

LABORATORY REPORTS AND RATING CRITERIA
FOR THE PROFICIENCY ANALYTICAL TESTING (PAT) PROGRAM

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June 1990

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DHHS(NIOSH) Publication No. 91-102

ABSTRACT

The Proficiency Analytical Testing (PAT) Program is a collaborative effort of the American Industrial Hygiene Association (AIHA) and the National Institute for Occupational Safety and Health (NIOSH). The PAT Program provides quality control reference samples to over 1500 occupational health and environmental laboratories in over 15 countries. Although one objective of the PAT Program is to evaluate the analytical ability of participating laboratories, the primary objective is to assist participating laboratories in improving analytical performance.

NIOSH's Division of Physical Sciences and Engineering, Monitoring and Control Research Branch, Quality Assurance Section provides the data and statistical analysis for the PAT Program as well as provides technical assistance to ensure the quality of the Program. This protocol describes the procedures used to evaluate data from laboratories, and consists of three parts. Part I contains a general description of the PAT Program; Part II explains how various statistics provided to participants are calculated; and Part III contains an example and explanation of the laboratory performance report provided to participants.

ABBREVIATIONS

PAT	Proficiency Analytical Testing
AIHA	American Industrial Hygiene Association
NIOSH	National Institute for Occupational Safety and Health
Ref Lab	Reference Laboratory
Lab ID	Laboratory Identification
Z score	Difference of the laboratory's reported result and the reference mean value, divided by the reference standard deviation
Reptd	Reported
RSD	Relative Standard Deviation
SD	Standard Deviation
HI	High
LO	Low
BNZ	Benzene
CFM	Chloroform
CTC	Carbon Tetrachloride
DCE	1,2-Dichloroethane
HEX	Hexane
MCL	Methylene Chloride
MCM	Methyl Chloroform
MEK	Methyl Ethyl Ketone
MIK	Methyl Isobutyl Ketone
OCT	Octane
OXY	o-Xylene
PCE	Tetrachloroethylene
PDX	p-Dioxane
TCE	Trichloroethylene
TOL	Toluene

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ACKNOWLEDGMENTS

We want to thank Kenneth Busch and William Crouse who assisted in the development of the statistical procedures used. We especially thank Sue Nowlin of PRI, Annapolis, MD, for developing the computer programs.

INTRODUCTION

In 1972, the Occupational Safety and Health Administration (OSHA) Target Health Hazards Program (THHP), (outlined in OSHA Program Directive #72-1, January 3, 1972), was aimed at detecting possible health hazards from asbestos, cotton dust, silica, lead, and carbon monoxide. The resulting problems encountered by state and federal laboratories performing the OSHA compliance sample analyses for THHP made a collaborative proficiency testing program a necessity. The National Institute for Occupational Safety and Health (NIOSH) was given the responsibility for developing and implementing this collaborative proficiency testing program. By May 1972, NIOSH initiated the Proficiency Analytical Testing (PAT) Program and distributed the first proficiency samples to ten government laboratories.

The PAT Program initially consisted of four lead filter samples, four silica filter samples, and blanks, with asbestos filter samples added soon thereafter. The sample mix of metals, silica, asbestos, and organic solvents was finalized in 1974. New individual analytes, various sample matrices, and improved generation methods have been added since then.

With an ever increasing number of laboratories participating in the PAT Program, there has been a continual need to improve and update the data and statistical analysis of the Program. This statistical protocol describes the procedures used to evaluate laboratories and provides explanations and examples of the statistics used and of the reports sent to participating laboratories. All statistical procedures have been performed and reports have been prepared using SAS[®] (SAS Institute Inc., Cary, NC) programming language.

PART I: General Description

Reference Samples

Each quarter sample kits are mailed to participating laboratories and data are analyzed to evaluate performance on a series of industrial hygiene analyses. Each mailing and subsequent data analysis is referred to as a round. Each round is completed in time for participants to obtain repeat samples and to correct analytical problems before the next round starts.

The reference samples included in a kit are designed to cover a variety of analytical methods used by laboratories and include some contaminants in which analytical agreement is poor. As of October 1990, the program includes four sets of samples: metals (a combination of three of the following: cadmium, chromium, lead, zinc), silica, asbestos, and organic solvents (a combination of one, two or three of the following: benzene, carbon tetrachloride, chloroform, 1,2 dichloroethane, hexane, methylene chloride, methyl chloroform, methyl ethyl ketone, methyl isobutyl ketone, octane, p-dioxane, toluene, tetrachloroethylene, trichloroethylene, and o-xylene). The metals and organics are rotated from the above list for each round. Additional metals and organics will be included in the future.

The reference sample concentrations are randomly selected from the measurement ranges stated in NIOSH methods (1) or from ranges found to have acceptable reference sample homogeneity from previous experience in generating reference samples.(2) In the case of asbestos, reference sample concentrations may be above the fiber density range observed at abatement sites in order to expand the range of concentrations used to challenge laboratories. Each contaminant set consists of four concentration levels and a blank. The organic solvent set also includes five blank charcoal tubes for desorption efficiency determination.

Participant Procedures

Each participating laboratory in the PAT Program is required to analyze and submit results for all sets which are similar to the analytical workload of the laboratory. The results for each contaminant set must be complete (4 values reported) or the laboratory will not be rated. This insures that all participants are rated over the entire concentration range for that round. The analyst for a given contaminant set should change each round so that all analysts performing similar field analyses are eventually evaluated. In this way, the PAT Program is a laboratory proficiency program, not an individual analyst certification program. PAT Program participants are instructed to use analytical methods identical to or as similar as possible to the methods routinely used to analyze field samples. Also, the PAT Program is not designed to replace a laboratory's internal quality control program. Internal controls such as spiked samples, calibration checks, and duplicate samples routinely run with field samples should be run with PAT samples so that the effectiveness of the internal quality control system can be evaluated.

Evaluation of Laboratories

Laboratories are statistically evaluated on the current round. This involves the establishment of acceptable performance limits or an acceptable concentration range for each PAT Program sample. Each reported value is then determined to be either acceptable, (i.e., within designated performance limits), or an outlier, (i.e., outside designated performance limits).

The calculation of acceptable performance limits involves four steps.

The first step is to identify the analytical results reported by a preselected group of reference laboratories. Reference laboratories are selected to ensure that performance limits are based upon the results of laboratories that have good performance records. Reference laboratories meet the following criteria: 1) The laboratory was rated proficient in the previous PAT round for all PAT contaminants, and; 2) The laboratory, if located in the United States, is AIHA accredited.

In 1990, approximately 100 laboratories in the PAT Program analyzed all PAT analytes to potentially qualify as a reference laboratory. Of these 100 laboratories, a little over 5% were eliminated from consideration as a reference laboratory because of previous PAT performance and one quarter were eliminated because the laboratory was not AIHA accredited.

The second step is the treatment of reference laboratory data which appears to be inconsistent with the remainder of that set of data. Mistakes in analysis or in reporting results (especially those mistakes

which result in order of magnitude errors) substantially affect estimates of central tendency and dispersion unless treated.⁽³⁾ Reference laboratory data are Winsorized. Winsorization involves the ranking of reference laboratory results for each PAT sample. Those reference laboratory results which fall in the top 5 percent of results are replaced by a value equal to the highest result remaining in the set. Similarly, those results which fall in the bottom 5 percent of results are replaced by a value equal to the lowest result remaining in the set. Unlike other approaches, the extreme observation is not eliminated, but is adjusted.⁽⁴⁾

To use reference laboratory data without any modification requires one to assume that reference laboratories never make mistakes. If reference laboratory data involving mistakes are not treated, then the standard deviation estimate will be inflated and the performance limits will be too wide. One problem with outlier tests is that it is not always easy to distinguish between outliers (values obtained due to mistakes) and extreme values which are extreme merely due to random chance. Since Winsorization adjusts suspected outliers rather than eliminating them (unlike other outlier tests), there is less risk that the standard deviation will be underestimated and performance limits too narrow if some data are inadvertently treated as outliers when no mistakes have actually occurred.

