State of California
California Environmental Protection Agency
AIR RESOURCES BOARD

A Study of Architectural Coatings Thinning Practices in the Field

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SUMMARY

The results of an architectural coatings field study undertaken during the latter half of 1998 by Air Resources Board staff, with the help of local air pollution control and air quality management district personnel, suggest that there is not a significant amount of thinning resulting in noncompliant architectural coatings. Thirty-six percent of the coatings sampled were solvent-borne. Fifty-three percent of these were thinned with material containing volatile organic compounds. However, of all of the solvent-borne coatings sampled, only eleven percent were thinned to noncompliance with district rules, and only six percent were thinned out of compliance with low VOC limits. Overall, solvent-borne thinned, noncompliant coatings made up only five percent of all the coatings observed.

I. INTRODUCTION

Architectural coatings are coatings applied to stationary structures and their accessories, and include such coatings as house paints, stains, industrial maintenance coatings, and traffic coatings. Emissions in 2002 from architectural coatings in California are estimated to be about 120 tons per day (TPD), on an annual average, of volatile organic compounds (VOC). This represents about eight percent of the total stationary source VOC emissions, and about four percent of all VOC emissions statewide. This 120 TPD is more than all the VOC emissions from petroleum refining and marketing combined, and is comparable in size to the VOC emissions from the emission categories of pesticides, degreasing operations, and all other coatings.

In recent years, through a series of lawsuits, some architectural coatings manufacturers have claimed that mandating lower VOC coatings results in an increase in emissions for a variety of reasons. These reasons include claims that the low-VOC coatings result in thicker films, require more thinning, more priming, more topcoats, more frequent recoating, and more touch-ups and repair, all of which these manufacturers claim result in more emissions. Some manufacturers also claim that low-VOC coatings contain more reactive solvents than traditional solvent-borne coatings, thereby resulting in more ozone being produced. Also, these manufacturers have claimed that another reason that low VOC limits increase emissions is because consumers are substituting solvent-borne coatings, from a coating category with a higher VOC limit, for poor-performing coatings in a lower VOC limit coating category.

As a result of the above concerns put forth by some members of the architectural coatings industry, Air Resources Board (ARB) staff, along with local air pollution control and air quality management district (district) staff, undertook this architectural coatings field study to investigate the extent of thinning occurring in solvent-borne architectural coatings. Thinning of water-borne paints was not addressed, since they are typically thinned with water, which does not increase their VOC content. The other claims made by some manufacturers, in addition to the increased thinning claim, are addressed at length in the ARB's Final Program Environmental Impact Report for the June 2000 Suggest Control Measure for Architectural Coatings.

This architectural coatings field study consisted of random, unannounced field inspections at architectural coating application sites to determine if thinning practices of painting contractors resulted in violations of VOC limits specified in local district regulations. Samples were gathered from these inspection sites and tested for their VOC content. The data were compiled from seven different air districts by ARB staff with the help of district personnel. The districts that participated in the study included:

- Bay Area Air Quality Management District (AQMD)
- Placer County Air Pollution Control District (APCD)
- Sacramento Metropolitan AQMD
- San Diego County APCD
- San Joaquin Valley APCD

- Ventura County APCD
- Yolo-Solano AQMD

Similar data collected independently by South Coast AQMD staff are also included in this report.

II. BACKGROUND

A. ACHITECTURAL COATING REGULATION IN CALIFORNIA

Control of VOC emissions from architectural coatings is primarily the responsibility of the local air districts. The ARB, to fulfil its oversight responsibilities, adopted a Suggested Control Measure (SCM) for architectural coatings in 1977, with an amendment occurring in 1989, and the latest revision taking place in June 2000. The SCM has been used as a model for districts when adopting and amending their local architectural coatings rules. The traditional approach used to reduce emissions through architectural coatings rules is by setting VOC content limits for various coating categories. In this way, existing low-VOC coatings either replace high-VOC coatings, or the high-VOC coatings are reformulated to meet the VOC limits.

Widespread regulation of VOC emissions from architectural coatings in California began around 1977. Some districts adopted or amended their architectural coatings rules after the 1989 revisions to the SCM. Districts have also revised their rules numerous times independent of changes to the SCM.

On August 14, 1998, the United States Environmental Protection Agency (U.S. EPA) promulgated their national rule for architectural coatings, which was first proposed on June 25, 1996. This "national rule" became effective on September 13, 1999.

Currently, 22 of California's 35 local air districts have an architectural coatings rule. These 22 districts encompass about 95 percent of California's population. Table 1 lists the districts' VOC limits for the coatings sampled at the time tested, and for the areas where the samples were obtained.

B. LITIGATION

In 1990, several districts amended their architectural coatings rules based on the 1989 SCM, lowering many VOC limits, which were to go into effect a few years later. Shortly after the adoption of these limits, however, a group of coatings manufacturers filed a lawsuit against the ARB and these districts claiming, among other things, that the 1990 amendments did not comply with the California Environmental Quality Act (CEQA). The lawsuit alleged that the districts' CEQA analyses did not adequately address potentially significant air quality impacts related to the alleged impacts discussed above arising from the implementation of the lower VOC limits. As a result of these lawsuits, the courts invalidated the rules adopted by the South Coast AQMD, the Bay Area AQMD, and the Ventura County APCD, on the grounds that these districts did not prepare adequate environmental analyses under CEQA. Accordingly, these districts were prevented from going forward with the lower VOC limits for industrial maintenance coatings, lacquers, quick dry enamels, and quick dry primers, sealers, and undercoaters.

Regarding the environmental analysis prepared by the South Coast AQMD, the District prevailed on six of the seven alleged impacts. The court suggested that further study be undertaken to determine whether or not illegal thinning of coatings in the field results in a negative air quality impact, before the 1990 amendments could be re-adopted. The South Coast

AQMD undertook such a further study prior to amending its architectural coatings rule in 1996. The South Coast AQMD data included in this report include the data collected prior to the South Coast AQMD's 1996 amendment. An appellate court has rejected the manufacturers' appeals of the original ruling on the other six alleged impacts.

TABLE 1: Applicable District Architectural Coating Rules' VOC Limits (g/l) Which Were in Effect at the Time of Sample Collection

Coating Category	BA 8-3	Placer 218	Sacto 442	SD 67	SJV 4601	SC 1113	Ventura 74.2
Flat	250	250	250	250	250	250	250
Industrial Maintenance Coatings	420	420	340	420	340	420	420
Lacquer (includes Lacquer Sanding Sealers)	680	680	680	680	680	680	680
Non Flat	250	250	250	250	250	250	250
Primers, Sealers & Undercoaters	350	350	350	350	350	350	350
Quick Dry Enamels	400	400	400	400	400	400	400
Quick Dry Primers, Sealers, and Undercoaters	X	350	450	525	450	X	X
Stains: Semitransparent	350	350	350	350	350	350	350
Stains: Opaque	350	350	350	350	350	350	350
Traffic	250	250	250	250	250	250	250
Varnishes	350	350	350	350	350	350	350

Key: BA: Bay Area; Sacto: Sacramento; SD: San Diego; SJV: San Joaquin Valley; SC: South Coast; X: exempted;

Note: This table includes limits for coatings that were sampled. It does not include VOC limits for all regulated categories. South Coast data were not collected by ARB staff for this study. South Coast data were collected separately by South Coast inspectors and are included as a separate section in this report. Yolo-Solano AQMD did not have an architectural coatings rule with VOC limits in their rulebook at the time of this study.

C. PREVIOUS STUDIES

Several studies have been conducted over the years to address the issue of thinning. A brief summary of each study is provided below, along with comments received on the studies.

Field Investigation on Thinning Practices during the Application of Architectural Coatings in Selected Districts in California (December 1991)

In 1991, the ARB conducted a study throughout the state to look at the frequency and quantity of thinning actually occurring in the field. The investigation consisted of field inspections at architectural coating application sites to determine if the thinning practices of painting contractors for certain specialty architectural coatings and for general architectural coatings (flat and non flat) resulted in violations of VOC limits specified in local district regulations. Additionally, the study attempted to determine if painters and coating manufacturers were adhering to other portions of the district rules, including the appropriate application or "end-use" of specialty coatings, coating labeling requirements, and "as formulated" coating VOC content

limits. The study also identified other compliance issues which impact the architectural coating rules.

The results of the field investigation showed that the thinning practices of painting contractors applying architectural coatings within the districts studied did not result in a substantial level of violations of VOC content limits. A third of the specialty architectural coatings observed were thinned with material containing VOC, while the general architectural coatings were not usually thinned. Only six percent of all specialty coatings observed were thinned in excess of the required VOC content limit. A total of only two percent of all architectural coatings were in violation due to thinning.

The field study also tended to show that a larger percentage of violations resulted from the application of coatings which exceeded the VOC content limit without being thinned. This appeared to be a combination of coatings being applied which did not meet the limits set for the specialty category, and coatings formulated for a specific specialty category which were applied by the painter to surfaces outside its designated end-use.

The laboratory results from this study showed that a large percentage of specialty architectural coatings used in the districts studied met or had a lower VOC content than required by the rule. This showed that complying specialty coatings were being applied successfully by the applicator without thinning.

The laboratory results from this limited study tended to show that the VOC content of the water-borne coatings, both specialty and general category coatings, were much lower than the required VOC limit and were often much lower than the level identified on the label.

Additionally, the data obtained during the study tends to support inclusion of colorants during the determination of the VOC content.

VOC Studies for Rules 1113/1129 prepared by Woodward-Clyde Consultants (Woodward-Clyde) for the South Coast District (March 1993)

SCAQMD contracted with Woodward-Clyde to conduct investigations to determine the VOC content of architectural coatings that were used by painting contractors in the South Coast Air Basin. In addition, Woodward-Clyde conducted a consumer survey on the use of paint products by painting contractors and other consumers in the Basin. The focus of this study was on solvent-borne coatings. The categories chosen for this investigation included the following coatings: flat, non-flat, quick dry enamel, lacquers, clear wood finishes, industrial maintenance coatings, quick dry primers, and stains.

Woodward-Clyde staff surveyed 36 contractors by telephone to determine the types of paints that were being used and to solicit permission to obtain samples from their painting sites. The majority of the paints being used were water-borne paints. Four independent contractors that were using solvent-borne paints consented to allow samples to be gathered at their painting sites. Samples were gathered just prior to application of the paints. The paints were not thinned prior

to the application. The VOC content and density were tested in the samples. The tested VOC content of theses samples was compared to the VOC content listed on the label of each paint. About 84 percent of the samples tested had a VOC content equivalent to or lower than the listed VOC content, accounting for the standard VOC content compliance margin of 10 percent.

In addition to gathering samples, Woodward-Clyde staff asked the contractors to fill out paint application survey forms. The survey solicited information on the use of solvent-borne coatings. Results of the survey that relate to thinning indicate that paint thinner is used as needed, lacquer thinner is used to clean brushes, rollers, and spray guns, and water-borne paints are used whenever possible.

An additional survey was conducted of paint consumers as they were emerging from paint stores. More than 120 people consented to answer the survey questions. A large majority of the paints being purchased were water-borne paints. The ratio of water-borne paints purchased to solvent-borne paints was 2:1. The survey results had no information related to thinning practices.

Survey of Field Thinning as Practiced by Professional Architectural Coating Applicators prepared by David A. Leehy & Associates (DAL & A) for the Environmental Legislative & Regulatory Advocacy Program of the Southern California Paint & Coatings Association (EL RAP) (September 1996)

The survey created by DAL & A, with the cooperation of EL RAP, gathered background information and responses concerning thinning in the field for the following coating categories: low VOC (250 g/l) high-solids, solvent-borne enamels; low VOC (350 g/l) high-solids, solvent-borne primers, sealers and undercoaters; low VOC (350 g/l) high solids, solvent-borne varnishes; and low VOC (550g/l) solvent-borne lacquers formulated with 1,1,1 tricholoroethane. Other general questions were asked that related to the performance of the coatings and the general reasons for thinning.

The surveys took place in Pasadena, La Habra, Glendale and Van Nuys and were conducted by telephone interview, telefax and field interviews. The respondents to the survey were owners, supervisors, or crew chiefs. This survey was originally targeted for larger companies but was eventually expanded to include some additional responses by smaller painting firms.

The firms surveyed employed more than 1,500 painters. The survey results indicated that 86 percent of these firms used solvent-borne primers, sealers, and undercoaters, 85 percent used solvent-borne enamels, 69 percent used solvent-borne varnishes and 43 percent used solvent-borne lacquers. According to the survey results, all four of these categories were thinned by more than 50 percent of the users. Table 2 shows the frequency of thinning by contractors for each of the four categories.

TABLE 2: DAL & A Thinning Survey Results

Category	Did Not Thin	Thinned Less Than 1/2 of the Time	Thinned at Least 1/2 the Time	Thinned All of the Time
250 g/l SB Enamels	25%	21%	21%	33%
350 g/l SB PSUs	27%	21%	29%	23%
350 g/l SB Varnishes	47%	13%	21%	19%
550 g/l Lacquers	33%	9%	21%	37%

Key: SB: Solvent-borne; PSUs: Primers, Sealers and Undercoaters

Many of the reasons given for thinning include: to increase surface penetration, smooth brushing marks, facilitate drying, reduce coating viscosity, facilitate the ease of spraying, and to decrease drying times.

Paint contracting firms had a number of concerns regarding the quality of low VOC products on the market. Many of the concerns raised by the contractors paralleled those described as the seven claims made by the industry as described above in Section I, including that low VOC products increase thinning frequency.

III. SOUTH COAST DISTRICT ARCHITECTURAL COATING FIELD STUDY (April 1996-August 1998)

In a span of more than two years, the South Coast District conducted an architectural coating field study similar to that of this current study. Inspectors did unannounced inspections of construction areas and other sites where painting was being done. They gathered samples of paints as they were being applied and had them tested for their VOC content. South Coast inspectors collected more than 200 samples in categories similar to those of the ARB architectural coatings field study.

Originally, our intent was to combine the data we gathered with that gathered by the South Coast District. However, in reviewing the data it was found that the information obtained during the collection processes were not the same between the two studies. For example, water-borne and solvent-borne classifications were not always noted with the South Coast District samples. As a result, water-borne and solvent-borne classifications of the South Coast samples are not included in this report. Accordingly, the South Coast data are not combined with the ARB field data, but are included as a separate section in this report. Nevertheless, important information can be gleaned from the South Coast data, and it is referenced in some cases where ARB data were inconclusive.

The South Coast District VOC limits for lacquers and traffic paints were lowered from the limits identified in Table 1 to 550 g/l and 150 g/l, respectively, on January 1, 1998. We assume that these rule changes did not impact the samples taken after the rule changes went into effect, because of a sell-through provision in the rule. This provision allows retailers to sell their remaining stock of the previously higher limit compliant coatings, provided the coatings were manufactured prior to January 1, 1998. In addition, as is common practice in many districts, a 10 percent compliance margin was included with the tested VOC contents.

South Coast District Summary

The results of the data showed that only about nine percent of the paints sampled were thinned. Out of that nine percent, approximately 33 percent were thinned out of compliance. Overall then, only three percent of the paints were excessively thinned to a noncompliant VOC content. Table 3 shows the district wide data for South Coast. The small percentage of thinned noncompliant paints indicates that there is not a problem of thinning to the point of noncompliance. There were 206 tested samples, but seven of these samples did not fall into the major architectural coatings categories included in this report. These seven samples were classified as Others. Also classified as Others were eight samples that did not have district limits specified by the South Coast laboratory, which meant that compliance for these samples could not be determined for this report. There were also 28 samples that appeared to be either flat or non flat coatings, but these samples could not be properly categorized based on the data provided by the South Coast District. These 28 flat/non flat samples were not included in the report. There was also one industrial maintenance coating for which the test for VOC content could not be run, because an insufficient amount of paint was gathered. Therefore, out of the original 206 samples, there were 162 samples that were included in this report. All 206 samples in their

entirety can be seen in Appendix A. In the following figures, all of the thinned paints have a "T" after the sample number.

TABLE 3: South Coast District Summary

	Total	Compliant	Noncompliant
Samples	162	139	23
Unthinned	147	129	18
Thinned	15	10	5

Flats (South Coast)

Table 4 and Figure 1 contain the breakdown of data for the category of flats. In the South Coast data, there was one thinned flat found and it was compliant. Two unthinned flats were found to be noncompliant. The average VOC content of flats was 148 grams per liter (g/l), which is well below the 250 g/l limit. Since most flats are water-borne, this implies that they would be thinned with water, and thus have no impact on the VOC content of the coating. Assuming the two flats with unusually high VOC contents are water-borne, such high values could be due to very low solids contents, or unusually high VOC amounts for a water-borne coating. (See Section IV.E for further discussion.) Considering that most flats are water-borne and the data gathered in Table 4, it is highly unlikely that painters and contractors are thinning flat coatings out of compliance.

TABLE 4: Flats (South Coast)

	Total	Compliant	Noncompliant	Average VOC
Samples	48	46	2	148
Unthinned	47	45	2	147
Thinned	1	1	0	200

Industrial Maintenance Coatings (South Coast)

Table 5 shows that only two of the 21 industrial maintenance samples were thinned and both were found to be compliant. The only noncompliant sample found was an unthinned sample of an industrial maintenance paint. The average VOC of the two thinned paints was 430 g/l, which is 10 g/l over the limit, but which is within the 10 percent compliance margin. The samples can be seen individually in Figure 2. The results of the data suggest that no excess thinning is occurring in the category of industrial maintenance coatings.

TABLE 5: Industrial Maintenance Coatings (South Coast)

	Total	Compliant	Noncompliant	Average VOC
Samples	21	20	1	333
Unthinned	19	18	1	323
Thinned	2	2	0	430

Figure 1: VOC of Flats in South Coast District

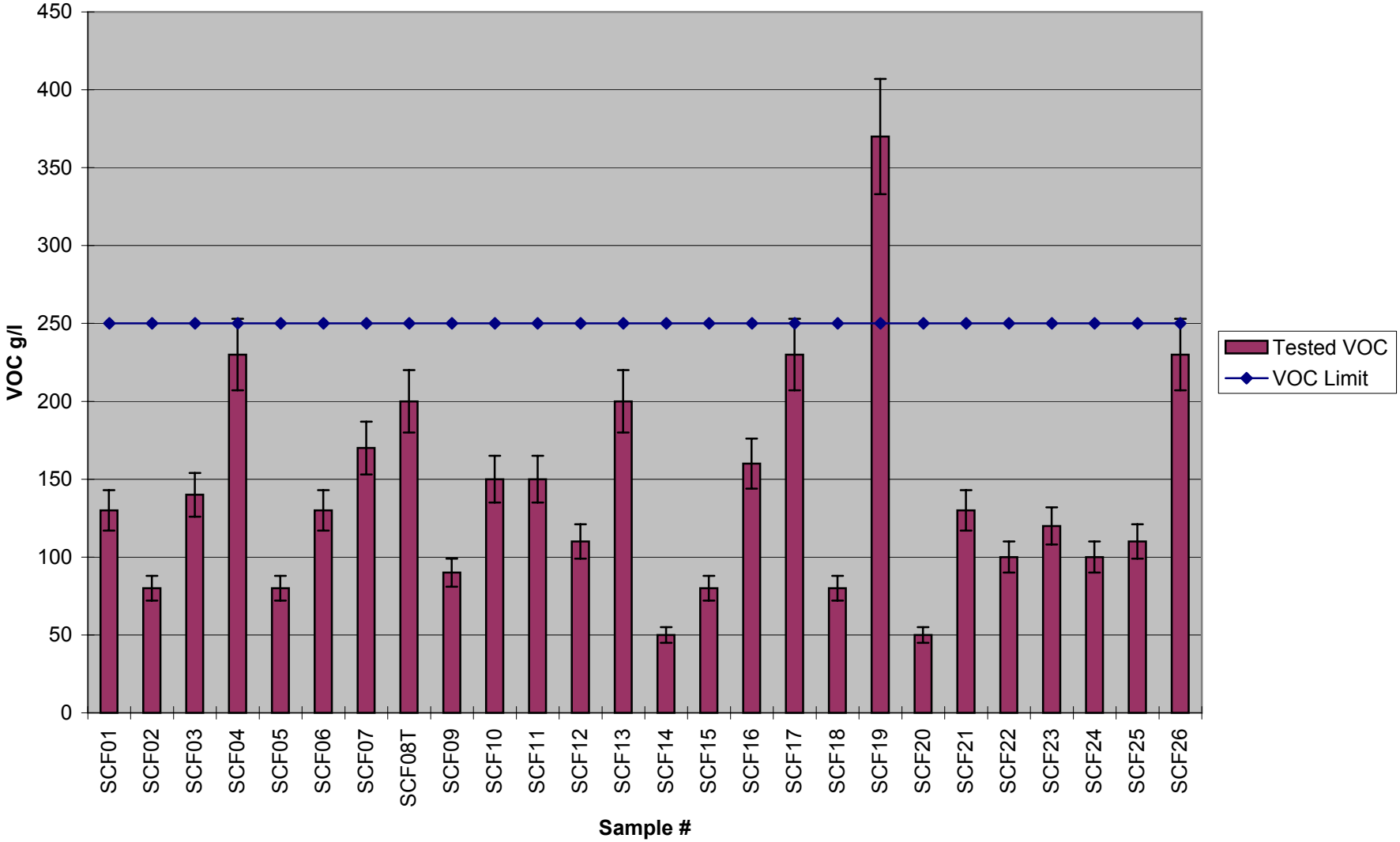


Figure 1: VOC of Flats in South Coast District (cont'd)

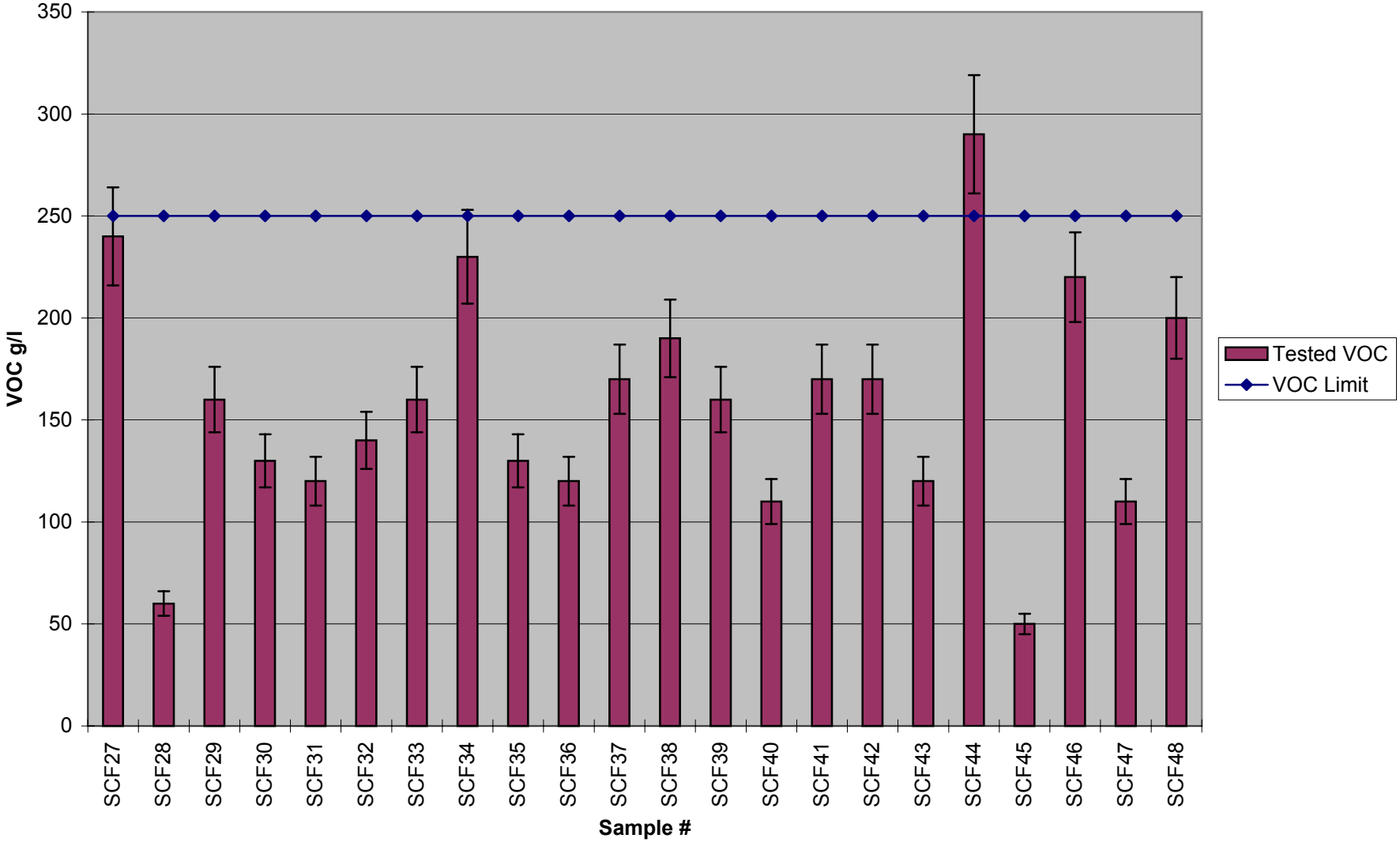
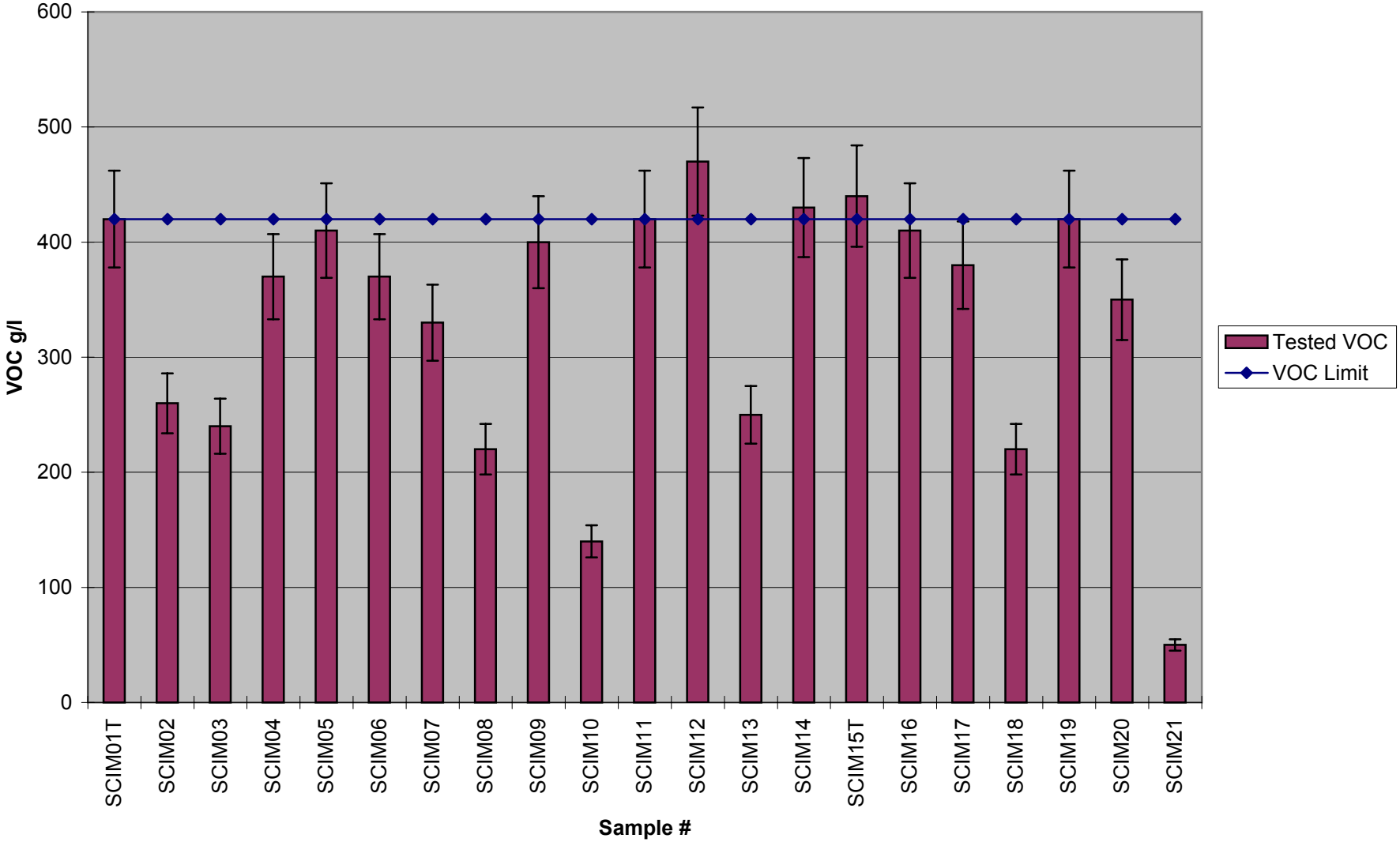


Figure 2: VOC of Industrial Maintenance in South Coast District



Lacquers and Lacquer Sanding Sealers (South Coast)
Twenty-two percent of the lacquers were thinned, but all of them were found to be compliant. Table 6 and Figure 3 show the results from this category. Since all lacquers sampled were found to be compliant, excess thinning is most likely not occurring within the category of lacquers. All lacquer sanding sealers were found to be compliant also. Table 7 and Figure 4 contain the results. Only five samples were collected for this category. This is probably not enough samples from which to make any definite conclusions, but based on the data, it does not appear that there is a problem of excessive thinning.

