10 inches Hg where feasible. The SVE blower unit installed at each site was used for the testing. Each test run lasted for at least 2 hours. At the end of each test, oxygen content and PID readings were taken at the wellheads of each SVE well and VM well using field instruments. Influent and effluent vapor samples were collected from the vapor-phase carbon adsorption units to determine carbon treatment efficiencies. The samples were shipped in SUMMA™ canisters to Smart Chemistry for EPA TO-14 analysis.

Field data collected from step testing at each site were summarized and reduced. Plots of extraction airflow yields at the test wells versus vacuum applied during the step testing at the two building sites were presented in Appendix B (see respective Figure 1).

2.4 Constant Rate Testing

The constant rate tests for Buildings 231 and 272 started on March 6 and March 20, respectively, whereas tests for Buildings 251, 211/253, and 134 began in February and continued through the month of April. All SVE blowers were placed on 24-hour continuous run, except during several short-term shutdown periods and the interim noise abatement period when the systems were only running between 8:00 a.m. and 5:30 p.m. Some of the shutdown events were necessary to accommodate field sampling activities conducted by TtEMI inside the buildings. A summary of system operation status is presented in Appendix C.

For Buildings 231 and 272, system operations were monitored at various frequencies since the startup of the equipment: from once every 2 hours for the first 8 to 10 hours on the first day of operation to once every 8 hours on the third day of the operation. Beginning the fourth day of the operation, system monitoring was reduced to once daily. Carbon treatment system samples were collected once daily for the first 3 days of operation and then once a week thereafter for the subsequent 2 weeks of operation. Samples were taken at the preset frequency but only on days when the systems were running. After approximately 2 weeks of system monitoring, system samples were taken once every 2 weeks.

For each of the other three building sites, system monitoring was conducted once a week and treatment system vapor samples were collected biweekly. System performance information gathered during the constant rate testing is presented in Section 3.0.

3.0 Data and Results Presentation

This section reviews the performance of the SVE pilot test systems based on the following four areas: (1) radius of vacuum influence, (2) extraction flow rate and mass removal, (3) carbon treatment, and (4) well performance.

3.1 Radius of Vacuum Influence

The estimated radii of vacuum influence for the five SVE treatability study (TS) sites are presented in Table 2, Estimated Radii of Vacuum Influence for the SVE Treatability Study Sites." The radius of influence (ROI) was determined based on a minimum vacuum reading of 0.1 inch water column (wc) observed at the furthermost observation well from the SVE well.

Table 2
Estimated Radii of Vacuum Influence for the SVE Treatability Study Sites

IR Site	Building Number	Vacuum Operated on for Constant Rate Test (inches Hg)	Estimated ROI (a) (feet)
25	134	4.5 to 5	24 to 58
28	211/253	7.5	11 to 50
28	251	7.5	35 to 43
28	231	7 to 7.5	33(b)
28	272	6.5	15 to 20(b)

(a) Determined based on vacuum observed in VM wells located nearest an SVE well.
(b) These initially estimated values are based on the step test results

As shown in Table 2, the estimated ROI not only varied from one building site to another but also within a building site. Buildings 134 and 211/253 showed greater variations of the ROI. The higher ends of the ROI values are typically associated with the more permeable subsurface soil, such as gravel and sand. This suggests that some SVE and adjacent VM wells are located in a relatively more permeable subsurface zone layer. Except for Building 272, the average estimated ROI for most of the SVE TS sites ranged between 30 and 40 feet.

3.2 System Extraction Flow Rate and Volatile Organic Compound Mass Removal

During the months of March and April, the extraction airflow yields at the SVE TS sites ranged from 90 cubic feet per minute (cfm) to 1,170 cfm. Most of the airflow yields were noted to have decreased over time, particularly immediately after the startup of the systems (see Table 2). In most instances, the decrease in airflow yield was associated with reduction of operating vacuum at the SVE wellheads because of liquid entrainment. Whenever entrainment of significant amount of moisture was observed, the wellhead vacuum was reduced to minimize the amount of liquid entering the SVE system.

The rate of volatile organic compound (VOC) mass removal from the vadose zone at each site is summarized in Table 3, "Summary of Volatile Organic Compound Mass Removal Rate and Cumulative Mass Removal," presented as follows:

Table 3
Summary of Volatile Organic Compound Mass Removal Rate and Cumulative Mass Removal

IR Site	Building Number	Airflow Yield (SCFM)	VOC Mass Removal Rates (lb./hr.)	Predominant VOC Species Detected	Cumulative VOC Mass Removal (lb.)
25	134	600 to 1,170	4.0E-4 to 4.4E-3	PCE, TCE, and Trichloro-fluoromethane	2.3
28	211/253	90 to 240	2.0E-3 to 8.0E-3	Cis-1,2-DCE and TCE	6.7
28	251	110 to 210	4.0E-4 to 1.5E-3	Dichlorobenzenes and Trimethylbenzenes	1.0
28	231	120 to 350	3.0E-4 to 7.0E-3	Cis-1,2-DCE, TCE and PCE	0.6
28	272	130 to 200	1.4E-3 to 3.2E-3	TCE	1.0

DCE denotes dichloroethene.
lb. denotes pound.
lb./hr. denotes pounds per hour.
SCFM denotes standard cubic feet per minute
PCE denotes tetrachloroethene.
TCE denotes trichloroethene.

As shown in the table, the calculated VOC mass removal rates were on the order of 10^{-3} to 10^{-4} pounds per hour. The mass removal rates for Buildings 134, 211/253, and 251 showed relatively sharp increases during the month of April. The increases in VOC mass removal for Buildings 134 and 211/253 were due mostly to increases in airflow yield. The mass removal increase at Building 251 was due to an increase in the soil vapor concentration. The mass removal rate for Building 231 showed only a slight increase at the beginning of April and then stayed relatively constant throughout the month. For Building 272, the mass removal rate also had a slight jump early in April but then gradually decreased toward the end of the month. The decrease was apparently a result of a gradual decline in the influent soil vapor concentration.

A PID was used at each site to provide periodic monitoring of the soil vapor concentration at the SVE system inlet. Measured PID readings were plotted against hours of system operations. In spite of the apparent differences between the PID measurements and the laboratory data, the changes in the influent soil vapor concentration over time based on PID readings mirrored those in the VOC mass extraction rates established based on the laboratory analytical results (see Appendix B). All mass removal rates were calculated based on the influent vapor sample analytical data. Appendix B contains plots of VOC mass extraction rate and cumulative VOC mass extraction over time for each site. As shown in Table 3, the cumulative VOC mass extraction from the subsurface since the commencement of the constant rate test ranged from 0.6 to 6.7 pounds. Predominant VOC species detected in the soil vapor at each site are also presented in the table.

3.3 Vapor-Phase Carbon Treatment

Based on the analytical results of the influent and effluent vapor samples collected from the vapor-phase carbon treatment units, the vapor treatment efficiencies for all three SVE systems were generally maintained above 90 percent. PID readings were also used to provide qualitative monitoring of the carbon treatment efficiency. PID measurements were generally consistent with the laboratory results, except when the instruments experienced interference that resulted in erroneous readings. Much of the interference was apparently caused by the presence of excess moisture and/or fine solid particles in the vapor stream due in part to liquid entrainment into the SVE wells. As such, frequent maintenance of the PID instrument was required to ensure that proper measurements were obtained when the instrument was used on systems with excess liquid entrainment.

In summary, PID readings were still used to provide real-time monitoring for signs of carbon breakthrough at each of the SVE systems. During the operating period, no carbon breakthrough was believed to have occurred with any of the systems. Vapor-phase carbon continued to effectively treat the soil vapor removed from the vadose zone.

3.4 Well Performance

Generally, most of the SVE and VM wells continued to exhibit to some degree the characteristic patterns typical of SVE operations. The wellhead vapor concentrations, based on PID measurements, showed decreases amid occasional fluctuations since the commencement of the constant rate testing. More site-specific discussions on well performance among the building sites are presented as follows.

3.4.1 Building 134

All 17 SVE wells were operating, with an average airflow of approximately 50 cfm per well. SVE wells, IR25VW6-6A and IR25VW6-19A, continued to operate at substantially reduced vacuum to minimize liquid entrainment into the system. These two wells are located in the below-grade sump on the north end of the building, where elevated levels of VOCs, including vinyl chloride, have been detected in the groundwater. Because of the limited vadose zone interval beneath the sump and the significant moisture entrainment noted from previous operations, airflow yields from these two wells had been particularly limited.

PID readings taken from the SVE wells were mostly lower than 40 parts per million by volume (ppmv), with slight fluctuations in the wellhead vapor concentrations in almost all wells. PID readings from the VM wells were relatively higher. IR25SG58D continued to show the highest PID readings of between 400 and 500 ppmv. The wellhead vapor concentration in this well appeared to stay fluctuating rather than in a gradual decrease. This may suggest (1) the presence of a VOC source in the vadose zone soil near the deeper screened level of IR25SG58D and/or (2) the effect of VOC migration from groundwater due to volatilization.

3.4.2 Building 211/253

All five SVE wells were operating in this reporting period until April 20. IR28VW2-15A was closed off early on April 20 when a slight discoloration of the liquid entering into the system via the well was observed. The slightly discolored liquid was believed to be the groundwater containing a trace amount of potassium permanganate. Injection of potassium permanganate into the groundwater was conducted as part of the in-situ chemical oxidation treatability study being co-performed at the site. Excess moisture entrained into the SVE system via the SVE well was noted before at the beginning of the constant rate test. Even operating with vacuum at inches of water column, this SVE well could yield a substantial amount of moisture.

Airflow yield increased from 34 cfm to approximately 38 cfm per well on average from March to April. During the potassium permanganate injection period, the airflow yield was reduced to less than 100 cfm to minimize entrainment of groundwater in nearby SVE wells.

Except for IR28SG427D, IR28SG429D, and IR28SG430D, PID readings taken at the wellheads of all other SVE and VM wells showed not greater than 100 ppmv. The three VM wells are all located in concrete sumps. PID readings collected at IR28SG429D showed decreases to approximately 850 ppmv at the end of the reporting period. For IR28SG430D, the PID readings dropped gradually from 1000 ppmv to less than 200 ppmv. For IR28SG427D, slight rebounds of wellhead vapor concentrations were noted, with the PID reading returning to approximately

400 ppmv. IR28SG420S and IR28SG420D continued to show a lack of vacuum influence (i.e., less than 0.1 inch wc) because of their respective distance from any nearest SVE well. These two wells, however, never showed greater than 10 ppmv of PID readings during the 2 months of operation.

3.4.3 Building 251

All six SVE wells were operating in this reporting period. Average airflow per well increased from 27 cfm in March to approximately 29 cfm in April. Liquid entrainment continued to limit the amount of airflow yielded by the SVE wells. Vacuum influence also continued to be limited to the east and west of the SVE wells inside the building.

Most of the wellhead vapor concentrations measured using the PID at the SVE and VM wells showed less than 20 ppmv. SVE well IR28VW5-03A was the only well with a PID reading of greater than 200 ppmv. The other wells that showed similarly high PID readings were IR28SG459D and IR28SG460D. All three wells are located in the concrete sumps inside the building.

IR28SG460D had the highest PID readings of between 900 and 1,000 ppmv during the 2 months of operations. The wellhead vapor concentrations measured from this VM well appeared to be mostly fluctuating, rather than showing actual decline. This phenomenon suggested a limitation to the rate of VOC removal at that location. Converting the well into an SVE well may assist in the mass removal of VOCs beneath the sump.

3.4.4 Building 231

All 14 SVE wells were in operation during the reporting period. Six of the wells are 2-inch wells and were used in a previous SVE TS conducted by another contractor. The other eight wells are 4-inch wells and were installed for this Phase II SVE TS. Similar to the startup of the SVE systems at other building sites, the operating vacuum at greater than half of the SVE wells at this site was reduced to minimize entrainment of excess moisture to the system. It did not seem to have any significant difference in the potential for liquid entrainment between a 2-inch well and a 4-inch well. The average airflow yield in this reporting period was maintained at approximately 11 cfm per well.

Wellhead vapor concentrations measured using the PID at the SVE and VM wells were almost all below 50 ppmv at the beginning of the constant rate test. After approximately 2 months of system operations, most of the wellhead vapor concentrations dropped to between 5 and 10 ppmv. Only a few of them showed an increase trend in wellhead vapor concentrations near the end of the reporting period.

3.4.5 Building 272

All four SVE wells were running during the reporting period. Limited liquid entrainment was noted in the wells at this building site. The average airflow yield was maintained at approximately 42 cfm per well throughout the entire operational period.

PID readings taken at the wellheads indicated that VM wells located on the north end of the building had the highest vapor concentrations. Several of them, particularly IR28SG433S, IR28SG434D, IR28SG436D, and IR28SG437D, consistently had PID readings of greater than 500 ppmv during the first days of operation. Wellhead vapor concentrations decreased gradually for most of the wells. Some, however, showed slight rebound. This may be due to the rather short system runtime. More runtime is considered necessary to assess the cause of the rebound.

4.0 Activities Anticipated for Next Reporting Period

Constant rate testing of all five SVE pilot-scale systems is expected to continue. However, depending on the mass removal rates, continuous operations of some of the systems, such as the one at Building 231, may cease, and rebound monitoring may begin at those sites. For some other systems, such as those at Buildings 134 and 251, operations will enter into the third month of the treatability test period. Those systems may also be turned off, followed by monitoring for VOC concentration rebound.

In any event, routine system monitoring will continue to be conducted on a weekly schedule, with system vapor sampling for laboratory analysis on a biweekly schedule. Vapor-phase carbon treatment will be monitored based on PID readings and laboratory vapor sample results. Laboratory data will also be used to confirm if carbon breakthrough occurs. To verify if carbon breakthrough occurs, a 24-turnaround time will be requested of the system samples collected.