The third step is used only for non-symmetric distributions of data. Silica and asbestos exhibit such distributions. To obtain approximately normal distributions, the Winsorized reference data for silica and asbestos are transformed. Statistical theory for the normal distribution is well developed and only a small percentage of the results by PAT laboratories will be determined to be an outlier by random chance if the distribution is approximately normal. The silica data are transformed by taking logarithms,⁽⁵⁾ whereas asbestos data are transformed by taking square roots.⁽⁶⁾

The fourth step is the calculation of reference laboratory means and standard deviations using Winsorized data. The reference value equals the mean, and the performance limits equal the mean \pm 3 standard deviations. For silica and asbestos, means and standard deviations are calculated on the transformed scale. Then the antilogarithms or squares of the reference values and performance limits are reported to the laboratories. Performance limits based upon the mean \pm 3 standard deviations (on transformed scales for silica and asbestos) result in a very low probability, less than 1%, that an outlier is obtained by a PAT laboratory by random chance, if approximate normality holds on the scale used for performance analysis.

After the performance limits have been calculated, the data from all participating laboratories including reference laboratories are compared to these limits to determine acceptability. For silica and asbestos, these comparisons are actually done on the transformed data. Data are acceptable if they fall within the performance limits. Data falling outside the performance limits are reported as outliers.

Proficiency Ratings

Laboratories are rated based upon performance in the PAT Program over the last year, (four rounds). The proficiency criteria are designed to:

- 1) Require multiple errors in different rounds before nonproficiency is determined.
- 2) Minimize the lag in ratings when performance changes.
- 3) Limit any advantage a laboratory may have in improving its rating by not performing on the next round.
- 4) Adversely rate laboratories which fail to correct analytical problems in a timely manner.
- 5) Limit the risk that laboratories rated nonproficient are nonproficient due to random chance and not because of analytical mistakes within the laboratory.

Laboratories are rated on individual contaminant performances and overall performance. Individual contaminants are metals, silica, asbestos, and organic solvents.

Individual Contaminant Performance is rated as:

- 1) Proficient if all results have been reported and all are classified as acceptable for the last two consecutive rounds.
- 2) Proficient in all other situations if three-quarters or more of the results reported in the last four consecutive rounds are classified as acceptable.

(Note: Missed rounds of data are ignored in calculating proficiency, and no rating is given if two consecutive rounds are missed.)

Overall Laboratory Performance is rated as:

- 1) Proficient if two-thirds or more of the individual PAT contaminant performances are rated proficient, but
- 2) Non-proficient if any individual PAT contaminant performances are rated non-proficient for more than four consecutive rounds (one year).

A rating of non-proficiency indicates that a serious analytical problem has been identified and warrants immediate action. However, PAT proficiency ratings have limitations.

- 1) Samples are provided to participants only quarterly. In addition, only one analyst in the lab is evaluated each round on each contaminant.
- 2) PAT samples, while containing unknown concentration levels, are known to the laboratory as special test samples. The program relies upon the integrity of participants to ensure that PAT samples do not receive special treatment.

- 3) The PAT Program can only cover a limited number of the analyses performed by laboratories.
- 4) The use of synthetic reference samples may not uncover all the analytical problems which may be encountered with similar field samples.
- 5) The statistical power of the PAT Program to detect excessive bias and poor precision is dependent upon the variability of PAT reference laboratories and the small number of samples (4 to 16) used to determine proficiency over 4 rounds (i.e., one year). For silica and asbestos, PAT reference laboratory variability is large and it takes considerable bias or imprecision for a participating laboratory to have a high probability of being rated non-proficient.

The PAT Program does not evaluate laboratory personnel, facilities, equipment, or internal quality control procedures. A laboratory interested in a more complete evaluation of their laboratory program is encouraged to contact AIHA about the AIHA Laboratory Accreditation Program. (Laboratory Accreditation Coordinator, AIHA, P.O. Box 8390, 345 White Pond Drive, Akron, OH 44320. Phone: (216/873-2442)).

Corrective Actions

The primary purpose of the PAT Program is to assist laboratories in improving analytical performance. PAT results are provided to participating laboratories so that laboratories have approximately one month to investigate and correct analytical problems before the next PAT round. If necessary, limited supplies of extra PAT samples may be purchased by participants from AIHA to help in this investigation. (Extra practice samples are not reported in the PAT Program.)

Laboratories in the PAT Program, that are also in the AIHA Laboratory Accreditation Program, must provide information to AIHA indicating how the laboratory has corrected analytical problems uncovered by the PAT Program. If PAT Program performance problems involve a laboratory in the initial process of applying for accreditation, these performance problems can delay a laboratory in obtaining AIHA accreditation.

The PAT Program is designed to complement, not replace a participating laboratory's internal quality control program. Internal controls such as spiked samples, calibration checks, and duplicate samples can sometimes uncover analytical problems that are not uncovered by the PAT Program.

This may be a result of:

(1) Differences between PAT samples and internal QC samples (e.g., matrices, concentration levels, interferences, analytical steps covered by the evaluation);

(2) the inclusion of the laboratory to laboratory component of variation in PAT performance limit calculations which may mask intralaboratory variability (precision) problems especially for analyses such as silica and asbestos where laboratory-to-laboratory variability is large; and

(3) statistical power limitations of the PAT Program related to the use of 3 standard deviation limits for performance limits, and nonproficiency criteria designed to have a low risk of rating a laboratory as poorly performing when no analytical problem truly exists, and the use of a small number of samples (4 to 16) to determine proficiency. Therefore it is not warranted to ignore out-of-control situations identified by the laboratory's internal quality control program merely because the laboratory has not had outliers in the PAT Program.

Similarly, the PAT Program may identify analytical problems when the laboratory's internal controls do not. In these instances, the investigation by the laboratory not only should determine the source of the analytical problem and its correction, but should also examine plausible reasons why the laboratory's internal QC program did not catch the problem and determine if the laboratory's internal QC system should be changed.

PART II: Statistical Procedures

The examples on the following pages are for lead and asbestos. These examples show the mathematical steps involved in evaluating laboratories based upon a sampling of data received for PAT Round 99, the round analyzed in November 1989. Lead is used as an example of a normal distribution and asbestos is an example of a transformed distribution.

Table A: Round 99

<u>Ref. Lab</u>	Indicates which laboratories are designated as reference laboratories.
<u>Lab ID</u>	Each laboratory's unique identifying number (8 digit alpha-numeric).
<u>Result Reported</u>	The data reported by each laboratory analyzing the contaminant identified. Also high and low outliers indicated with an H and an L, respectively, next to the reported result.
<u>Z Score</u>	Using Table D Summary Statistics, Z-scores are calculated for each reported result. The Z-score is the difference of the laboratory's reported result and the reference mean value, divided by the reference standard deviation. For silica and asbestos, the transformed data in Table D are used to calculate similar statistics. The Z-scores are reported as truncated integers, e.g.: 3.6 is reported as 3. In addition, Z-scores higher than 9 or lower than -9 are shown as 9 or -9 respectively.
<u>Transformed Results (Silica and Asbestos Only)</u>	The results reported are transformed by taking logarithms for silica or square roots for asbestos. ⁽⁴⁾

Table B: Reference Lab Data Round 99

<u>Results Reported</u>	Data reported by those participating laboratories designated as reference laboratories.
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Winsorized/Transformed Results Data from the results reported are Winsorized at the 5% level in Table C and transformed by taking logarithms for silica or square roots for asbestos.