TABLE 6: Lacquers (South Coast)

	Total	Compliant	Noncompliant	Average VOC
Samples	9	9	0	653
Unthinned	7	7	0	654
Thinned	2	2	0	650

TABLE 7: Lacquer Sanding Sealers (South Coast)

	Total	Compliant	Noncompliant	Average VOC
Samples	5	5	0	700
Unthinned	5	5	0	700
Thinned	0	0	0	N/A

Non Flats (South Coast)
There was one noncompliant thinned sample in the non flat category. This made up roughly six percent of the total. Because this is a case where we know that this one unthinned non flat with a high VOC content was water-borne, this could be due to a low solids content or an unusually large amount of VOC for a water-borne coating. (See Section IV.E for further discussion.) Table 8 and Figure 5 show the results for this category. There does not appear to be a significant problem of excess thinning of non flat coatings.

TABLE 8: Non Flats (South Coast)

	Total	Compliant	Noncompliant	Average VOC
Samples	16	14	2	196
Unthinned	15	14	1	186
Thinned	1	0	1	340

Figure 3: VOC of Lacquers in South Coast District

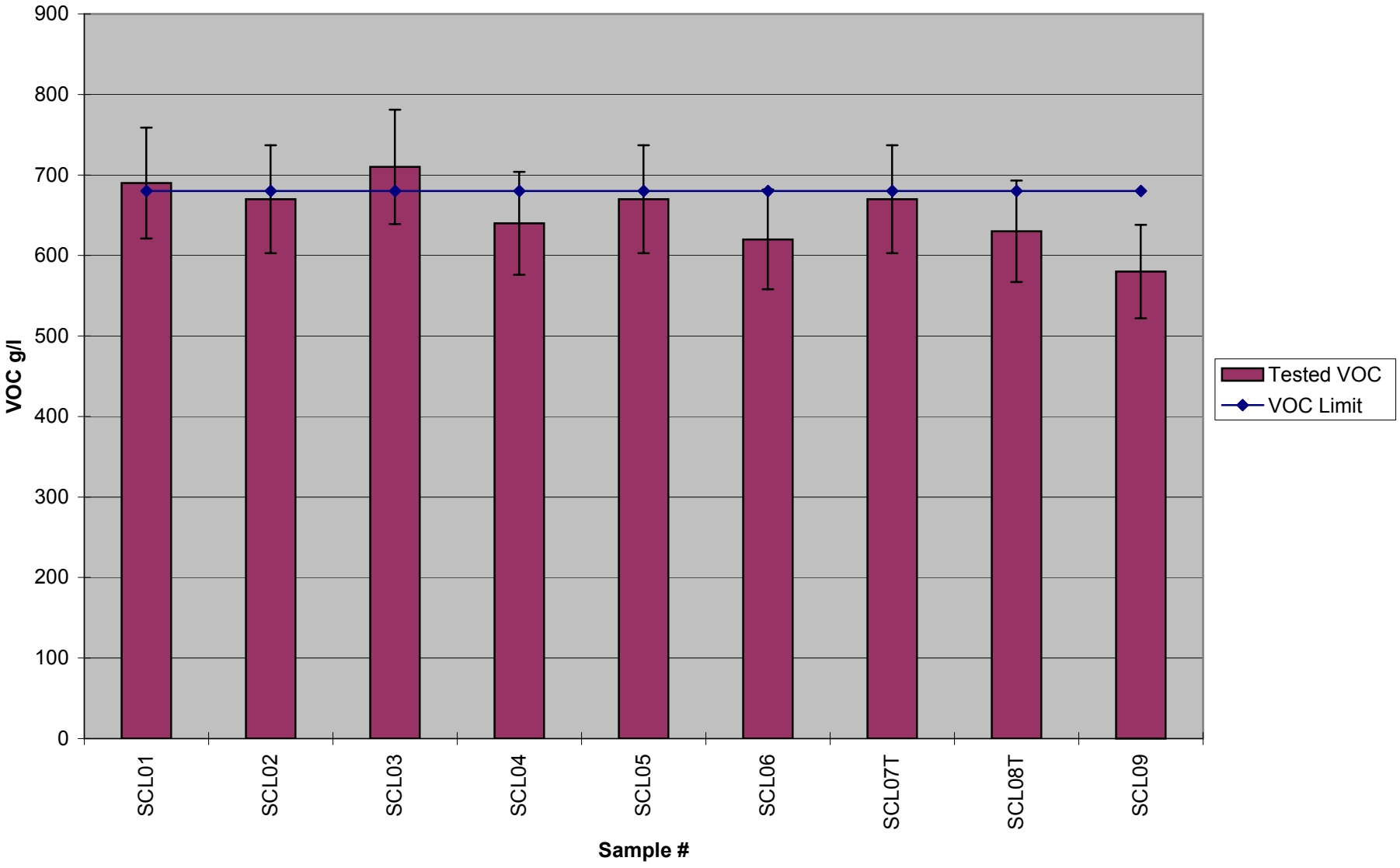


Figure 4: VOC of Lacquer Sanding Sealers in South Coast District

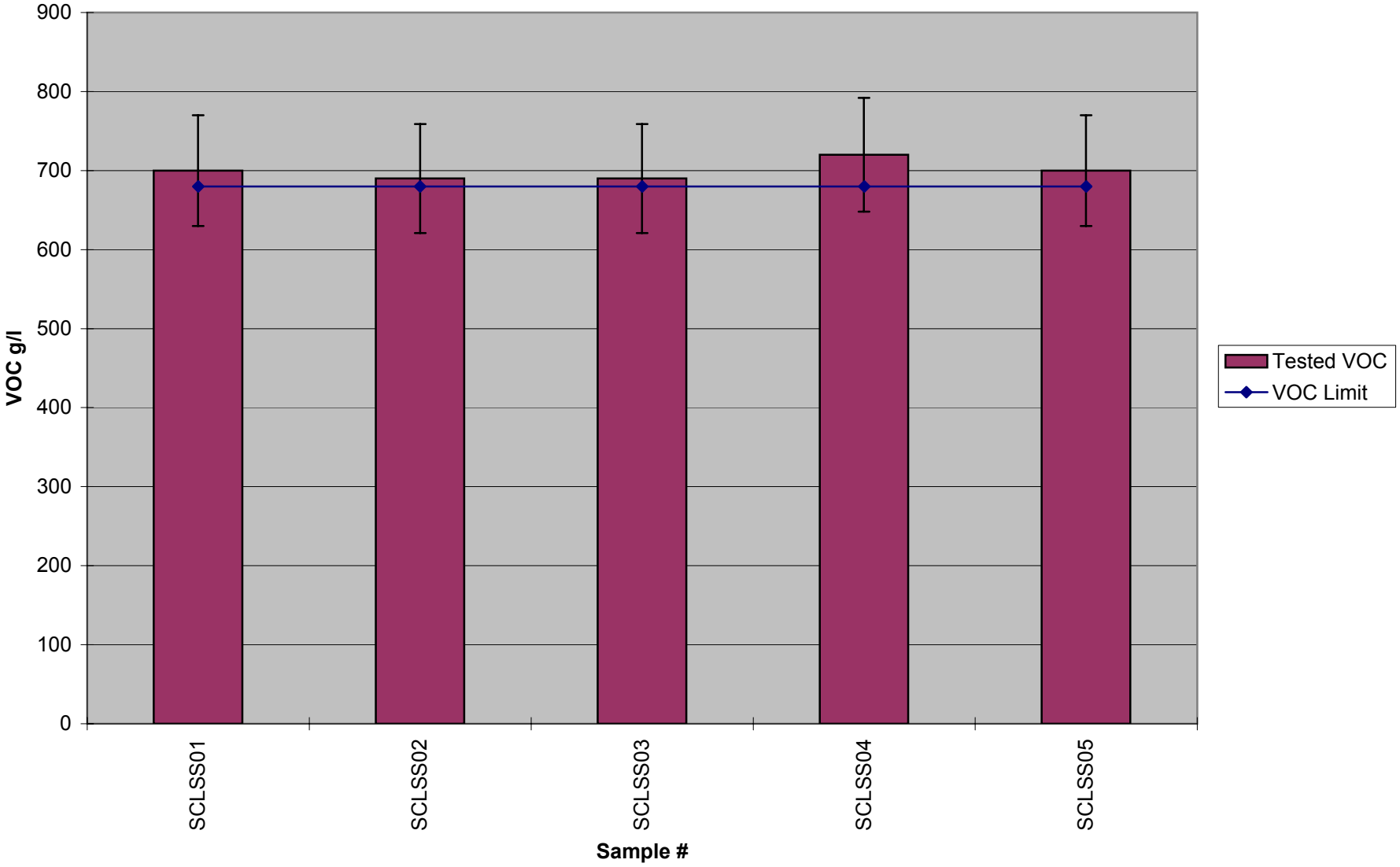
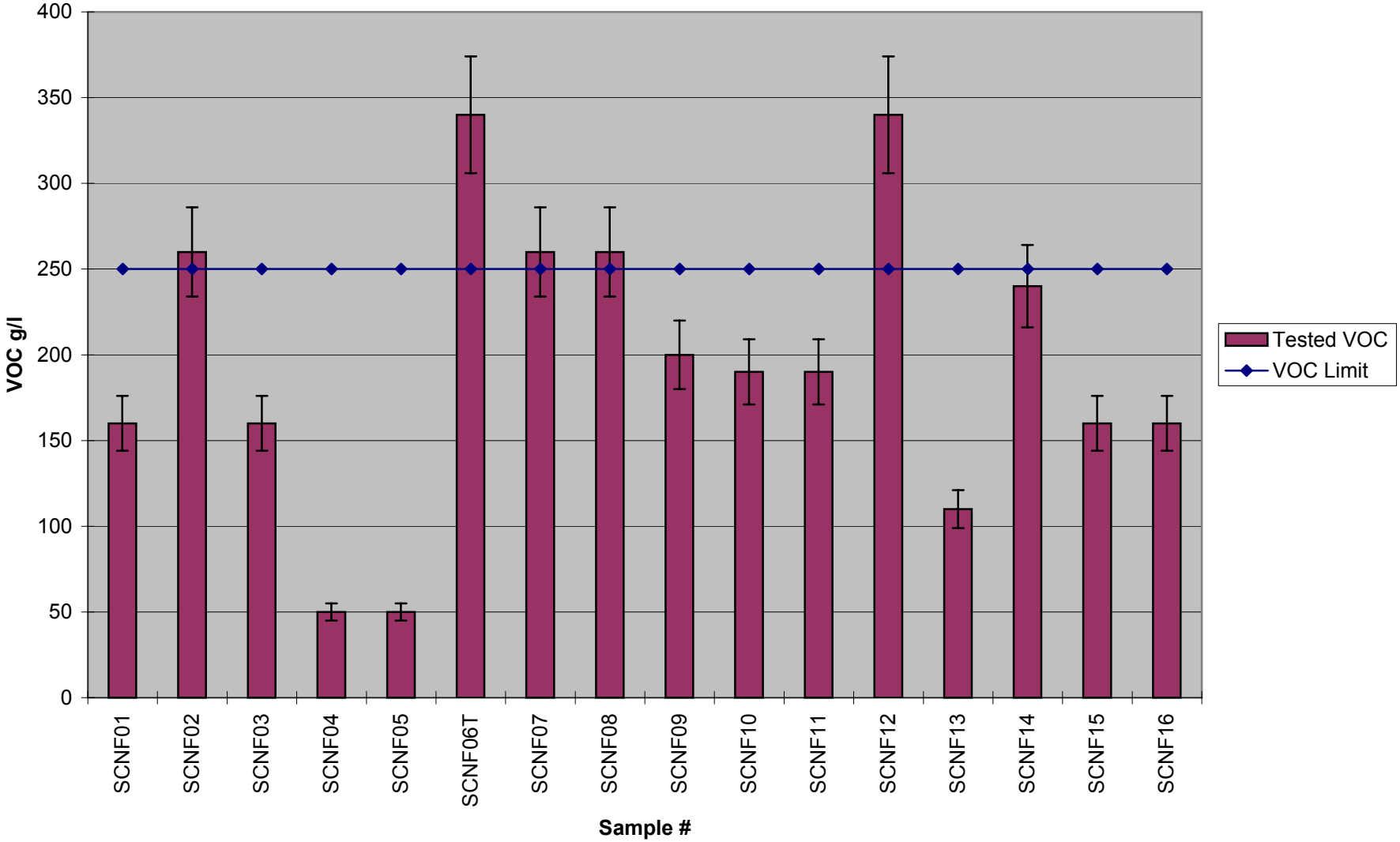


Figure 5: VOC of Non Flats in South Coast District



Primers, Sealers, and Undercoaters (South Coast)
Table 9 shows that two of the three thinned samples in the primers, sealers, and undercoaters category were noncompliant. The three thinned samples average VOC content was over the district limit, but the two thinned noncompliant samples made up only nine percent of this category. Figure 6 shows the individual results of each coating versus the district limit. From the data it is evident that thinning out of compliance was not prominent in primers, sealers, and undercoaters.

TABLE 9: Primers, Sealers, and Undercoaters (South Coast)

	Total	Compliant	Noncompliant	Average VOC
Samples	23	20	3	226
Unthinned	20	19	1	200
Thinned	3	1	2	403

Quick Dry Enamels (South Coast)
Roughly 31 percent of quick dry enamels were thinned and approximately 13 percent were thinned to noncompliant VOC contents. With the exception of waterproofing sealers, this category had the largest percentage of thinned noncompliant coatings. This may indicate excess thinning occurring within this category. However, the VOC limit of 400 g/l is high enough to allow traditional solvent-borne paints, which is counter to the industry's argument that it is the low (250 g/l) limits which promote excess thinning. Table 10 and Figure 7 show the results of the data for quick dry enamels.

TABLE 10: Quick Dry Enamels (South Coast)

	Total	Compliant	Noncompliant	Average VOC
Samples	16	13	3	424
Unthinned	11	10	1	414
Thinned	5	3	2	446

Traffic Paints (South Coast)
There were no thinned traffic paints sampled, and all six of the samples were compliant. The average VOC content was 147 g/l, which is well below the previous District limit of 250 g/l and even below the 1998 limit of 150 g/l. These few samples imply that there is not a problem of excess thinning occurring among traffic paints. Table 11 and Figure 8 show the results for traffic paints.

TABLE 11: Traffic Paints (South Coast)

	Total	Compliant	Noncompliant	Average VOC
Samples	6	6	0	147
Unthinned	6	6	0	147
Thinned	0	0	0	N/A

Figure 6: VOC of Primers, Sealers, & Undercoaters in South Coast District

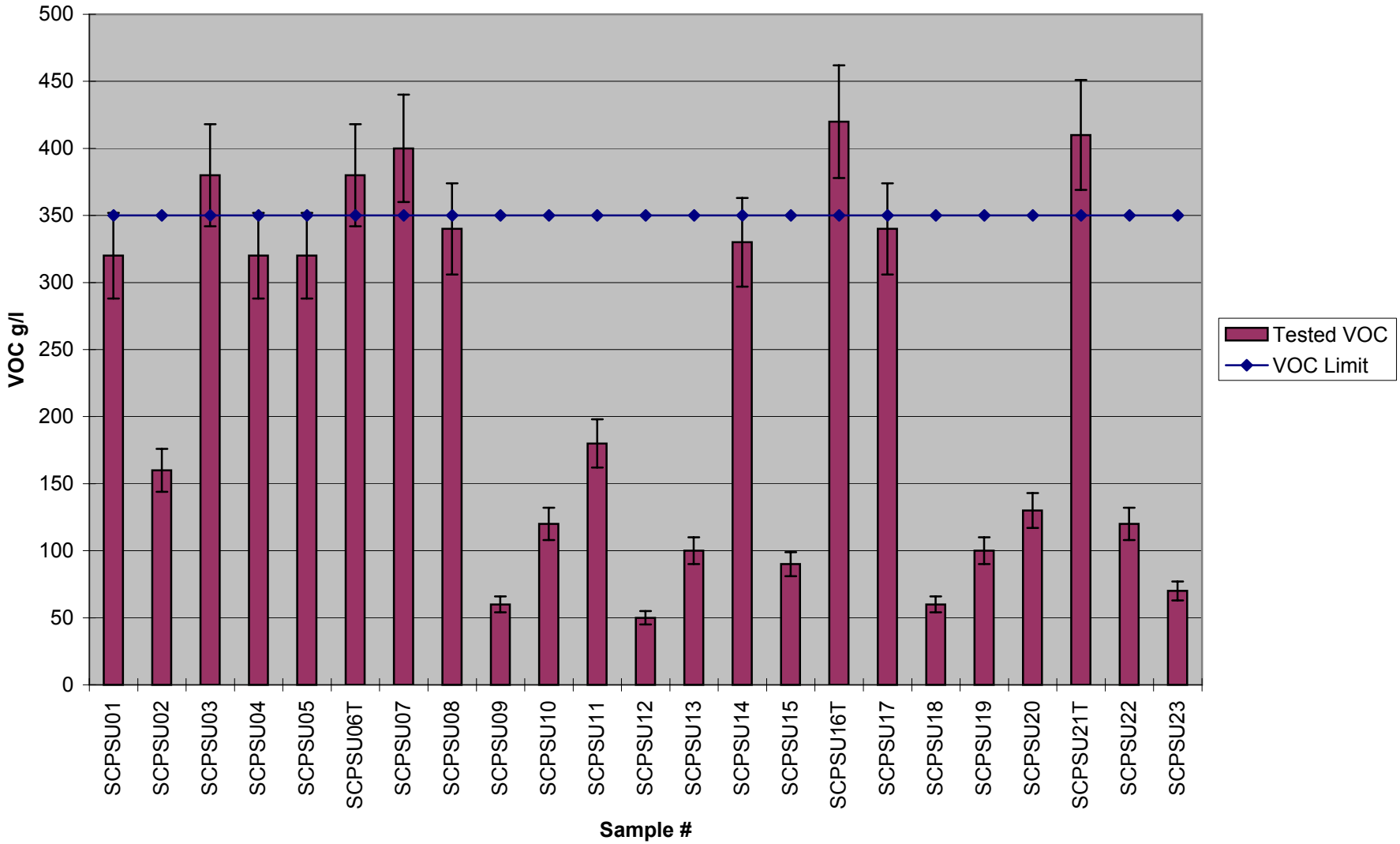


Figure 7: VOC of Quick Dry Enamels in South Coast District

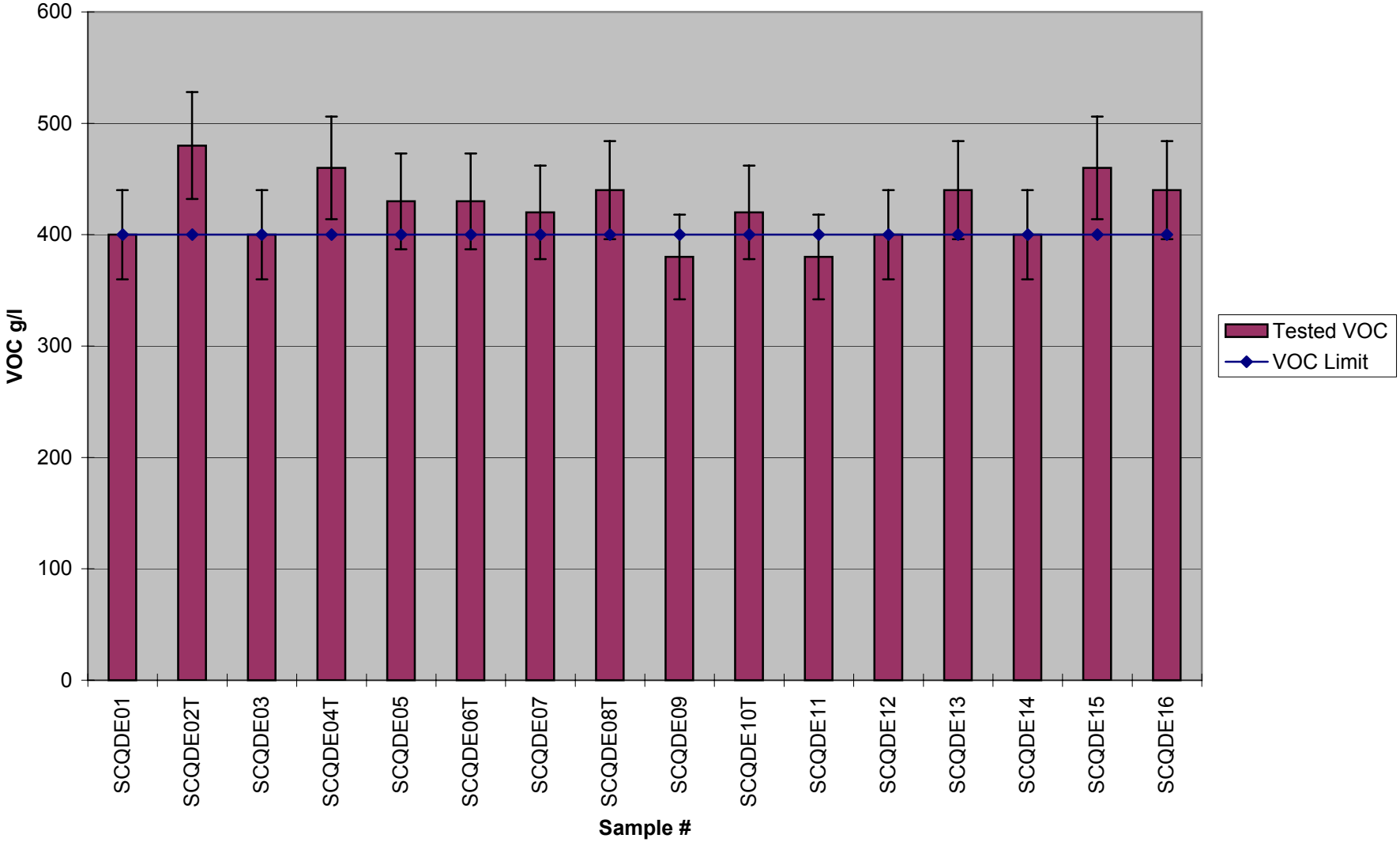
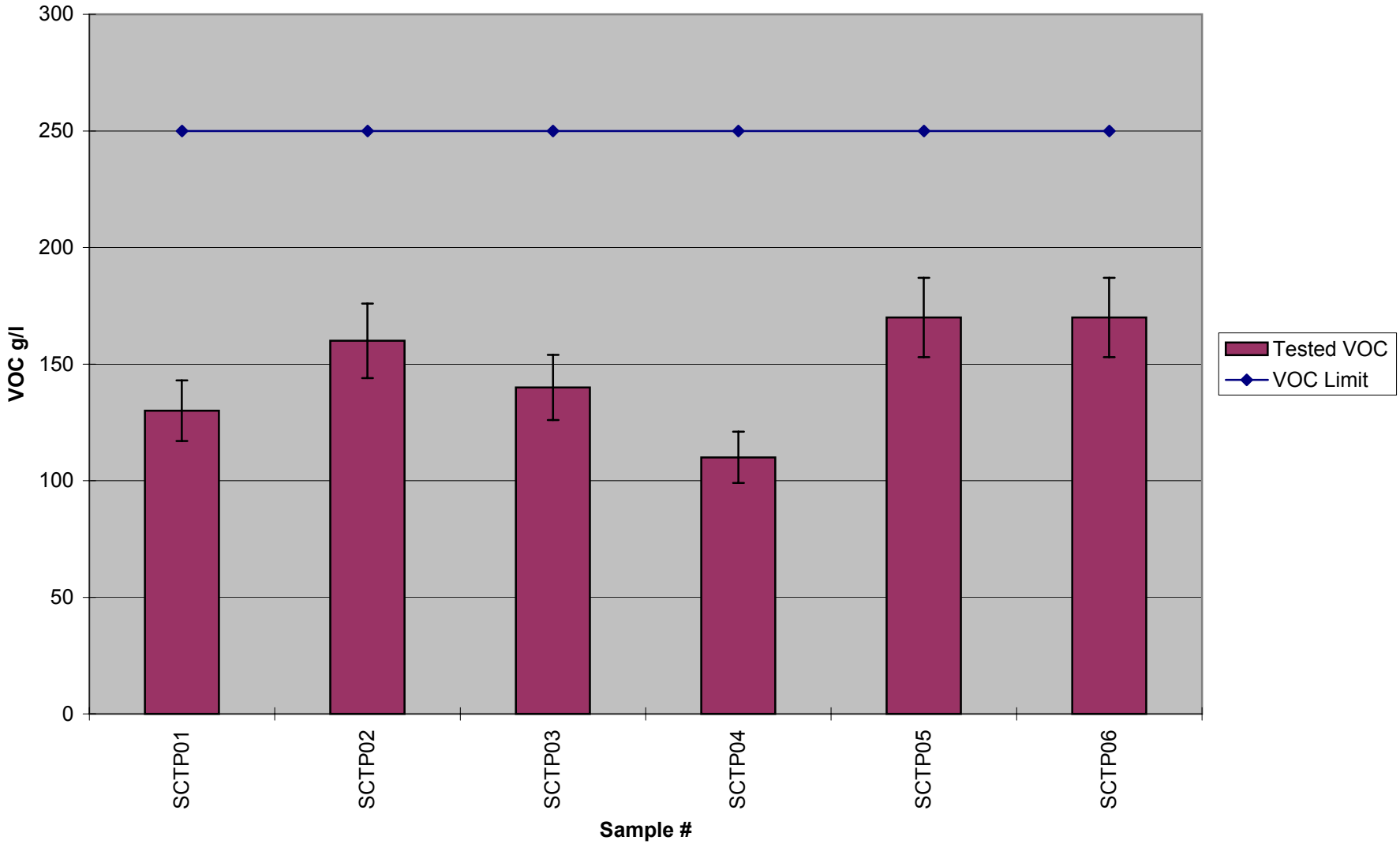