APPENDIX A
DATA SUMMARY TABLES

Appendix A contains the following:

- Attachment 1: Soil Vapor Wells Constructions As-Builts
- Attachment 2: Baseline Wellhead Vapor Concentrations for SVE Wells at IR28 (Buildings 231 and 272)

ATTACHMENT 1
SOIL VAPOR WELLS CONSTRUCTIONS AS-BUILTS

Soil Vapor Well Construction Tracking												
				Direct Push / Continuous soil sampling				**Well Completion**				
Vapor Extraction Wells												
Parcel	RU	Well No.	Well Type	Boring drill date	Date Soil samples collected/shipped	TD of boring (feet bgs)	Comments	Date of Well completion	Well TD	Screen Interval	Well Diameter (in.)	Comments
C	IR-28	IR28VW2-07A	VEW	10/19/2000	10/19/2000	7.0		10/25/2000	6.0	2 - 6 "	4 "	Above ground completion
C	IR-28	IR28VW2-08A	VEW	10/19/2000	10/19/2000	7.0		10/25/2000	6.0	2 - 6 "	4 "	Above ground completion
C	IR-28	IR28VW2-09A	VEW	10/19/2000	10/19/2000	7.0		10/26/2000	6.0	2 - 6 "	4 "	Above ground completion
C	IR-28	IR28VW2-10A	VEW	10/23/2000	10/23/2000	7.0		10/26/2000	6.0	2 - 6 "	4 "	Above ground completion
C	IR-28	IR28VW2-11A	VEW	10/19/2000	10/19/2000	7.0		10/26/2000	6.0	2 - 6 "	4 "	Above ground completion
C	IR-28	IR28VW2-12A	VEW	10/18/2000	10/18/2000	7.0		10/31/2000	6.0	2 - 6 "	4 "	Above ground completion
C	IR-28	IR28VW2-13A	VEW	10/23/2000	10/23/2000	7.0		10/31/2000	6.0	2 - 6 "	4 "	Above ground completion
C	IR-28	IR28VW2-14A	VEW	10/19/2000	10/19/2000	7.0		10/26/2000	6.0	2 - 6 "	4 "	Above ground completion
Vapor Monitoring Points (Lower Zone)												
C	IR-28	IR28SG402	VMP-L	10/19/2000	10/19/2000	7.0		10/25/2000	6.0	4 - 6 "	2 "	Above ground completion
C	IR-28	IR28SG403	VMP-L	10/19/2000	10/19/2000	7.0		10/31/2000	6.0	4 - 6 "	2 "	Above ground completion
C	IR-28	IR28SG404	VMP-L	10/19/2000	10/19/2000	7.0		10/30/2000	6.0	4 - 6 "	2 "	Above ground completion
C	IR-28	IR28SG405	VMP-L	10/19/2000	10/19/2000	7.0		10/31/2000	6.0	4 - 6 "	2 "	Above ground completion
C	IR-28	IR28SG406	VMP-L	10/19/2000	10/19/2000	7.0		10/25/2000	6.0	4 - 6 "	2 "	Above ground completion
C	IR-28	IR28SG407	VMP-L	10/19/2000	10/19/2000	7.0		10/26/2000	6.0	4 - 6 "	2 "	Above ground completion
C	IR-28	IR28SG408	VMP-L	10/23/2000	10/23/2000	7.0		10/26/2000	6.0	4 - 6 "	2 "	Above ground completion
C	IR-28	IR28SG409	VMP-L	10/16/2000	10/16/2000	7.0		10/25/2000	6.0	4 - 6 "	2 "	Above ground completion
C	IR-28	IR28SG410	VMP-L	10/16/2000	10/16/2000	7.0		10/25/2000	6.0	4 - 6 "	2 "	Above ground completion
C	IR-28	IR28SG411	VMP-L	10/19/2000	10/19/2000	7.0		10/26/2000	6.0	4 - 6 "	2 "	Above ground completion
C	IR-28	IR28SG412	VMP-L	10/18/2000	10/18/2000	7.0		10/31/2000	6.0	4 - 6 "	2 "	Above ground completion
C	IR-28	IR28SG413	VMP-L	10/16/2000	10/16/2000	7.0		10/26/2000	6.0	4 - 6 "	2 "	Above ground completion
C	IR-28	IR28SG414	VMP-L	10/16/2000	10/16/2000	7.0		10/26/2000	6.0	4 - 6 "	2 "	Above ground completion
C	IR-28	IR28SG415	VMP-L	10/18/2000	10/18/2000	7.0		10/31/2000	6.0	4 - 6 "	2 "	Above ground completion
C	IR-28	IR28SG416	VMP-L	10/18/2000	10/18/2000	7.0		10/31/2000	6.0	4 - 6 "	2 "	Above ground completion
C	IR-28	IR28SG417	VMP-L	10/18/2000	10/18/2000	7.0		10/31/2000	6.0	4 - 6 "	2 "	Above ground completion
C	IR-28	IR28SG418	VMP-L	10/18/2000	10/18/2000	7.0		10/31/2000	6.0	4 - 6 "	2 "	Above ground completion
C	IR-28	IR28SG419	VMP-L	10/18/2000	10/18/2000	7.0		10/31/2000	6.0	4 - 6 "	2 "	Above ground completion
Vapor Monitoring Points (Upper Zone)												
C	IR-28	IR28SG402	VMP-U					10/25/2000	3.5	2 - 3.5 '	2 "	Above ground completion
C	IR-28	IR28SG403	VMP-U					10/31/2000	3.5	2 - 3.5 '	2 "	Above ground completion
C	IR-28	IR28SG404	VMP-U					10/30/2000	3.5	2 - 3.5 '	2 "	Above ground completion
C	IR-28	IR28SG405	VMP-U					10/31/2000	3.5	2 - 3.5 '	2 "	Above ground completion
C	IR-28	IR28SG406	VMP-U					10/25/2000	3.5	2 - 3.5 '	2 "	Above ground completion
C	IR-28	IR28SG407	VMP-U		same as lower zone wells;			10/26/2000	3.5	2 - 3.5 '	2 "	Above ground completion

Soil Vapor Well Construction Tracking									
				Direct Push / Continuous soil sampling	Well Completion				
C	IR-28	IR28SG408	VMP-U	one boring done for each lower/upper zone well pair	10/26/2000	3.5	2 - 3.5 '	2 "	Above ground completion
C	IR-28	IR28SG409	VMP-U		10/25/2000	3.5	2 - 3.5 '	2 "	Above ground completion
C	IR-28	IR28SG410	VMP-U		10/25/2000	3.5	2 - 3.5 '	2 "	Above ground completion
C	IR-28	IR28SG411	VMP-U		10/26/2000	3.5	2 - 3.5 '	2 "	Above ground completion
C	IR-28	IR28SG412	VMP-U		10/31/2000	3.5	2 - 3.5 '	2 "	Above ground completion
C	IR-28	IR28SG413	VMP-U		10/26/2000	3.5	2 - 3.5 '	2 "	Above ground completion
C	IR-28	IR28SG414	VMP-U		10/26/2000	3.5	2 - 3.5 '	2 "	Above ground completion
C	IR-28	IR28SG415	VMP-U		10/31/2000	3.5	2 - 3.5 '	2 "	Above ground completion
C	IR-28	IR28SG416	VMP-U		10/31/2000	3.5	2 - 3.5 '	2 "	Above ground completion
C	IR-28	IR28SG417	VMP-U		10/31/2000	3.5	2 - 3.5 '	2 "	Above ground completion
C	IR-28	IR28SG418	VMP-U		10/31/2000	3.5	2 - 3.5 '	2 "	Above ground completion
C	IR-28	IR28SG419	VMP-U		10/31/2000	3.5	2 - 3.5 '	2 "	Above ground completion
	Footage Totals for Building 231			Borings: 182.0	Wells:	219.0			

VEW = vapor extraction well
VMP-L = vapor monitoring well, lower zone
VMP-U = vapor monitoring well, upper zone

Soil Vapor Well Construction Tracking												
				Direct Push / Continuous soil sampling				Well Completion				
Vapor Extraction Wells												
Parcel	RU	Well No.	Well Type	Boring drill date	Date Soil samples collected/shipped	TD of boring (feet bgs)	Comments	Date of Well completion	Well TD	Screen Interval	Well Diameter (in.)	Comments
	IR-28	IR28VW4-01A	VEW	11/14/2000	11/14/2000	7		12/07/2000	6.0	2 - 6 '	4 "	Above ground completion
	IR-28	IR28VW4-02A	VEW	11/16/2000	11/16/2000	7		12/04/2000	6.0	2 - 6 '	4 "	Above ground completion
	IR-28	IR28VW4-03A	VEW	11/16/2000	11/16/2000	7		12/01/2000	6.0	2 - 6 '	4 "	Above ground completion
	IR-28	IR28VW4-04A	VEW	11/20/2000	11/20/2000	3	refusal at 3'	11/30/2000	6.0	2 - 6 '	4 "	Above ground completion
Vapor Monitoring Points (Lower Zone)												
	IR-28	IR28SG433	VMP-L	11/15/2000	11/15/2000	7		12/07/2000	6.0	4 - 6 '	2 "	Above ground completion
	IR-28	IR28SG434	VMP-L	11/15/2000	11/15/2000	7		12/06/2000	6.0	4 - 6 '	2 "	Above ground completion
	IR-28	IR28SG435	VMP-L	11/16/2000	11/16/2000	4.5	refusal at 4.5'	12/01/2000	6.0	4 - 6 '	2 "	Above ground completion
	IR-28	IR28SG436	VMP-L	11/14/2000	11/14/2000	7		12/07/2000	6.0	4 - 6 '	2 "	Above ground completion
	IR-28	IR28SG437	VMP-L	11/15/2000	11/15/2000	7		12/06/2000	6.0	4 - 6 '	2 "	Above ground completion
	IR-28	IR28SG438	VMP-L	11/16/2000	11/16/2000	7		12/01/2000	6.0	4 - 6 '	2 "	Above ground completion
	IR-28	IR28SG439	VMP-L	11/20/2000	11/20/2000	7		11/30/2000	6.0	4 - 6 '	2 "	Above ground completion
	IR-28	IR28SG440	VMP-L	11/14/2000	11/14/2000	7		12/07/2000	6.0	4 - 6 '	2 "	Above ground completion
	IR-28	IR28SG441	VMP-L	11/16/2000	11/16/2000	7		12/01/2000	6.0	4 - 6 '	2 "	Above ground completion
	IR-28	IR28SG442	VMP-L	11/16/2000	11/16/2000	4.5	refusal at 4.5'	12/06/2000	6.0	4 - 6 '	2 "	Above ground completion
	IR-28	IR28SG443	VMP-L	11/15/2000	11/15/2000	7		12/06/2000	6.0	4 - 6 '	2 "	Above ground completion
	IR-28	IR28SG444	VMP-L	11/15/2000	11/15/2000	7		12/07/2000	6.0	4 - 6 '	2 "	Above ground completion
	IR-28	IR28SG445	VMP-L	11/14/2000	11/14/2000	7		12/06/2000	6.0	4 - 6 '	2 "	Above ground completion
	IR-28	IR28SG446	VMP-L	11/20/2000	11/20/2000	7		12/07/2000	6.0	4 - 6 '	2 "	Above ground completion
	IR-28	IR28SG447	VMP-L	11/14/2000	11/14/2000	6.5	refusal at 6.5	12/06/2000	6.0	4 - 6 '	2 "	Above ground completion
	IR-28	IR28SG448	VMP-L	11/16/2000	11/16/2000	7		11/30/2000	6.0	4 - 6 '	2 "	Above ground completion
	IR-28	IR28SG449	VMP-L	11/14/2000	11/14/2000	7		12/04/2000	6.0	4 - 6 '	2 "	Above ground completion
	IR-28	IR28SG450	VMP-L	11/16/2000	11/16/2000	7		12/04/2000	6.0	4 - 6 '	2 "	Above ground completion
	IR-28	IR28SG451	VMP-L	11/15/2000	11/15/2000	7		12/04/2000	6.0	4 - 6 '	2 "	Above ground completion
Vapor Monitoring Points (Upper Zone)												
	IR-28	IR28SG433	VMP-U					12/07/2000	3.5	2 - 3.5 '	2 "	Above ground completion
	IR-28	IR28SG434	VMP-U					12/06/2000	3.5	2 - 3.5 '	2 "	Above ground completion
	IR-28	IR28SG435	VMP-U					12/01/2000	3.5	2 - 3.5 '	2 "	Above ground completion
	IR-28	IR28SG436	VMP-U					12/07/2000	3.5	2 - 3.5 '	2 "	Above ground completion
	IR-28	IR28SG437	VMP-U					12/06/2000	3.5	2 - 3.5 '	2 "	Above ground completion
	IR-28	IR28SG438	VMP-U		same as lower zone wells,			12/01/2000	3.5	2 - 3.5 '	2 "	Above ground completion
	IR-28	IR28SG439	VMP-U		one boring done for each lower/upper zone well pair			11/30/2000	3.5	2 - 3.5 '	2 "	Above ground completion
	IR-28	IR28SG440	VMP-U					12/07/2000	3.5	2 - 3.5 '	2 "	Above ground completion
	IR-28	IR28SG441	VMP-U					12/01/2000	3.5	2 - 3.5 '	2 "	Above ground completion

Soil Vapor Well Construction Tracking												
				Direct Push / Continuous soil sampling				**Well Completion**				
	IR-28	IR28SG442	VMP-U					12/06/2000	3.5	2 - 3.5 '	2 "	Above ground completion
	IR-28	IR28SG443	VMP-U					12/06/2000	3.5	2 - 3.5 '	2 "	Above ground completion
	IR-28	IR28SG444	VMP-U					12/07/2000	3.5	2 - 3.5 '	2 "	Above ground completion
	IR-28	IR28SG445	VMP-U					12/06/2000	3.5	2 - 3.5 '	2 "	Above ground completion
	IR-28	IR28SG446	VMP-U					12/07/2000	3.5	2 - 3.5 '	2 "	Above ground completion
	IR-28	IR28SG447	VMP-U					12/06/2000	3.5	2 - 3.5 '	2 "	Above ground completion
	IR-28	IR28SG448	VMP-U					11/30/2000	3.5	2 - 3.5 '	2 "	Above ground completion
	IR-28	IR28SG449	VMP-U					12/04/2000	3.5	2 - 3.5 '	2 "	Above ground completion
	IR-28	IR28SG450	VMP-U					12/04/2000	3.5	2 - 3.5 '	2 "	Above ground completion
	IR-28	IR28SG451	VMP-U					12/04/2000	3.5	2 - 3.5 '	2 "	Above ground completion
	Footage Totals for Building 231				**Borings:**	**151.5**		**Wells:**	**204.5**			
		VEW = vapor extraction well										
		VMP-L = vapor monitoring well, lower zone										
		VMP-U = vapor monitoring well, upper zone										

ATTACHMENT 2
BASELINE WELLHEAD VAPOR CONCENTRATIONS FOR SVE WELLS AT IR28 (BUILDINGS 231 AND 272)

ATTACHMENT 2
Baseline Wellhead Vapor Concentrations for SVE Wells at IR28 (Building 231)
Hunters Point Naval Shipyard, San Francisco, California

SVE Well ID	PID Reading (ppmv)	Analytical Data (ppmv)	Ratio of Field to Lab Results (a)
IR28VW2-1A	22.9	6.3	4
IR28VW2-2A	33.9	12.6	3
IR28VW2-3A	14.8	6.6	2
IR28VW2-4A	19.8	9.5	2
IR28VW2-5A	15.9	8.1	2
IR28VW2-6A	22.8	4.8	5
IR28VM2-07A	18.5	4.6	4
IR28VM2-08A	14.7	4.8	3
IR28VM2-09A	9.1	0.9	10
IR28VM2-10A	23.8	2.7	9
IR28VM2-11A	22	7.3	3
IR28VM2-12A	8	0.7	11
IR28VM2-13A	10.2	1.9	6
IR28VM2-14A	17	4.0	4

(a) The ratio of field to lab results for the vapor sample collected at each SVE well is determined by dividing the PID reading by the laboratory data.

Table 1
Baseline Wellhead Vapor Concentrations for SVE Wells at IR28, Building 272
Hunters Point Naval Shipyard, San Francisco, California

SVE Well ID	PID Reading (ppmv)	Laboratory Results of Detected VOC (ppmv)		Total Detected VOC (ppmv) (a)	Ratio of Field to Lab Results (b)
		2-Butanone	Trichloroethene		
IR28VW4-01A	110	19.6	7.1	26.7	4.1
IR28VW4-02A	50.1	5.19	2.48	7.67	6.5
IR28VW4-03A	48.3	ND	7.91	7.91	6.1
IR28VW4-04A	24.2	ND	0.63	0.63	38.5

Explanations:

(a) The total volatile organic concentration is the sum of the concentrations of only detected volatile organic compounds (VOC), including those with "J" qualifier.

(b) The ratio of field-to-lab results for the vapor sample collected at each SVE well is determined by dividing the PID readings by the total volatile organic concentration measured in the offsite laboratory.

ND denotes not detected at the method quantitation limit.

ppmv denotes parts per million by volume.