Table C: Winsorized Reference Data Round 99

Data from Table B is Winsorized at the 5% level and listed in rank order. Those values with an asterisk (*) have been replaced (Winsorized). (2.3)

Table D: Summary Statistics Round 99

Winsorized Mean concentrations, standard deviations and relative standard deviations after Winsorizing are calculated from Table B. The total number of reference laboratories reporting is also indicated. In this table, the mean values reported are called the Laboratory Performance Reports reference values and the upper limit and lower limit values reported are the means \pm 3 standard deviations. The range between the upper and lower limits for a given analyte is defined as the performance limit for that analyte.

Transformed (silica and asbestos) Mean concentrations and standard deviations are calculated from Table B to determine reference values and performance limits for the transformed values.

Re-transformed (silica and asbestos) The transformed summary statistics from above are retransformed to obtain summary statistics which are in the same concentration scale as the original data. Retransformation involves antilogs for silica and squaring for asbestos.

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TABLE A: ROUND 99

CONTAMINANT = LEAD (LEA)

REF LAB	LAB ID	RESULT1		RESULT2		RESULT3		RESULT4		TRANSFORMED RESULTS			
		REPTD	ZSCORE	REPTD	ZSCORE	REPTD	ZSCORE	REPTD	ZSCORE	RESLT1	RESLT2	RESLT3	RESLT4
	35601001	0.0383	L -6	0.0548	L -5	0.0262	L -5	0.0376	L -3				
	35816001	0.0505	1	0.0708	2	0.0351	1	0.0423	0				
	36830003	0.0517	2	0.0678	0	0.0369	2	0.0415	0				
	37027001	0.0447	-2	0.0609	-2	0.0307	-2	0.0382	L -3				
YES	37219001	0.0480	0	0.0610	-2	0.0327	0	0.0403	-1				
	37389001	0.0473	0	0.0676	0	0.0338	0	0.0440	0				
YES	37401001	0.0458	-1	0.0638	0	0.0310	-1	0.0402	-1				
YES	37662001	0.0463	-1	0.0663	0	0.0318	-1	0.0425	0				
	37830001	0.0503	1	0.0673	0	0.0338	0	0.0257	L -9				
	37830002	0.0451	-2	0.0611	-2	0.0315	-1	0.0417	0				
	37830003	0.0497	0	0.0678	0	0.0338	0	0.0427	0				
	37830004	0.0473	0	0.0647	0	0.0317	-1	0.0409	-1				
	37921001	0.0463	-1	0.0680	1	0.0321	-1	0.0416	0				
	38103001	0.0496	0	0.0658	0	0.0341	0	0.0435	0				
	40208001	0.0485	0	0.0649	0	0.0330	0	0.0422	0				
8	YES	40601001	0.0477	0	0.0645	0	0.0120	L -9	0.0412	-1			
	42001002	0.0497	0	0.0668	0	0.0339	0	0.0434	0				
	43025001	0.0484	0	0.0666	0	0.0336	0	0.0427	0				
	43085001	0.0477	0	0.0629	-1	0.0321	-1	0.0423	0				
	43201001	0.0425	L -3	0.0584	L -3	0.0299	-2	0.0392	-2				
	43212001	0.0480	0	0.0643	0	0.0316	-1	0.0413	-1				
	43215001	0.0438	L -3	0.0588	L -3	0.0303	-2	0.0390	-2				
	43215002	0.0444	-2	0.0641	0	0.0324	0	0.0403	-1				
	43229001	0.0495	0	0.0681	1	0.0344	0	0.0442	1				
	44060001	0.0500	0	0.0681	1	0.0333	0	0.0439	0				
	44077001	0.0479	0	0.0659	0	0.0328	0	0.0424	0				
YES	44101001	0.0482	0	0.0674	0	0.0336	0	0.0427	0				
	44101002	0.0475	0	0.0635	-1	0.0330	0	0.0412	-1				
	44112001	0.0489	0	0.0666	0	0.0338	0	0.0430	0				
	44131003	0.0482	0	0.0646	0	0.0329	0	0.0422	0				
	44136001	0.0493	0	0.0651	0	0.0331	0	0.0423	0				
	44141001	0.0418	L -4	0.0684	1	0.0290	L -3	0.0440	0				
YES	44313001	0.0470	0	0.0636	-1	0.0330	0	0.0425	0				
YES	44316001	0.0474	0	0.0671	0	0.0343	0	0.0444	1				
	44317001	0.0464	-1	0.0696	1	0.0323	0	0.0419	0				
	44512001	0.0425	L -3	0.0591	L -3	0.0268	L -5	0.0393	-2				
	45005001	0.0530	2	0.0794	H 6	0.0374	H 3	0.0514	H 6				
	45215001	0.0532	H 3	0.0707	2	0.0367	2	0.0467	2				
	45220001	0.0507	1	0.0588	L -3	0.0350	1	0.0448	1				
YES	45226001	0.0502	1	0.0681	1	0.0345	0	0.0433	0				
	45242001	0.0436	L -3	0.0631	-1	0.0303	-2	0.0380	L -3				

(H=HIGH OUTLIER, L=LOW OUTLIER)

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TABLE B: REFERENCE LAB DATA ROUND 99

CONTAMINANT = LEAD (LEA)

LAB ID	RESULTS REPORTED				WINSORIZED / TRANSFORMED RESULTS			
	1	2	3	4	1	2	3	4
CN201001	0.0489	0.0672	0.0330	0.0414				
CN205001	0.0475	0.0674	0.0347	0.0434				
CN305001	0.0495	0.0665	0.0336	0.0446				
CN309001	0.0480	0.0650	0.0330	0.0420				
CN600001	0.0469	0.0639	0.0320	0.0353				
SP040001	0.0490	0.0671	0.0343	0.0439				
01748001	0.0500	0.0674	0.0348	0.0448				
06101001	0.0454	0.0610	0.0316	0.0400				
06115001	0.0495	0.0666	0.0330	0.0431				
06115002	0.0470	0.0640	0.0330	0.0420				
06115003	0.0514	0.0699	0.0351	0.0448				
06115004	0.0474	0.0638	0.0326	0.0420				
06504001	0.0480	0.0649	0.0336	0.0423				
06904001	0.0483	0.0675	0.0333	0.0433				
12533001	0.0468	0.0636	0.0320	0.0414				
13057001	0.0545	0.0719	0.0355	0.0420				
14650001	0.0467	0.0642	0.0322	0.0414				
15069001	0.0478	0.0662	0.0337	0.0447				
15213003	0.0474	0.0648	0.0349	0.0424				
16335001	0.0486	0.0661	0.0328	0.0432				
21010001	0.0447	0.0682	0.0317	0.0405				
21203001	0.0492	0.0670	0.0338	0.0432				
21227001	0.0500	0.0682	0.0354	0.0445				
23260001	0.0465	0.0634	0.0321	0.0408				
27611001	0.0505	0.0665	0.0353	0.0453				
29201001	0.0495	0.0654	0.0329	0.0425				
29602001	0.0510	0.0665	0.0358	0.0455				
31208001	0.0486	0.0664	0.0330	0.0419				
37219001	0.0480	0.0610	0.0327	0.0403				
37401001	0.0458	0.0638	0.0310	0.0402				
37662001	0.0463	0.0663	0.0318	0.0425				
40601001	0.0477	0.0645	0.0120	0.0412				
44101001	0.0482	0.0674	0.0336	0.0427				
44313001	0.0470	0.0636	0.0330	0.0425				
44316001	0.0474	0.0671	0.0343	0.0444				
45226001	0.0502	0.0681	0.0345	0.0433				
45661001	0.0490	0.0664	0.0325	0.0426				
48024001	0.0513	0.0673	0.0347	0.0429				
48075001	0.0483	0.0278	0.0343	0.0418				
48090001	0.0490	0.0663	0.0335	0.0428				
48231001	0.0483	0.0650	0.0333	0.0432				
48914001	0.0480	0.0660	0.0330	0.0420				
52240001	0.0491	0.0698	0.0348	0.0442				
53154001	0.0498	0.0663	0.0385	0.0465				