Figure 8: VOC of Traffic Paints in South Coast District



Waterproofing Sealers (South Coast)
During the analysis of the data, waterproofing sealers stood out statistically. Approximately 89 percent of the waterproofing sealers sampled were found to be out of compliance. The noncompliant waterproofing sealers made up approximately 35 percent of the noncompliant samples from the study. Table 12 and Figure 9 show the data for waterproofing sealers. The unusually high number of noncompliant waterproofing sealers was due to manufacturers' confusion with the District rule. The manufacturers believed that their products were not waterproofing sealers because they did not change the grain of the wood. These products were being labeled as lacquers. SCAQMD staff found these misclassified lacquers to be waterproofing sealers under their District rule. The manufacturers of these waterproofing sealers, as well as the retailer, were issued violations as a result of these infractions.

TABLE 12: Waterproofing Sealers (South Coast)

	Total	Compliant	Noncompliant	Average VOC
Samples	9	1	8	581
Unthinned	9	1	8	581
Thinned	0	0	0	N/A

Quick Dry Primers, Sealers, and Undercoaters, Semi-transparent Stains, Opaque Stains, and Varnishes (South Coast)
Quick dry primers, sealers, and undercoaters, semi-transparent stains, opaque stains, and varnishes were listed together because there was only a total of nine samples between the four categories. All of the quick dry primers, sealers, and undercoaters were found to be compliant. Two out of the three opaque stains were noncompliant, one semi-transparent stain was noncompliant, and the one varnish sample was noncompliant. Since there was a lack of sufficient samples for these categories, no definitive analysis can be made for these categories. These data are contained in the district wide statistics. Table 13, Table 14, Table 15, Table 16 and Figure 10 show the results of the statistics for these categories. Although quick dry primers, sealers, and undercoaters can be exempt under SCAQMD's Rule 1113, the most common district limit of 450 g/l was used in Figure 10.

TABLE 13: Quick Dry Primers, Sealers, and Undercoaters (South Coast)

	Total	Compliant	Noncompliant	Average VOC
Samples	3	3	0	437
Unthinned	2	2	0	420
Thinned	1	1	0	470

TABLE 14: Semi-transparent Stains (South Coast)

	Total	Compliant	Noncompliant	Average VOC
Samples	2	1	1	395
Unthinned	2	1	1	395
Thinned	0	0	0	N/A

TABLE 15: Opaque Stains (South Coast)

	Total	Compliant	Noncompliant	Average VOC
Samples	3	1	2	450
Unthinned	3	1	2	450
Thinned	0	0	0	N/A

TABLE 16: Varnishes (South Coast)

	Total	Compliant	Noncompliant	Average VOC
Samples	1	0	1	400
Unthinned	1	0	1	400
Thinned	0	0	0	N/A

Figure 9: VOC of Waterproofing Sealers in South Coast District

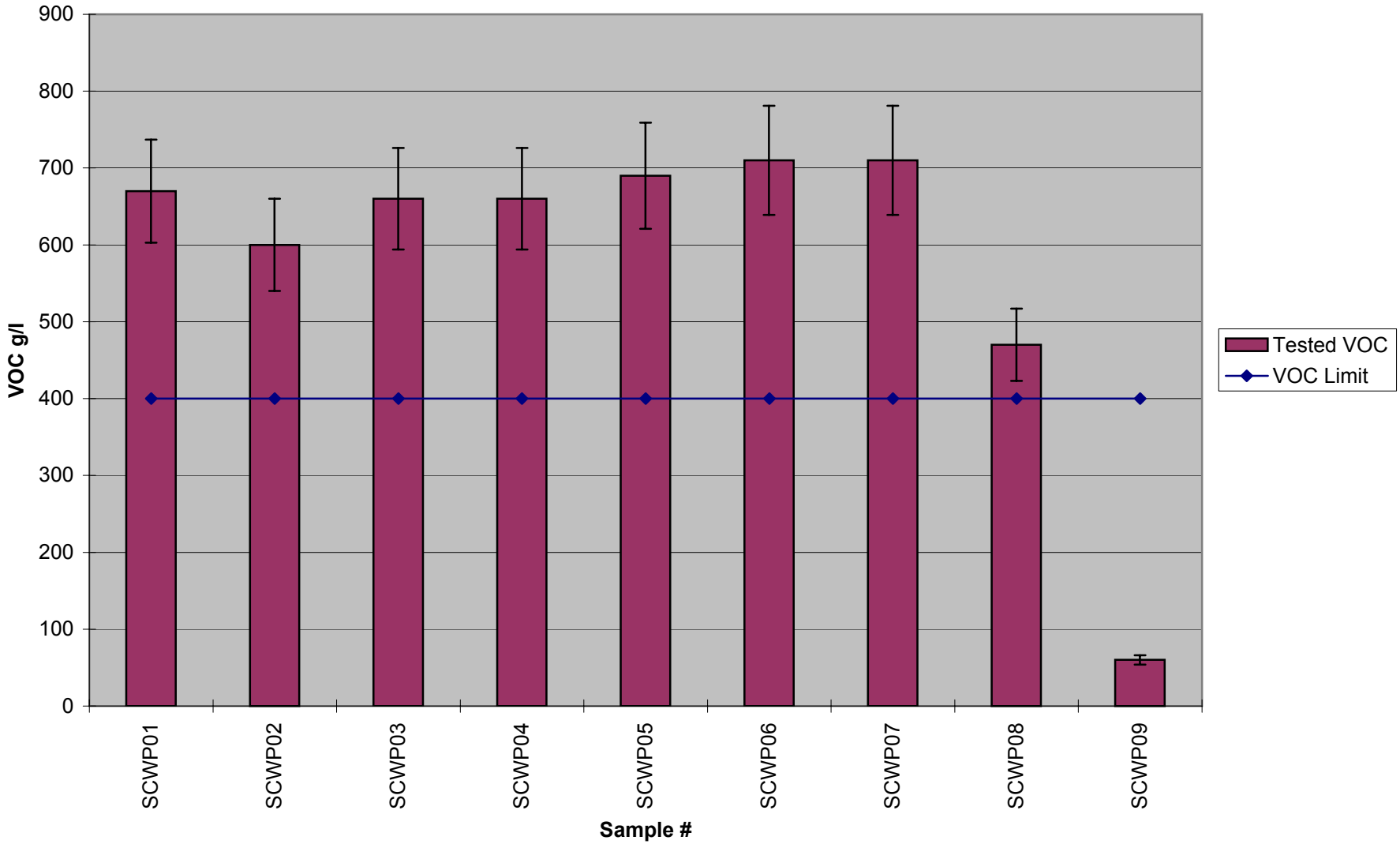
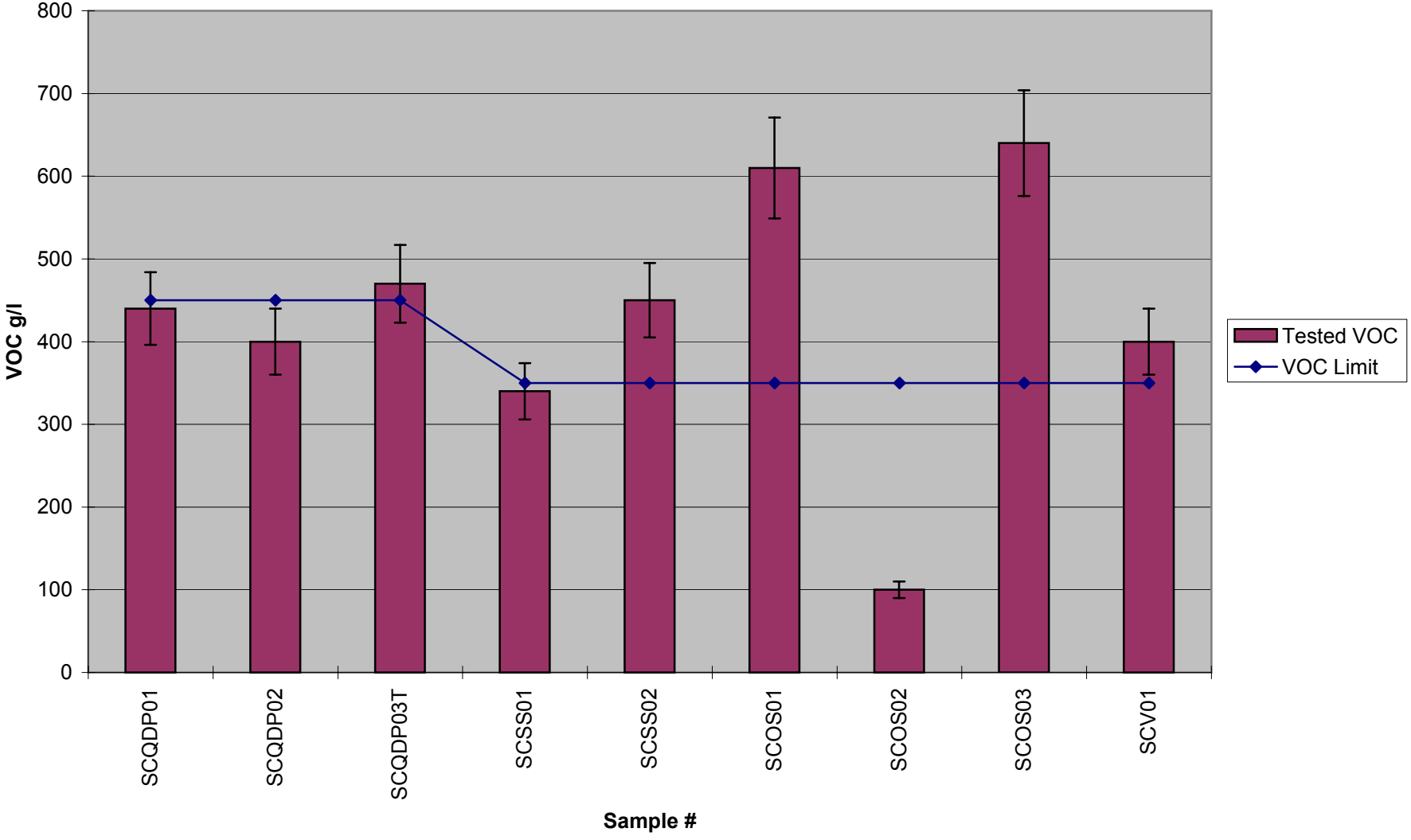


Figure 10: VOC of Quick Dry Primers, Sealers, and Undercoaters, Semi-transparent Stains, Opaque Stains, and Varnishes in South Coast District



IV. CURRENT ARCHITECTURAL COATINGS FIELD STUDY

A. PURPOSE

In order to address the concern of low-VOC solvent-borne coatings requiring more thinning, ARB staff in cooperation with the staffs of seven districts conducted this field study of architectural coatings from August to October 1998. The purpose of this study was to determine the extent of thinning occurring in solvent-borne architectural coatings.

B. DEVELOPMENT

In the early summer of 1998, ARB staff met on several occasions with the districts to develop an outline and protocol for the field study. A copy of the final protocol is in Appendix B. In developing this study, ARB and district staff reviewed previous architectural coating studies and examined the strengths and weaknesses of each study. The strengths of each study were incorporated into ARB's study and the weaknesses were improved. ARB and district staff noted that previous studies often did not have an adequate amount of samples, and had insufficient samples to cover many of the districts of California.

ARB and district staff worked to create an architectural coating field study that would produce a complete and representative picture of thinning practices throughout the state. ARB staff with the help of district personnel collected approximately 200 samples from over 100 different sites in the Bay Area, Placer County, Sacramento Metropolitan, San Diego County, San Joaquin Valley, Ventura County, and Yolo-Solano districts. Along with over 200 samples collected by SCAQMD staff, these data cover roughly 90 percent of California's population.

There were many ideas exchanged between ARB and district staff via several conference calls to decide how to conduct the study and which categories to include in the study. Eventually it was decided that the categories to be included in the study would be lacquers, semi-transparent stains, opaque stains, flats, non flats, quick dry enamels, industrial maintenance coatings, primers, sealers, undercoaters, (primers, sealers, and undercoaters were considered as one category) quick dry primers, sealers and undercoaters, traffic paints, varnishes, waterproofing sealers, and sanding sealers. These categories were chosen because the districts and ARB staff felt that many of these are the largest emissions categories. No samples of waterproofing sealers or non-lacquer sanding sealers were collected since use of such coatings was not encountered.

C. SAMPLING PROTOCOL

District personnel assisted ARB staff by investigating their districts the week before samples were to be collected for possible painting sites, and in many instances accompanied the ARB staff during the sample collection. Construction areas were frequently selected, since painting was most likely to occur there. Samples were collected from the coatings being applied. Inspections were on an unannounced basis to reduce the potential for modifications to the painters' normal thinning practices. Unthinned samples were obtained for comparison, if possible, when thinned coatings were being applied. The inspectors noted the coating information on the *Coating Observation Form* (see Appendix C). All the samples collected were

labeled and immediately sealed using ARB supplied containers, labels, and seals. Whenever possible, Material Safety Data Sheets (MSDS) and /or coating labels from an empty coating container for each sample were obtained and submitted. Any time the sample changed hands, the person relinquishing the sample and the person receiving the sample had to sign and date the *Laboratory Request and Sample Transfer Form* (see Appendix D). The delivery of the samples to the laboratory was arranged by the ARB staff. All samples were tested at the ARB's Monitoring and Laboratory Division in Sacramento, California with the exception of one two component coating, which was tested at the Bay Area Air Quality Management District. The complete sampling protocol developed by ARB and district staff is contained in Appendix B.

All coating containers from which samples were obtained were thoroughly mixed prior to the actual sample collection. Samples of coatings as supplied were obtained from an unopened container of coating. All thinned solvent-borne coating samples, except for one two-part coating, were sampled both as they were supplied (before thinning) and as they were applied (from the spray pot or applicator). In some cases, inspectors arrived in time to only receive the samples as they were being applied because the painter or contractor was on his last batch of paint. Pre-mixed mutli-component coatings were not sampled. In the case of the two-part coating, the components were sampled separately and the mix ratio noted in the comment area of the *Laboratory Request and Sample Transfer Form*. After each sample was obtained, the container was tightly sealed and clearly labeled with an ARB supplied label and seal. Samples were placed in ARB supplied 250 ml containers made of amber glass with a screw top nonreactive teflon coated lid. Containers were filled to greater than 90 percent capacity. To minimize VOC losses, containers were stored upside down. All coating samples were kept between 40°F and 100°F for storage and transportation. After samples were obtained they were transported to the lab as quickly as possible, which took about three to four days on average. The sampling methods created by ARB and district staff are included with the sampling protocol in Appendix B.

D. TESTING PROTOCOL

The samples used in this study were tested with ARB Test Method 310 for the purposes of determining the VOC content of architectural coatings. ARB Test Method 310 is equivalent to the U.S. EPA's Test Method 24, because it incorporates Method 24's testing standards. In addition, due to the recent exemptions of several compounds from the definition of VOC, Method 310 incorporates additional testing standards not included in Method 24.

E. RESULTS

Overall, 197 samples were collected at over 100 different sites. One hundred seventy-seven different coatings were collected and of those coatings, 20 solvent-borne samples were collected as thinned and unthinned samples. While taking samples, ARB inspectors inquired as to why the paints were being thinned. There were various reasons given. Many of the painters and contractors indicated that thinning aided in the application of the paints due to the consistency of the coatings. Some coatings were too thick or viscous to spray, brush, work with, or soak into the substrate. Some painters wanted the paint to cover more surface area or have the paint last longer. Every painter seemed to have their own individual reasons for thinning. In general, painters and contractors thinned when they felt it was necessary and not as a rule.

At the time of the study, the Yolo-Solano District did not have an architectural coatings rule in its rulebook with VOC limits, so in the tables and graphs it was given the most common district limit of the category. The focus of the data analysis in this report will be on the solvent-borne coatings, since water-borne paints are thinned with water, which does not increase their VOC content. When thinned paints are discussed in this report, it will refer to solvent-borne coatings unless specified otherwise. As is common practice in many districts, a 10 percent compliance margin was included with the tested VOC contents. In the graphs, all of the thinned paints have a "T" after the sample number and all the unthinned samples of that same coating have a "U" after the sample number. In the graphs, even water-borne coatings that were thinned with water are noted with a "T." Also, the sample numbers in the graphs have either a "WB" or a "SB" in the sample number, which stand for water-borne and solvent-borne, respectively. There were five coatings that were not included in this report. Two coatings were Opaque Stains that were exempt from VOC limits because they were taken from quart size containers. The remaining three coatings were not among the categories that were collected for this report and were marked as "Others." All three of the coatings marked as "Others" were unthinned and compliant with the general architectural coatings default VOC limit of 250 g/l. All tested samples are summarized in Appendix E.

Statewide Summary

Table 17 shows a breakdown of the results of compliance and noncompliance in water-borne and solvent-borne coatings statewide. The results from the data collected showed that the majority (64 percent) of the paints sampled were water-borne. Out of the 64 solvent-borne paints sampled, approximately 53 percent of them were thinned. Of the 53 percent thinned, 26 percent of those were thinned out of compliance. Overall, only 14 percent of the total solvent-borne coatings were thinned and noncompliant. Twenty of the solvent-borne coatings collected were collected as thinned and unthinned. These results showed that out of the 20 coatings, 13 were thinned within compliance and seven were thinned out of compliance. Overall, thinned noncompliant coatings represent only five percent of all the coatings sampled. A more detailed analysis of the individual categories studied is provided below.

TABLE 17: Statewide Summary

	Total	Compliant	Noncompliant
Coatings	177	154	23
WB	113	101	12
SB	64	53	11
SB Thinned	34	25	9
SB Unthinned	30	28	2

Key: WB: Water-borne; SB: Solvent-borne
Note: 197 total samples were collected. 20 of the SBs collected were collected as thinned and unthinned.

Flats

Flats, which made up the largest category, contained no solvent-borne samples. There were 59 samples of flats gathered, which makes up about 33 percent of the total coatings sampled. The significant amount of flats gathered shows that a large number of paints being used are water-borne flats. Table 18 compiles the results of all the flats gathered statewide by the ARB staff. The average VOC content calculated in the table clearly shows that the water-borne flats are well below the VOC limit (250 g/l) set by the districts. Each individual sample taken by ARB staff is shown in Figure 11. The graph compares the tested VOC content of the sample to the districts' VOC limit. Except for seven unusually high tested VOC contents, most flats tended to be at or well below the 250 g/l limit. Upon further analysis of the unusually high VOC content samples, it was found that one of the samples had an unusually low solids content, which would tend to elevate the calculated "less water" VOC content. The other high VOC samples were found to have nearly twice the percent volume of VOC of the average water-borne flat, which would also result in unusually high "less water" VOC contents. The results of the flats from the South Coast data appear to be consistent with the data found here.

TABLE 18: Flats

	Total	Compliant	Noncompliant	Average VOC
Coatings	59	52	7	164
WB	59	52	7	164
SB	0	0	0	N/A
SB Thinned	0	0	0	N/A
SB Unthinned	0	0	0	N/A

Key: WB: Water-borne; SB: Solvent-borne

Industrial Maintenance Coatings

Unlike the flats, 78 percent of the 18 industrial maintenance samples gathered were solvent-borne. From the results compiled in Table 19, there were six (33 percent) thinned samples and three (17 percent) of those were found to be out of compliance with their respective district limits. When the six thinned samples are compared with unthinned samples, the results show that three of the coatings were thinned out of compliance, while three of the samples were thinned to compliant levels. Results also showed that there was one water-borne sample that tested unusually high in VOC content. This unusually high VOC content sample was found to have nearly twice the percent volume of VOC of an average water-borne coating, which would result in an unusually high "less water" VOC content. The district limits for industrial maintenance coatings varied between 340 g/l and 420 g/l. The average VOC listed in Table 19 reflects the varying limits. Figure 12 shows the VOC limit where each sample was taken and its tested value. Four of the districts in this study have a limit for industrial maintenance coatings of 420 g/l, and two districts have the limit set at 340 g/l. The concern is that an architectural coating sold in one district may be compliant, but in another district it may be out of compliance by about 80 g/l. One of the industrial maintenance coatings may have been thinned to a noncompliant level because there is not a consistent limit among districts.