APPENDIX B
SVE SYSTEM PERFORMANCE PLOTS

Appendix B contains the following:

- Attachment 1: System Performance Plots for Building 134
- Attachment 2: System Performance Plots for Building 211/253
- Attachment 3: System Performance Plots for Building 251
- Attachment 4: System Performance Plots for Building 231
- Attachment 5: System Performance Plots for Building 272

ATTACHMENT 1
SYSTEM PERFORMANCE PLOTS FOR BUILDING 134

Figure 1 -- Plot of Influent Soil Vapor Concentration Over Hours of System Operation at IR25, Building 134, HPS, SF, CA

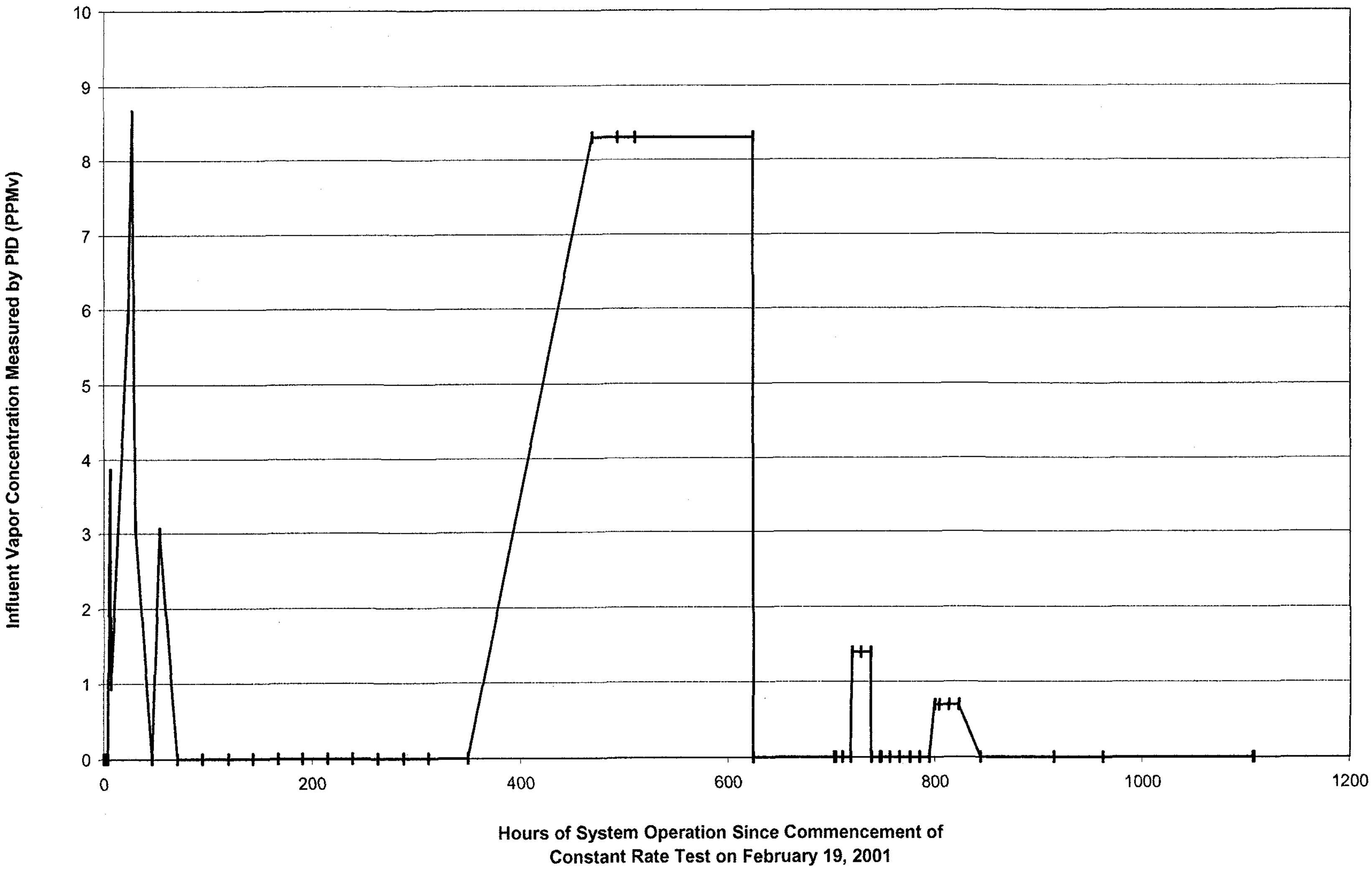


Figure 2 -- Plot of VOC Mass Extraction Rate Over Hours of System Operation at IR25, Building 134, HPS, SF, CA

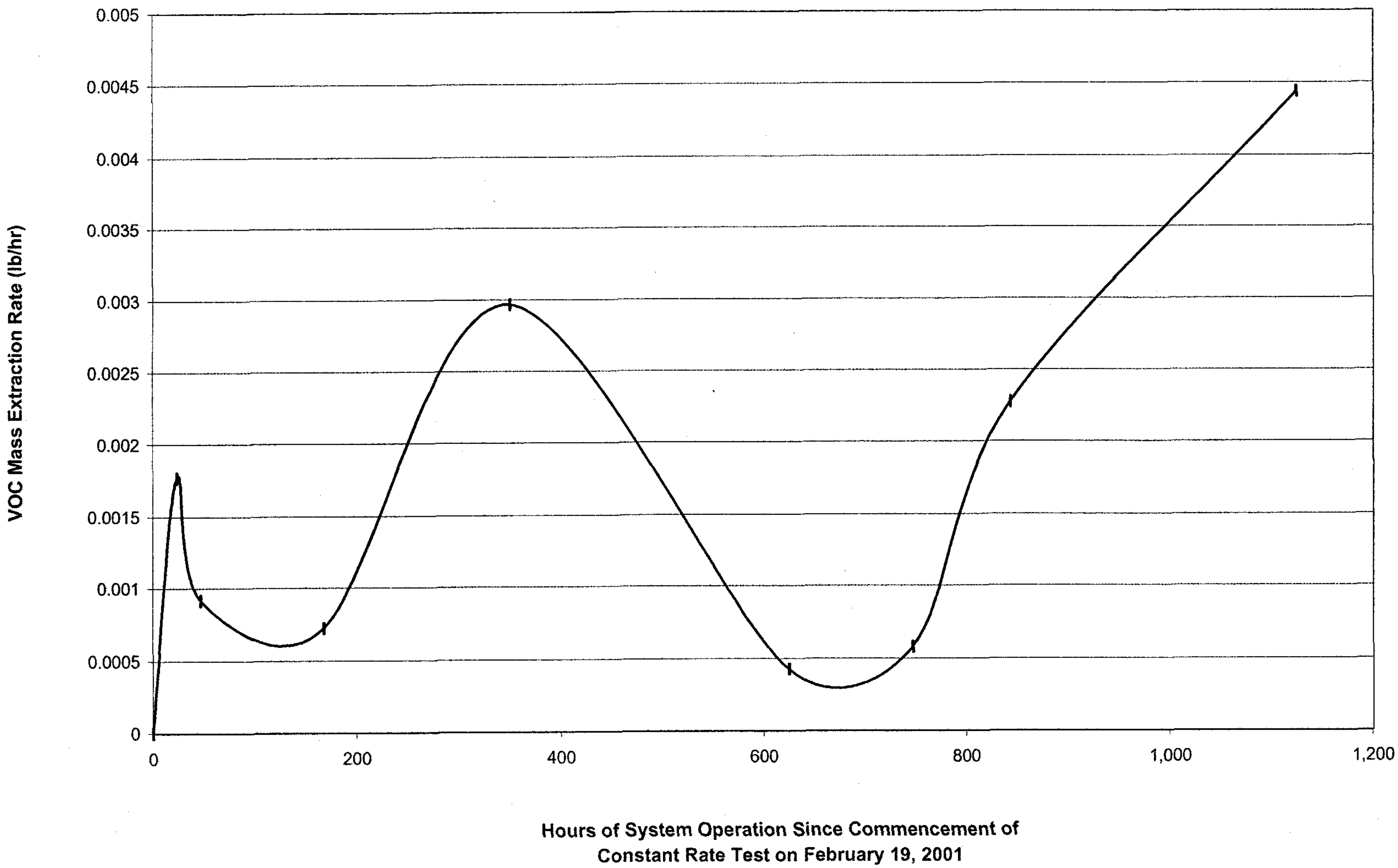


Figure 3 -- Plot of Cumulative VOC Mass Extraction Versus Hours of System Operation at IR25, Building 134, HPS, SF, CA

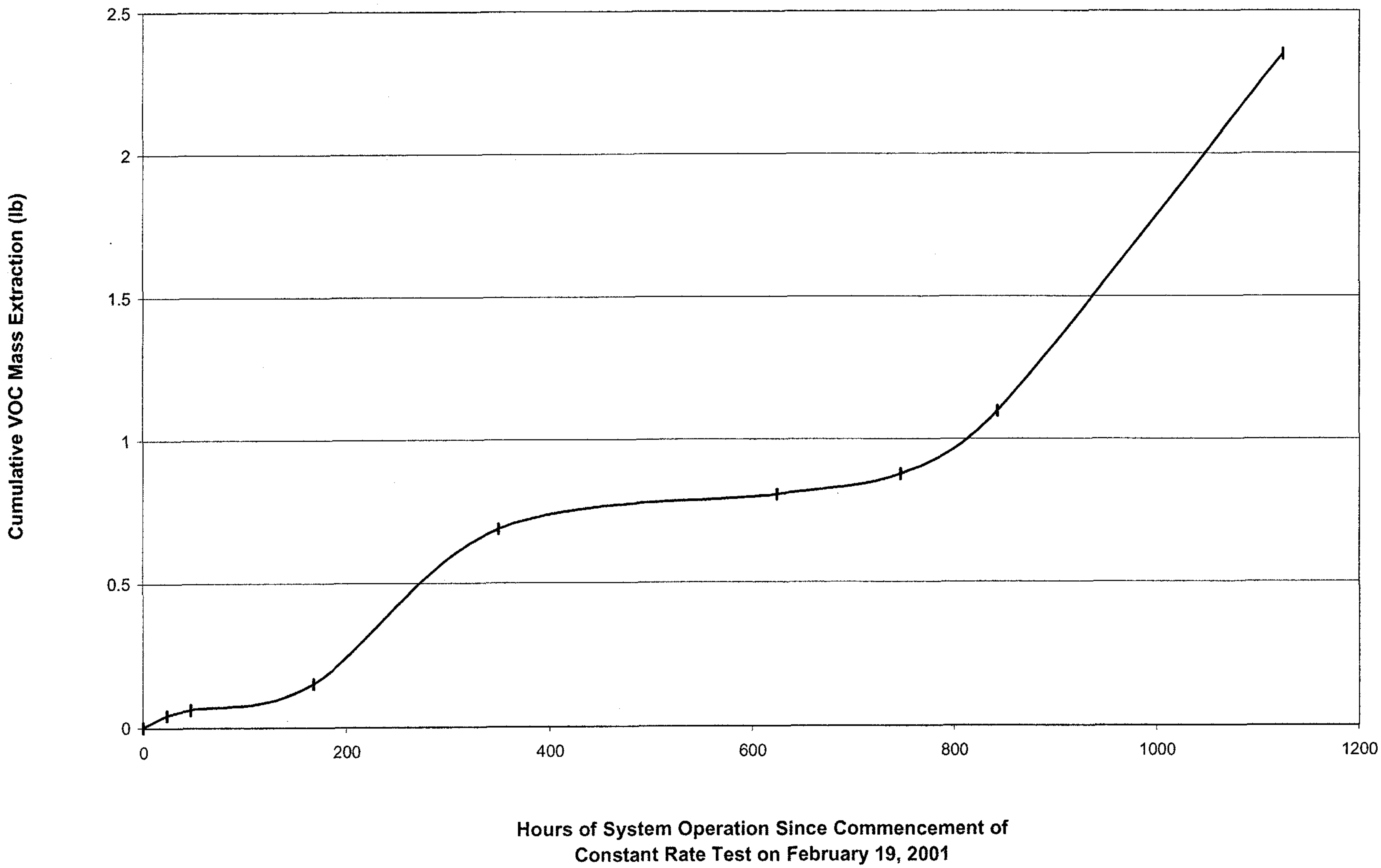
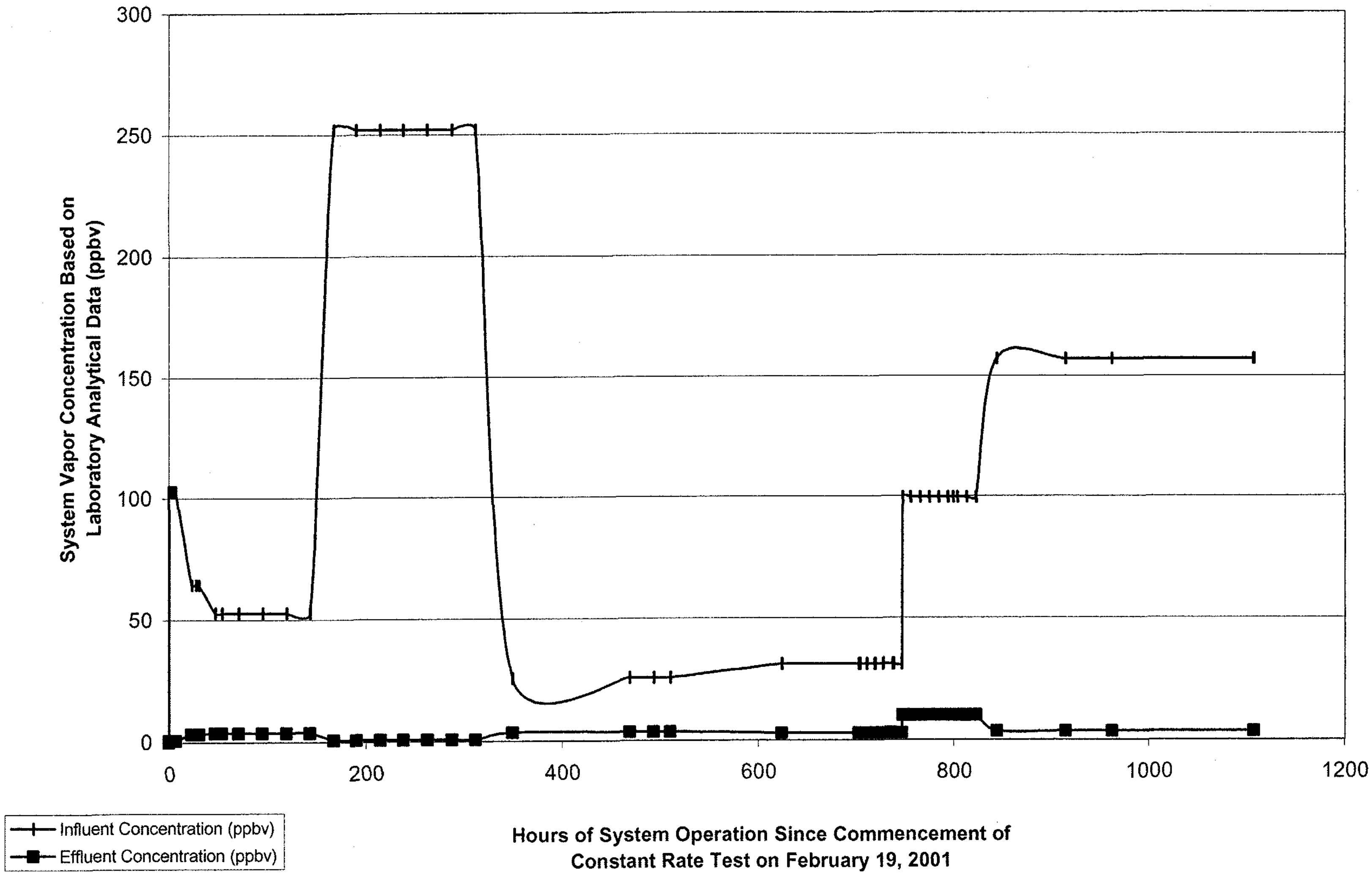


Figure 4 -- Plot of Carbon Treatment Unit Influent and Effluent Concentrations Versus Hours of System Operation at IR25, Building 134, HPS, SF, CA