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TABLE B: REFERENCE LAB DATA ROUND 99

CONTAMINANT = LEAD (LEA)

LAB ID	RESULTS REPORTED				WINSORIZED / TRANSFORMED RESULTS			
	1	2	3	4	1	2	3	4
53706001	0.0490	0.0647	0.0328	0.0429				
54401001	0.0495	0.0625	0.0350	0.0430				
55114001	0.0520	0.0638	0.0372	0.0475				
55133001	0.0503	0.0635	0.0346	0.0440				
60049001	0.0490	0.0655	0.0335	0.0435				
60685001	0.0466	0.0648	0.0328	0.0423				
63105001	0.0476	0.0656	0.0329	0.0425				
75201001	0.0492	0.0696	0.0339	0.0433				
77001001	0.0468	0.0642	0.0333	0.0412				
78247001	0.0513	0.0689	0.0349	0.0448				
80217001	0.0508	0.0673	0.0306	0.0428				
80239001	0.0485	0.0649	0.0328	0.0416				
84108001	0.0499	0.0682	0.0339	0.0431				
84108002	0.0410	0.0666	0.0427	0.0331				
84147001	0.0495	0.0668	0.0348	0.0442				
89114001	0.0490	0.0677	0.0330	0.0431				
90250001	0.0502	0.0679	0.0353	0.0437				
90720001	0.0483	0.0544	0.0310	0.0408				
94025001	0.0481	0.0648	0.0339	0.0417				
94119001	0.0479	0.0664	0.0334	0.0432				
94704001	0.0504	0.0706	0.0354	0.0439				
97201001	0.0476	0.0651	0.0324	0.0419				
98195001	0.0488	0.0660	0.0340	0.0426				
98314002	0.0451	0.0617	0.0309	0.0407				
98352001	0.0492	0.0655	0.0339	0.0432				
98607001	0.0464	0.0646	0.0322	0.0406				

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TABLE C: WINSORIZED REFERENCE DATA ROUND 99

CONTAMINANT = LEAD (LEA)

LAB ID	RESULT1	LAB ID	RESULT2	LAB ID	RESULT3	LAB ID	RESULT4
* 06101001	0.0458	37219001	0.0617	37401001	0.0310	37401001	0.0403
* 98314002	0.0458	06101001	0.0617	98314002	0.0310	06101001	0.0403
* 21010001	0.0458	90720001	0.0617	80217001	0.0310	CN600001	0.0403
* 84108002	0.0458	48075001	0.0617	40601001	0.0310	84108002	0.0403
37401001	0.0458	98314002	0.0617	90720001	0.0310	37219001	0.0403
37662001	0.0463	54401001	0.0625	06101001	0.0316	21010001	0.0405
98607001	0.0464	23260001	0.0634	21010001	0.0317	98607001	0.0406
23260001	0.0465	55133001	0.0635	37662001	0.0318	98314002	0.0407
60685001	0.0466	12533001	0.0636	CN600001	0.0320	23260001	0.0408
14650001	0.0467	44313001	0.0636	12533001	0.0320	90720001	0.0408
12533001	0.0468	06115004	0.0638	23260001	0.0321	40601001	0.0412
77001001	0.0468	37401001	0.0638	14650001	0.0322	77001001	0.0412
CN600001	0.0469	55114001	0.0638	98607001	0.0322	CN201001	0.0414
06115002	0.0470	CN600001	0.0639	97201001	0.0324	12533001	0.0414
44313001	0.0470	06115002	0.0640	45661001	0.0325	14650001	0.0414
06115004	0.0474	14650001	0.0642	06115004	0.0326	80239001	0.0416
15213003	0.0474	77001001	0.0642	37219001	0.0327	94025001	0.0417
44316001	0.0474	40601001	0.0645	16335001	0.0328	48075001	0.0418
CN205001	0.0475	98607001	0.0646	53706001	0.0328	31208001	0.0419
63105001	0.0476	53706001	0.0647	60685001	0.0328	97201001	0.0419
97201001	0.0476	15213003	0.0648	80239001	0.0328	CN309001	0.0420
40601001	0.0477	60685001	0.0648	29201001	0.0329	06115002	0.0420
15069001	0.0478	94025001	0.0648	63105001	0.0329	06115004	0.0420
94119001	0.0479	06504001	0.0649	CN201001	0.0330	13057001	0.0420
CN309001	0.0480	80239001	0.0649	CN309001	0.0330	48914001	0.0420
06504001	0.0480	CN309001	0.0650	06115001	0.0330	06504001	0.0423
37219001	0.0480	48231001	0.0650	06115002	0.0330	60685001	0.0423
48914001	0.0480	97201001	0.0651	31208001	0.0330	15213003	0.0424
94025001	0.0481	29201001	0.0654	44313001	0.0330	29201001	0.0425
44101001	0.0482	60049001	0.0655	48914001	0.0330	37662001	0.0425
06904001	0.0483	98352001	0.0655	89114001	0.0330	44313001	0.0425
48075001	0.0483	63105001	0.0656	06904001	0.0333	63105001	0.0425
48231001	0.0483	48914001	0.0660	48231001	0.0333	45661001	0.0426
90720001	0.0483	98195001	0.0660	77001001	0.0333	98195001	0.0426
80239001	0.0485	16335001	0.0661	94119001	0.0334	44101001	0.0427
16335001	0.0486	15069001	0.0662	48090001	0.0335	48090001	0.0428
31208001	0.0486	37662001	0.0663	60049001	0.0335	80217001	0.0428
98195001	0.0488	48090001	0.0663	CN305001	0.0336	48024001	0.0429
CN201001	0.0489	53154001	0.0663	06504001	0.0336	53706001	0.0429
SP040001	0.0490	31208001	0.0664	44101001	0.0336	54401001	0.0430
45661001	0.0490	45661001	0.0664	15069001	0.0337	06115001	0.0431
48090001	0.0490	94119001	0.0664	21203001	0.0338	84108001	0.0431
53706001	0.0490	CN305001	0.0665	75201001	0.0339	89114001	0.0431
60049001	0.0490	27611001	0.0665	84108001	0.0339	16335001	0.0432
89114001	0.0490	29602001	0.0665	94025001	0.0339	21203001	0.0432

* WINSORIZED VALUES

PROFICIENCY ANALYTICAL TESTING PROGRAM

TABLE C: WINSORIZED REFERENCE DATA ROUND 99

CONTAMINANT = LEAD (LEA)