Figure 11: VOC of Flats Statewide

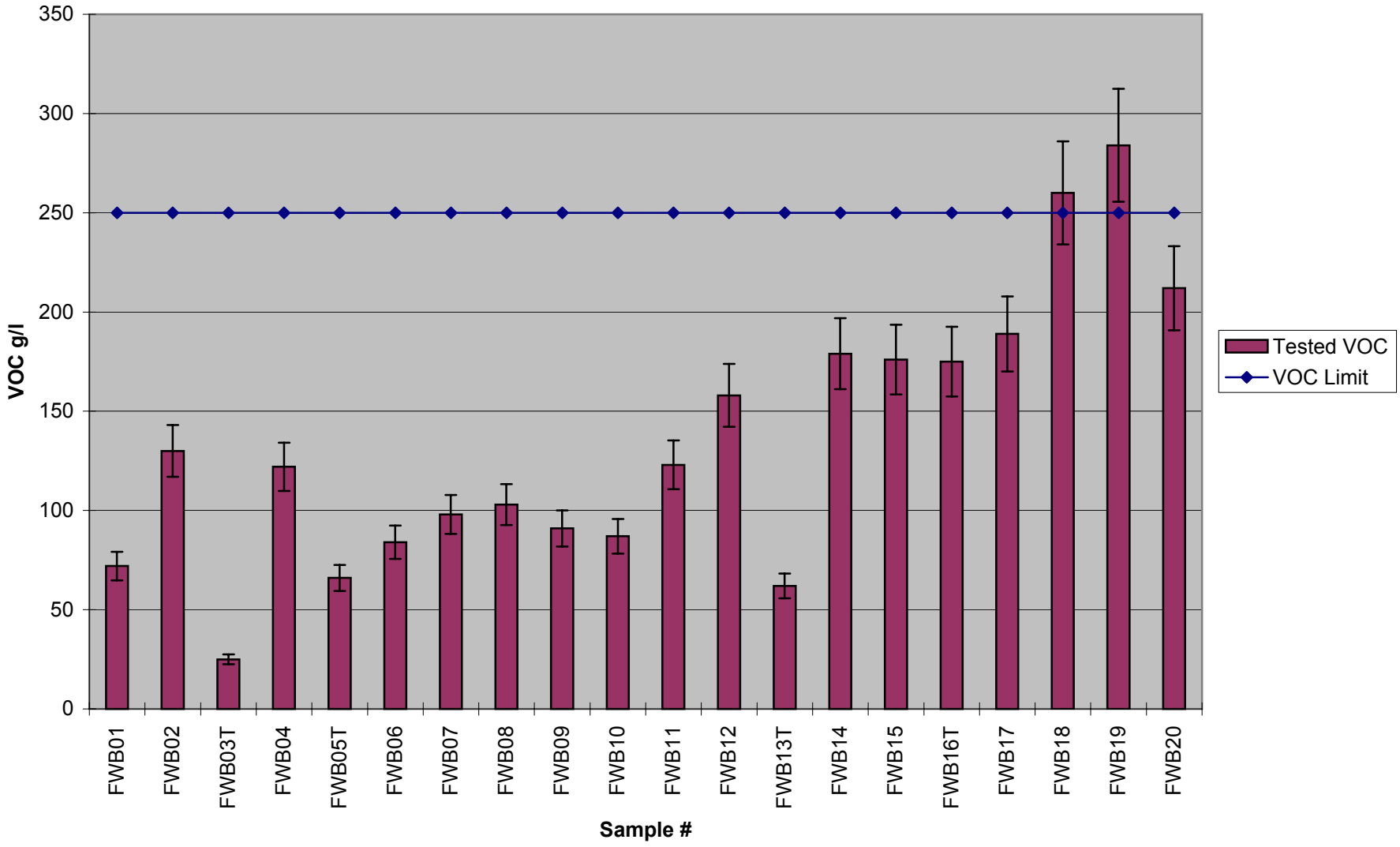


Figure 11: VOC of Flats Statewide (cont'd)

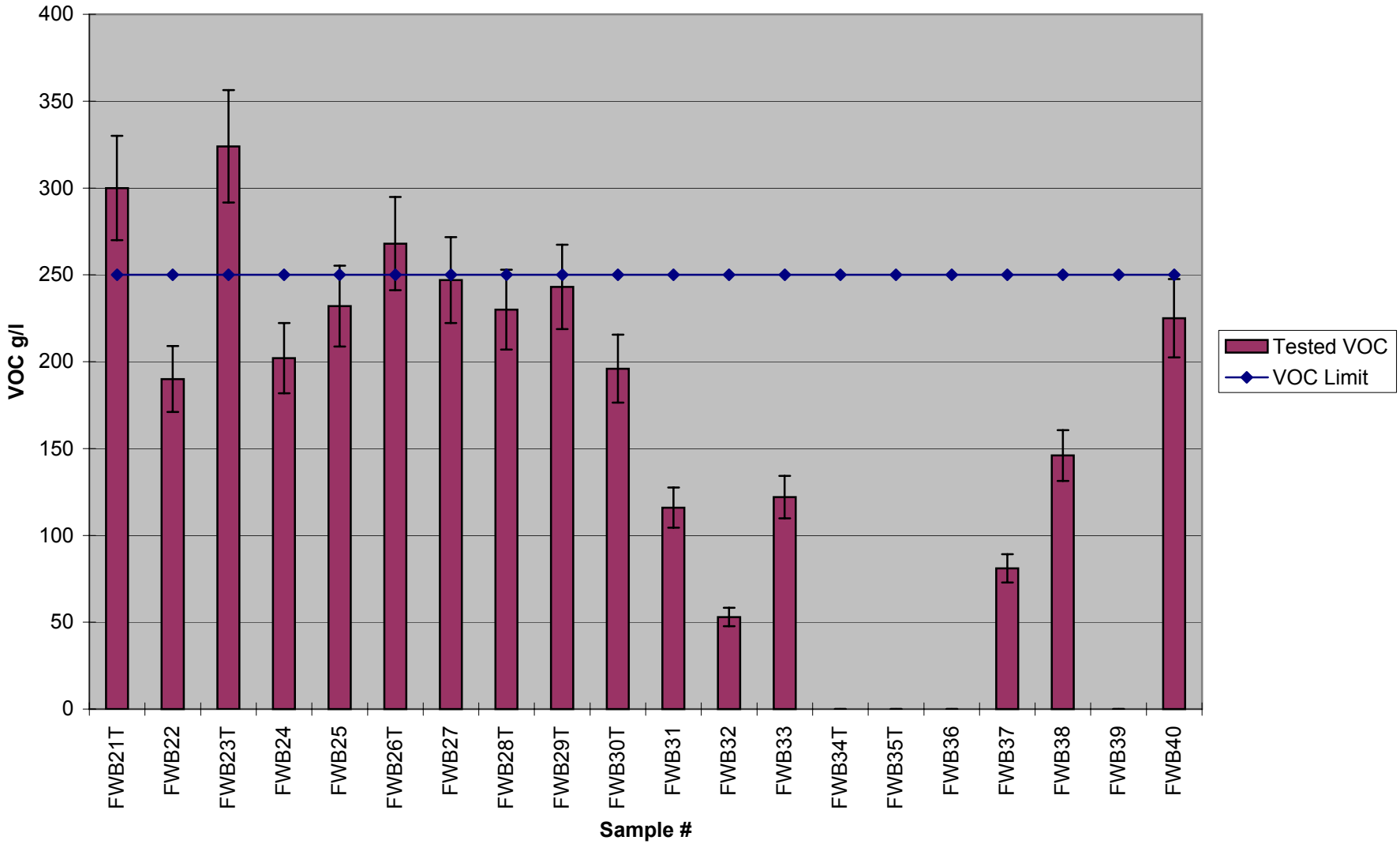


Figure 11: VOC of Flats Statewide (cont'd)

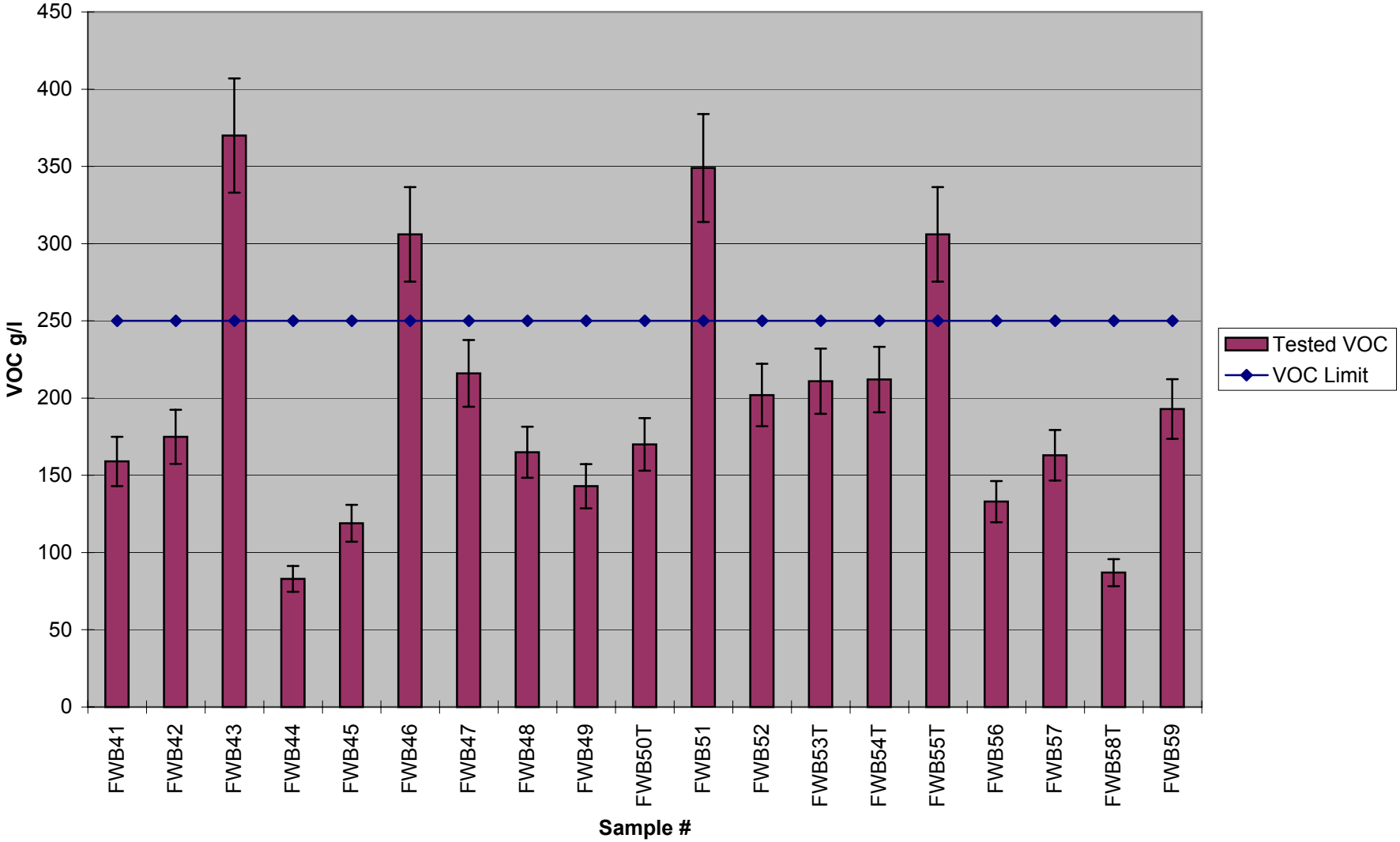


Figure 12: VOC of Industrial Maintenance Statewide

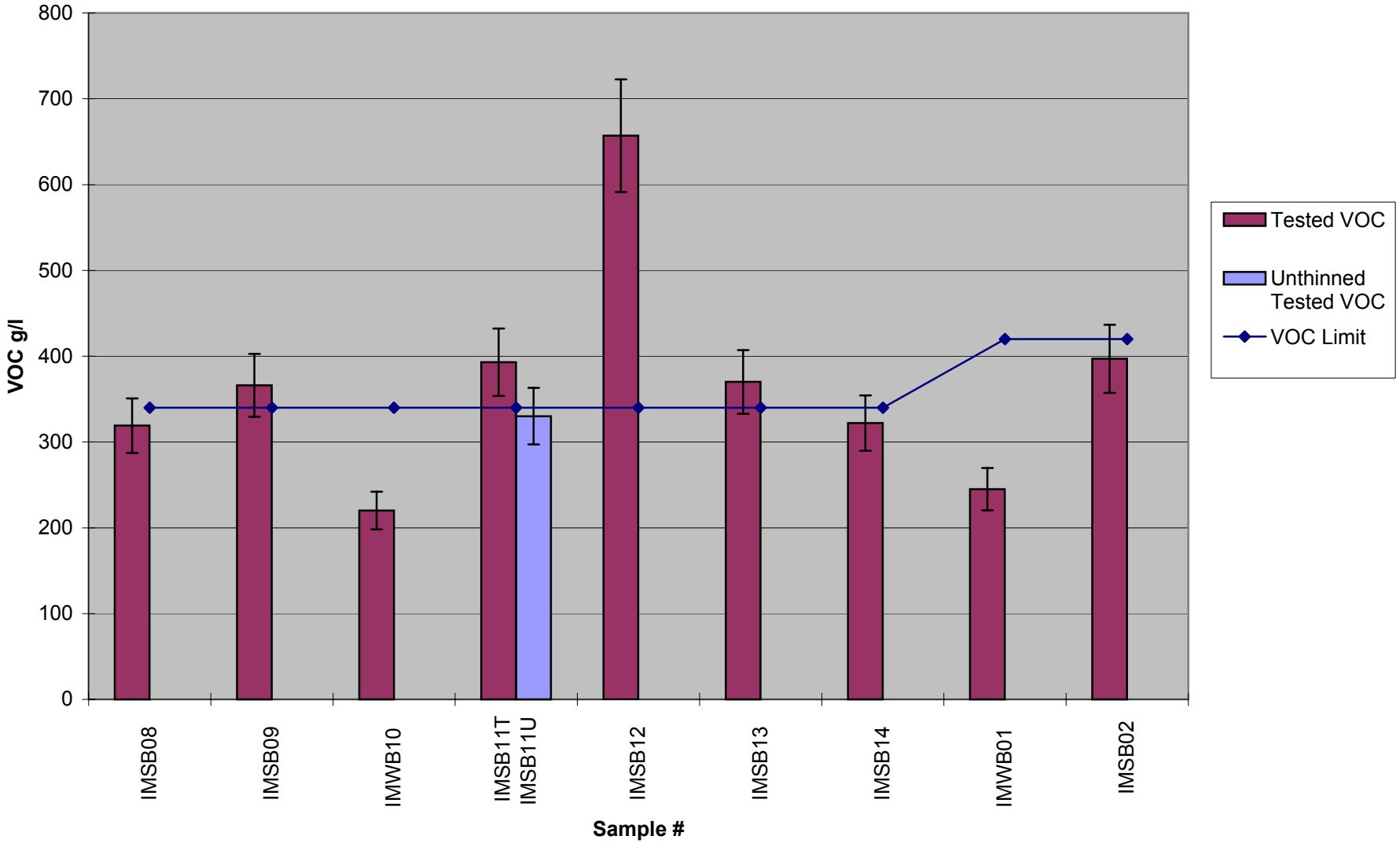
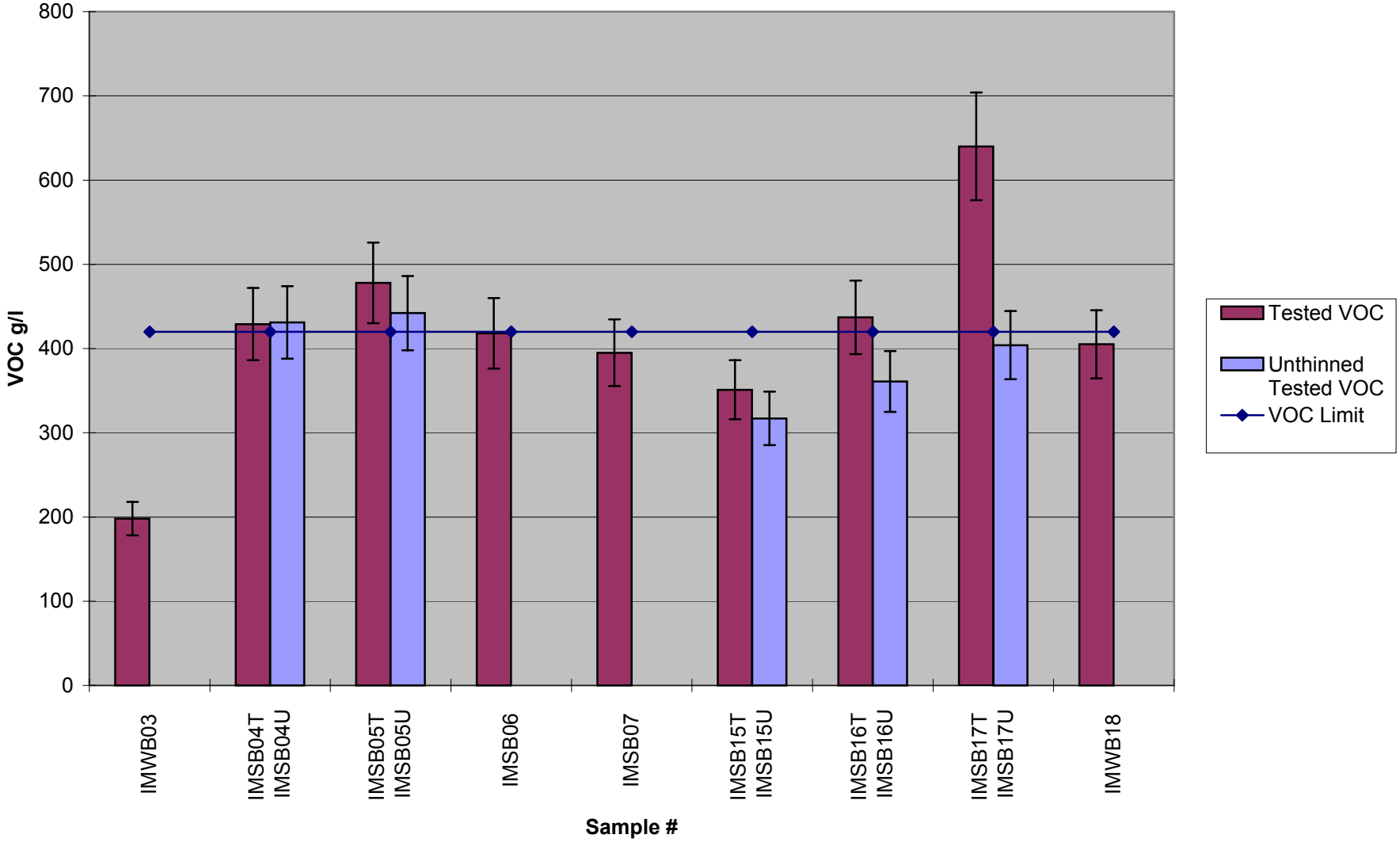


Figure 12: VOC of Industrial Maintenace Statewide (cont'd)



A comparison of South Coast data and ARB data may help to determine if industrial maintenance coatings are being thinned out of compliance. In the South Coast data, industrial maintenance coatings had 21 total samples and of those 21, two samples were thinned and found to be compliant. The one noncompliant sample was an unthinned coating. The South Coast data suggest that excess thinning is not occurring in industrial maintenance coatings. The ARB and South Coast data show that thinned noncompliant samples made up only eight percent of the total samples in this category. As a whole, the two groups of data suggest that there is not a problem of excess thinning of industrial maintenance paints.

TABLE 19: Industrial Maintenance Coatings

	Total	Compliant	Noncompliant	Average VOC
Coatings	18	14	4	391
WB	4	4	0	267
SB	14	10	4	427
SB Thinned	6	3	3	455
SB Unthinned	8	7	1	406

Key: WB: Water-borne; SB: Solvent-borne
Note: 24 total samples were collected. 6 of the SBs collected were collected as thinned and unthinned.

Lacquers and Lacquer Sanding Sealers

Lacquers and lacquer sanding sealers have one of the highest VOC limits in the State at 680 g/l. The lacquer category had more thinned solvent-borne samples than any other category, contributing roughly 30 percent of all the thinned solvent-borne coatings in the data compiled for this report. Lacquers and lacquer sanding sealers combined make up about 35 percent of all the thinned solvent-borne coatings in this study. Neither category had any water-borne samples. In comparison with the South Coast data, lacquers seem to be fairly consistent. Lacquer sanding sealers had a slight variance in the amount of samples being thinned; however, neither the South Coast data nor these data contained samples that were thinned out of compliance.

Every lacquer and lacquer sanding sealer tested was compliant. Table 20 and Table 21 show the breakdown of the data. Figure 13 and Figure 14 show how each sample fared versus their respective district limits. It is interesting to note that the industry's claim that low VOC limits are forcing painters and contractors to thin their paints more is not supported by these results. The results from this analysis show that a large number of the solvent-borne paints being thinned are the lacquers and lacquer sanding sealers, which have one of the highest VOC limits in the State.

TABLE 20: Lacquers

	Total	Compliant	Noncompliant	Average VOC
Coatings	15	15	0	659
WB	0	0	0	N/A
SB	15	15	0	659
SB Thinned	10	10	0	655
SB Unthinned	5	5	0	670

Key: WB: Water-borne; SB: Solvent-borne
Note: 21 total samples were collected. 6 of the SBs collected were collected as thinned and unthinned.

Figure 13: VOC of Lacquers Statewide

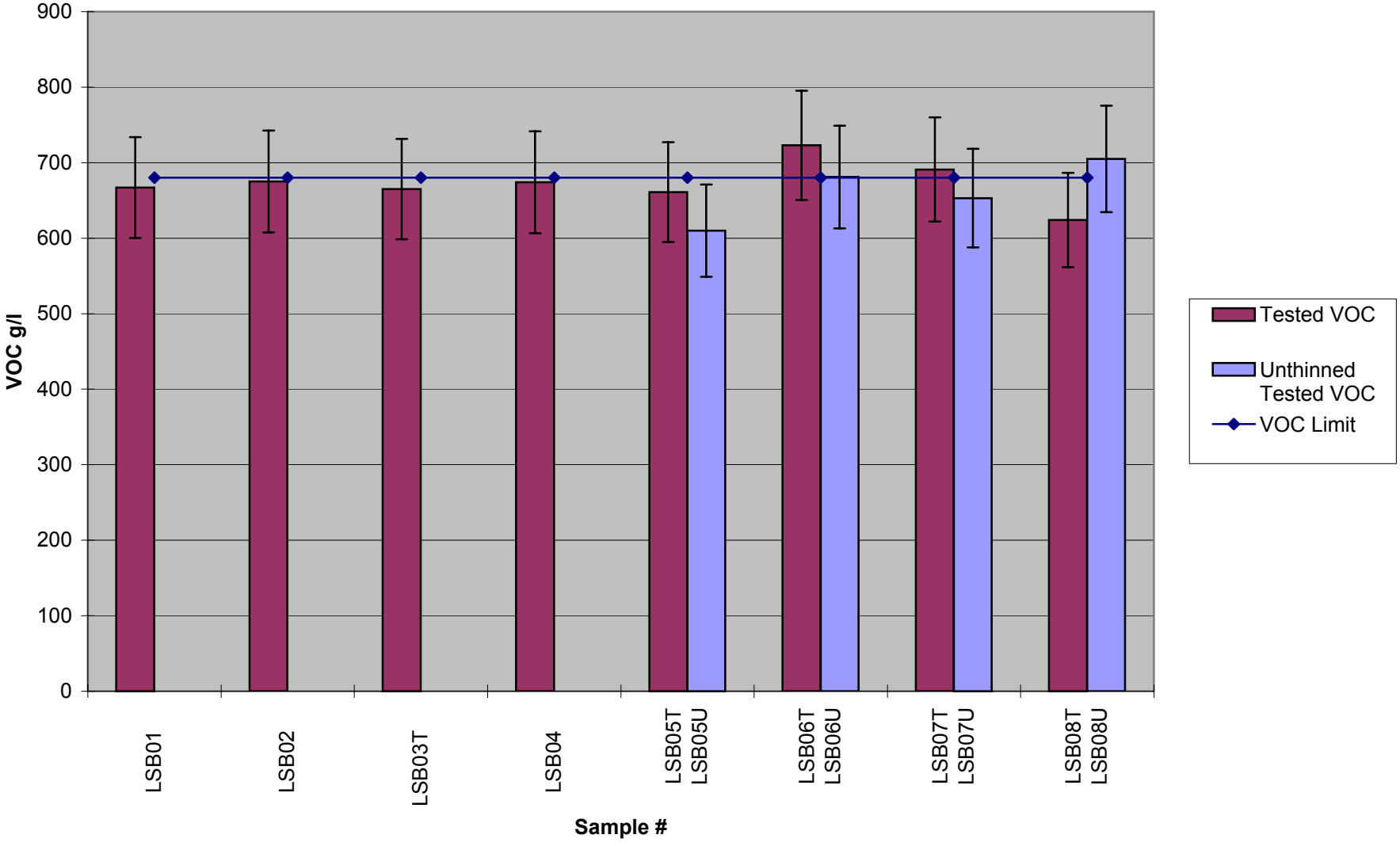


Figure 13: VOC of Lacquers Statewide (cont'd)