ATTACHMENT 2
SYSTEM PERFORMANCE PLOTS FOR BUILDING 211

Figure 1 -- Plot of Influent Soil Vapor Concentration Over Hours of System Operation at IR28, Building 211, HPS, SF, CA

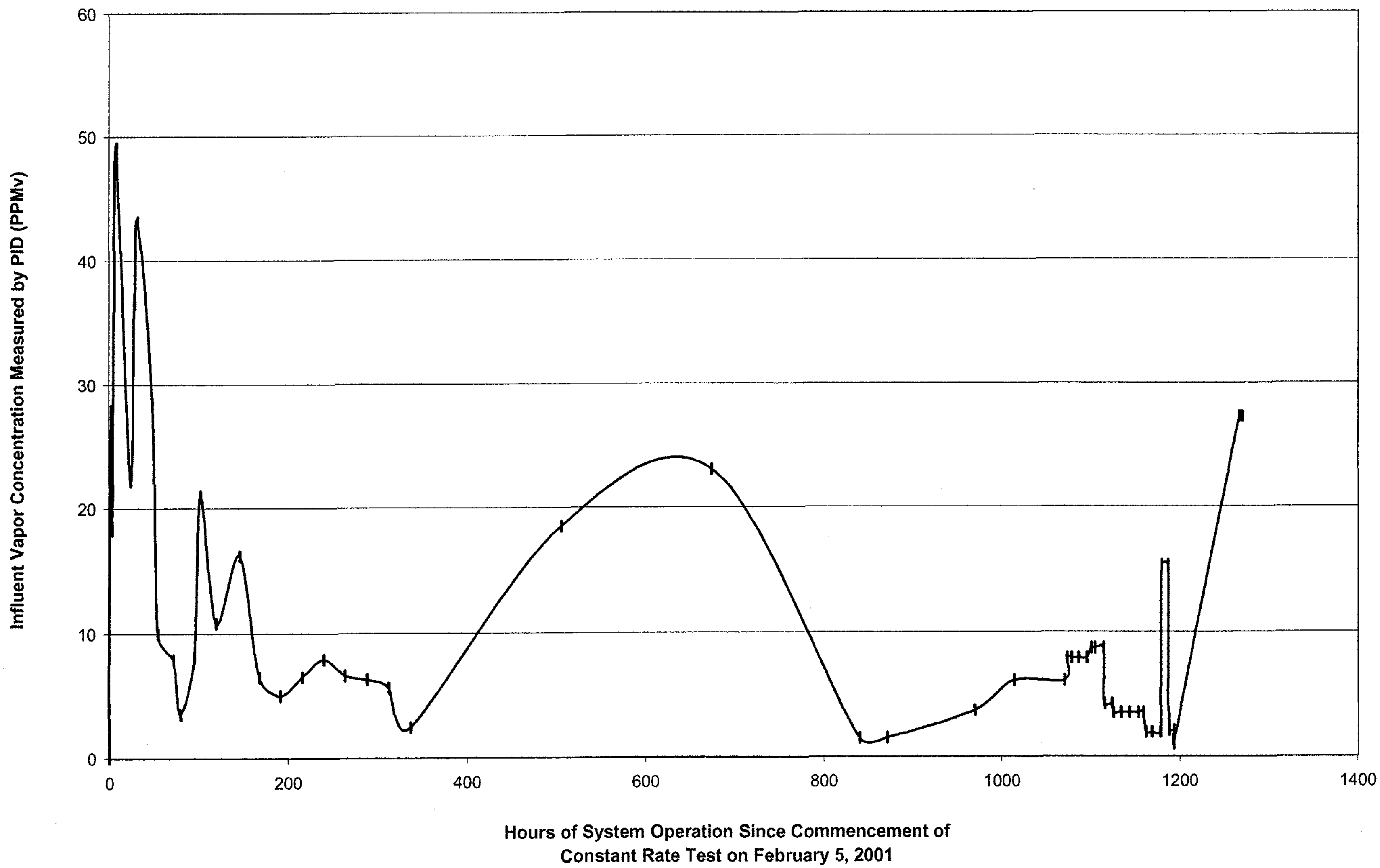


Figure 2 -- Plot of VOC Mass Extraction Rate Over Hours of System Operation at IR28, Building 211, HPS, SF, CA

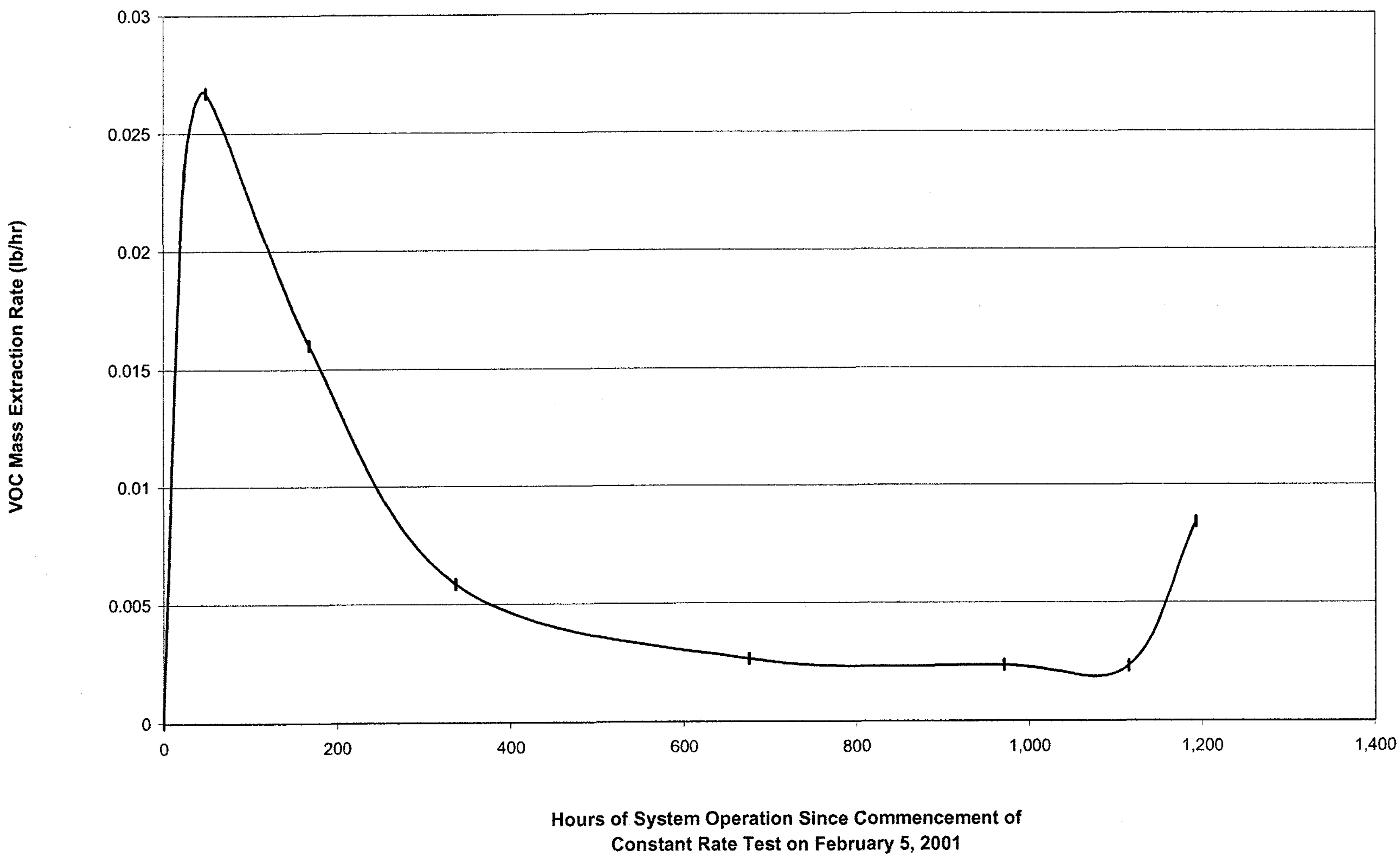


Figure 3 -- Plot of Cumulative VOC Mass Extraction Versus Hours of System Operation at IR28, Building 211, HPS, SF, CA

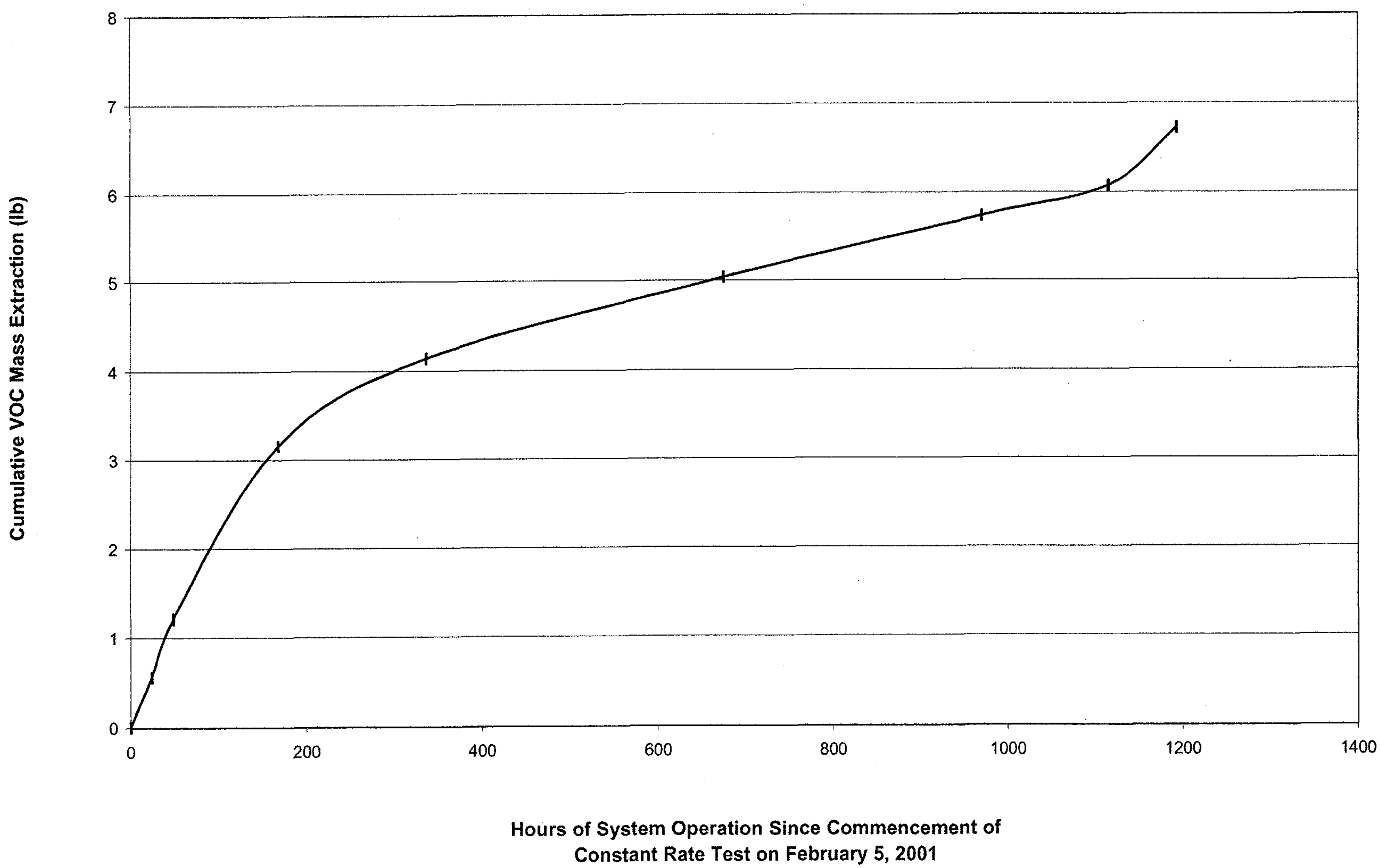
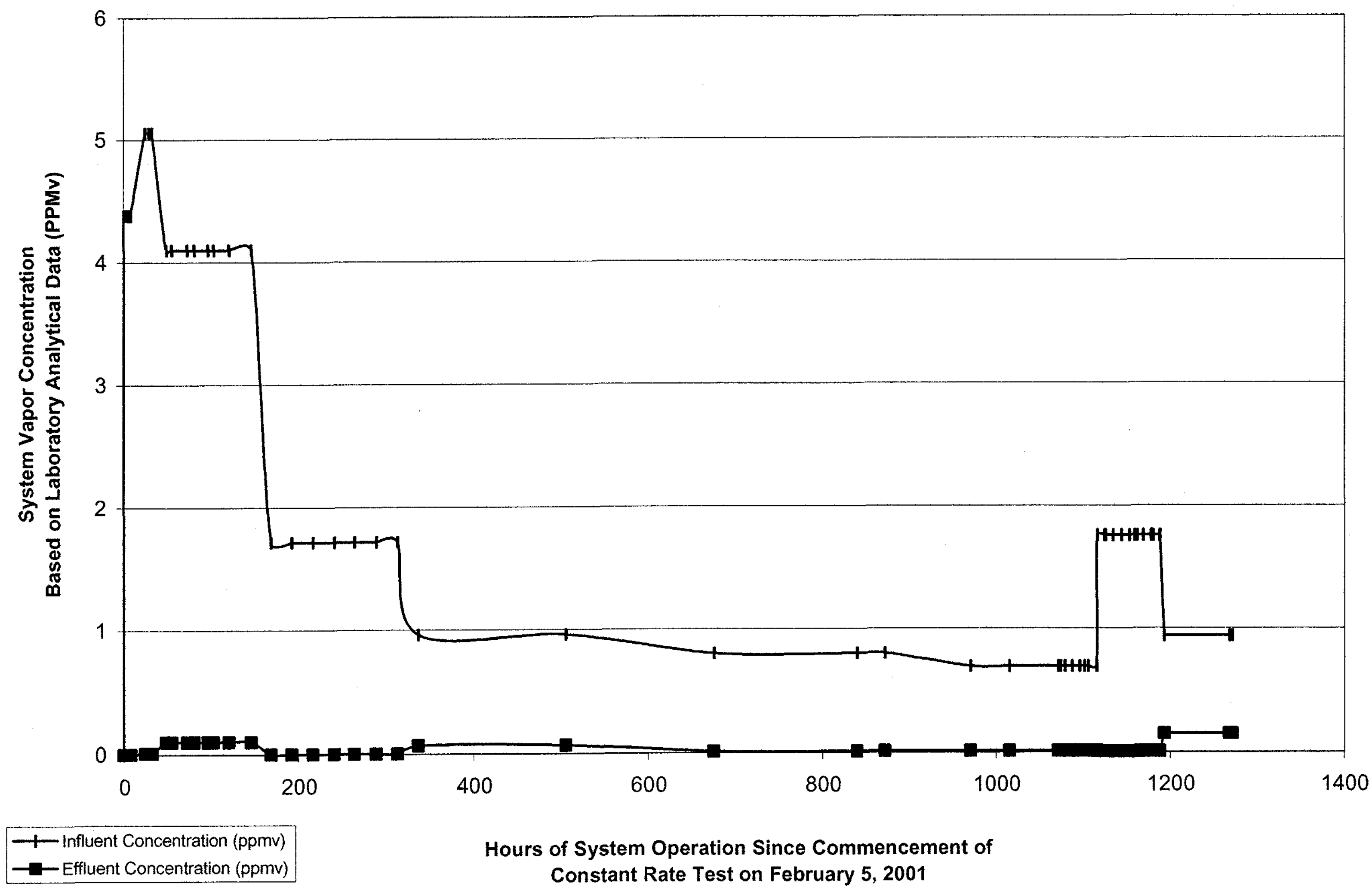