LAB ID	RESULT1	LAB ID	RESULT2	LAB ID	RESULT3	LAB ID	RESULT4
52240001	0.0491	06115001	0.0666	98352001	0.0339	48231001	0.0432
21203001	0.0492	84108002	0.0666	98195001	0.0340	94119001	0.0432
75201001	0.0492	84147001	0.0668	SP040001	0.0343	98352001	0.0432
98352001	0.0492	21203001	0.0670	44316001	0.0343	06904001	0.0433
CN305001	0.0495	SP040001	0.0671	48075001	0.0343	45226001	0.0433
06115001	0.0495	44316001	0.0671	45226001	0.0345	75201001	0.0433
29201001	0.0495	CN201001	0.0672	55133001	0.0346	CN205001	0.0434
54401001	0.0495	48024001	0.0673	CN205001	0.0347	60049001	0.0435
84147001	0.0495	80217001	0.0673	48024001	0.0347	90250001	0.0437
53154001	0.0498	CN205001	0.0674	01748001	0.0348	SP040001	0.0439
84108001	0.0499	01748001	0.0674	52240001	0.0348	94704001	0.0439
01748001	0.0500	44101001	0.0674	84147001	0.0348	55133001	0.0440
21227001	0.0500	06904001	0.0675	15213003	0.0349	52240001	0.0442
45226001	0.0502	89114001	0.0677	78247001	0.0349	84147001	0.0442
90250001	0.0502	90250001	0.0679	54401001	0.0350	44316001	0.0444
55133001	0.0503	45226001	0.0681	06115003	0.0351	21227001	0.0445
94704001	0.0504	21010001	0.0682	27611001	0.0353	CN305001	0.0446
27611001	0.0505	21227001	0.0682	90250001	0.0353	15069001	0.0447
80217001	0.0508	84108001	0.0682	21227001	0.0354	01748001	0.0448
29602001	0.0510	78247001	0.0689	94704001	0.0354	27611001	0.0448
78247001	0.0513	75201001	0.0696	13057001	0.0355	29602001	0.0448
* 48024001	0.0513	52240001	0.0696	29602001	0.0355	53154001	0.0448
* 06115003	0.0513	06115003	0.0696	55114001	0.0355	55114001	0.0448
* 55114001	0.0513	94704001	0.0696	53154001	0.0355	06115003	0.0448
* 13057001	0.0513	13057001	0.0696	84108002	0.0355	78247001	0.0448

PROFICIENCY ANALYTICAL TESTING PROGRAM

TABLE D: SUMMARY STATISTICS ROUND 99

CONTAMINANT = LEAD (LEA)

NUMBER OF LABS ANALYZED	FILTER	WINSORIZED -----					RSD
		MEAN	STANDARD DEVIATION	UPPER LIMIT	LOWER LIMIT		
70	1	0.0485	0.0015	0.0531	0.0439	3.1633	
	2	0.06582	0.00205	0.07198	0.05966	3.11916	
	3	0.03349	0.00129	0.03736	0.02962	3.85199	
	4	0.04268	0.00135	0.04672	0.03864	3.15317	

TRANSFORMED

1
2
3
4

RE-TRANSFORMED

1
2
3
4

PROFICIENCY ANALYTICAL TESTING PROGRAM

TABLE A: ROUND 99

CONTAMINANT = ASBESTOS (ASB)

REF LAB	LAB ID	TRANSFORMED RESULTS											
		RESULT1		RESULT2		RESULT3		RESULT4		RESLT1	RESLT2	RESLT3	RESLT4
		REPTD	ZSCORE	REPTD	ZSCORE	REPTD	ZSCORE	REPTD	ZSCORE				
	43026001	133.8000	0	211.0000	-1	588.1000	-1	150.2000	-1	11.5672	14.5258	24.2508	12.2556
	43081001	153.5000	0	296.3000	-1	489.9000	-1	205.5000	0	12.3895	17.2134	22.1337	14.3353
	43085001	82.2000	-1	184.7000	-2	555.4000	-1	179.2000	0	9.0664	13.5904	23.5669	13.3866
	43201001	233.2000	1	347.4000	0	839.2000	0	286.3000	0	15.2709	18.6387	28.9689	16.9204
	43204001	77.1000	-1	278.9000	-1	438.6000	-1	204.4000	0	8.7807	16.7003	20.9428	14.2969
	43212001	147.6000	0	271.1000	-1	860.9000	0	276.9000	0	12.1491	16.4651	29.6800	16.6403
	43215001	114.7000	0	317.2000	0	758.0000	0	227.9000	0	10.7098	17.8101	27.5318	15.0964
	43215002	134.3000	0	376.2000	0	784.3000	0	264.3000	0	11.5888	19.3959	28.0054	16.2573
	43228001	133.5000	0	318.4000	0	569.9000	-1	168.2000	-1	11.5542	17.8438	23.8726	12.9692
	43528001	164.9000	0	502.6000	0	533.4000	-1	150.7000	-1	12.8413	22.4187	23.0955	12.2760
	43605001	188.9000	0	490.4000	0	657.9000	0	273.4000	0	13.7441	22.1450	25.6496	16.5348
	43606001	30.6000 L	-3	31.2000 L	-5	199.3000 L	-3	38.2000 L	-3	5.5317	5.5857	14.1174	6.1806
	44060001	72.7000	-1	317.7000	0	699.3000	0	224.4000	0	8.5264	17.8241	26.4443	14.9800
	44077001	92.4000	-1	276.0000	-1	503.2000	-1	165.6000	-1	9.6125	16.6132	22.4321	12.8686
YES	44101001	154.0000	0	383.4000	0	527.4000	-1	209.8000	0	12.4097	19.5806	22.9652	14.4845
	44114001	163.3000	0	668.8000	2	460.7000	-1	258.0000	0	12.7789	25.8612	21.4639	16.0624
	44130001	169.0000	0	448.9000	0	661.3000	0	329.4000	1	13.0000	21.1873	25.7158	18.1494
14	44131002	86.6000	-1	299.9000	0	525.8000	-1	193.1000	0	9.3059	17.3176	22.9303	13.8960
	44131003	122.7000	0	320.4000	0	824.9000	0	267.2000	0	11.0770	17.8997	28.7211	16.3463
	44141001	51.2000	-2	121.9000 L	-3	556.8000	-1	112.8000	-2	7.1554	11.0408	23.5966	10.6207
	44147001	68.8000	-1	48.8000 L	-4	54.1000 L	-5	77.7000	-2	8.2946	6.9857	7.3553	8.8148
	44203001	140.7000	0	290.7000	-1	782.0000	0	292.0000	0	11.8617	17.0499	27.9643	17.0880
YES	44313001	97.9000	-1	281.8000	-1	675.3000	0	177.6000	0	9.8944	16.7869	25.9865	13.3267
YES	44316001	133.7000	0	451.3000	0	795.0000	0	266.0000	0	11.5629	21.2438	28.1957	16.3095
	44317001	216.1000	1	465.4000	0	1112.0000	1	332.4000	1	14.7003	21.5731	33.3467	18.2318
	44321001	223.9000	1	493.8000	0	689.8000	0	244.7000	0	14.9633	22.2216	26.2640	15.6429
	44503001	117.5000	0	294.1000	-1	508.6000	-1	174.2000	0	10.8397	17.1493	22.5522	13.1985
	44512001	182.8000	0	567.5000	1	938.9000	0	340.0000	1	13.5204	23.8223	30.6415	18.4391
	44702001	71.3000	-1	200.0000	-2	238.2000 L	-3	123.6000	-1	8.4439	14.1421	15.4337	11.1176
	44870001	77.3000	-1	246.5000	-1	524.7000	-1	220.1000	0	8.7920	15.7003	22.9063	14.8358
	44887001	151.4000	0	423.2000	0	845.0000	0	271.3000	0	12.3045	20.5718	29.0689	16.4712
	45005001	158.2000	0	342.7000	0	509.1000	-1	187.7000	0	12.5778	18.5122	22.5632	13.7004
	45030001	79.2000	-1	226.2000	-1	284.7000	-2	143.3000	-1	8.8994	15.0399	16.8731	11.9708
	45044001	128.7000	0	367.4000	0	594.9000	-1	183.4000	0	11.3446	19.1677	24.3906	13.5425
	45171001	103.7000	0	264.5000	-1	418.2000	-2	196.4000	-1	10.1833	16.2635	20.4499	14.0143
	45203001	175.3000	0	415.6000	0	771.7000	0	270.8000	0	13.2401	20.3863	27.7795	16.4560
	45215001	95.5000	-1	255.9000	-1	746.6000	0	149.9000	-1	9.7724	15.9969	27.3240	12.2434
	45220001	169.4000	0	415.3000	0	686.6000	0	192.4000	0	13.0154	20.3789	26.2031	13.8708
YES	45226001	89.8000	-1	457.2000	0	802.5000	0	266.7000	0	9.4763	21.3822	28.3284	16.3310
	45239001	229.2000	1	393.7000	0	761.9000	0	245.4000	0	15.1394	19.8419	27.6025	15.6652
	45242001	117.0000	0	325.0000	0	670.0000	0	207.0000	0	10.8167	18.0278	25.8844	14.3875