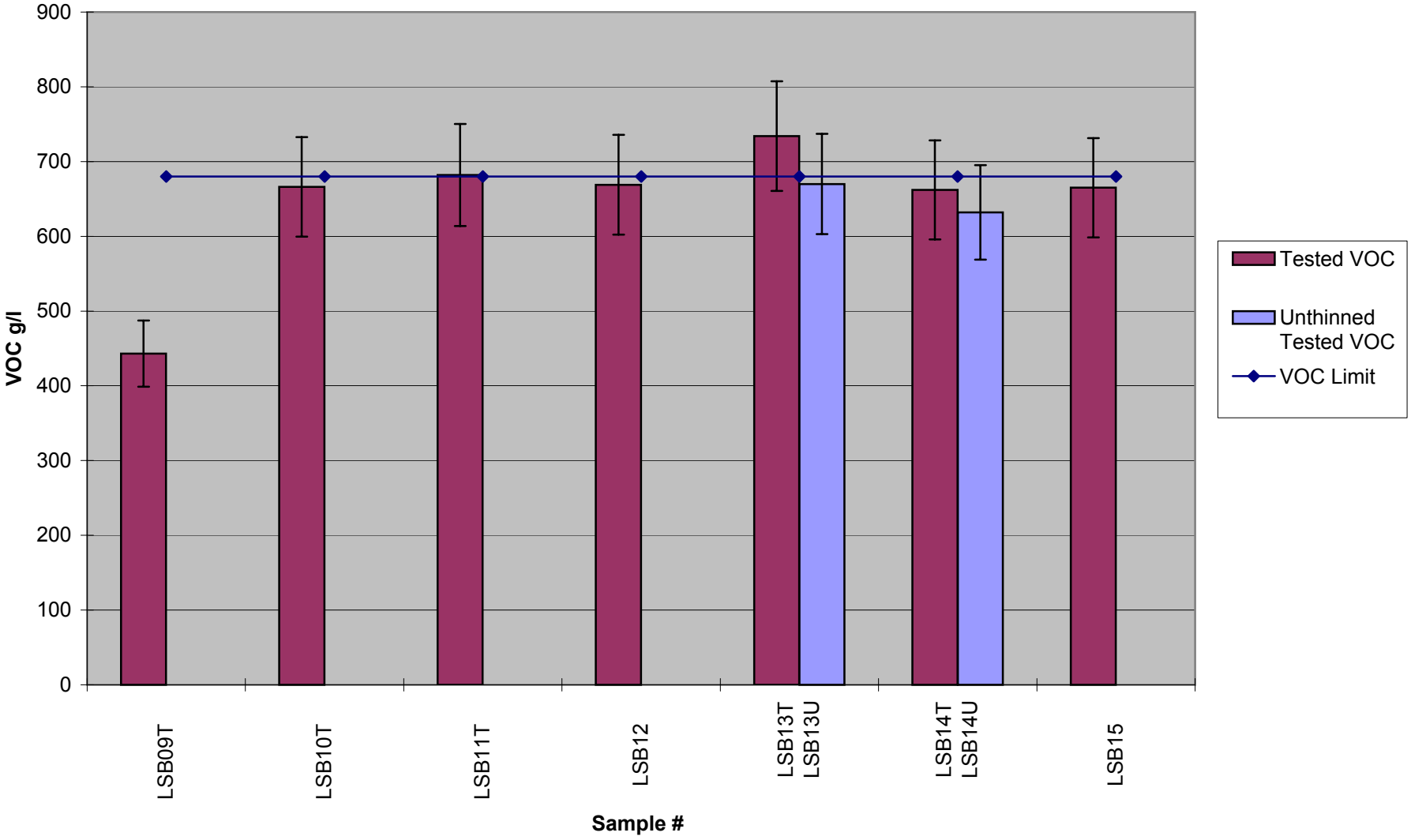


Figure 14: VOC of Lacquer Sanding Sealers Statewide

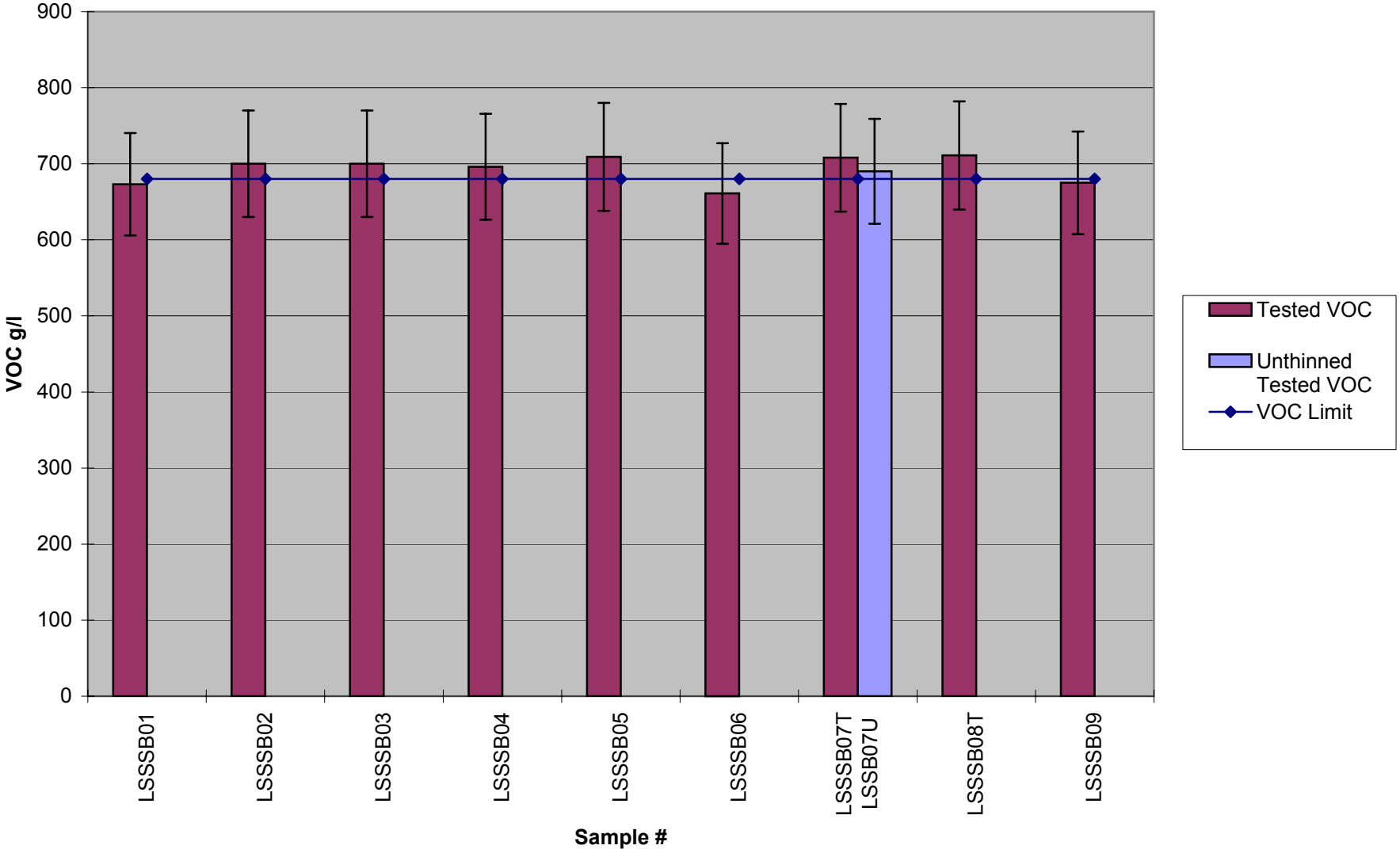


TABLE 21: Lacquer Sanding Sealers

	Total	Compliant	Noncompliant	Average VOC
Coatings	9	9	0	693
WB	0	0	0	N/A
SB	9	9	0	693
SB Thinned	2	2	0	710
SB Unthinned	7	7	0	688

Key: WB: Water-borne; SB: Solvent-borne
Note: 10 total samples were collected. 1 of the SBs collected was collected as thinned and unthinned.

Non Flats

In the second largest category sampled, next to flats, 94 percent of all the non flats were water-borne. Table 22 shows the breakdown of the data gathered for non flats. Only two of the 36 non flats (six percent) were solvent-borne and one of the 36 non flats (three percent) was thinned and noncompliant. Figure 15 shows the results of Table 22 more specifically. The water-borne flats and non flats represent 54 percent of the total amount of samples. There were three water-borne samples that were found to have unusually high VOC contents. After reviewing these three samples further, one sample was found to have nearly three times the percent volume of VOC of the average water-borne non flat, and the other two were found to have nearly double that same average. This results in unusually high "less water" VOC contents. The one sample that was collected as both an unthinnned sample and as the applied thinnned sample was found to be thinned out of compliance. The results suggest that excessive thinning is not occurring significantly within the category of non flats, because a large majority of those being used are water-borne. These results parallel those found in the South Coast study.

TABLE 22: Non Flats

	Total	Compliant	Noncompliant	Average VOC
Coatings	36	32	4	191
WB	34	31	3	182
SB	2	1	1	356
SB Thinned	2	1	1	356
SB Unthinned	0	0	0	N/A

Key: WB: Waterborne; SB: Solventborne
Note: 37 total samples were collected. 1 of the SBs collected was collected as thinned and unthinned.

Primers, Sealers, and Undercoaters

Thinned samples comprised 33 percent of the primers, sealers, and undercoaters. Approximately 11 percent of the total were thinned and noncompliant, which is a larger percentage than most categories, but is still fairly low. As a result of having an unusually low volume solids content, one water-borne coating had a "less water" VOC content that was unusually high for a water-borne coating. There were three samples collected as thinned and unthinned. The results from these samples showed that two out of the three samples were thinned out of compliance. The average tested VOC content of the thinned coatings is 374 g/l, which is within the 10 percent compliance margin of the 350 g/l district limit. This tends to suggest that thinning of solvent-borne coatings in this category is not excessive. Table 23 and Figure 16 contain the results and data for primers, sealers, and undercoaters.

Figure 15: VOC of Non Flats Statewide

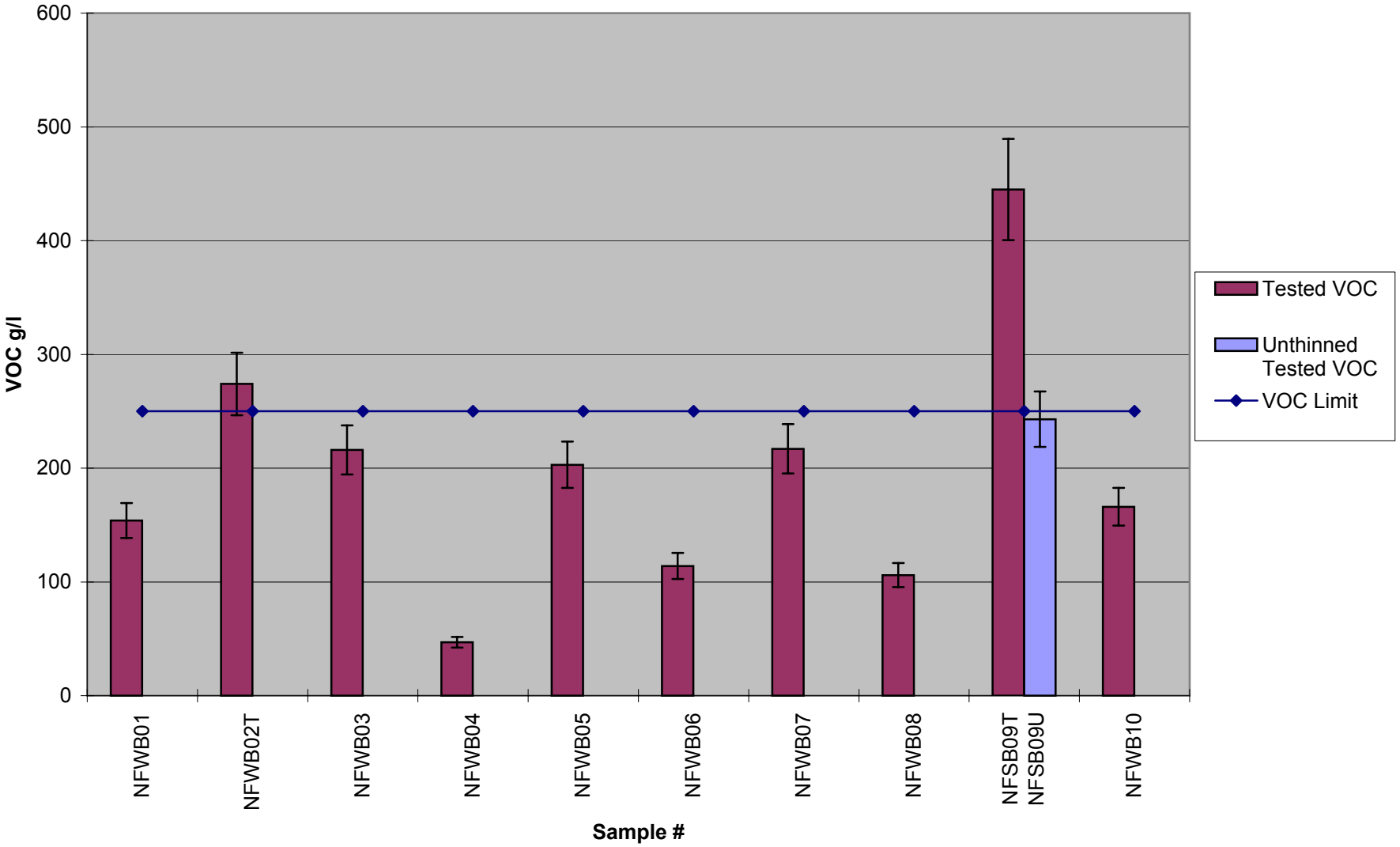


Figure 15: Non Flats Statewide (cont'd)

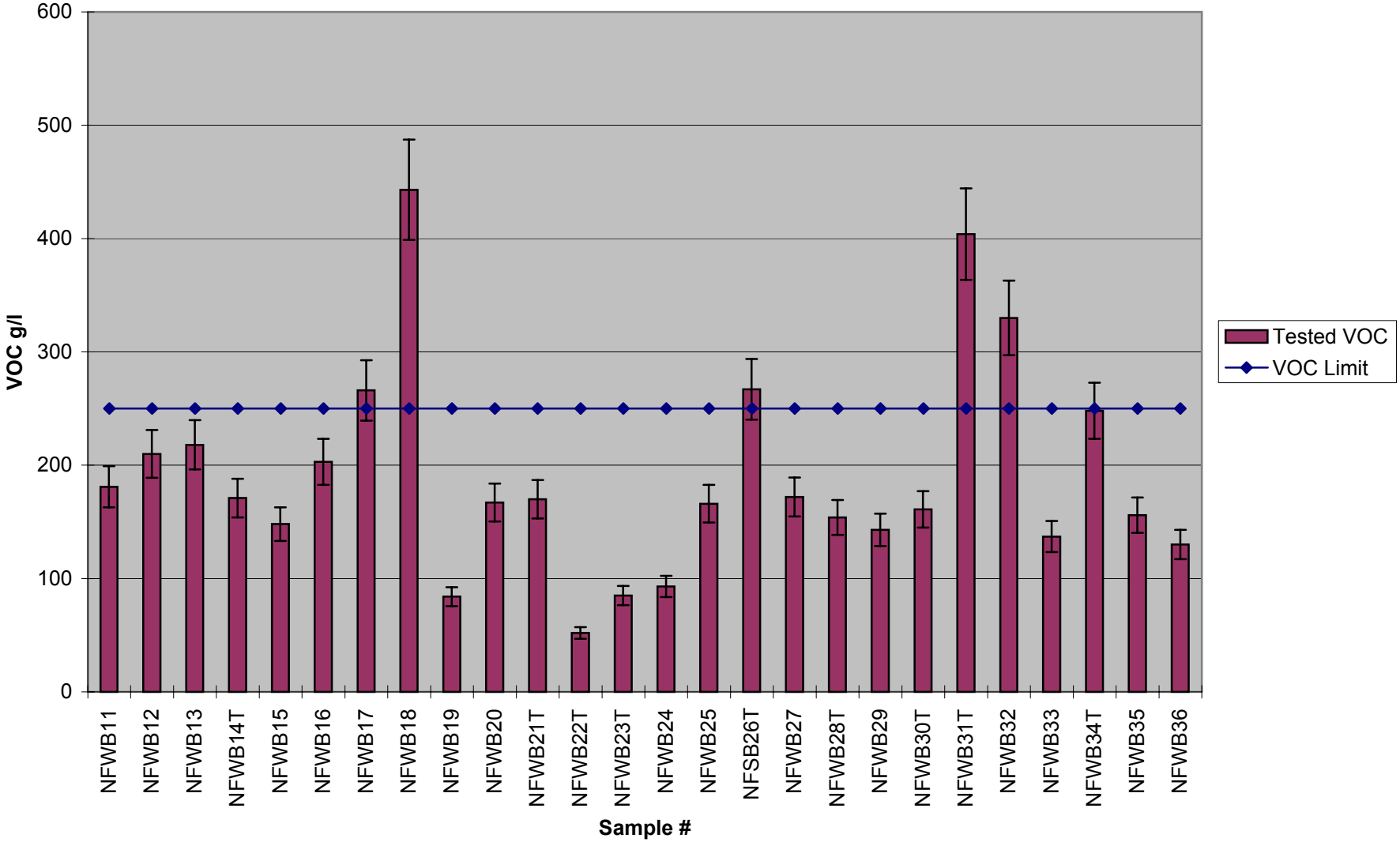


Figure 16: VOC of Primers, Sealers, and Undercoaters Statewide

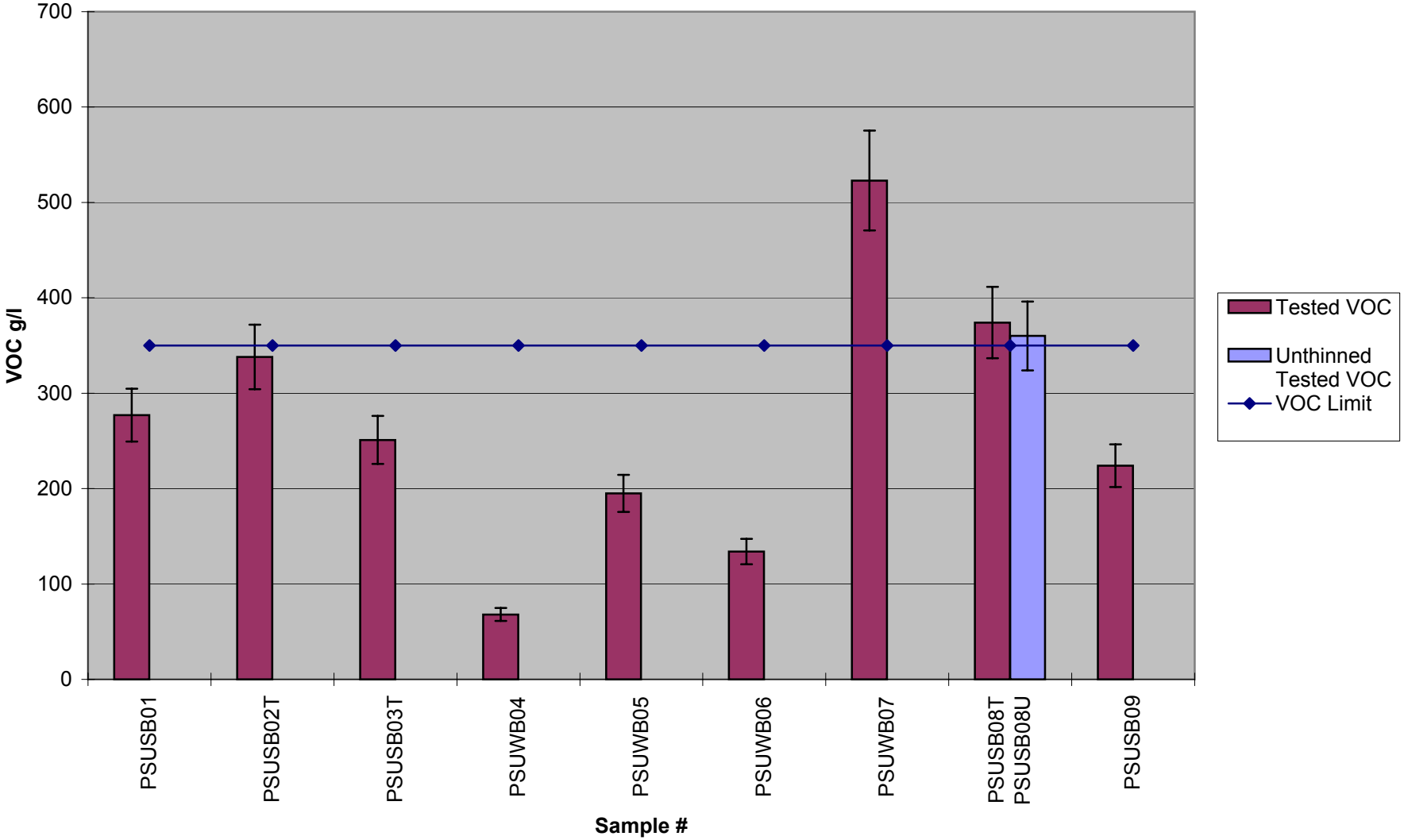


Figure 16: VOC of Primers, Sealers, and Undercoaters Statewide (cont'd)

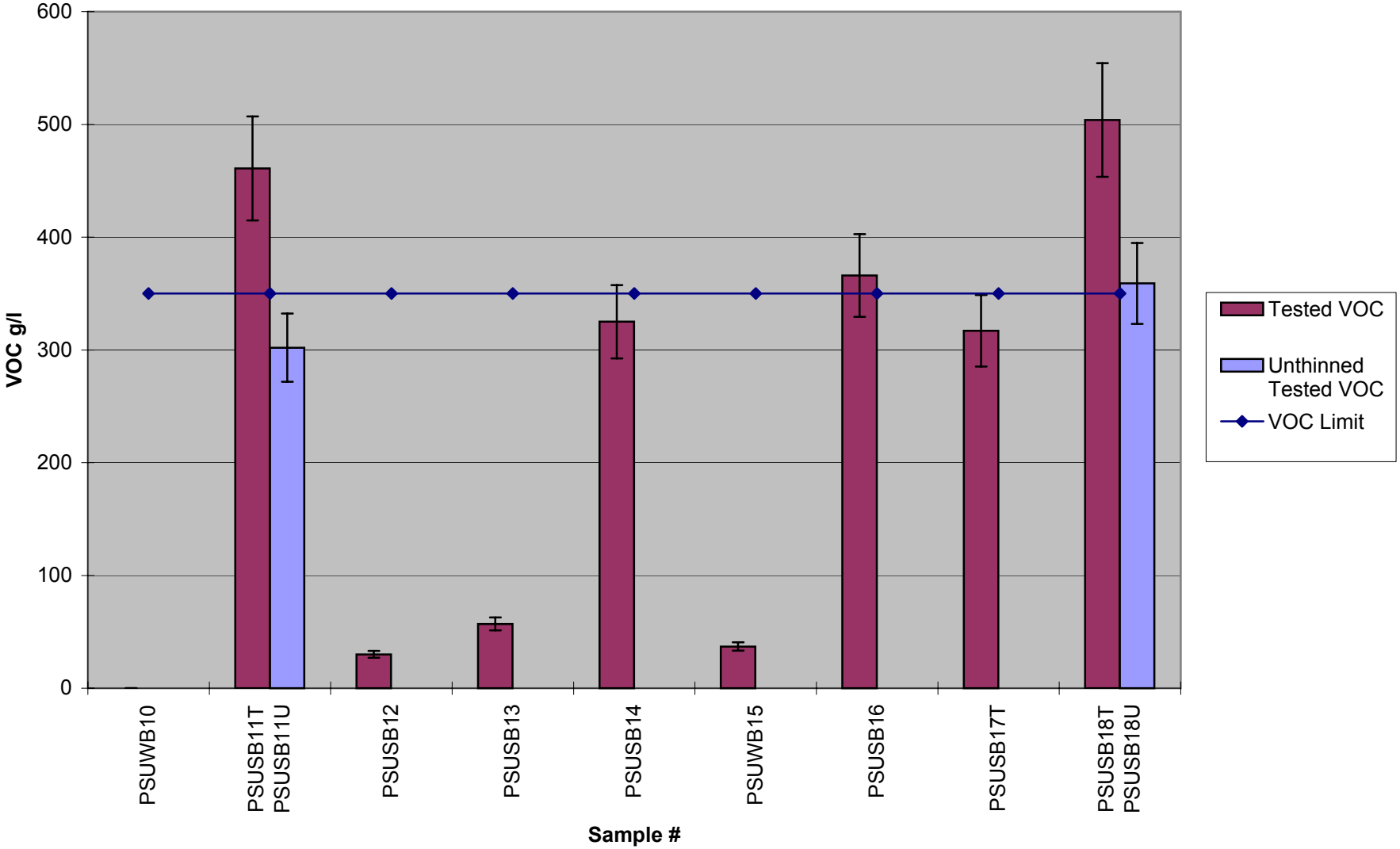


Table 23 shows that of the six thinned samples, two of were thinned out of compliance. The South Coast data show that out of the 23 samples collected for primers, sealers, and undercoaters, only three of them were thinned. Similar to the ARB data, the South Coast data also had two thinned noncompliant samples. Overall, the ARB and South Coast data show thinned noncompliant samples represent only 10 percent of the samples in these two data sets. The South Coast and the data in this report suggest that excessive thinning is not taking place with primers, sealers, and undercoaters.

TABLE 23: Primers, Sealers, and Undercoaters

	Total	Compliant	Noncompliant	Average VOC
Coatings	18	15	3	249
WB	8	7	1	131
SB	10	8	2	344
SB Thinned	6	4	2	374
SB Unthinned	4	4	0	298

Key: WB: Water-borne; SB: Solvent-borne
Note: 21 total samples were collected. 3 of the SBs collected were collected as thinned and unthin0ned.

Quick Dry Enamels

Quick dry enamels was a small category with six total samples and five different coatings. All of the samples gathered were solvent-borne. Of these five different coatings, four of them were thinned (80 percent). There were two thinned noncompliant samples (40 percent). The one sample that was gathered as thinned and unthinned was thinned out of compliance. The average VOC for quick dry enamels was noncompliant with the districts' limits of 400 g/l. The average VOC was 454 g/l, which is in excess of the districts' VOC limits even including the 10 percent compliance margin. The initial analysis of the data indicates that there may be excessive thinning within this category. However, the data are too limited to determine if excess thinning routinely occurs for quick dry enamels. Table 24 and Figure 17 show this information.

Referencing the data collected by SCAQMD, the quick dry enamel numbers suggest that there was a fair amount of excessive thinning taking place. Table 9 shows that the average VOC content of quick dry enamels is about 423 g/l, which is 23 g/l over the district limit, but is within the 10 percent compliance margin. The South Coast data show that about 13 percent of the samples collected were thinned and noncompliant. This category has one of the highest percentages of coatings that were thinned out of compliance. The two groups of data tend to suggest that there is a fair amount of excessive thinning occurring in the category of quick dry enamels. Again, it is interesting to note that there may be excessive thinning in this category, since it has a high enough VOC limit to allow traditional solvent-borne coatings. This does not seem to support the industry's argument that excessive thinning occurs with lower (e.g., 250 g/l) VOC limits.