Figure 4 -- Plot of Carbon Treatment Unit Influent and Effluent Concentrations Versus Hours of System Operation at IR28, Building 211, HPS, SF, CA



ATTACHMENT 3
SYSTEM PERFORMANCE PLOTS FOR BUILDING 251

Figure 1 -- Plot of Influent Soil Vapor Concentration Over Hours of System Operation at IR28, Building 251, HPS, SF, CA

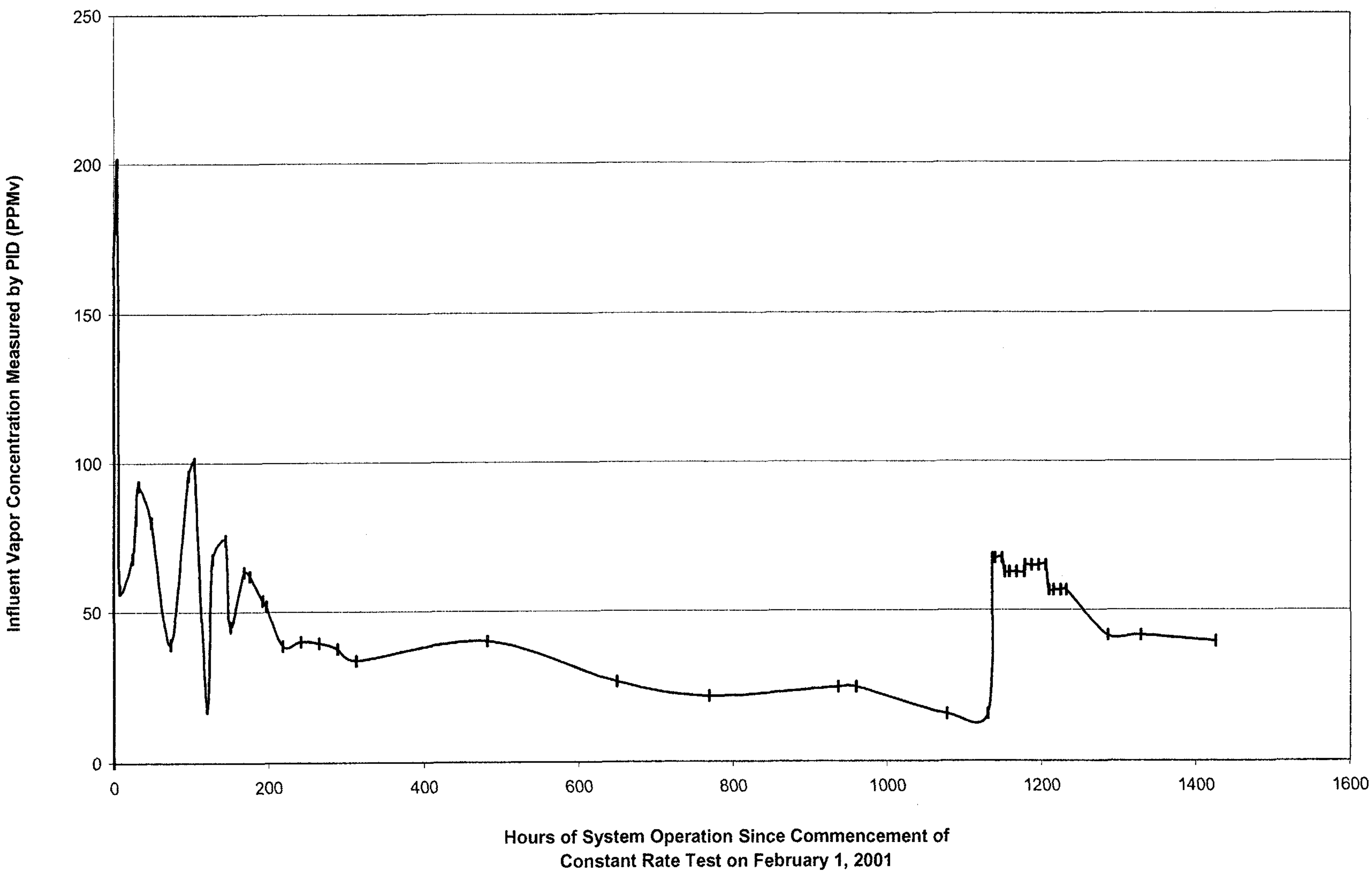


Figure 2 -- Plot of VOC Mass Extraction Rate Over Hours of System Operation at IR28, Building 251, HPS, SF, CA

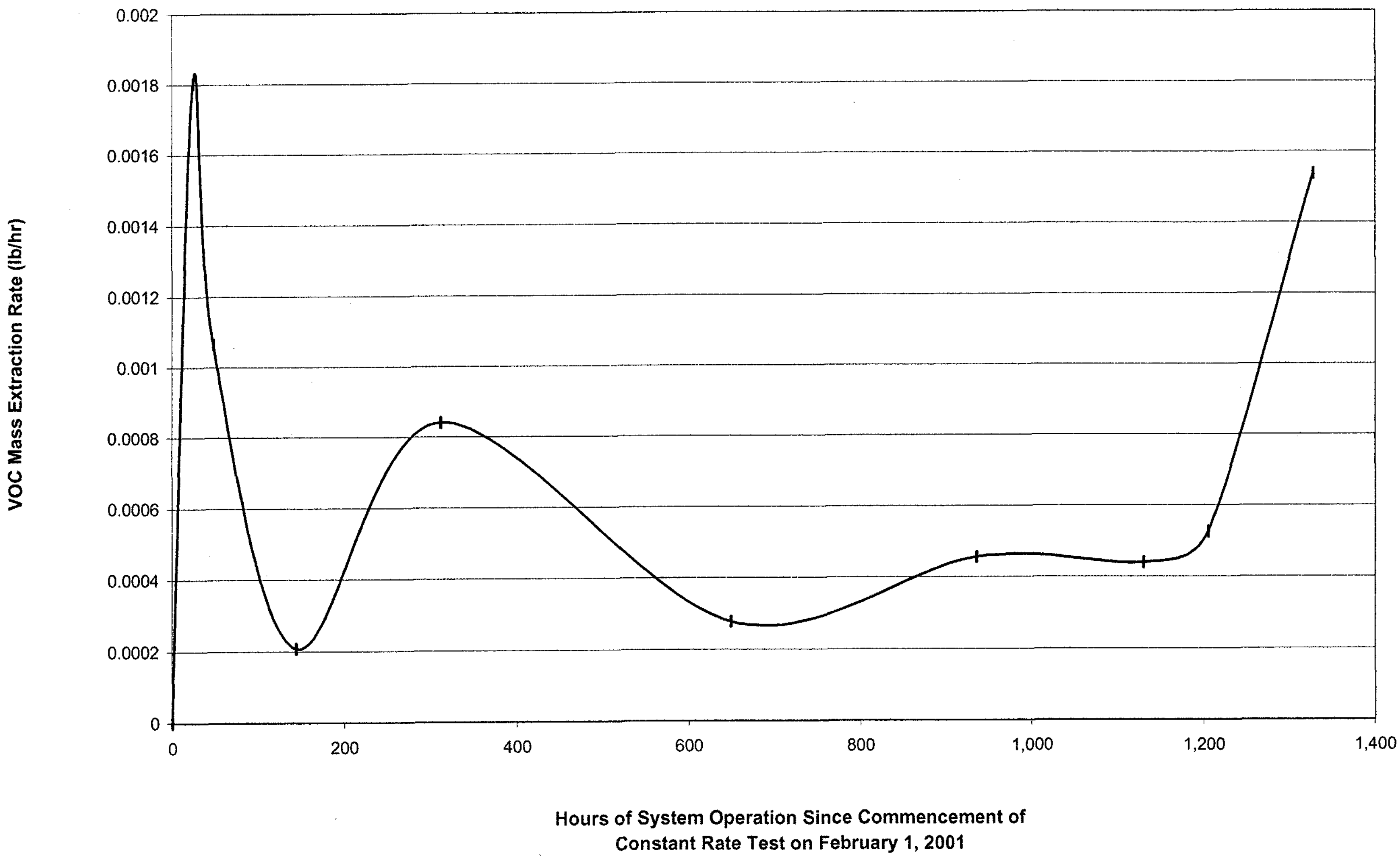


Figure 3 -- Plot of Cumulative VOC Mass Extraction Versus Hours of System Operation at IR28, Building 251, HPS, SF, CA

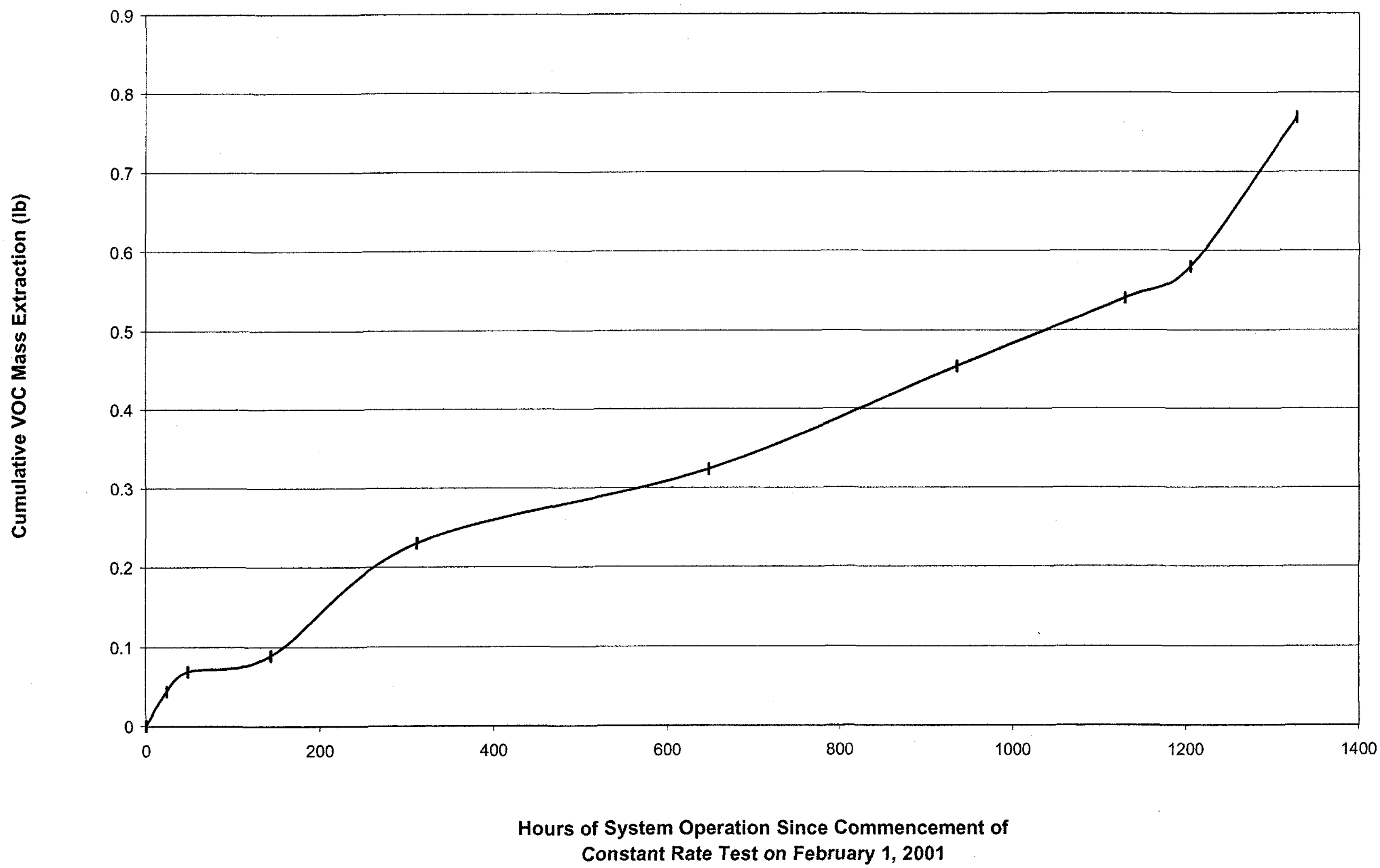
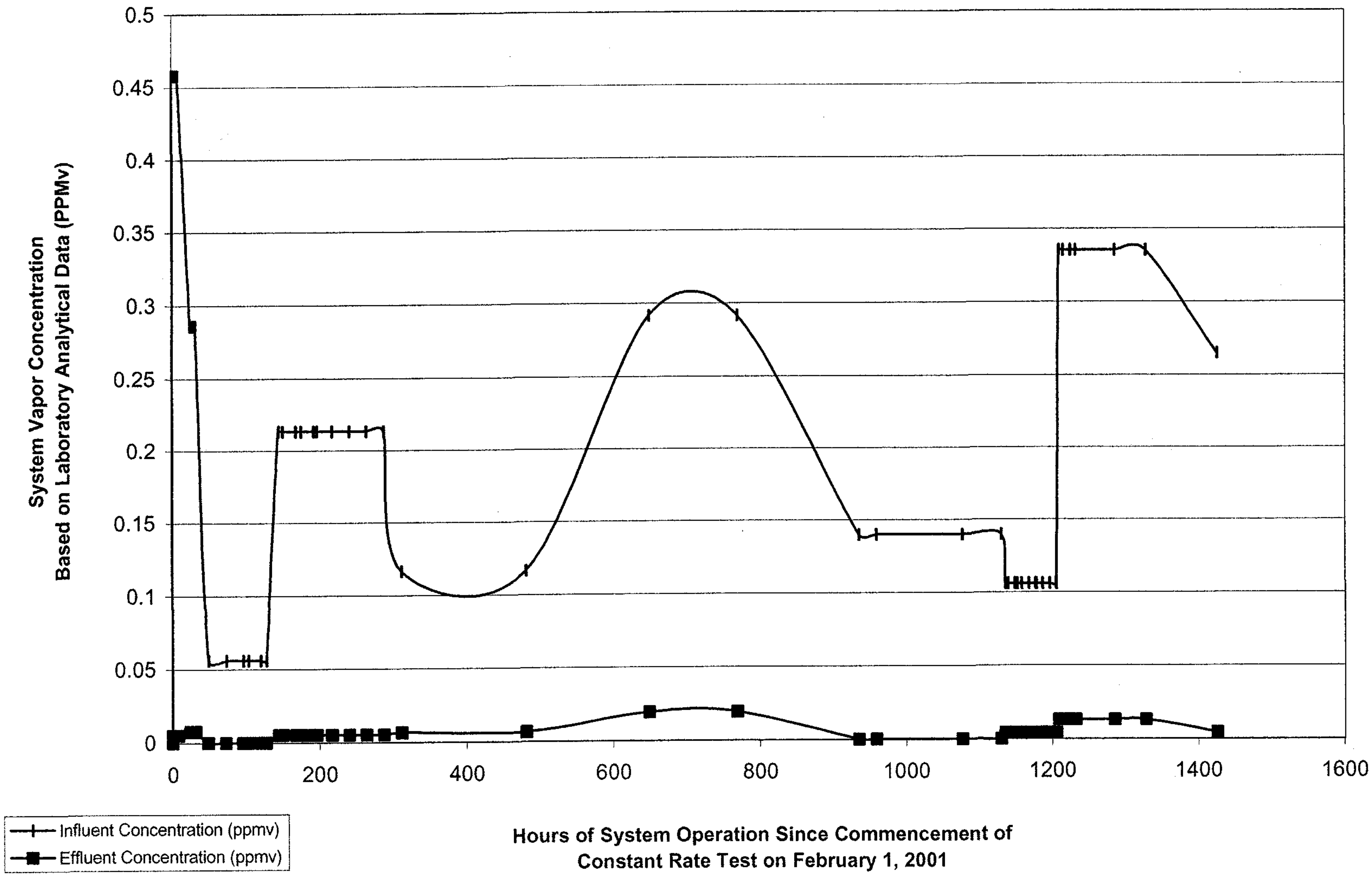