(H=HIGH OUTLIER, L=LOW OUTLIER)

PROFICIENCY ANALYTICAL TESTING PROGRAM

TABLE B: REFERENCE LAB DATA ROUND 99

CONTAMINANT = ASBESTOS (ASB)

LAB ID	RESULTS REPORTED				WINSORIZED / TRANSFORMED RESULTS			
	1	2	3	4	1	2	3	4
CN201001	173.2000	611.4000	803.8000	220.0000	13.1605	24.7265	28.3514	14.8324
CN205001	245.8000	712.7000	887.9000	285.6000	15.6780	24.9419	29.7977	16.8997
CN305001	196.6000	590.5000	473.8000	286.5000	14.0214	24.3002	21.7669	16.9263
CN309001	284.5000	919.1000	1318.9000	380.8000	15.6780	24.9419	35.5893	19.5141
CN600001	125.1000	377.6000	897.1000	324.7000	11.1848	19.4319	29.9516	18.0194
SP040001	209.8000	430.8000	1045.8000	326.3000	14.4845	20.7557	32.3388	18.0638
01748001	166.6000	327.1000	678.0000	192.7000	12.9074	18.0859	26.0384	13.8816
06101001	164.4000	423.8000	1069.1000	270.6000	12.8219	20.5864	32.6971	16.4499
06115001	293.5000	453.0000	812.8000	327.0000	15.6780	21.2838	28.5096	18.0831
06115002	186.5000	398.1000	745.2000	233.9000	13.6565	19.9524	27.2984	15.2938
06115003	127.1000	469.8000	923.7000	202.7000	11.2739	21.6749	30.3924	14.2373
06115004	181.9000	499.4000	977.0000	345.8000	13.4870	22.3473	31.2570	18.5957
06504001	140.3000	415.1000	823.8000	246.1000	11.8448	20.3740	28.7019	15.6876
06904001	170.7000	431.8000	784.7000	309.6000	13.0652	20.7798	28.0125	17.5955
12533001	193.0000	579.0000	1324.8000	445.9000	13.8924	24.0624	35.5893	20.0948
13057001	73.9000	386.0000	645.2000	150.8000	8.5965	19.6469	25.4008	12.2801
14650001	122.3000	303.3000	656.1000	202.7000	11.0589	17.4155	25.6144	14.2373
15069001	176.9000	534.3000	1317.7000	307.2000	13.3004	23.1149	35.5893	17.5271
15213003	150.0000	403.0000	888.0000	227.0000	12.2474	20.0749	29.7993	15.0665
16335001	59.9000	113.8000	437.2000	90.1000	8.5965	14.4153	20.9093	11.4018
21010001	220.6000	622.1000	1117.6000	324.3000	14.8526	24.9419	33.4305	18.0083
21203001	141.0000	347.0000	729.0000	180.0000	11.8743	18.6279	27.0000	13.4164
21227001	94.0000	286.0000	643.0000	199.0000	9.6954	16.9115	25.3574	14.1067
23260001	161.8000	328.7000	865.4000	221.0000	12.7201	18.1301	29.4177	14.8661
27611001	133.7000	272.6000	687.9000	188.4000	11.5629	16.5106	26.2278	13.7259
29201001	73.9000	186.0000	390.3000	83.4000	8.5965	14.4153	20.9093	11.4018
29602001	219.8000	293.0000	780.3000	134.8000	14.8257	17.1172	27.9339	11.6103
31208001	234.4000	415.0000	870.0000	230.0000	15.3101	20.3715	29.4958	15.1658
37219001	79.5000	207.8000	481.7000	103.7000	8.9163	14.4153	21.9477	11.4018
37401001	143.7000	412.0000	961.9000	202.2000	11.9875	20.2978	31.0145	14.2197
37662001	91.7000	237.6000	457.3000	133.8000	9.5760	15.4143	21.3846	11.5672
44101001	154.0000	383.4000	527.4000	209.8000	12.4097	19.5806	22.9652	14.4845
44313001	97.9000	281.8000	675.3000	177.6000	9.8944	16.7869	25.9865	13.3267
44316001	133.7000	451.3000	795.0000	266.0000	11.5629	21.2438	28.1957	16.3095
45226001	89.8000	457.2000	802.5000	266.7000	9.4763	21.3822	28.3284	16.3310
45661001	223.5000	145.9000	1117.8000	364.0000	14.9499	14.4153	33.4335	19.0788
48024001	121.0000	415.0000	761.2000	209.8000	11.0000	20.3715	27.5899	14.4845
48075001	92.2000	357.1000	912.3000	264.5000	9.6021	18.8971	30.2043	16.2635
48090001	161.2000	478.9000	989.7000	225.7000	12.6965	21.8838	31.4595	15.0233
48231001	194.3000	538.3000	936.4000	133.8000	13.9392	23.2013	30.6007	11.5672
48914001	157.0000	476.0000	920.0000	284.0000	12.5300	21.8174	30.3315	16.8523
52240001	210.0000	606.6000	1242.0000	439.3000	14.4914	24.6293	35.2420	20.0948
53154001	131.7000	302.6000	928.0000	278.4000	11.4761	17.3954	30.4631	16.8653
53706001	167.5000	430.4000	836.2000	257.3000	12.9422	20.7461	28.9171	16.0406

PROFICIENCY ANALYTICAL TESTING PROGRAM

TABLE B: REFERENCE LAB DATA ROUND 99

CONTAMINANT = ASBESTOS (ASB)

LAB ID	RESULTS REPORTED				WINSORIZED / TRANSFORMED RESULTS			
	1	2	3	4	1	2	3	4
54401001	135.0000	330.0000	464.0000	130.0000	11.6190	18.1659	21.5407	11.4018
55114001	173.3000	396.4000	743.0000	211.0000	13.1643	19.9098	27.2580	14.5258
55133001	128.0000	331.0000	701.0000	154.0000	11.3137	18.1934	26.4764	12.4097
60049001	112.4000	694.2000	960.2000	286.4000	10.6019	24.9419	30.9871	16.9234
60685001	39.5000	314.7000	398.6000	148.0000	8.5965	17.7398	20.9093	12.1655
63105001	92.4000	307.1000	461.2000	171.4000	9.6125	17.5243	21.4756	13.0920
75201001	186.5000	514.5000	999.5000	320.8000	13.6565	22.6826	31.6149	17.9109
77001001	108.3000	426.8000	796.2000	226.8000	10.4067	20.6591	28.2170	15.0599
78247001	90.5000	316.0000	773.0000	253.0000	9.5131	17.7764	27.8029	15.9060
80217001	134.6000	370.3000	723.2000	222.2000	11.6017	19.2432	26.8924	14.9064
80239001	65.0000	386.0000	867.5000	214.4000	8.5965	19.6469	29.4534	14.6424
84108001	164.0000	390.7000	1140.9000	440.5000	12.8062	19.7661	33.7772	20.0948
84108002	123.5000	337.3000	1266.6000	236.6000	11.1131	18.3657	35.5893	15.3818
84147001	151.0000	316.0000	1114.0000	228.0000	12.2882	17.7764	33.3766	15.0997
89114001	209.0000	442.0000	823.0000	308.0000	14.4568	21.0238	28.6880	17.5499
90250001	141.5000	426.8000	975.0000	304.0000	11.8954	20.6591	31.2250	17.4356
90720001	1061.9000	468.7000	151.7000	287.5000	15.6780	21.6495	20.9093	16.9558
94025001	203.0000	411.0000	885.0000	272.0000	14.2478	20.2731	29.7489	16.4924
94119001	173.4000	492.0000	1200.2000	316.2000	13.1681	22.1811	34.6439	17.7820
94704001	212.3000	389.4000	984.1000	234.2000	14.5705	19.7332	31.3704	15.3036
97201001	214.6000	558.0000	949.0000	403.8000	14.6492	23.6220	30.8058	20.0948
98195001	158.1000	448.2000	918.5000	239.5000	12.5738	21.1707	30.3068	15.4758
98314002	120.6000	303.7000	849.9000	240.1000	10.9818	17.4270	29.1530	15.4952
98352001	115.4000	391.2000	994.7000	236.1000	10.7424	19.7788	31.5389	15.3655
98607001	90.9000	279.8000	640.2000	191.6000	9.5341	16.7272	25.3022	13.8420