Figure 17: VOC of Quick Dry Enamels Statewide

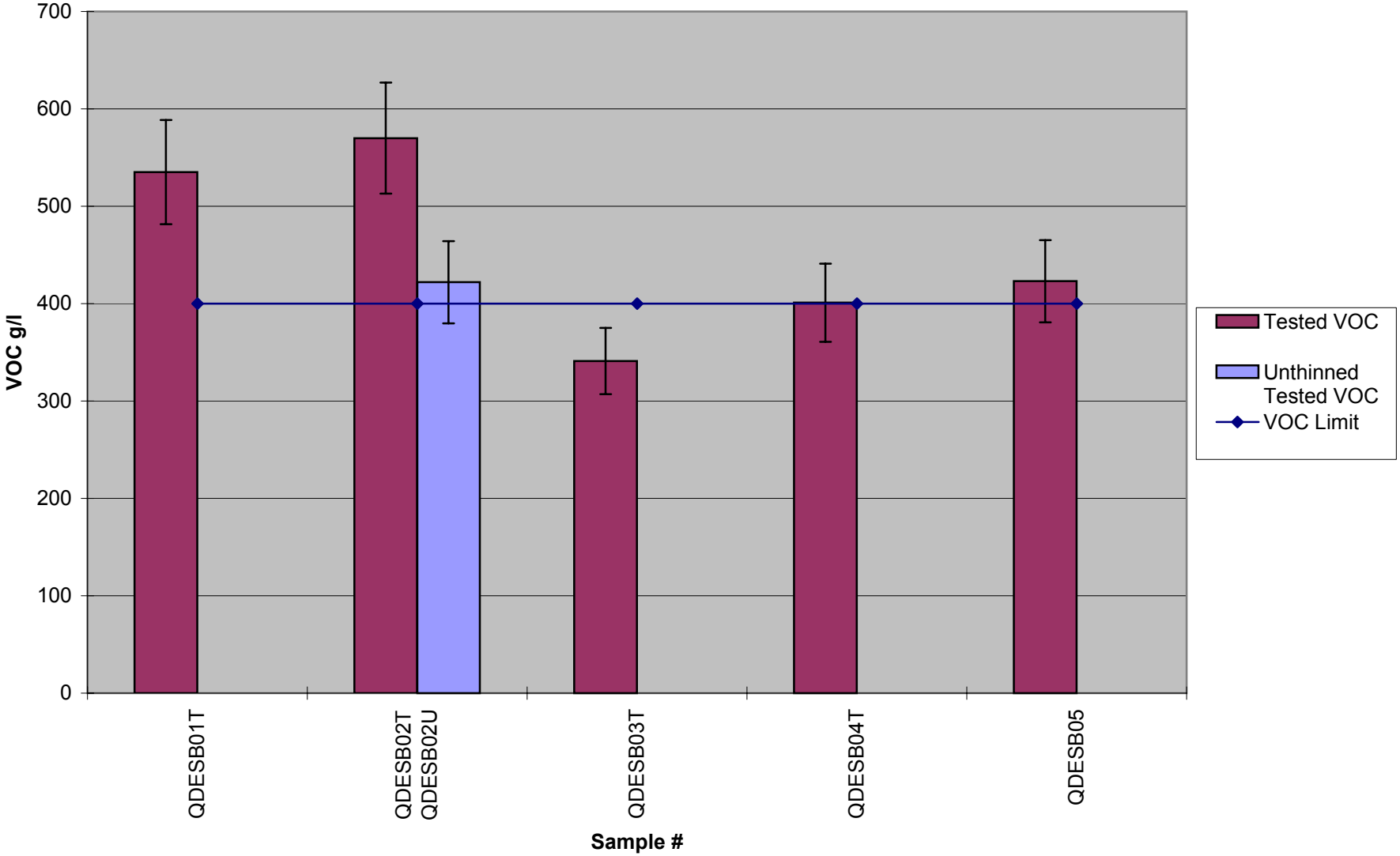


TABLE 24: Quick Dry Enamels

	Total	Compliant	Noncompliant	Average VOC
Coatings	5	3	2	454
WB	0	0	0	N/A
SB	5	3	2	454
SB Thinned	4	2	2	462
SB Unthinned	1	1	0	423

Key: WB: Water-borne; SB: Solvent-borne
Note: 6 total samples were collected. 1 of the SBs collected was collected as thinned and unthinned.

Quick Dry Primers, Sealers, and Undercoaters

Table 25 and Figure 18 show that the five samples of quick dry primers, sealers, and undercoaters were all compliant. All of the quick dry primers, sealers, and undercoaters were solvent-borne with the exception of one sample. Neither of the two thinned samples of quick dry primers, sealers, and undercoaters were found to be excessively thinned. One has to be careful when analyzing this category, because many districts have different limits for quick dry primers, sealers, and undercoaters. The limits range from exempt to 350 g/l to 450 g/l to 525 g/l. The limits for the specific districts can be seen in Table 1. On Figure 18 the most common district VOC limit of 450 g/l was used for samples that were collected in districts that exempt this category from a limit. There were only two samples of quick dry primers, sealers, and undercoaters collected in the South Coast data, and they were both unthinned and compliant.

TABLE 25: Quick Dry Primers, Sealers, and Undercoaters

	Total	Compliant	Noncompliant	Average VOC
Coatings	5	5	0	414
WB	1	1	0	354
SB	4	4	0	428
SB Thinned	2	2	0	444
SB Unthinned	2	2	0	414

Key: WB: Water-borne; SB: Solvent-borne
Note: 7 total samples were collected. 2 of the SBs collected were collected as thinned and unthinned.

Traffic Paints

There were no thinned samples of traffic paints collected. This was also a small category with only seven samples collected, with four being water-borne and three being solvent-borne. None of the solvent-borne samples were found to be out of compliance. Table 26 and Figure 19 contain the data and results for traffic paints. These results are consistent with those found in the South Coast data for traffic paints.

Figure 18: VOC of Quick Dry Primers, Sealers, and Undercoaters Statewide

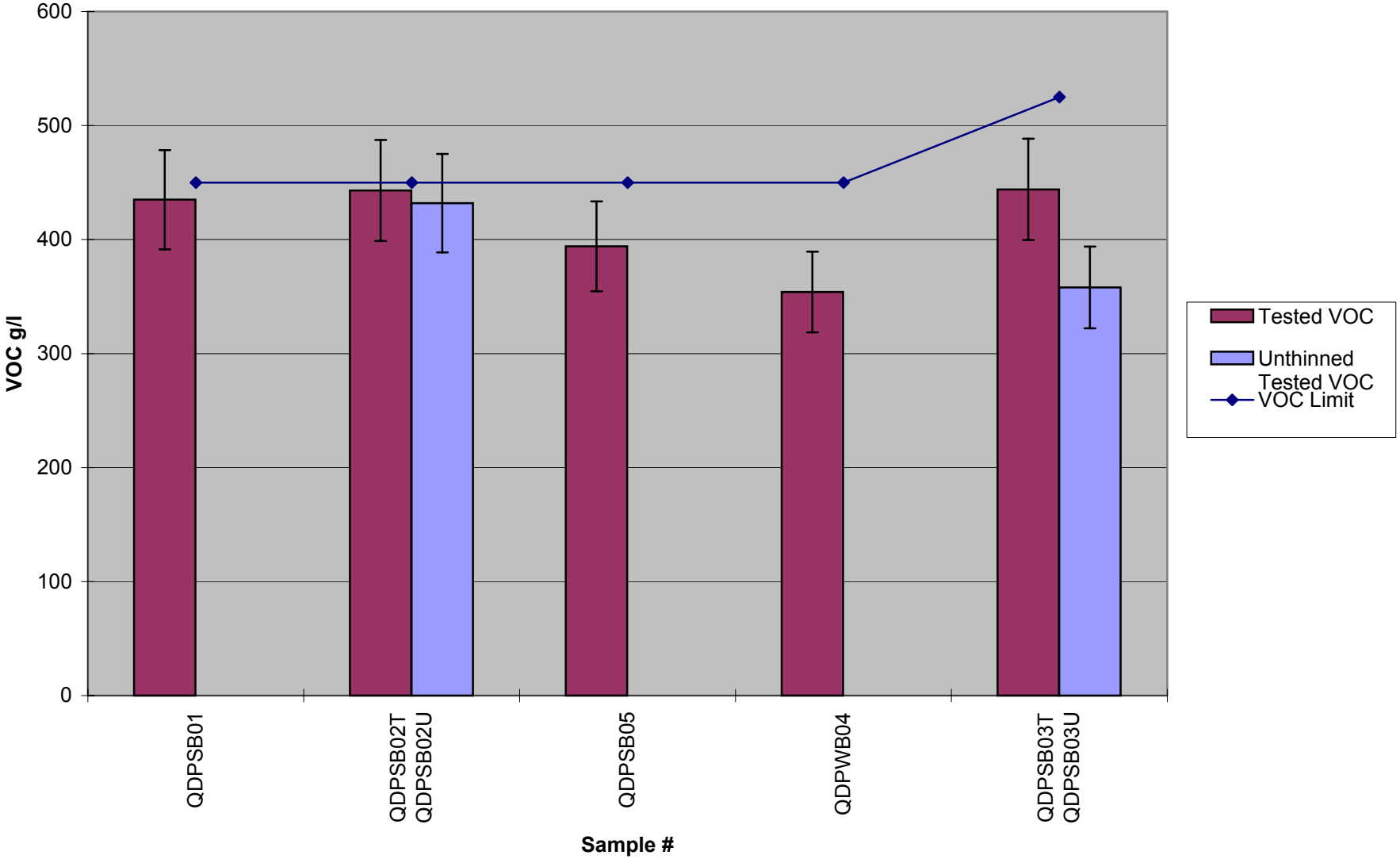


Figure 19: VOC of Traffic Paints Statewide

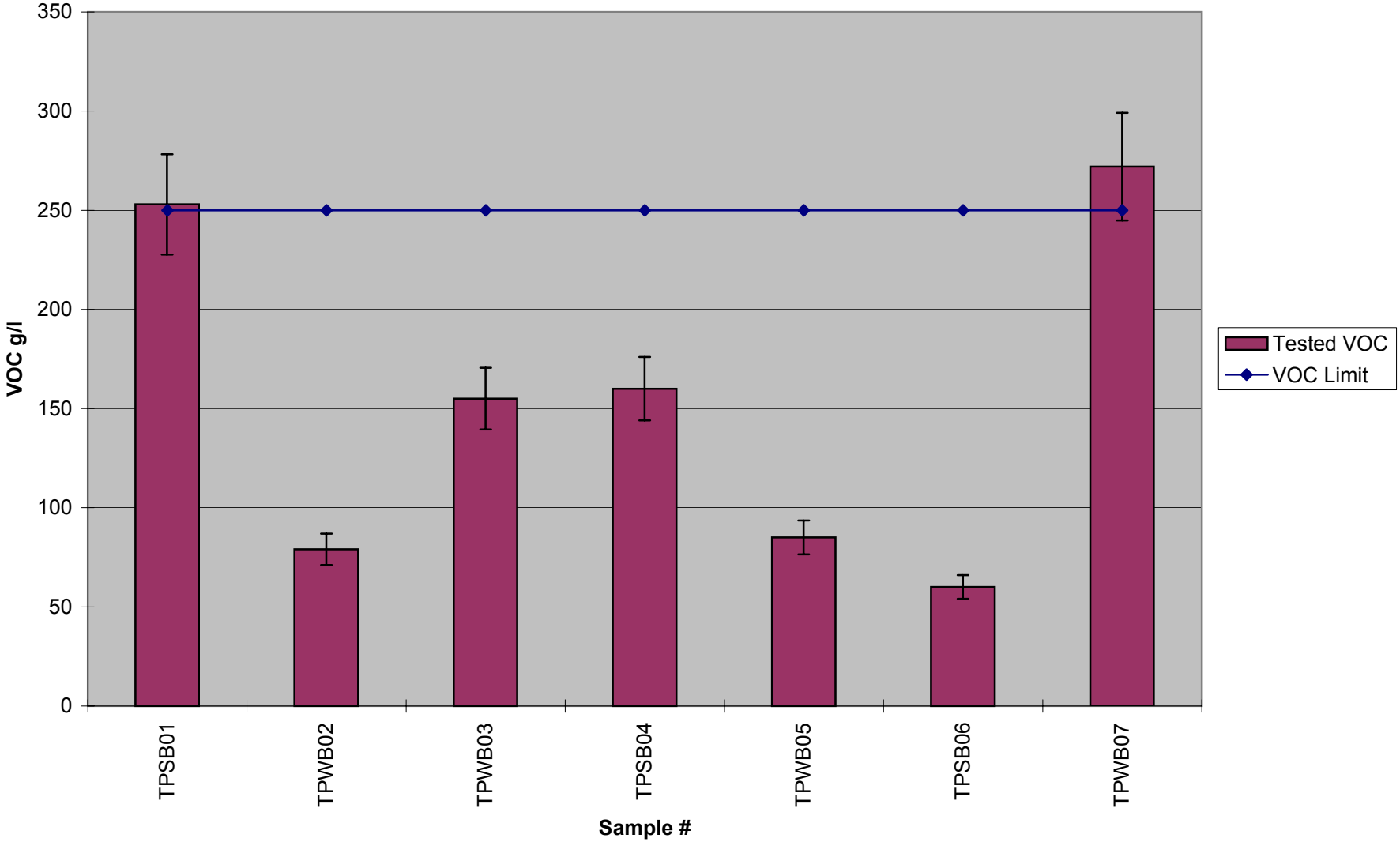


TABLE 26: Traffic Paints

	Total	Compliant	Noncompliant	Average VOC
Coatings	7	7	0	152
WB	4	4	0	148
SB	3	3	0	157
SB Thinned	0	0	0	N/A
SB Unthinned	3	3	0	157

Key: WB: Water-borne; SB: Solvent-borne
Note: 7 total samples were collected. 0 of the SBs collected were collected as thinned and unthinned.

Opaque Stains, Semi-transparent Stains, and Varnishes

Opaque stains, semi-transparent stains, and varnishes were classified together because there were only five samples among the three categories. One of the solvent-borne varnishes and one of the solvent-borne opaque stains were thinned. Both opaque stains and the semi-transparent stain were found to be out of compliance, while both varnishes were compliant. The one water-borne opaque stain sample was found to have an unusually high VOC content. After reviewing this sample further, it was found that it had an extremely low volume solids content for a water-borne coating. This results in an unusually high "less water" VOC content. Because of the small number of samples, no conclusions can be made about each category, but each will contribute to the overall statewide data. Table 27, Table 28, Table 29, and Figure 20 contain the results and the data for these three categories. The South Coast data also contained a sparse number of samples for these three categories.

TABLE 27: Opaque Stains

	Total	Compliant	Noncompliant	Average VOC
Coatings	2	0	2	625
WB	1	0	1	644
SB	1	0	1	606
SB Thinned	1	0	1	606
SB Unthinned	0	0	0	N/A

Key: WB: Water-borne; SB: Solvent-borne
Note: 2 total samples were collected. 0 of the SBs collected were collected as thinned and unthinned.

TABLE 28: Semi-transparent Stains

	Total	Compliant	Noncompliant	Average VOC
Coatings	1	0	1	679
WB	0	0	0	N/A
SB	1	0	1	679
SB Thinned	0	0	0	N/A
SB Unthinned	1	0	1	679

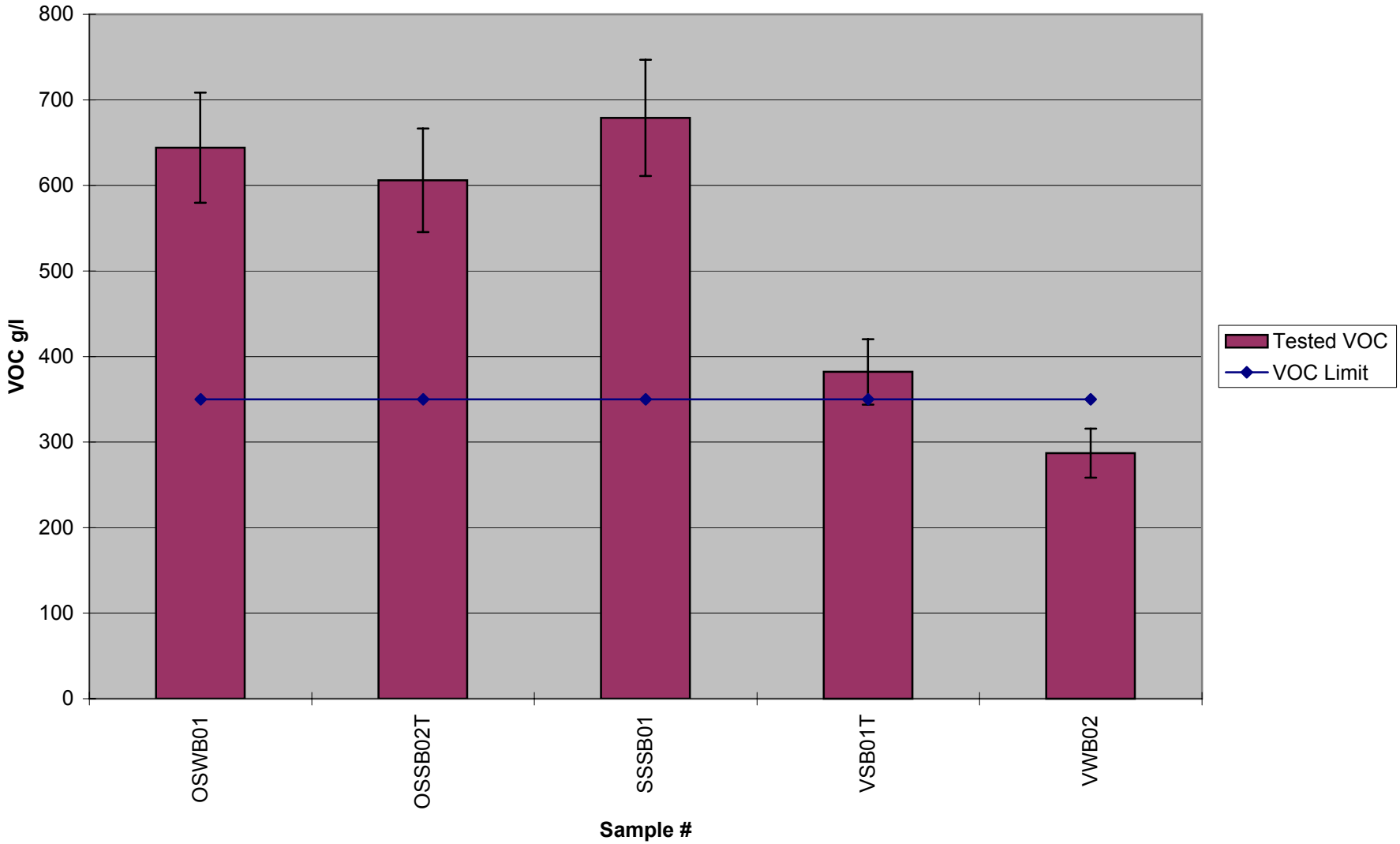
Key: WB: Water-borne; SB: Solvent-borne
Note: 1 total samples were collected. 0 of the SBs collected were collected as thinned and unthinned.

TABLE 29: Varnishes

	Total	Compliant	Noncompliant	Average VOC
Coatings	2	2	0	335
WB	1	1	0	287
SB	1	1	0	382
SB Thinned	1	1	0	382
SB Unthinned	0	0	0	N/A

Key: WB: Water-borne; SB: Solvent-borne
Note: 2 total samples were collected. 0 of the SBs collected were collected as thinned and unthinned.

Figure 20: VOC of Opaque Stains, Semi-transparent Stains, and Varnishes Statewide



V. CONCLUSIONS

The results of this study suggest that there is not a significant amount of excessive thinning of architectural coatings resulting in noncompliance. Thirty-six percent of the coatings sampled were solvent-borne. Fifty-three percent of these were thinned with material containing VOCs. However, of all of the solvent-borne coatings, only 11 percent were thinned to noncompliance with district rules, and only six percent were thinned out of compliance with low VOC limits (350 g/l or less). Twenty of the solvent-borne coatings collected were collected as thinned and unthinned. These results showed that out of the 20 coatings, 13 were thinned within compliance and seven were thinned out of compliance. Overall, thinned noncompliant coatings represent only five percent of all the coatings sampled.

Some members of the architectural coating industry are concerned that the thickness of low VOC solvent-borne paints will lead to increased thinning, and thus offset the emission reductions of the low VOC paints. However, the category with the most thinned coatings in this study was lacquers, which has one of the highest VOC limits. In addition, both the ARB and the South Coast data show that quick dry enamels had the highest percentage of thinned noncompliant coatings at 24 percent. Quick dry enamels also have a high limit of 400 g/l, which also goes against some of the industry's claims that low VOC paints are being thinned out of compliance. Unlike quick dry enamels, the rest of the high VOC limit paints (i.e. >350 g/l VOC limit products) were not excessively thinned. Industrial maintenance coatings, lacquers, lacquer sanding sealers and quick dry primers, sealers, and undercoaters had a six percent thinned noncompliant percentage, which was far lower than that of quick dry enamels. Approximately 71 percent of the thinned samples in this study came from industrial maintenance coatings, lacquers, lacquer sanding sealers, quick dry enamels and quick dry primers, sealers, and undercoaters, which are considered the higher end limits with limits greater than 350 g/l.

The results of this study seem to show that most of the thinning is occurring in the categories with the higher VOC limits, and that the lower VOC limit categories are not being thinned to the point of noncompliance. Thus, the data gathered in this study do not support the claim of some members of industry that low VOC coatings are excessively thinned.

Primers, sealers, and undercoaters, opaque stains, semi-transparent stains and varnishes had the next lowest VOC limit at 350 g/l. There were only five total samples collected for opaque stains, semitransparent stains, and varnishes, so no proper determinations can be made about thinning in those three categories. In the category of primers, sealers and undercoaters, two of the 18 samples taken were thinned out of compliance and one water-borne sample was noncompliant without thinning. Combined with the South Coast data, a total of 41 samples were tested and only nine of those were thinned. Of those nine, only four were noncompliant.

A majority (64 percent) of the coatings sampled were water-borne. This is significant because it confirms that a large number of the paints being used are water-borne. Thinning of water-borne paints has no impact on the VOC content because water-borne paints are thinned with water. Flats, non flats, and traffic paints have the lowest VOC limits at 250 g/l. These three categories were found to be 95 percent water-borne in this study. The results of the water-borne coatings showed that 88 percent of flats, non flats and traffic paints were found to be compliant. These

numbers suggest that a large number of acceptable products are available that are low VOC. There were 13 water-borne coatings that were found to have unusually high VOC contents for waterborne coatings. After reviewing these coatings further, all of them were found to have these high VOC contents due to either having nearly two or three times the average amount of VOC by volume than the average water-bornes in those categories, or due to having very low amounts of solids. Both of these factors tend to result in unusually high "less water" VOC contents.

Thus, the study shows that many of the low VOC coatings are not being thinned as often as the higher VOC coatings. The number of thinned coatings in categories with 250 g/l and 350 g/l VOC limits is 10, and the number of thinned coatings in categories with VOC limits higher than 350 g/l is 24. These numbers are significant because there were 125 samples gathered in the categories with 250 g/l and 350 g/l VOC limits, while only 52 samples were collected for the categories with VOC limits higher than 350 g/l. This means only eight percent of the lower VOC products (i.e., 250 g/l and 350 g/l VOC limit products) were thinned in this study, while 46 percent of the higher VOC products (i.e., >350 g/l VOC limit products) were thinned. Thus, the results from this report are contrary to the assertions made by some members of the architectural coating industry that the low VOC limit products will cause contractors and painters to thin products out of compliance. Based on data gathered from this report, low VOC limits are not causing architectural coatings to be thinned out of compliance.