Figure 4 -- Plot of Carbon Treatment Unit Influent and Effluent Concentrations Versus Hours of System Operation at IR28, Building 251, HPS, SF, CA



ATTACHMENT 4
SYSTEM PERFORMANCE PLOTS FOR BUILDING 231

Figure 1 -- Plot of Vacuum vs. Extraction Airflow for SVE Wells During Step Test at IR28, Building 231, HPS, SF, CA

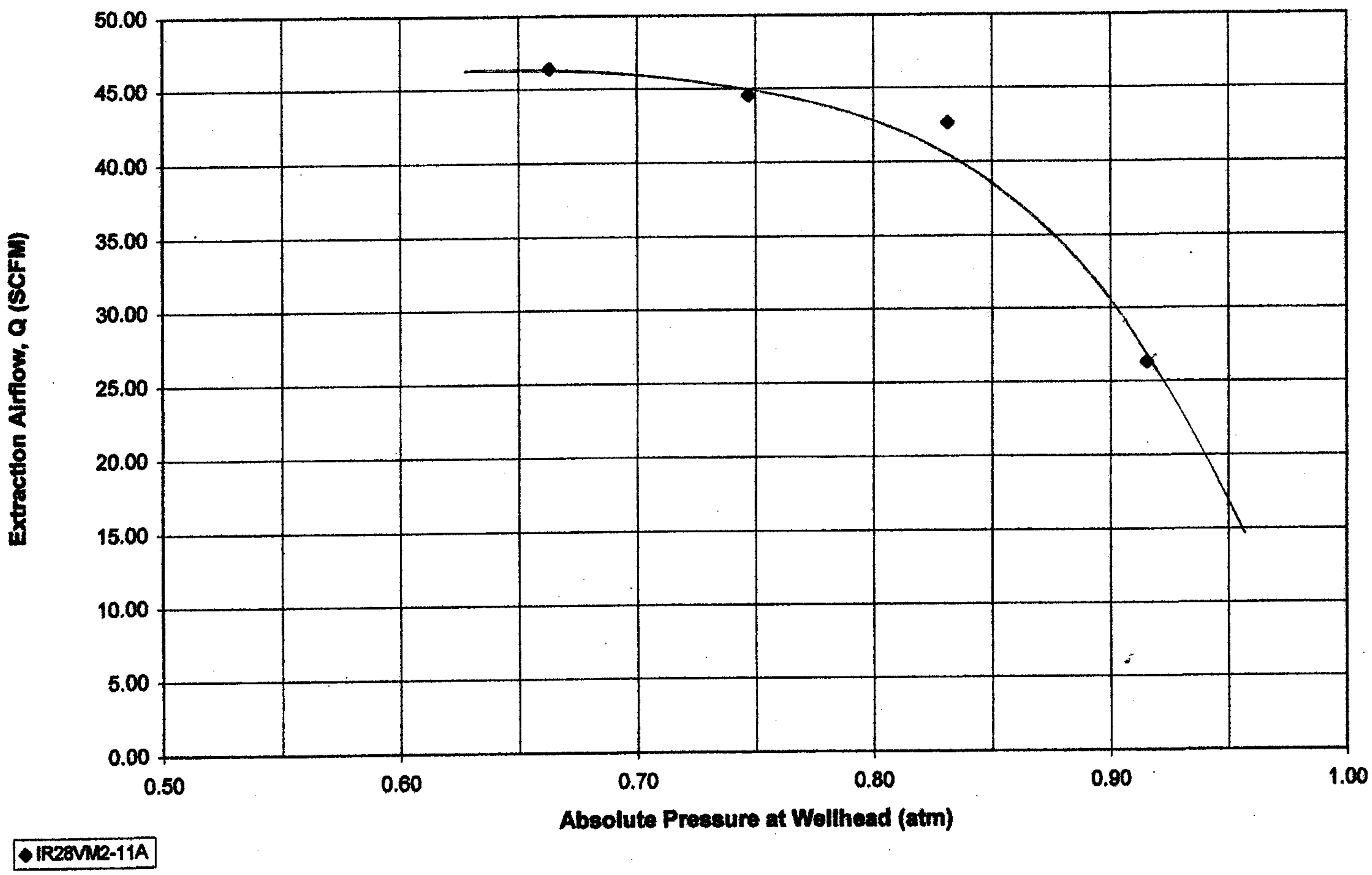


Figure 2 -- Plot of Influent Soil Vapor Concentration Over Hours of System Operation at IR28, Building 231, HPS, SF, CA

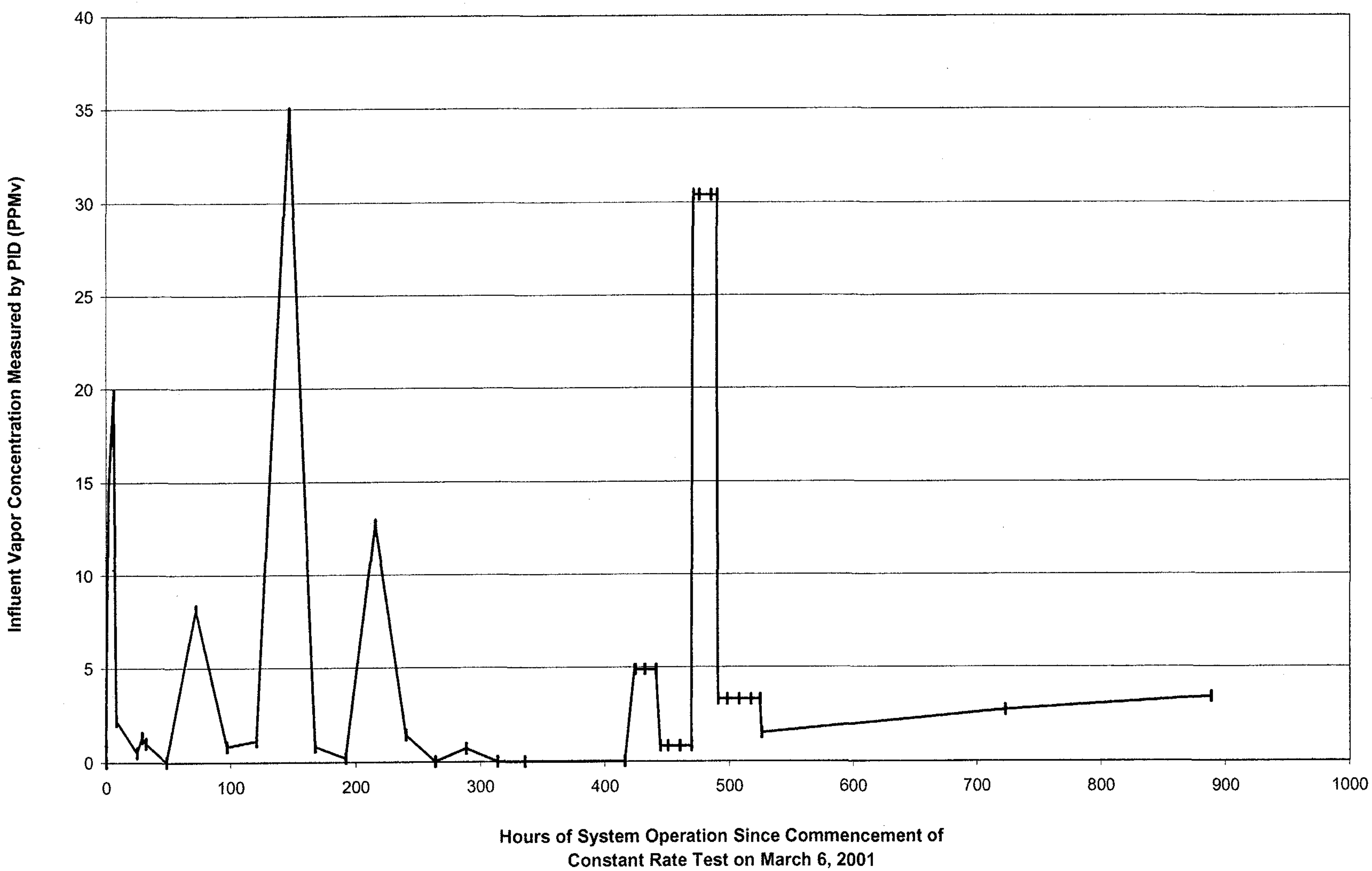


Figure 3 -- Plot of VOC Mass Extraction Rate Over Hours of System Operation at IR28, Building 231, HPS, SF, CA

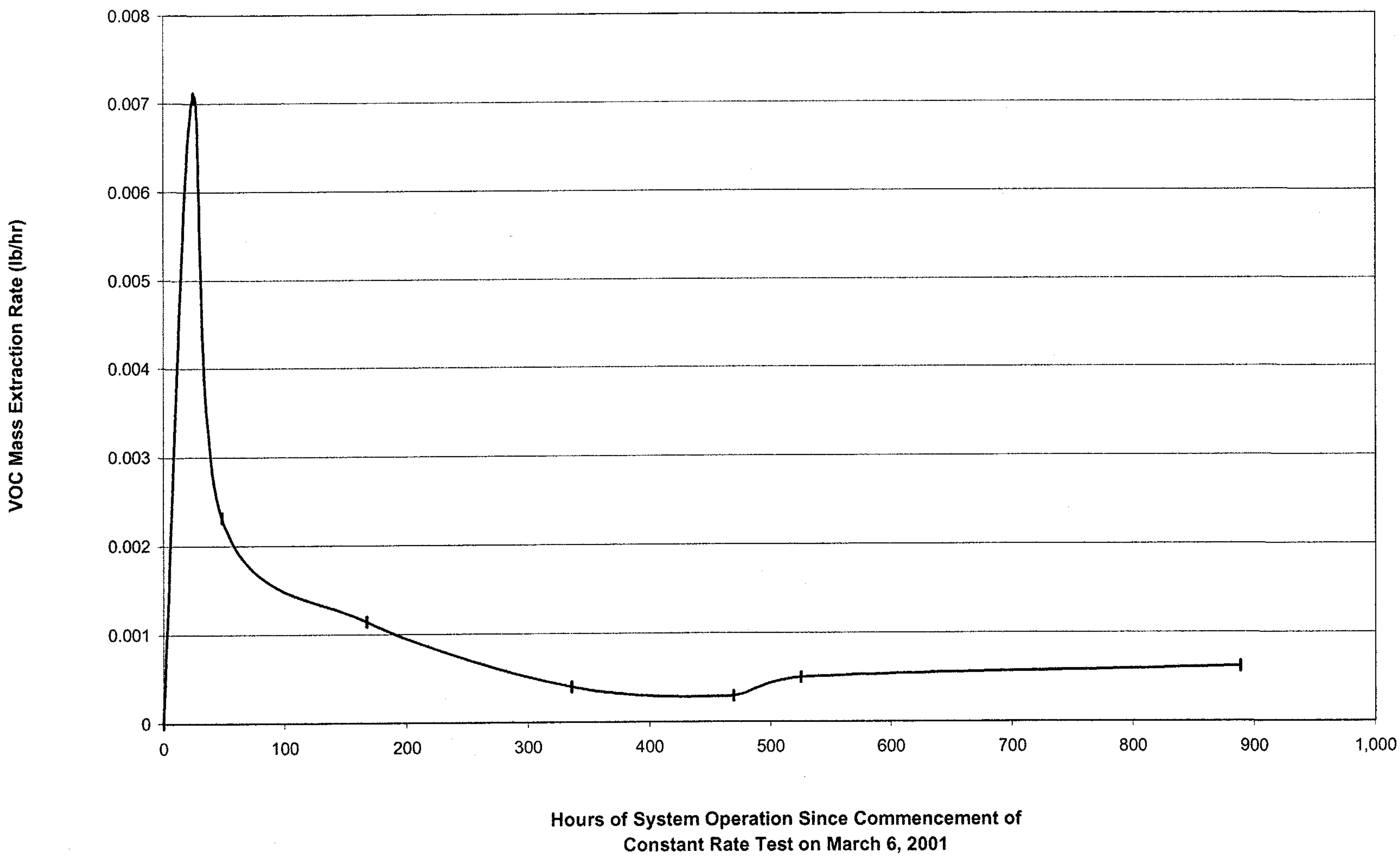


Figure 4 -- Plot of Cumulative VOC Mass Extraction Versus Hours of System Operation at IR28, Building 231, HPS, SF, CA