PROFICIENCY ANALYTICAL TESTING PROGRAM

TABLE C: WINSORIZED REFERENCE DATA ROUND 99

CONTAMINANT = ASBESTOS (ASB)

LAB ID	RESULT1	LAB ID	RESULT2	LAB ID	RESULT3	LAB ID	RESULT4
* 80239001	73.9000	29201001	207.8000	60685001	437.2000	37219001	130.0000
* 16335001	73.9000	45661001	207.8000	29201001	437.2000	16335001	130.0000
* 60685001	73.9000	16335001	207.8000	90720001	437.2000	29201001	130.0000
13057001	73.9000	37219001	207.8000	16335001	437.2000	54401001	130.0000
29201001	73.9000	37662001	237.6000	37662001	457.3000	37662001	133.8000
37219001	79.5000	27611001	272.6000	63105001	461.2000	48231001	133.8000
45226001	89.8000	98607001	279.8000	54401001	464.0000	29602001	134.8000
78247001	90.5000	44313001	281.8000	CN305001	473.8000	60685001	148.0000
98607001	90.9000	21227001	286.0000	37219001	481.7000	13057001	150.8000
37662001	91.7000	29602001	293.0000	44101001	527.4000	55133001	154.0000
48075001	92.2000	53154001	302.6000	98607001	640.2000	63105001	171.4000
63105001	92.4000	14650001	303.3000	21227001	643.0000	44313001	177.6000
21227001	94.0000	98314002	303.7000	13057001	645.2000	21203001	180.0000
44313001	97.9000	63105001	307.1000	14650001	656.1000	27611001	188.4000
77001001	108.3000	60685001	314.7000	44313001	675.3000	98607001	191.6000
60049001	112.4000	78247001	316.0000	01748001	678.0000	01748001	192.7000
98352001	115.4000	84147001	316.0000	27611001	687.9000	21227001	199.0000
98314002	120.6000	01748001	327.1000	55133001	701.0000	37401001	202.2000
48024001	121.0000	23260001	328.7000	80217001	723.2000	06115003	202.7000
14650001	122.3000	54401001	330.0000	21203001	729.0000	14650001	202.7000
84108002	123.5000	55133001	331.0000	55114001	743.0000	44101001	209.8000
CN600001	125.1000	84108002	337.3000	06115002	745.2000	48024001	209.8000
06115003	127.1000	21203001	347.0000	48024001	761.2000	55114001	211.0000
55133001	128.0000	48075001	357.1000	78247001	773.0000	80239001	214.4000
53154001	131.7000	80217001	370.3000	29602001	780.3000	CN201001	220.0000
27611001	133.7000	CN600001	377.6000	06904001	784.7000	23260001	221.0000
44316001	133.7000	44101001	383.4000	44316001	795.0000	80217001	222.2000
80217001	134.6000	13057001	386.0000	77001001	796.2000	48090001	225.7000
54401001	135.0000	80239001	386.0000	45226001	802.5000	77001001	226.8000
06504001	140.3000	94704001	389.4000	CN201001	803.8000	15213003	227.0000
21203001	141.0000	84108001	390.7000	06115001	812.8000	84147001	228.0000
90250001	141.5000	98352001	391.2000	89114001	823.0000	31208001	230.0000
37401001	143.7000	55114001	396.4000	06504001	823.8000	06115002	233.9000
15213003	150.0000	06115002	398.1000	53706001	836.2000	94704001	234.2000
84147001	151.0000	15213003	403.0000	98314002	849.9000	98352001	236.1000
44101001	154.0000	94025001	411.0000	23260001	865.4000	84108002	236.6000
48914001	157.0000	37401001	412.0000	80239001	867.5000	98195001	239.5000
98195001	158.1000	31208001	415.0000	31208001	870.0000	98314002	240.1000
48090001	161.2000	48024001	415.0000	94025001	885.0000	06504001	246.1000
23260001	161.8000	06504001	415.1000	CN205001	887.9000	78247001	253.0000
84108001	164.0000	06101001	423.8000	15213003	888.0000	53706001	257.3000
06101001	164.4000	77001001	426.8000	CN600001	897.1000	48075001	264.5000
01748001	166.6000	90250001	426.8000	48075001	912.3000	44316001	266.0000
53706001	167.5000	53706001	430.4000	98195001	918.5000	45226001	266.7000
06904001	170.7000	SP040001	430.8000	48914001	920.0000	06101001	270.6000

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* WINSORIZED VALUES

PROFICIENCY ANALYTICAL TESTING PROGRAM

TABLE C: WINSORIZED REFERENCE DATA ROUND 99

CONTAMINANT = ASBESTOS (ASB)

LAB ID	RESULT1	LAB ID	RESULT2	LAB ID	RESULT3	LAB ID	RESULT4
CN201001	173.2000	06904001	431.8000	06115003	923.7000	94025001	272.0000
55114001	173.3000	89114001	442.0000	53154001	928.0000	53154001	278.4000
94119001	173.4000	98195001	448.2000	48231001	936.4000	48914001	284.0000
15069001	176.9000	44316001	451.3000	97201001	949.0000	CN205001	285.6000
06115004	181.9000	06115001	453.0000	60049001	960.2000	60049001	286.4000
06115002	186.5000	45226001	457.2000	37401001	961.9000	CN305001	286.5000
75201001	186.5000	90720001	468.7000	90250001	975.0000	90720001	287.5000
12533001	193.0000	06115003	469.8000	06115004	977.0000	90250001	304.0000
48231001	194.3000	48914001	476.0000	94704001	984.1000	15069001	307.2000
CN305001	196.6000	48090001	478.9000	48090001	989.7000	89114001	308.0000
94025001	203.0000	94119001	492.0000	98352001	994.7000	06904001	309.6000
89114001	209.0000	06115004	499.4000	75201001	999.5000	94119001	316.2000
SP040001	209.8000	75201001	514.5000	SP040001	1045.8000	75201001	320.8000
52240001	210.0000	15069001	534.3000	06101001	1069.1000	21010001	324.3000
94704001	212.3000	48231001	538.3000	84147001	1114.0000	CN600001	324.7000
97201001	214.6000	97201001	558.0000	21010001	1117.6000	SP040001	326.3000
29602001	219.8000	12533001	579.0000	45661001	1117.8000	06115001	327.0000
21010001	220.6000	CN305001	590.5000	84108001	1140.9000	06115004	345.8000
45661001	223.5000	52240001	606.6000	94119001	1200.2000	45661001	364.0000
31208001	234.4000	CN201001	611.4000	52240001	1242.0000	CN309001	380.8000
CN205001	245.8000	21010001	622.1000	84108002	1266.6000	97201001	403.8000
* CN309001	245.8000	60049001	622.1000	15069001	1266.6000	52240001	403.8000
* 06115001	245.8000	CN205001	622.1000	CN309001	1266.6000	84108001	403.8000
* 90720001	245.8000	CN309001	622.1000	12533001	1266.6000	12533001	403.8000