VI. REFERENCES

1. Air Resources Board, *Field Investigation on Thinnning Practices During the Application of Architectural Coatings in Selected Districts in California*, December 1991

2. Woodward-Clyde, *VOC studies for Rules 1113/1129 prepared by Woodward-Clyde Consultants for the South Coast Air Quality Management Distrct*, March 1993

3. David A. Leehy & Associates, *Survey of Field Thinning as Practiced by Professional Architectural Coating Applicators prepared by David A. Leehy & Associates for the Environmental Legislative & Regulatory Advocacy Program of the Southern California Paint & Coatings Association*, September 1996

4. U.S. E.P.A, *Method 24 - Determination of Volatile Matter Content, Water Content, Density, Volume Solids, and Weight Solids of Surface Coatings*, July 1992

5. Air Resources Board, *ARB Method 310-Determination of Volatile Organic Compounds in Consumer Products*, September 1997

6. Air Resources Board. Environmental Impact Report. *Suggested Control Measure for Architectural Coatings,* June 2000

APPENDIX A

SOUTH COAST SAMPLING DATA

Lab #	SC Report #	Category	WB	SB	Thinned	Listed VOC	VOC Limit	Tested VOC	Within Limit (+\- 10%)
	Not in Report	Flat/Non Flat?	☑	☐	☐		250	130	☑
91456-06-001 MR96-0052	Not in Report	Flat/Non Flat?	☑	☐	☐		250	130	☑
92126-02B	Not in Report	Flat/Non Flat?	☑	☐	☐		250	90	☑
91456-07-002 MR96-0053	Not in Report	Flat/Non Flat?	☑	☐	☐		250	170	☑
91496-05-002 MR96-0054	Not in Report	Flat/Non Flat?	☑	☐	☐		250	80	☑
91496-07-001 MR96-0055	Not in Report	Flat/Non Flat?	☑	☐	☐		250	130	☑
91806-08B	Not in Report	Other	☐	☐	☐		420	<50	☑
91806-08A	Not in Report	Other	☐	☐	☐		420	<50	☑
91796-04A	Not in Report	Flat/Non Flat?	☑	☐	☐		250	170	☑
91796-04B	Not in Report	Flat/Non Flat?	☑	☐	☐		250	160	☑
91996-01B	Not in Report	Flat/Non Flat?	☑	☐	☐		250	140	☑
91376-01-012 MR96-0046	Not in Report	Flat/Non Flat?	☑	☐	☐		250	120	☑
92006-06C	Not in Report	Other	☐	☐	☐			370	☐
91456-07-001 MR96-0053	Not in Report	Flat/Non Flat?	☑	☐	☐		250	130	☑
91287-01-001	Not in Report	Flat/Non Flat?	☐	☐	☐		250	90	☑
92216-05B	Not in Report	Flat/Non Flat?	☑	☐	☐		250	70	☑
92216-02	Not in Report	Flat/Non Flat?	☑	☐	☐		250	150	☑
92906-05G	Not in Report	Flat/Non Flat?	☑	☐	☐		250	170	☑
91227-03-001	Not in Report	Flat/Non Flat?	☐	☐	☐		250	80	☑
92906-05H	Not in Report	Flat/Non Flat?	☑	☐	☐		250	150	☑
92916-04	Not in Report	Flat/Non Flat?	☐	☑	☐	700-800	250	220	☑
93126-02	Not in Report	Flat/Non Flat?	☑	☐	☐		250	120	☑
93526-02A	Not in Report	Flat/Non Flat?	☑	☐	☐		250	240	☑
93526-02B	Not in Report	Flat/Non Flat?	☑	☐	☐		250	200	☑
90037-04A	Not in Report	Flat/Non Flat?	☐	☐	☐	250	250	150	☑
91036-02-001	Not in Report	Other	☐	☑	☑		350	380	☑
91176-05-002	Not in Report	Other	☐	☐	☐				☐
91426-07-007 MR96-0048	Not in Report	Other	☐	☐	☐			760	☐
92947-04-001	Not in Report	Other	☐	☐	☐		500	440	☑
91036-02-002	Not in Report	Other	☐	☑	☐		350	330	☑
91516-08-003	Not in Report	Flat/Non Flat?	☐	☑	☐		250	350	☐

Lab #	SC Report #	Category	WB	SB	Thinned	Listed VOC	VOC Limit	Tested VOC	Within Limit (+\- 10%)
91146-12-001	Not in Report	Other	☐	☐	☐				☐
91146-12-003	Not in Report	Other	☐	☐	☐				☐
91146-12-002	Not in Report	Other	☐	☐	☐		350	370	☑
91496-05-001 MR96-0054	Not in Report	Flat/Non Flat?	☑	☐	☐		250	190	☐
91146-12-005	Not in Report	Other	☐	☐	☐				☐
92178-03-001	Not in Report	Flat/Non Flat?	☐	☐	☐	250	250	170	☑
91156-16-001	Not in Report	Other	☑	☐	☐		250	100	☑
91376-01-004 MR96-0046	Not in Report	Flat/Non Flat?	☐	☐	☐		250	90	☑
91376-01-008 MR96-0046	Not in Report	Flat/Non Flat?	☑	☐	☐		250	210	☑
91218-08-001	Not in Report	Industrial Maintenance	☐	☐	☑		420		☐
92006-06D	Not in Report	Other	☐	☐	☐			180	☐
91376-01-011 MR96-0046	Not in Report	Flat/Non Flat?	☑	☐	☐		250	120	☑
91146-12-004	Not in Report	Other	☐	☐	☐				☐
90787-05-001	SCF01	Flat	☐	☐	☐	250	250	130	☑
91106-05-001	SCF02	Flat	☑	☐	☐		250	80	☑
91456-04-001 MR96-0050	SCF03	Flat	☑	☐	☐		250	140	☑
90037-05-001	SCF04	Flat	☐	☐	☐	250	250	230	☑
91106-02-001	SCF05	Flat	☑	☐	☐		250	80	☑
91106-04-001	SCF06	Flat	☑	☐	☐		250	130	☑
90667-02-001	SCF07	Flat	☐	☐	☐	250	250	170	☑
91106-06-001	SCF08T	Flat	☑	☐	☑		250	200	☑
90717-01-001	SCF09	Flat	☐	☐	☐	250	250	90	☑
90997-01-001	SCF10	Flat	☐	☐	☐	250	250	150	☑
91017-08-001	SCF11	Flat	☐	☐	☐	250	250	150	☑
91106-01-001	SCF12	Flat	☑	☐	☐		250	110	☑
91426-08-001 MR96-0049	SCF13	Flat	☑	☐	☐		250	200	☑
91376-01-014 MR96-0046	SCF14	Flat	☑	☐	☐		250	50	☑
90727-01-001	SCF15	Flat	☐	☐	☐	51	250	80	☑
92206-02	SCF16	Flat	☑	☐	☐		250	160	☑
91996-01A	SCF17	Flat	☑	☐	☐	250	250	230	☑
91156-14-001	SCF18	Flat	☑	☐	☐		250	80	☑

Lab #	SC Report #	Category	WB	SB	Thinned	Listed VOC	VOC Limit	Tested VOC	Within Limit (+\- 10%)
91156-11-001	SCF19	Flat	☑	☐	☐		250	370	☐
91156-10-002	SCF20	Flat	☑	☐	☐		250	50	☑
91156-10-001	SCF21	Flat	☑	☐	☐		250	130	☑
92126-02A	SCF22	Flat	☑	☐	☐		250	100	☑
91106-07-001	SCF23	Flat	☑	☐	☐		250	120	☑
91506-01-001 MR96-0058	SCF24	Flat	☑	☐	☐		250	100	☑
91207-02-001	SCF25	Flat	☐	☐	☐	250	250	110	☑
91496-10-001 MR96-0057	SCF26	Flat	☑	☐	☐		250	230	☑
92216-06B	SCF27	Flat	☑	☐	☐		250	240	☑
91496-08-001 MR96-0056	SCF28	Flat	☑	☐	☐		250	60	☑
92906-05A	SCF29	Flat	☑	☐	☐	76	250	160	☑
92906-05B	SCF30	Flat	☑	☐	☐	75	250	130	☑
90247-11-001	SCF31	Flat	☐	☐	☐	250	250	120	☑
92906-05F	SCF32	Flat	☑	☐	☐		250	140	☑
91156-05-001	SCF33	Flat	☑	☐	☐		250	160	☑
91096-02-001	SCF34	Flat	☑	☐	☐		250	230	☑
91166-05-001	SCF35	Flat	☑	☐	☐		250	130	☑
91096-06-001	SCF36	Flat	☑	☐	☐		250	120	☑
91096-11-001	SCF37	Flat	☑	☐	☐		250	170	☑
91096-13-001	SCF38	Flat	☑	☐	☐		250	190	☑
91096-15-001	SCF39	Flat	☑	☐	☐		250	160	☑
91376-01-006 MR96-0046	SCF40	Flat	☑	☐	☐		250	110	☑
91096-04-001	SCF41	Flat	☑	☐	☐		250	170	☑
91357-03-003	SCF42	Flat	☐	☐	☐		250	170	☑
91176-02-001	SCF43	Flat	☑	☐	☐		250	120	☑
91297-01-002	SCF44	Flat	☐	☐	☐		250	290	☐
91086-07-001	SCF45	Flat	☑	☐	☐		250	<50	☑
91267-07-001	SCF46	Flat	☐	☐	☐	250	250	220	☑
91227-02-001	SCF47	Flat	☑	☐	☐		250	110	☑
91516-08-002	SCF48	Flat	☑	☐	☐		250	200	☑
91357-03-001	SCIM01T	Industrial Maintenance	☐	☐	☑		420	420	☑

Lab #	SC Report #	Category	WB	SB	Thinned	Listed VOC	VOC Limit	Tested VOC	Within Limit (+\- 10%)
91637-08	SCIM02	Industrial Maintenance	☐	☐	☐		420	260	☑
91096-19-002	SCIM03	Industrial Maintenance	☑	☐	☐		420	240	☑
91617-05-001	SCIM04	Industrial Maintenance	☐	☐	☐		420	370	☑
91357-03-002	SCIM05	Industrial Maintenance	☐	☐	☐		420	410	☑
91376-01-005 MR96-0046	SCIM06	Industrial Maintenance	☐	☑	☐		420	370	☑
90848-04-003	SCIM07	Industrial Maintenance	☐	☐	☐		420	330	☑
90647-10-001	SCIM08	Industrial Maintenance	☐	☐	☐	340	420	220	☑
91176-05-003	SCIM09	Industrial Maintenance	☐	☑	☐		420	400	☑
92986-04	SCIM10	Industrial Maintenance	☑	☐	☐	136	420	140	☑
91096-19-001	SCIM11	Industrial Maintenance	☐	☑	☐		420	420	☑
90147-02-001	SCIM12	Industrial Maintenance	☐	☐	☐	250	420	470	☐
92906-05E	SCIM13	Industrial Maintenance	☑	☐	☐	250	420	250	☑
92906-05D	SCIM14	Industrial Maintenance	☐	☑	☐	420	420	430	☑
91637-11-001	SCIM15T	Industrial Maintenance	☐	☑	☑	420	420	440	☑
91376-01-010 MR96-0046	SCIM16	Industrial Maintenance	☐	☑	☐		420	410	☑
91617-05-002	SCIM17	Industrial Maintenance	☐	☐	☐		420	380	☑
91767-02-001	SCIM18	Industrial Maintenance	☐	☐	☐	138	420	220	☑
91637-10-001	SCIM19	Industrial Maintenance	☐	☐	☐	420	420	420	☑
92137-05-001	SCIM20	Industrial Maintenance	☐	☐	☐		420	350	☑
92317-04-001	SCIM21	Industrial Maintenance	☑	☐	☐		420	<50	☑
91516-08-004 MR96-0059	SCL01	Lacquer	☐	☑	☐		680	690	☑
91516-08-001 MR96-0059	SCL02	Lacquer	☐	☑	☐		680	670	☑
93546-06	SCL03	Lacquer	☐	☐	☐	680	680	710	☑
91096-02-003	SCL04	Lacquer	☐	☑	☐		680	640	☑
90718-05A	SCL05	Lacquer	☐	☐	☐	680	680	670	☑
92136-03B	SCL06	Lacquer	☐	☑	☐		680	620	☑
92986-06A	SCL07T	Lacquer	☐	☑	☑	680	680	670	☑
91106-08-001	SCL08T	Lacquer	☐	☑	☑		680	630	☑
91106-08-002	SCL09	Lacquer	☐	☑	☐		680	580	☑
92986-06B	SCLSS01	Lacquer Sanding Sealer	☐	☐	☐		680	700	☑
91096-02-002	SCLSS02	Lacquer Sanding Sealer	☐	☑	☐		680	690	☑

Lab #	SC Report #	Category	WB	SB	Thinned	Listed VOC	VOC Limit	Tested VOC	Within Limit (+\- 10%)
91096-03-002	SCLSS03	Lacquer Sanding Sealer	☐	☑	☐		680	690	☑
91137-13-001	SCLSS04	Lacquer Sanding Sealer	☐	☐	☐	680	680	720	☑
90037-04B	SCLSS05	Lacquer Sanding Sealer	☐	☐	☐	680	680	700	☑
92006-01	SCNF01	Non Flat	☑	☐	☐		250	160	☑
92006-07A	SCNF02	Non Flat	☐	☑	☐		250	260	☑
91096-14-001	SCNF03	Non Flat	☑	☐	☐		250	160	☑
91456-05-001 MR96-0051	SCNF04	Non Flat	☑	☐	☐		250	50	☑
91166-02-003	SCNF05	Non Flat	☑	☐	☐		250	50	☑
92006-07B	SCNF06T	Non Flat	☐	☑	☑		250	340	☐
91156-12-001	SCNF07	Non Flat	☑	☐	☐		250	260	☑
91166-02-004	SCNF08	Non Flat	☑	☐	☐		250	260	☑
92016-01B	SCNF09	Non Flat	☑	☐	☐		250	200	☑
92216-06A	SCNF10	Non Flat	☑	☐	☐		250	190	☑
92006-06B	SCNF11	Non Flat	☑	☐	☐		250	190	☑
92216-03	SCNF12	Non Flat	☑	☐	☐		250	340	☐
91376-01-001 MR96-0046	SCNF13	Non Flat	☑	☐	☐		250	110	☑
91376-01-001	SCNF14	Non Flat	☑	☐	☐		250	240	☑
91767-02-003	SCNF15	Non Flat	☐	☐	☐	104	250	160	☑
92216-05A	SCNF16	Non Flat	☑	☐	☐		250	160	☑
91568-02-001	SCOS01	Opaque Stain	☐	☐	☐	653	350	610	☐
91096-05-002	SCOS02	Opaque Stain	☑	☐	☐		350	100	☑
90718-05B	SCOS03	Opaque Stain	☐	☐	☐	653	350	640	☐
91176-05-001	SCPSU01	Primer, Sealer, & Undercoater	☐	☑	☐		350	320	☑
91096-04-002	SCPSU02	Primer, Sealer, & Undercoater	☑	☐	☐		350	160	☑
91096-05-001	SCPSU03	Primer, Sealer, & Undercoater	☐	☑	☐		350	380	☑
91096-05-003	SCPSU04	Primer, Sealer, & Undercoater	☐	☑	☐		350	320	☑
91096-20-002	SCPSU05	Primer, Sealer, & Undercoater	☐	☑	☐		350	320	☑
91096-20-001	SCPSU06T	Primer, Sealer, & Undercoater	☐	☑	☑		350	380	☑
93596-02	SCPSU07	Primer, Sealer, & Undercoater	☐	☐	☐	350	350	400	☐
92136-03A	SCPSU08	Primer, Sealer, & Undercoater	☐	☑	☐		350	340	☑
92056-07	SCPSU09	Primer, Sealer, & Undercoater	☑	☐	☐		350	60	☑

Lab #	SC Report #	Category	WB	SB	Thinned	Listed VOC	VOC Limit	Tested VOC	Within Limit (+\- 10%)
92016-01A	SCPSU10	Primer, Sealer, & Undercoater	☑	☐	☐		350	120	☑
92178-03-002	SCPSU11	Primer, Sealer, & Undercoater	☐	☐	☐	250	350	180	☑
92906-05C	SCPSU12	Primer, Sealer, & Undercoater	☑	☐	☐	62	350	<50	☑
92016-02	SCPSU13	Primer, Sealer, & Undercoater	☑	☐	☐		350	100	☑
90807-01-001	SCPSU14	Primer, Sealer, & Undercoater	☐	☐	☐	350	350	330	☑
92897-07-001	SCPSU15	Primer, Sealer, & Undercoater	☐	☐	☐		350	90	☑
92178-01-001	SCPSU16T	Primer, Sealer, & Undercoater	☐	☑	☑	350	350	420	☐
91376-01-003 MR96-0046	SCPSU17	Primer, Sealer, & Undercoater	☐	☐	☐		350	340	☑
92006-06A	SCPSU18	Primer, Sealer, & Undercoater	☑	☐	☐		350	60	☑
91166-02-002	SCPSU19	Primer, Sealer, & Undercoater	☑	☐	☐		350	100	☑
91166-02-001	SCPSU20	Primer, Sealer, & Undercoater	☑	☐	☐		350	130	☑
91087-02-001	SCPSU21T	Primer, Sealer, & Undercoater	☐	☑	☑	350	350	410	☐
91767-02-002	SCPSU22	Primer, Sealer, & Undercoater	☐	☐	☐	350	350	120	☑
91996-02	SCPSU23	Primer, Sealer, & Undercoater	☐	☐	☐	<420	350	70	☑
90087-04-001	SCQDE01	Quick Dry Enamel	☐	☐	☐		400	400	☑
92916-03A	SCQDE02T	Quick Dry Enamel	☐	☑	☑		400	480	☐
91297-01-001	SCQDE03	Quick Dry Enamel	☐	☑	☐		400	400	☑
91096-03-001	SCQDE04T	Quick Dry Enamel	☐	☑	☑		400	460	☐
93546-05	SCQDE05	Quick Dry Enamel	☐	☐	☐	400	400	430	☑
92916-03B	SCQDE06T	Quick Dry Enamel	☐	☑	☑		400	420	☑
91106-09-001	SCQDE07	Quick Dry Enamel	☐	☑	☐		400	420	☑
91106-09-002	SCQDE08T	Quick Dry Enamel	☐	☑	☑		400	440	☑
91376-01-013 MR96-0046	SCQDE09	Quick Dry Enamel	☐	☑	☐		400	380	☑
91146-12-006	SCQDE10T	Quick Dry Enamel	☐	☑	☑		400	420	☑
91146-12-007	SCQDE11	Quick Dry Enamel	☐	☑	☐		400	380	☑
91156-09-001	SCQDE12	Quick Dry Enamel	☐	☑	☐		400	400	☑
92056-06	SCQDE13	Quick Dry Enamel	☐	☑	☐		400	440	☑
91156-13-001	SCQDE14	Quick Dry Enamel	☐	☑	☐		400	400	☑
92006-03	SCQDE15	Quick Dry Enamel	☐	☑	☐		400	460	☐
91166-04-001	SCQDE16	Quick Dry Enamel	☐	☑	☐		400	440	☑
91376-01-009 MR96-0046	SCQDP01	Quick Dry Primer, Sealer, & Undercoater	☐	☑	☐		450	440	☑

Lab #	SC Report #	Category	WB	SB	Thinned	Listed VOC	VOC Limit	Tested VOC	Within Limit (+\- 10%)
91146-11-001	SCQDP02	Quick Dry Primer, Sealer, & Undercoater	☐	☑	☐		450	410	☑
91996-03	SCQDP03T	Quick Dry Primer, Sealer, & Undercoater	☐	☑	☑	700	450	470	☑
90848-05-001	SCSS01	Semi-transparent Stain	☐	☐	☐	348	350	340	☑
91897-02-001	SCSS02	Semi-transparent Stain	☐	☐	☐	350	350	450	☐
91227-01-001	SCTP01	Traffic Paint	☑	☐	☐	<100	250	130	☑
92178-02-001	SCTP02	Traffic Paint	☐	☐	☐	150	250	160	☑
92996-08	SCTP03	Traffic Paint	☐	☐	☐	100	250	140	☑
91156-15-001	SCTP04	Traffic Paint	☑	☐	☐		250	110	☑
91376-01-002 MR96-0046	SCTP05	Traffic Paint	☑	☐	☐		250	170	☑
91287-02-001	SCTP06	Traffic Paint	☐	☐	☐		250	170	☑
91376-01-007 MR96-0046	SCV01	Varnish	☐	☑	☐		350	400	☐
92737-07-001	SCWP01	Waterproofing Sealer	☐	☐	☐	672	400	670	☐
91148-02-003	SCWP02	Waterproofing Sealer	☐	☐	☐	400	400	600	☐
91148-02-002	SCWP03	Waterproofing Sealer	☐	☐	☐	350	400	660	☐
91148-02-001	SCWP04	Waterproofing Sealer	☐	☐	☐	350	400	660	☐
90448-04A	SCWP05	Waterproofing Sealer	☐	☐	☐		400	690	☐
90448-04B	SCWP06	Waterproofing Sealer	☐	☐	☐		400	710	☐
92757-05-001	SCWP07	Waterproofing Sealer	☐	☐	☐	600	400	710	☐
90147-02-002	SCWP08	Waterproofing Sealer	☐	☐	☐	250	400	470	☐
92767-14-001	SCWP09	Waterproofing Sealer	☐	☐	☐		400	60	☑

APPENDIX B

SAMPLING PROTOCOL

Peter M. Rooney

Secretary for Environmental Protection

Pete Wilson

Governor

Sampling Protocol

1. General Overview

The purpose of this study is to evaluate the extent of thinning of solvent-borne architectural coatings that is occurring during their application. It will also examine the differences in volatile organic compound (VOC) content of different coatings throughout the state. Proper laboratory analysis is dependent upon the integrity of the sample. Samples will be analyzed primarily for VOC content.

2. Sampling Procedures

Coating Observation Forms, *Laboratory Request and Sample Transfer Forms*, sample containers, sample labels and seals will be provided by Air Resources Board (ARB) staff.

Samples will be collected of coatings observed being applied. Samples will also be collected of solvent-borne coatings that have been thinned prior to application.

For any unthinned coating sampled previously within the District, it is not necessary to take additional samples. The application of any such coating should still be noted on the *Coating Observation Form*.

Samples will be taken in the presence of a District and/or ARB employee, unless circumstances dictate otherwise.

All samples collected will be labeled and sealed immediately using ARB supplied containers, labels and seals.

Whenever possible, obtain a copy of the Material Safety Data Sheet (MSDS) and/or coating label from an empty coating container for each sample collected and submitted.

Any time the sample changes hands, the person relinquishing the sample and the person receiving the sample must sign and date the *Laboratory Request and Sample Transfer Form*.

Delivery to the ARB laboratory will be arranged by ARB staff.

3. Sampling Methods

All coating containers from which samples will be obtained should be thoroughly mixed prior to sample collection.

Samples of coatings as supplied should be obtained from an unopened container of coating. All thinned solvent borne coating samples, except for two-part or three-part catalyzed coatings, will be sampled both as they are supplied (before thinning) and as they are applied (from the spray pot or applicator).

Pre-mixed polyurethane coatings will not be sampled.

In the case of a catalyzed coating, all components should be sampled separately and the mix ratio noted in the comment area of the *Laboratory Request and Sample Transfer Form.* For **each** catalyzed coating, use a new *Laboratory Request and Sample Transfer Form*. Do not include any other coatings on a *Laboratory Request and Sample Transfer Form* containing a catalyzed coating.

The sample must be clearly labeled and sealed with an ARB supplied label and seal.

Ensure that sample container is tightly sealed upon completion of sampling.

Samples should be stored upside down to reduce possibility of loss of volatile content.

All coating samples should be kept between 40°F and 100°F for storage and transportation.

4. Container Type and Sample Size

All paint samples will be collected in air tight containers supplied by the ARB.

Containers have a volume of 250 ml and are rubber coated amber glass with screw-top seals.

Every effort should be made to minimize the amount of headspace in the sample container. Containers must be filled to greater than 90% of capacity.

5. *Coating Observation Form*

Do not include multiple sites on one form. For each sampling site, use a new form. An example of a completed form is included in Attachment B.

Section 1:

Indicate the project name (job site), address (or nearest crossstreets), and type of site or facility. Type of site or facility should be as descriptive as possible. Indicate the name of the company (painting contractor), company address, phone number, coating applicator and their years of experience. Also, indicate the name of the person obtaining the sample, date and time of sampling, air pollution control district from where the sample was obtained and weather conditions.

Section 2:

Note in this section each coating observed being applied at the site. For each coating being applied (Coating I, Coating II, etc.), complete the area included within the heavy black lines in this section.

Coating Category - indicate the coating category using one of the following:

01-Lacquers
02-Stains (Semi-transparent)
03-Stains (Opaque)
04-Flats
05-Non-flats
06-Quick dry enamels
07-Industrial maintenance
08-Primers, sealers, and undercoaters
09-Quick dry primers, sealers, and undercoaters
10-Traffic paints
11-Varnishes
12-Waterproofing sealers
13-Sanding sealers
14-Other

Manufacturer Name - indicate the name of the coating manufacturer.

Product Name - indicate the name of the coating product.

Product Code - indicate the manufacturer's product code.

Carrier Type - indicate the carrier technology used in the coating.

Multi-Component - indicate whether the coating is a catalytic multi-component coating.

Thinned Coating - indicate whether the coating has been thinned prior to application.

Tint Added - indicate whether the coating has been tinted (ex., custom color, tint base, tinted clear coat).

Sample Obtained - indicate whether a sample of the coating was obtained.

Listed VOC - indicate the VOC content as stated on the coating label.

Resin Type - indicate the type of resin used in the coating.

Paint Type - indicate whether the coating is interior, exterior, or both.

Substrate Types - indicate the types of substrates to which the coating is being applied.

Application Methods - indicate the types of coating applicators being used for the coating.

Thinning Study Sample Number - follow the numbering scheme described in Attachment A.

Thinner Types - indicate the type of thinner used.

Recommended Thinning Ratio - indicate the recommended thinning ratio as noted by the coating manufacturer. If a maximum and/or minimum thinning ratio are noted, indicate this also.

Actual Thinning Ratio - indicate the actual thinning ratio used as applied.

Clean-up Solvent - indicate the type of solvents used for equipment clean up.

Amount of Clean-up Solvent - indicate, on a per gallon of coating basis, the amount of solvents used for equipment clean up.

6. Laboratory Request and Sample Transfer Form

If this form contains a catalyzed coating, be sure to note the mix ratio in the comments sections at the bottom of the form. An example of a completed form is included in Attachment C.

Section 1:

Indicate the name of the individual obtaining the sample, as well as the district from which the sample was obtained. Also, enter the date the sample(s) were collected. Up to five samples (non-catalyzed) may be submitted per form. All other fields should be left blank.

For catalyzed coatings, use one form per coating and do not include any other coatings on this form.

Section 2:

Laboratory Sample Number - Leave this field blank.

Thinning Study Sample Number - indicate the number assigned on the *Coating Observation Form*.

Coating Category - indicate the coating category using one of the following

01-Lacquers	08-Primers, sealers, and undercoaters
02-Stains (Semi-transparent)	09-Quick dry primers, sealers, and undercoaters
03-Stains (Opaque)	10-Traffic paints
04-Flats	11-Varnishes
05-Non-flats	12-Waterproofing sealers
06-Quick dry enamels	13-Sanding sealers
07-Industrial maintenance	14-Other

Catalytic Coating - indicate (Y or N) in the upper left portion of the box whether the coating is a multi-component coating. If a multi-component coating, indicate the number of components in the lower right hand portion of the box.

Sample Description - describe the sample in detail, giving product name, product code and color.

VOC Regulatory - Leave this field blank.

Section 3

Samples will be taken in the presence of a District and/or ARB employee, unless circumstances dictate otherwise.

All persons who handle the sample must sign the form. It is important that the chain of custody be maintained.