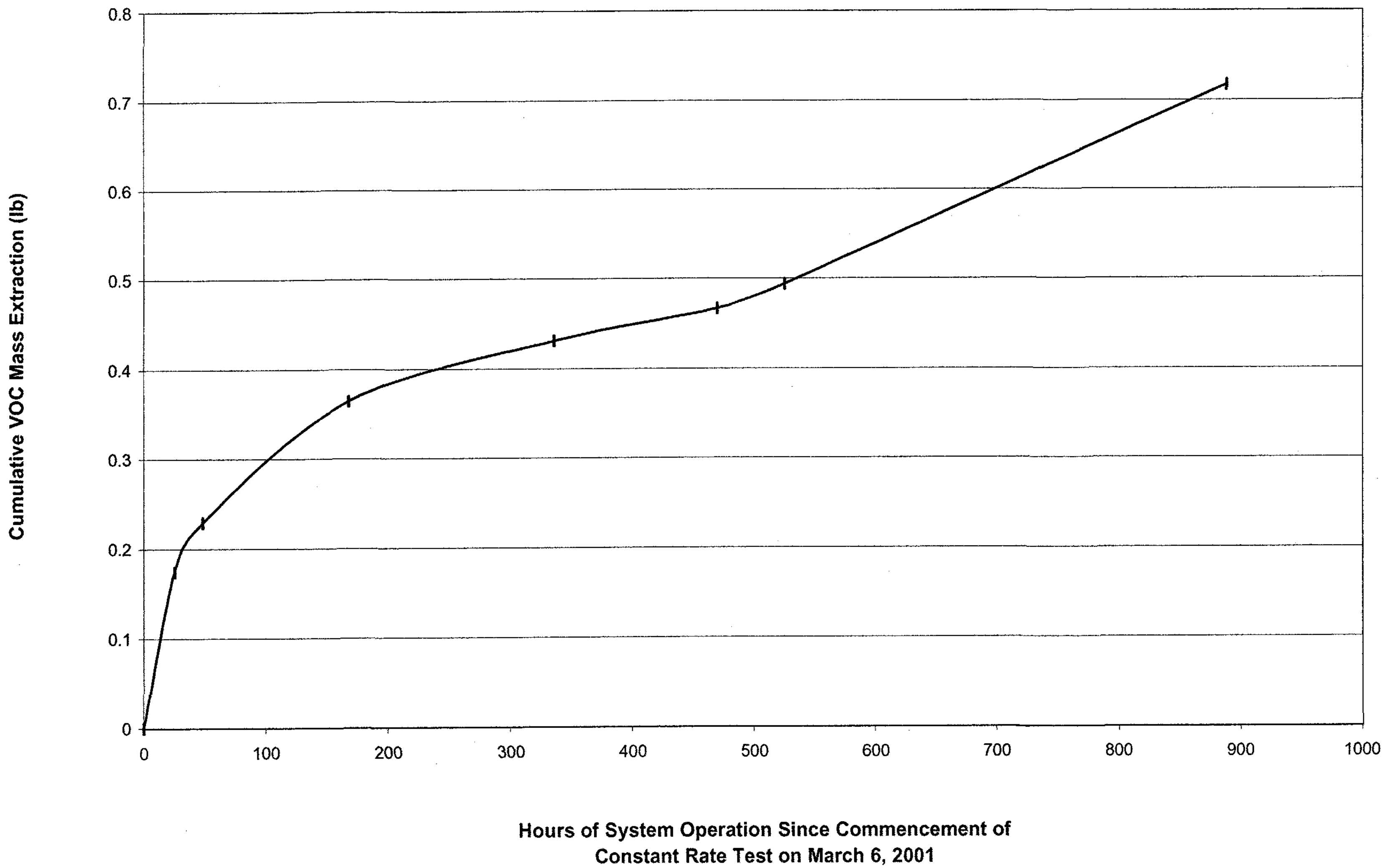
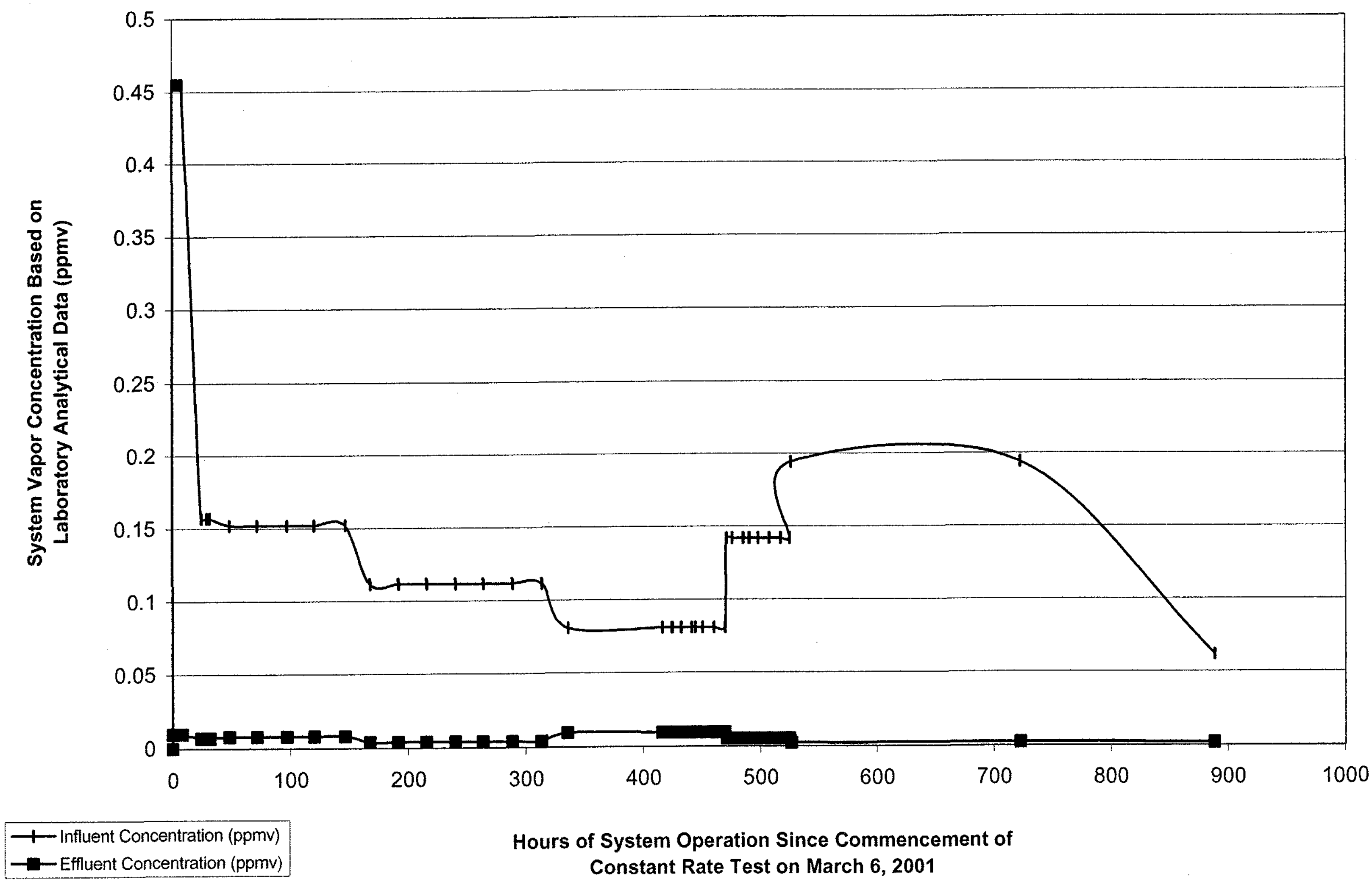


Figure 5 -- Plot of Carbon Treatment Unit Influent and Effluent Concentrations Versus Hours of System Operation at IR28, Building 231, HPS, SF, CA



ATTACHMENT 5
SYSTEM PERFORMANCE PLOTS FOR BUILDING 272

Figure 1 -- Plot of Vacuum vs. Extraction Airflow for SVE Wells During Step Test at IR28, Building 272, HPS, SF, CA

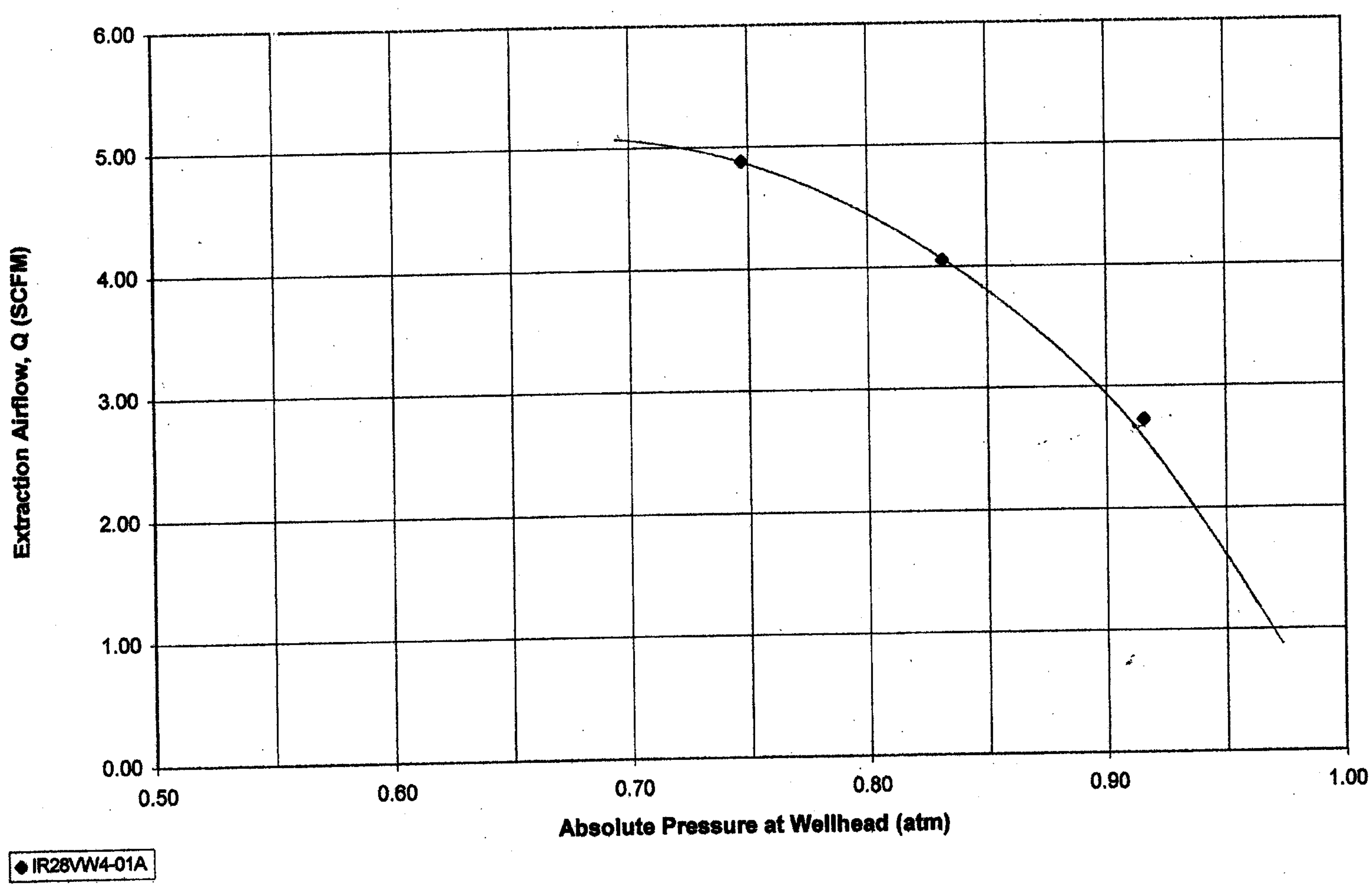


Figure 2 -- Plot of Influent Soil Vapor Concentration Over Hours of System Operation at IR28, Building 272, HPS, SF, CA

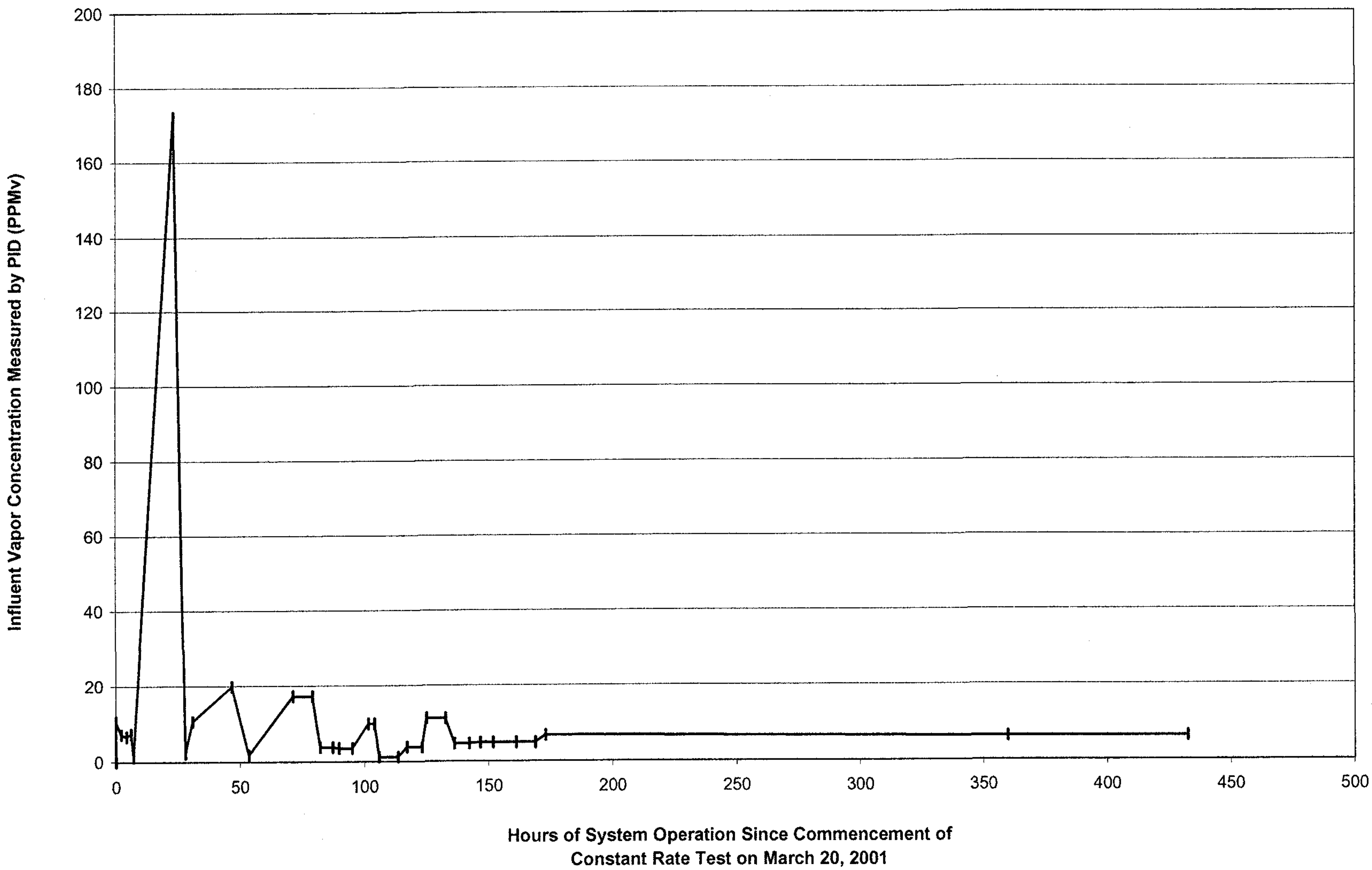


Figure 3 -- Plot of VOC Mass Extraction Rate Over Hours of System Operation at IR28, Building 272, HPS, SF, CA

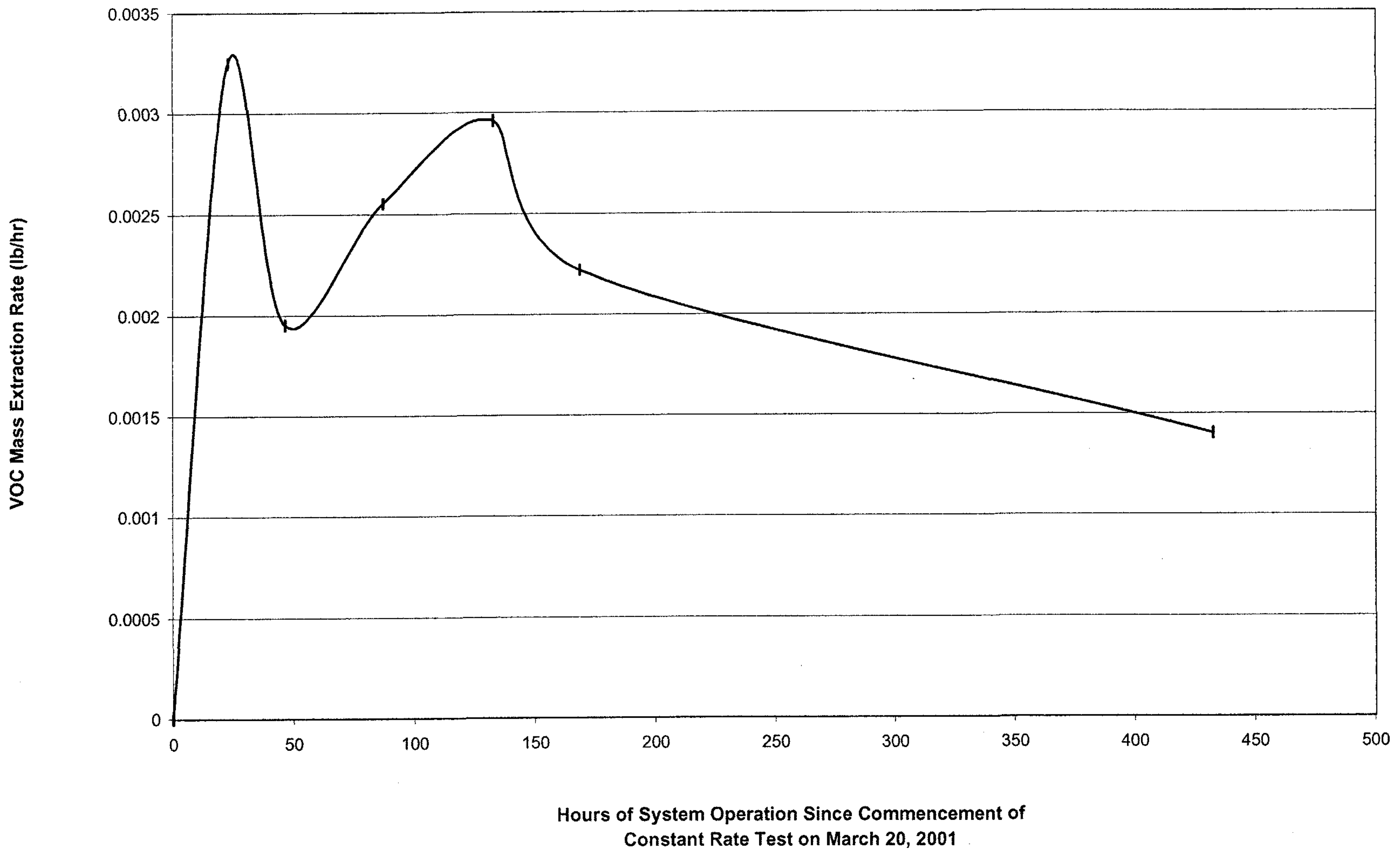


Figure 4 -- Plot of Cumulative VOC Mass Extraction Versus Hours of System Operation at IR28, Building 272, HPS, SF, CA

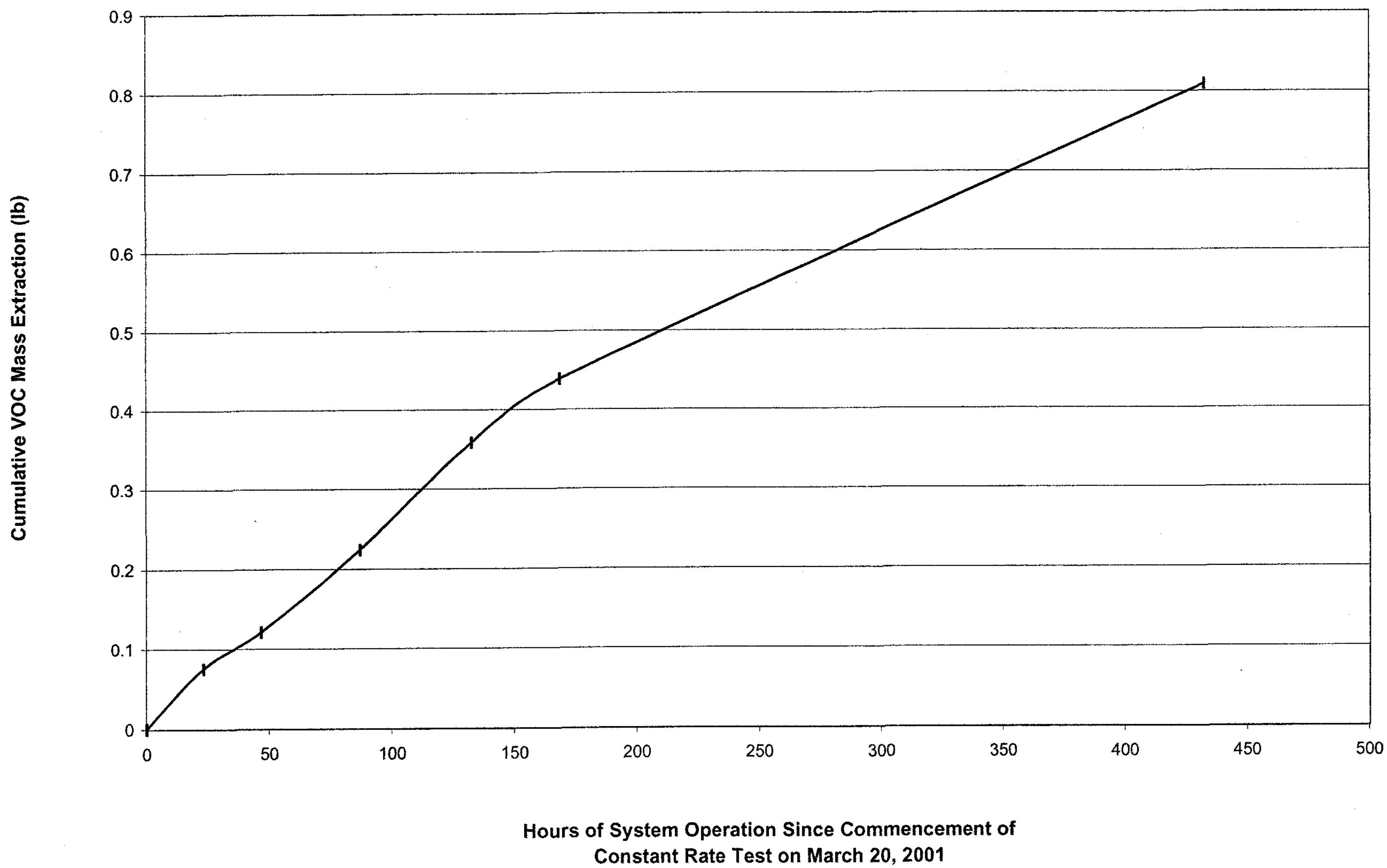
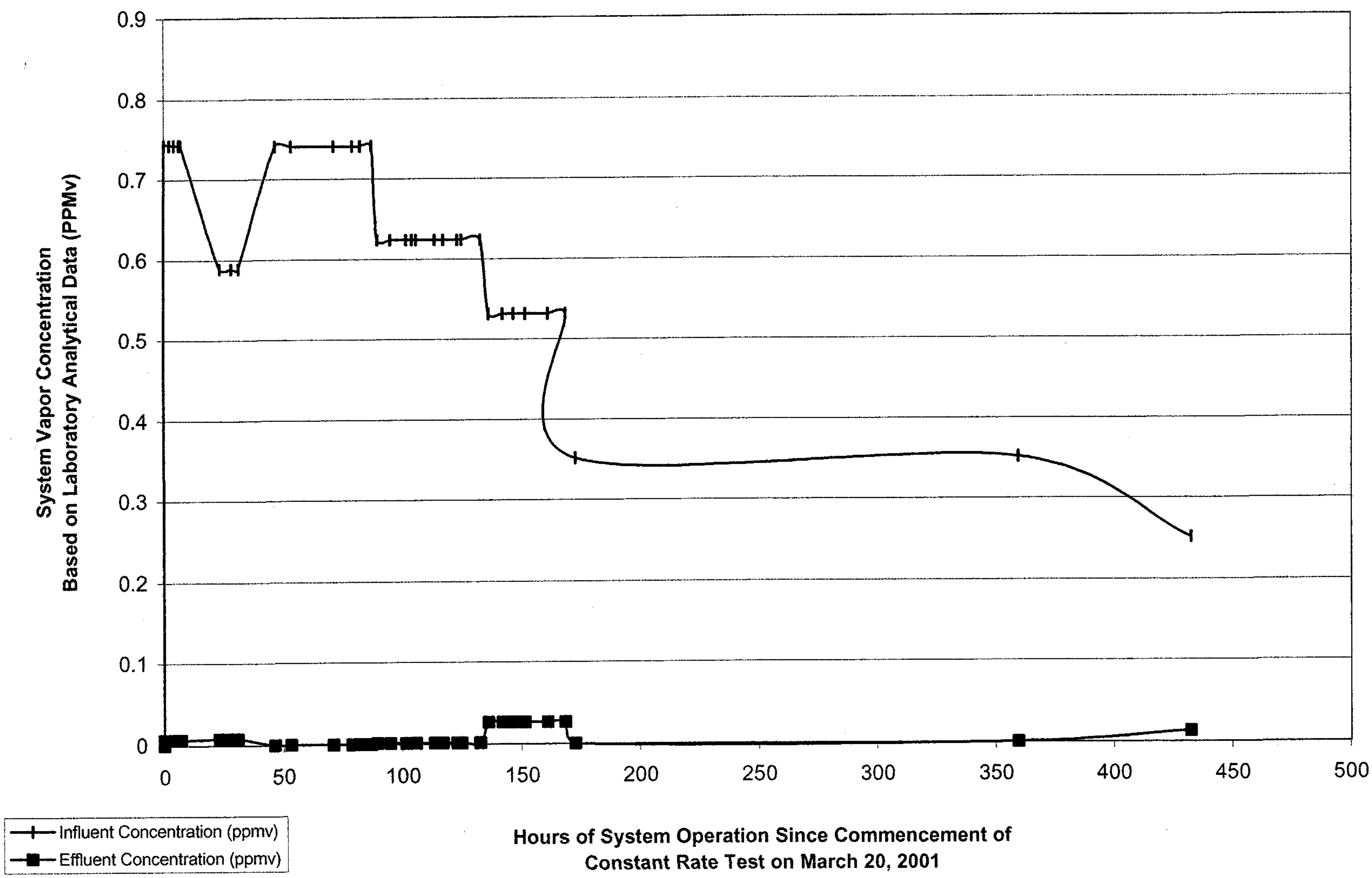


Figure 5 -- Plot of Carbon Treatment Unit Influent and Effluent Concentrations Versus Hours of System Operation at IR28, Building 272, HPS, SF, CA



APPENDIX C
SYSTEM OPERATION STATUS SUMMARY

Building 134

Shutdown Time	Re-start Time	Reason for Shutdown
03/05/2001 22:00	03/07/2001 9:00	Tetra Tech soil sampling
03/13/2001 8:30	03/13/2001 15:50	Soundproof housing installation
03/14/2001 9:00	3/14:01 15:00	Soundproof housing installation
03/19/2001 9:00	03/20/2001 8:30	Slug testing at nearby groundwater wells
03/23/2001 15:00	03/26/2000 8:00	Noise ordinance requirements
03/26/2001 16:00	03/27/2001 8:00	Noise ordinance requirements
03/27/2001 16:00	03/28/2001 8:00	Noise ordinance requirements
03/28/2001 17:00	03/29/2001 8:00	Noise ordinance requirements
03/29/2001 17:30	03/30/2001 8:00	Noise ordinance requirements
03/30/2001 17:30	04/02/2001 8:00	Noise ordinance requirements
04/02/2001 17:30	04/04/2001 8:00	Noise ordinance requirements and Tetra Tech sampling
04/04/2001 17:30	04/05/2001 8:00	Noise ordinance requirements
04/05/2001 17:30	04/06/2001 8:00	Noise ordinance requirements
04/06/2001 17:30	04/09/2001 8:00	Noise ordinance requirements
04/09/2001 17:30	04/10/2001 8:00	Noise ordinance requirements
04/10/2001 17:30	04/11/2001 8:00	Noise ordinance requirements
04/11/2001 16:30	04/16/2001 12:00	Heat exchanger motor burnout (Started running the system 24 hrs)
04/20/2001 8:00	04/21/2001 8:00	Tetra Tech soil sampling
04/29/2001 8:00	05/01/2001 15:00	Generator failure (Restarted 4/30 @9:00 then went down again 4/30 @10:00

Building 231

Shutdown Time	Re-start Time	Reason for Shutdown
03/23/2001 15:00	03/26/2000 8:00	Noise ordinance requirements
03/26/2001 16:00	03/27/2001 8:00	Noise ordinance requirements
03/27/2001 16:00	03/28/2001 8:00	Noise ordinance requirements
03/28/2001 17:00	03/29/2001 8:30	Noise ordinance requirements
03/29/2001 17:30	03/30/2001 8:00	Noise ordinance requirements
03/30/2001 17:30	04/02/2001 8:00	Noise ordinance requirements
04/02/2001 17:30	04/03/2001 8:00	Noise ordinance requirements
04/03/2001 14:30	04/06/2001 8:00	Tetra Tech sampling
04/06/2001 17:30	04/09/2001 8:00	Noise ordinance requirements
04/09/2001 13:00	04/10/2001 9:30	Sound enclosure installation
04/10/2001 17:30	04/11/2001 8:00	Noise ordinance requirements
04/11/2001 17:30	04/12/2001 8:00	Noise ordinance requirements
04/12/2001 17:30	04/13/2001 8:00	Noise ordinance requirements
04/13/2001 15:30	04/16/2001 8:00	Noise ordinance requirements (Started running the system 24 hrs)

Building 211

Shutdown Time	Re-start Time	Reason for Shutdown
03/13/2001 14:15	03/15/2001 7:30	Slug Testing at nearby groundwater wells
03/23/2001 15:00	03/26/2000 8:00	Noise ordinance requirements
03/26/2001 16:00	03/27/2001 8:00	Noise ordinance requirements
03/27/2001 16:00	03/28/2001 8:00	Noise ordinance requirements
03/28/2001 17:00	03/29/2001 8:30	Noise ordinance requirements
03/29/2001 17:30	03/30/2001 8:00	Noise ordinance requirements
03/30/2001 17:30	04/02/2001 8:00	Noise ordinance requirements
04/02/2001 17:30	04/03/2001 8:00	Noise ordinance requirements
04/03/2001 17:30	04/04/2001 8:00	Noise ordinance requirements
04/04/2001 17:30	04/05/2001 8:00	Noise ordinance requirements
04/05/2001 17:30	04/06/2001 8:00	Noise ordinance requirements
04/06/2001 14:00	04/09/2001 8:00	The unit went down due to hi-hi knockout tank level
04/09/2001 17:30	04/10/2001 8:00	Noise ordinance requirements
04/10/2001 17:30	04/11/2001 8:00	Noise ordinance requirements
04/11/2001 17:30	04/12/2001 8:00	Noise ordinance requirements
04/12/2001 13:20	04/17/2001 6:30	The unit went down due to high temperature
04/20/2001 13:00	----	Due to rising water level in nearby monitoring wells

Building 251

Shutdown Time	Re-start Time	Reason for Shutdown
2/28/01 AM	3/2/01 AM	Tetra Tech soil sampling
03/15/2001 7:35	03/16/2001 12:00	Slug Testing at nearby groundwater wells
03/23/2001 15:00	03/28/2001 8:00	Noise ordinance requirements and tetra tech coring
03/28/2001 17:00	03/29/2001 8:30	Noise ordinance requirements
03/29/2001 17:30	03/30/2001 8:00	Noise ordinance requirements
03/30/2001 17:30	04/02/2001 8:00	Noise ordinance requirements
04/02/2001 17:30	04/03/2001 8:00	Noise ordinance requirements
04/03/2001 17:30	04/04/2001 8:00	Noise ordinance requirements
04/04/2001 17:30	04/05/2001 8:00	Noise ordinance requirements
04/05/2001 17:30	04/06/2001 8:00	Noise ordinance requirements
04/06/2001 17:30	04/11/2001 8:00	Sound enclosure installation and Tetra Tech soil sampling
04/11/2001 17:30	04/12/2001 8:00	Noise ordinance requirements
04/12/2001 17:30	04/13/2001 8:00	Noise ordinance requirements
04/13/2001 15:30	04/16/2001 8:00	Noise ordinance requirements (Started running the system 24 hrs)
04/20/2001 8:00	04/21/2001 8:00	Tetra Tech soil sampling

Building 272

Shutdown Time	Re-start Time	Reason for Shutdown
03/23/2001 15:00	03/26/2000 8:00	Noise ordinance requirements
03/26/2001 16:00	03/27/2001 8:00	Noise ordinance requirements
03/27/2001 16:00	03/28/2001 8:00	Noise ordinance requirements
03/28/2001 17:00	03/29/2001 8:30	Noise ordinance requirements
03/29/2001 17:30	03/30/2001 8:00	Noise ordinance requirements
03/30/2001 17:30	04/02/2001 8:00	Noise ordinance requirements
04/02/2001 17:30	04/03/2001 8:00	Noise ordinance requirements
04/03/2001 17:30	04/11/2001 8:00	Due to IT groundwater sampling of nearby monitoring wells
04/11/2001 17:30	04/12/2001 8:00	Noise ordinance requirements
04/12/2001 17:30	04/13/2001 8:00	Noise ordinance requirements
04/13/2001 15:30	04/16/2001 8:00	Noise ordinance requirements (Started running the system 24 hrs)
04/27/2001 8:00	04/28/2001 8:00	Tetra Tech sampling