APPENDIX C

COATING OBSERVATION FORM

Air Resources Board

ARCHITECTURAL COATINGS THINNING STUDY

COATING OBSERVATION FORM

FOR ARB USE ONLY

SECTION 1 - Application Information

Project Name (Job Site):	Project Address (or nearest cross streets):		Type of Site/Facility:
Company Name (Painting Contractor):	Company Address:		Contact Phone No.:
Applicator:	Years of Experience:	Date/Time:	APCD:
Conducted by:	Reviewed by:	Page _____ of _____	Weather Conditions: ☐ Clear Sky ☐ Cloudy ☐ Rainy ☐ Hot ☐ Dry ☐ Humid

SECTION 2 - Coating Information

COATING I

Coating Category	Manufacturer Name	Product Name	Product Code	Carrier Type	Multi-Component	Thinned Coating	Tint Added	Sample Obtained
				☐Solvent ☐Water	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No

Listed VOC Content	Resin Type	Paint Type	Substrate Types	Application Methods	Thinning Study Sample No.	Thinner	Recommended Thinning Ratio	Actual Thinning Ratio	Clean-up Solvent	Amount of Clean-up Solvent
	☐Acrylic ☐Alkyd ☐Urethane ☐Epoxy ☐Vinyl ☐Other _____	☐Exterior ☐Interior ☐Both	☐Dry Wall ☐Wood Trim ☐Stucco ☐Masonry ☐Cabinets ☐Doors ☐Concrete ☐Other _____	☐Brushing ☐Rolling ☐Airless ☐Air-Assisted ☐Other _____	---------- ----------					

COATING II

Coating Category	Manufacturer Name	Product Name	Product Code	Carrier Type	Multi-Component	Thinned Coating	Tint Added	Sample Obtained
				☐Solvent ☐Water	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No

Listed VOC Content	Resin Type	Paint Type	Substrate Types	Application Methods	Thinning Study Sample No.	Thinner	Recommended Thinning Ratio	Actual Thinning Ratio	Clean-up Solvent	Amount of Clean-up Solvent
	☐Acrylic ☐Alkyd ☐Urethane ☐Epoxy ☐Vinyl ☐Other _____	☐Exterior ☐Interior ☐Both	☐Dry Wall ☐Wood Trim ☐Stucco ☐Masonry ☐Cabinets ☐Doors ☐Concrete ☐Other _____	☐Brushing ☐Rolling ☐Airless ☐Air-Assisted ☐Other _____	---------- ----------					

COATING III

Coating Category	Manufacturer Name	Product Name	Product Code	Carrier Type	Multi-Component	Thinned Coating	Tint Added	Sample Obtained
				☐Solvent ☐Water	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No

Listed VOC Content	Resin Type	Paint Type	Substrate Types	Application Methods	Thinning Study Sample No.	Thinner	Recommended Thinning Ratio	Actual Thinning Ratio	Clean-up Solvent	Amount of Clean-up Solvent
	☐Acrylic ☐Alkyd ☐Urethane ☐Epoxy ☐Vinyl ☐Other _____	☐Exterior ☐Interior ☐Both	☐Dry Wall ☐Wood Trim ☐Stucco ☐Masonry ☐Cabinets ☐Doors ☐Concrete ☐Other _____	☐Brushing ☐Rolling ☐Airless ☐Air-Assisted ☐Other _____	---------- ---------- ----------					

COATING IV

Coating Category	Manufacturer Name	Product Name	Product Code	Carrier Type	Multi-Component	Thinned Coating	Tint Added	Sample Obtained
				☐Solvent ☐Water	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No

Listed VOC Content	Resin Type	Paint Type	Substrate Types	Application Methods	Thinning Study Sample No.	Thinner	Recommended Thinning Ratio	Actual Thinning Ratio	Clean-up Solvent	Amount of Clean-up Solvent
	☐Acrylic ☐Alkyd ☐Urethane ☐Epoxy ☐Vinyl ☐Other _____	☐Exterior ☐Interior ☐Both	☐Dry Wall ☐Wood Trim ☐Stucco ☐Masonry ☐Cabinets ☐Doors ☐Concrete ☐Other _____	☐Brushing ☐Rolling ☐Airless ☐Air-Assisted ☐Other _____	---------- ---------- ----------					

COATING V

Coating Category	Manufacturer Name	Product Name	Product Code	Carrier Type	Multi-Component	Thinned Coating	Tint Added	Sample Obtained
				☐Solvent ☐Water	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No	☐Yes ☐No

Listed VOC Content	Resin Type	Paint Type	Substrate Types	Application Methods	Thinning Study Sample No.	Thinner	Recommended Thinning Ratio	Actual Thinning Ratio	Clean-up Solvent	Amount of Clean-up Solvent
	☐Acrylic ☐Alkyd ☐Urethane ☐Epoxy ☐Vinyl ☐Other _____	☐Exterior ☐Interior ☐Both	☐Dry Wall ☐Wood Trim ☐Stucco ☐Masonry ☐Cabinets ☐Doors ☐Concrete ☐Other _____	☐Brushing ☐Rolling ☐Airless ☐Air-Assisted ☐Other _____	---------- ---------- ----------					

Other Comments and Problems Noted by Inspector:

APPENDIX D

LABORATORY REQUEST AND SAMPLE TRANSFER FORM

Air Resources Board

ARCHITECTURAL COATINGS THINNING STUDY

LABORATORY REQUEST AND SAMPLE TRANSFER FORM

SECTION 1

Sample Obtained by: _____

Date Sample Obtained: _____

Sample Submitted by: _____

Phone Number of Submitter: _____

Submitting Facility: _____

Address: _____

_____

_____

Priority: _____

Total No. of Samples Submitted: _____

Date Submitted: _____

Date Results Returned: _____

District:
- ☐ Bay Area AQMD
- ☐ Mojave Desert AQMD
- ☐ Placer County APCD
- ☐ Sacramento Metropolitan AQMD
- ☐ San Diego County APCD
- ☐ San Joaquin Valley Unified APCD
- ☐ Ventura County APCD
- ☐ Yolo/Solano AQMD
- ☐ Other _____

SECTION 2

Laboratory Sample Number	Thinning Study Sample Number	Coating Category	Catalytic Coating	Sample Description	VOC Regulatory

SECTION 3

Sample Transfer: Record	I certify that I RELINQUISHED custody of the samples listed:	I certify that I RECEIVED custody of the samples listed:	This transfer occurred on: Date	Time
First Transfer:				
Second Transfer:				
Third Transfer:				
Fourth Transfer:				
Fifth Transfer:				
Sixth Transfer:				

Comments: _____

_____

_____

_____

APPENDIX E

ARB SAMPLING DATA

Lab#	Sample #	Report #	Category	WB	SB	Thinned	Listed VO	VOC Limi	Tested VO	Within Limit (+/- 10
9800015	SJ70T	Exempt	Opaque Stains	☐	☑	☑		350	828	☐
9800015	SJ70U	Exempt	Opaque Stains	☐	☑	☐		350	824	☐
9800014	BA01	FWB01	Flat	☑	☐	☐	200	250	72	☑
9800014	BA02	FWB02	Flat	☑	☐	☐	90	250	130	☑
9800014	BA03	FWB03T	Flat	☑	☐	☑	110	250	25	☑
9800014	BA04	FWB04	Flat	☑	☐	☐	121	250	122	☑
9800014	BA07	FWB05T	Flat	☑	☐	☑	90	250	66	☑
9800014	BA12	FWB06	Flat	☑	☐	☐	110	250	84	☑
9800014	BA27	FWB07	Flat	☑	☐	☐	250	250	98	☑
9800014	BA33	FWB08	Flat	☑	☐	☐	200	250	103	☑
9800015	BA50	FWB09	Flat	☑	☐	☐	98	250	91	☑
9800015	BA56	FWB10	Flat	☑	☐	☐	200	250	88	☑
9800015	BA59	FWB11	Flat	☑	☐	☐	50	250	123	☑
9800015	BA67	FWB12	Flat	☑	☐	☐	125	250	158	☑
9800015	BA68	FWB13T	Flat	☑	☐	☑	90	250	62	☑
9800012	PC01	FWB14	Flat	☑	☐	☐	125	250	179	☑
9800012	PC02	FWB15	Flat	☑	☐	☐	121	250	176	☑
9800012	PC03	FWB16T	Flat	☑	☐	☑	90	250	175	☑
9800012	PC04	FWB17	Flat	☑	☐	☐	100	250	189	☑
9800012	PC05	FWB18	Flat	☑	☐	☐	100	250	260	☑
9800012	PC08	FWB19	Flat	☑	☐	☐	127	250	284	☐
9800012	PC09	FWB20	Flat	☑	☐	☐	100	250	212	☑
9800012	PC11	FWB21T	Flat	☑	☐	☑	250	250	300	☐
9800014	SD02	FWB22	Flat	☑	☐	☐	250	250	190	☑
9800014	SD06	FWB23T	Flat	☑	☐	☑	250	250	324	☐
9800014	SD07	FWB24	Flat	☑	☐	☐	250	250	202	☑
9800014	SD12	FWB25	Flat	☑	☐	☐	250	250	232	☑
9800014	SD15	FWB26T	Flat	☑	☐	☑	250	250	268	☑

Lab#	Sample #	Report #	Category	WB	SB	Thinned	Listed VO	VOC Limi	Tested VO	Within Limit (+/- 10
9800014	SD19	FWB27	Flat	☑	☐	☐	250	250	244	☑
9800014	SD20	FWB28T	Flat	☑	☐	☑	250	250	230	☑
9800014	SD22	FWB29T	Flat	☑	☐	☑	250	250	243	☑
9800013	SJ01	FWB30T	Flat	☑	☐	☑	250	250	196	☑
9800013	SJ03	FWB31	Flat	☑	☐	☐	250	250	116	☑
9800013	SJ06	FWB32	Flat	☑	☐	☐	200	250	53	☑
9800013	SJ16	FWB33	Flat	☑	☐	☐	124	250	122	☑
9800013	SJ18	FWB34T	Flat	☑	☐	☑	0	250	0	☑
9800015	SJ50	FWB35T	Flat	☑	☐	☑	150	250	1	☑
9800015	SJ56	FWB36	Flat	☑	☐	☐	250	250	5	☑
9800015	SJ60	FWB37	Flat	☑	☐	☐	200	250	81	☑
9800015	SJ65	FWB38	Flat	☑	☐	☐		250	146	☑
9800015	SJ69	FWB39	Flat	☑	☐	☐	250	250	1	☑
9800012	SM04	FWB40	Flat	☑	☐	☐	150	250	225	☑
9800012	SM06	FWB41	Flat	☑	☐	☐	64	250	159	☑
9800012	SM08	FWB42	Flat	☑	☐	☐	51	250	175	☑
9800012	SM09	FWB43	Flat	☑	☐	☐		250	370	☐
9800012	SM11	FWB44	Flat	☑	☐	☐	110	250	83	☑
9800012	SM13	FWB45	Flat	☑	☐	☐	120	250	119	☑
9800012	SM16	FWB46	Flat	☑	☐	☐	260	250	306	☐
9800012	SM19	FWB47	Flat	☑	☐	☐	150	250	216	☑
9800013	SM21	FWB48	Flat	☑	☐	☐	250	250	165	☑
9800013	SM23	FWB49	Flat	☑	☐	☐	170	250	143	☑
9800013	VC03	FWB50T	Flat	☑	☐	☑	250	250	170	☑
9800013	VC05	FWB51	Flat	☑	☐	☐	49	250	349	☐
9800013	VC10	FWB52	Flat	☑	☐	☐	250	250	202	☑
9800013	VC13	FWB53T	Flat	☑	☐	☑	250	250	211	☑
9800014	VC19	FWB54T	Flat	☑	☐	☑	250	250	212	☑

Lab#	Sample #	Report #	Category	WB	SB	Thinned	Listed VO	VOC Limi	Tested VO	Within Limit (+/- 10
9800012	YS01	FWB55T	Flat	☑	☐	☑	127	No Limit	306	☐
9800012	YS08	FWB56	Flat	☑	☐	☐	100	No Limit	133	☑
9800012	YS10	FWB57	Flat	☑	☐	☐	90	No Limit	163	☑
9800012	YS11	FWB58T	Flat	☑	☐	☑	121	No Limit	87	☑
9800012	YS12	FWB59	Flat	☑	☐	☐	110	No Limit	193	☑
9800015	BA51	IMSB02	Industrial Mainte	☐	☑	☐	420	420	397	☑
9800014	SD03T	IMSB04T	Industrial Mainte	☐	☑	☑	420	420	429	☑
9800014	SD03U	IMSB04U	Industrial Mainte	☐	☑	☐	420	420	431	☑
9800014	SD05T	IMSB05T	Industrial Mainte	☐	☑	☑	420	420	478	☐
9800014	SD05U	IMSB05U	Industrial Mainte	☐	☑	☐	420	420	442	☑
9800014	SD14	IMSB06	Industrial Mainte	☐	☑	☐	420	420	418	☑
9800014	SD17	IMSB07	Industrial Mainte	☐	☑	☐	420	420	395	☑
9800013	SJ09	IMSB08	Industrial Mainte	☐	☑	☐	340	340	319	☑
9800013	SJ11	IMSB09	Industrial Mainte	☐	☑	☐	420	340	366	☑
9800015	SJ73T	IMSB11T	Industrial Mainte	☐	☑	☑	340	340	393	☐
9800015	SJ73U	IMSB11U	Industrial Mainte	☐	☑	☐	340	340	330	☑
9800012	SM03	IMSB12	Industrial Mainte	☐	☑	☐		340	657	☐
9800012	SM12	IMSB13	Industrial Mainte	☐	☑	☐	420	340	370	☑
9800012	SM17	IMSB14	Industrial Mainte	☐	☑	☐		340	322	☑
9800013	VC06T	IMSB15T	Industrial Mainte	☐	☑	☑	420	420	351	☑
9800013	VC06U	IMSB15U	Industrial Mainte	☐	☑	☐	420	420	317	☑
9800013	VC08T	IMSB16T	Industrial Mainte	☐	☑	☑	420	420	437	☑
9800013	VC08U	IMSB16U	Industrial Mainte	☐	☑	☐	420	420	361	☑
9800013	VC11T	IMSB17T	Industrial Mainte	☐	☑	☑	420	420	640	☐
9800013	VC11U	IMSB17U	Industrial Mainte	☐	☑	☐	420	420	404	☑
9800014	BA31	IMWB01	Industrial Mainte	☑	☐	☐	199	420	245	☑
9800015	BA58	IMWB03	Industrial Mainte	☑	☐	☐	250	420	198	☑
9800015	SJ64	IMWB10	Industrial Mainte	☑	☐	☐	250	340	220	☑

Lab#	Sample #	Report #	Category	WB	SB	Thinned	Listed VO	VOC Limi	Tested VO	Within Limit (+/- 10
9800012	YS07	IMWB18	Industrial Mainte	☑	☐	☐	172	No Limit	405	☑
9800014	BA05	LSB01	Lacquer	☐	☑	☐	680	680	667	☑
9800015	BA60	LSB02	Lacquer	☐	☑	☐	680	680	675	☑
9800015	BA69T	LSB03T	Lacquer	☐	☑	☑	680	680	665	☑
9800015	BA71	LSB04	Lacquer	☐	☑	☐	680	350	674	☑
9800014	SD04T	LSB05T	Lacquer	☐	☑	☑	600	680	661	☑
9800014	SD04U	LSB05U	Lacquer	☐	☑	☐	600	680	610	☑
9800014	SD09T	LSB06T	Lacquer	☐	☑	☑	680	680	723	☑
9800014	SD09U	LSB06U	Lacquer	☐	☑	☐	680	680	681	☑
9800013	SJ07T	LSB07T	Lacquer	☐	☑	☑	620	680	691	☑
9800013	SJ07U	LSB07U	Lacquer	☐	☑	☐	620	680	653	☑
9800013	SJ08T	LSB08T	Lacquer	☐	☑	☑	680	680	624	☑
9800013	SJ08U	LSB08U	Lacquer	☐	☑	☐	680	680	705	☑
9800015	SJ55T	LSB09T	Lacquer	☐	☑	☑	600	680	443	☑
9800015	SJ58T	LSB10T	Lacquer	☐	☑	☑	680	680	666	☑
9800015	SJ61T	LSB11T	Lacquer	☐	☑	☑		680	682	☑
9800015	SJ68	LSB12	Lacquer	☐	☑	☐	680	680	669	☑
9800015	SJ72T	LSB13T	Lacquer	☐	☑	☑	667	680	734	☑
9800015	SJ72U	LSB13U	Lacquer	☐	☑	☐	667	680	670	☑
9800013	VC17T	LSB14T	Lacquer	☐	☑	☑	680	680	662	☑
9800013	VC17U	LSB14U	Lacquer	☐	☑	☐	680	680	632	☑
9800012	YS03	LSB15	Lacquer	☐	☑	☐	669	No Limit	665	☑
9800014	BA06	LSSSB01	Lacquer Sanding	☐	☑	☐	680	680	673	☑
9800015	BA61	LSSSB02	Lacquer Sanding	☐	☑	☐	680	680	700	☑
9800015	BA62	LSSSB03	Lacquer Sanding	☐	☑	☐	680	680	700	☑
9800014	SD10	LSSSB04	Lacquer Sanding	☐	☑	☐	680	680	696	☑
9800015	SJ53	LSSSB05	Lacquer Sanding	☐	☑	☐	680	680	709	☑
9800015	SJ67	LSSSB06	Lacquer Sanding	☐	☑	☐	680	680	661	☑

Lab#	Sample #	Report #	Category	WB	SB	Thinned	Listed VO	VOC Limi	Tested VO	Within Limit (+/- 10
9800015	SJ71T	LSSSB07	Lacquer Sanding	☐	☑	☑	681	680	708	☑
9800015	SJ71U	LSSSB07	Lacquer Sanding	☐	☑	☐	681	680	690	☑
9800013	VC14T	LSSSB08	Lacquer Sanding	☐	☑	☑	660	680	711	☑
9800012	YS02	LSSSB09	Lacquer Sanding	☐	☑	☐	681	No Limit	675	☑
9800015	BA53T	NFSB09T	Non Flat	☐	☑	☑	250	250	445	☐
9800015	BA53U	NFSB09	Non Flat	☐	☑	☐	250	250	243	☑
9800012	SM01T	NFSB26T	Non Flat	☐	☑	☑	235	250	267	☑
9800014	BA08	NFWB01	Non Flat	☑	☐	☐	250	250	154	☑
9800014	BA09	NFWB02	Non Flat	☑	☐	☑	200	250	274	☑
9800014	BA10	NFWB03	Non Flat	☑	☐	☐	250	250	216	☑
9800014	BA13	NFWB04	Non Flat	☑	☐	☐		250	47	☑
9800014	BA30	NFWB05	Non Flat	☑	☐	☐	150	250	203	☑
9800014	BA34	NFWB06	Non Flat	☑	☐	☐	150	250	114	☑
9800014	BA35	NFWB07	Non Flat	☑	☐	☐	250	250	217	☑
9800015	BA52	NFWB08	Non Flat	☑	☐	☐	150	250	106	☑
9800015	BA54	NFWB10	Non Flat	☑	☐	☐	200	250	166	☑
9800015	BA55	NFWB11	Non Flat	☑	☐	☐	200	250	181	☑
9800015	BA66	NFWB12	Non Flat	☑	☐	☐	250	250	210	☑
9800012	PC06	NFWB13	Non Flat	☑	☐	☐	100	250	218	☑
9800012	PC10	NFWB14	Non Flat	☑	☐	☑	170	250	171	☑
9800014	SD01	NFWB15	Non Flat	☑	☐	☐	250	250	148	☑
9800014	SD08	NFWB16	Non Flat	☑	☐	☐	250	250	203	☑
9800014	SD16	NFWB17	Non Flat	☑	☐	☐	250	250	266	☑
9800013	SJ02	NFWB18	Non Flat	☑	☐	☐	250	250	443	☐
9800013	SJ04	NFWB19	Non Flat	☑	☐	☐	200	250	84	☑
9800013	SJ05	NFWB20	Non Flat	☑	☐	☐	250	250	167	☑
9800013	SJ17	NFWB21	Non Flat	☑	☐	☑	250	250	170	☑
9800015	SJ51	NFWB22	Non Flat	☑	☐	☑		250	52	☑

Lab#	Sample #	Report #	Category	WB	SB	Thinned	Listed VO	VOC Limi	Tested VO	Within Limit (+/- 10
9800015	SJ52	NFWB23	Non Flat	☑	☐	☑	250	250	85	☑
9800015	SJ54	NFWB24	Non Flat	☑	☐	☐	250	250	93	☑
9800015	SJ66	NFWB25	Non Flat	☑	☐	☐	215	250	166	☑
9800012	SM05	NFWB27	Non Flat	☑	☐	☐	200	250	172	☑
9800012	SM10	NFWB28	Non Flat	☑	☐	☑	126	250	154	☑
9800013	SM22	NFWB29	Non Flat	☑	☐	☐	90	250	143	☑
9800013	VC02	NFWB30	Non Flat	☑	☐	☑	200	250	161	☑
9800013	VC09	NFWB31	Non Flat	☑	☐	☑	250	250	404	☐
9800013	VC12	NFWB32	Non Flat	☑	☐	☐	250	250	330	☐
9800013	VC15	NFWB33	Non Flat	☑	☐	☐	200	250	137	☑
9800014	VC20	NFWB34	Non Flat	☑	☐	☑	250	250	248	☑
9800012	YS09	NFWB35	Non Flat	☑	☐	☐	210	No Limit	156	☑
9800013	SM24	NFWB36	Non Flat	☑	☐	☐		250	130	☑
9800013	SJ13	Not in Re	Other	☑	☐	☐		250	72	☑
9800013	VC07	Not in Re	Other	☑	☐	☐	10	300	107	☑
9800013	SJ12	Not in Re	Other	☑	☐	☐	150	250	19	☑
9800015	SJ59T	OSSB02	Opaque Stains	☐	☑	☑	350	350	606	☐
9800015	BA63	OSWB01	Opaque Stains	☑	☐	☐	350	350	644	☐
9800014	BA11	PSUSB0	Primer, Sealers,	☐	☑	☐	350	350	277	☑
9800014	BA28T	PSUSB0	Primer, Sealers,	☐	☑	☑	340	350	338	☑
9800014	BA29T	PSUSB0	Primer, Sealers,	☐	☑	☑	340	350	251	☑
9800014	SD13T	PSUSB0	Primer, Sealers,	☐	☑	☑	350	350	374	☑
9800014	SD13U	PSUSB0	Primer, Sealers,	☐	☑	☐	350	350	360	☑
980456	SJ10A/B	PSUSB0	Primer, Sealers,	☐	☑	☐		350	224	☑
9800015	SJ62T	PSUSB1	Primer, Sealers,	☐	☑	☑	350	350	461	☐
9800015	SJ62U	PSUSB1	Primer, Sealers,	☐	☑	☐	350	350	302	☑
9800012	SM18	PSUSB1	Primer, Sealers,	☐	☑	☐	350	350	325	☑
9800013	VC01	PSUSB1	Primer, Sealers,	☐	☑	☐	350	350	366	☑

Lab#	Sample #	Report #	Category	WB	SB	Thinned	Listed VO	VOC Limi	Tested VO	Within Limit (+/- 10
9800013	VC16T	PSUSB1	Primer, Sealers,	☐	☑	☑	350	350	317	☑
9800014	VC18T	PSUSB1	Primer, Sealers,	☐	☑	☑	350	350	504	☐
9800014	VC18U	PSUSB1	Primer, Sealers,	☐	☑	☐	350	350	360	☑
9800015	BA36	PSUWB0	Primer, Sealers,	☑	☐	☐	250	350	68	☑
9800015	BA57	PSUWB0	Primer, Sealers,	☑	☐	☐	350	350	195	☑
9800015	BA64	PSUWB0	Primer, Sealers,	☑	☐	☐	250	350	134	☑
9800012	PC07	PSUWB0	Primer, Sealers,	☑	☐	☐	86	350	523	☐
9800015	SJ57	PSUWB1	Primer, Sealers,	☑	☐	☐	200	350	1	☑
9800015	SJ74	PSUWB1	Primer, Sealers,	☑	☐	☐	250	350	30	☑
9800012	SM07	PSUWB1	Primer, Sealers,	☑	☐	☐	250	350	57	☑
9800013	SM20	PSUWB1	Primer, Sealers,	☑	☐	☐	450	350	37	☑
9800014	SD18T	QDESB0	Quick Dry Enam	☐	☑	☑	400	400	535	☐
9800014	SD21T	QDESB0	Quick Dry Enam	☐	☑	☑	400	400	570	☐
9800014	SD21U	QDESB0	Quick Dry Enam	☐	☑	☐	400	400	422	☑
9800015	SJ63T	QDESB0	Quick Dry Enam	☐	☑	☑		400	341	☑
9800014	VC21T	QDESB0	Quick Dry Enam	☐	☑	☑	400	400	401	☑
9800012	YS04	QDESB0	Quick Dry Enam	☐	☑	☐	400	No Limit	423	☑
9800015	BA65	QDPSB0	Quick Dry Primer	☐	☑	☐	450	No Limit	435	☑
9800015	BA70T	QDPSB0	Quick Dry Primer	☐	☑	☑	450	No Limit	443	☑
9800015	BA70U	QDPSB0	Quick Dry Primer	☐	☑	☐	450	No Limit	432	☑
9800014	SD11T	QDPSB0	Quick Dry Primer	☐	☑	☑	420	525	444	☑
9800014	SD11U	QDPSB0	Quick Dry Primer	☐	☑	☐	420	525	358	☑
9800013	VC04	QDPSB0	Quick Dry Primer	☐	☑	☐	450	No Limit	394	☑
9800013	SJ15	QDPWB0	Quick Dry Primer	☑	☐	☐	400	450	354	☑
9800014	BA26	SSSB01	Semi-transparent	☐	☑	☐		350	679	☐
9800013	SJ14	TPSB01	Traffic Paints	☐	☑	☐	250	250	253	☑
9800012	SM14	TPSB04	Traffic Paints	☐	☑	☐	150	250	160	☑
9800012	YS05	TPSB06	Traffic Paints	☐	☑	☐	150	No Limit	60	☑

Lab#	Sample #	Report #	Category	WB	SB	Thinned	Listed VO	VOC Limi	Tested VO	Within Limit (+/- 10
9800013	SJ19	TPWB02	Traffic Paints	☑	☐	☐	150	250	79	☑
9800012	SM02	TPWB03	Traffic Paints	☑	☐	☐	150	250	155	☑
9800012	SM15	TPWB05	Traffic Paints	☑	☐	☐	150	250	85	☑
9800012	YS06	TPWB07	Traffic Paints	☑	☐	☐	250	No Limit	272	☑
9800014	BA25T	VSB01T	Varnish	☐	☑	☑	350	350	382	☑
9800014	BA32	VWB02	Varnish	☑	☐	☐	300	350	287	☑