PROFICIENCY ANALYTICAL TESTING PROGRAM

TABLE D: SUMMARY STATISTICS ROUND 99

CONTAMINANT = ASBESTOS (ASB)

NUMBER OF LABS ANALYZED	FILTER	WINSORIZED -----				RSD
		MEAN	STANDARD DEVIATION	UPPER LIMIT	LOWER LIMIT	
69	1	152.6000	49.2941			32.3028
	2	406.83623	109.54139			26.92518
	3	839.54203	224.10947			26.69425
	4	246.78406	73.08659			29.61560
		TRANSFORMED -----				
	1	12.1871	2.0333	18.2871	6.0871	
	2	19.98629	2.73735	28.19835	11.77422	
	3	28.70297	3.98897	40.66988	16.73607	
	4	15.53670	2.33976	22.55599	8.51740	
		RE-TRANSFORMED -----				
	1	148.5255		334.4185	37.0527	
	2	399.45172		795.14705	138.63237	
	3	823.86077		1654.03897	280.09611	
	4	241.38890		508.77263	72.54614	

PART III: Laboratory Performance Report

Proficiency Analytical Testing Program
Laboratory Performance - Round 99

The PAT Program individual laboratory report includes the items listed below and an example report follows.

First page - Proficiency Analytical Testing Program
Laboratory Performance - Round 99

The left section of this page contains laboratory name and address.

Laboratory Name & Address Complete laboratory name and address. Top line of address includes the PAT lab identification number (8 digit alpha-numeric) and the sample analysis code (M = metals, S = silica, A = asbestos, O = organic solvents, X = no sample of this type).

Contaminant Contaminants are metals, silica, asbestos, and organic solvents. (As of October 1990, metals will be given one single performance rating for a group of three metals from the list: cadmium, chromium, lead, zinc).

Sample Filter or charcoal tube number (1,2,3,4)

The middle section of this page contains the Round 99 Statistical Summary.

Reference Value The arithmetic mean of Winsorized reference laboratory data for all contaminants except silica and asbestos. For silica and asbestos the reference value is the arithmetic mean of transformed reference laboratory data.

Performance Limits The range considered acceptable. See Part I for an explanation of calculations. These limits correspond to the -3 SD and +3 SD areas shown on the plots.

No. Labs Number of laboratories reporting results for current round for a given contaminant.

Overall No. Labs Total number of laboratories reporting results for current round.

Outliers High Number of laboratories reporting unacceptably high results for a sample.

Outliers Low Number of laboratories reporting unacceptably low results for a sample.

Outliers Total Total number of outliers for a given sample.
The right section of this page reports the individual laboratory results.

R99 Data The actual data submitted for each contaminant by the individual laboratory.

Proficiency Rating Summary of the laboratory's performance on all contaminants over the last four rounds (i.e., the last year). The legend at the bottom of the page is used to interpret the ratings shown. A laboratory may still be rated even though the laboratory has failed to submit results for the last round. However, a laboratory will not be rated when results have not been submitted for the last two rounds.

Outlier Summary Summarizes the laboratory's results for the last four rounds. Uses HI or LO to indicate those analytical results that were determined to be outliers. If the area next to the sample is blank, the analysis is acceptable. A dash (-) indicates the laboratory does not analyze for that contaminant.

Second Page - Proficiency Analytical Testing Program.
Rounds 96-99 Standard Deviation Plots.

These plots are provided to summarize a laboratory's performance over the last four rounds.

The area under zero standard deviation (0 SD), represents the location of the reference value (mean calculated from the Winsorized reference laboratory data) and indicates the center of the distribution. The area to the right of the +3 SD indicates the laboratory has exceeded the upper performance limit whereas the area to the left of the -3 SD indicates the laboratory has exceeded the lower performance limit.

The plots for silica and asbestos use transformed variables so that symmetric limits are shown. Thus the limits are equidistant from 0 SD. The plots for organic solvents show the codes to identify the specific solvent used and are defined as follows:

BNZ	Benzene
CFM	Chloroform
CTC	Carbon Tetrachloride
DCE	1,2-Dichloroethane
HEX	Hexane
MCL	Methylene Chloride
MCM	Methyl Chloroform
MEK	Methyl Ethyl Ketone
MIK	Methyl Isobutyl Ketone
OCT	Octane
OXY	o-Xylene
PCE	Tetrachloroethylene
PDX	p-Dioxane
TCE	Trichloroethylene
TOL	Toluene

PROFICIENCY ANALYTICAL TESTING PROGRAM
LABORATORY PERFORMANCE - ROUND 99

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CONTAMINANT SAMPLE	RND 99 STATISTICAL SUMMARY							LABORATORY RESULTS					
	REF. VALUE	PERFORMANCE LIMITS	NO. LABS	OUTLIERS			R 99 DATA	PROF RATING	OUTLIER SUMMARY				
				HI	LO	TOT			96	97	98	99	
LEAD (MG)	1	0.0485	0.0439-0.0531	362	16	28	44	0.0502	P				
	2	0.0658	0.0597-0.0720		15	31	46	0.0681					
	3	0.0335	0.0296-0.0374		14	28	42	0.0345					
	4	0.0427	0.0386-0.0467		17	31	48	0.0433					
CADMIUM (MG)	1	0.0120	0.0108-0.0132	360	6	24	30	0.0123	P				
	2	0.0148	0.0133-0.0163		7	25	32	0.0153					
	3	0.0090	0.0080-0.0100		12	26	38	0.0093				LO	
	4	0.0100	0.0089-0.0111		10	24	34	0.0101					
ZINC (MG)	1	0.0884	0.0782-0.0986	360	12	31	43	0.0882	P				
	2	0.1170	0.1060-0.1280		15	37	52	0.1188					
	3	0.1589	0.1416-0.1762		6	24	30	0.1620					
	4	0.1909	0.1703-0.2116		8	28	36	0.1920					
SILICA (MG)	1	0.0604	0.0295-0.1234	112	0	5	5	0.0665	P				
	2	0.0887	0.0526-0.1496		1	5	6	0.0660					
	3	0.1963	0.1134-0.3396		2	5	7	0.2151					
	4	0.1341	0.0805-0.2235		1	9	10	0.1504					
ASBESTOS (F/MM2)	1	148.53	37.053-334.42	1202	25	26	51	89.8	P				
	2	399.45	138.63-795.15		23	54	77	457.2					
	3	823.86	280.1-1654		1	54	55	802.5					
	4	241.39	72.546-508.77		11	38	49	266.7					
SOLVENT (MG)	1	0.3185	0.2429-0.3940	352	21	8	29	0.3220	-				
	2	1.0517	0.8372-1.2661		10	12	22	1.0330					
	3	0.8144	0.6916-0.9371		21	14	35	0.8150				LO	
	4	0.6020	0.4977-0.7062		18	16	34	0.6100					
SOLVENT (MG)	1	1.0250	0.8696-1.1803	352	15	15	30	1.0100	-				
	2	0.5183	0.4061-0.6305		12	3	15	0.5080					
	3	0.7673	0.6495-0.8851		9	15	24	0.7640					
	4	0.6428	0.5400-0.7457		16	6	22	0.6380					
SOLVENT (MG)	1	0.4453	0.3384-0.5522	352	14	4	18	0.4350	-				
	2	0.7930	0.6321-0.9539		10	8	18	0.7650					
	3	0.5760	0.4482-0.7039		14	3	17	0.5640					
	4	0.9006	0.7547-1.0465		12	11	23	0.8910					
OVERALL:				1326					P				

NOTES: PROFICIENCY RATINGS: (P=PROFICIENT, NP = NUMBER OF TIMES NON-PROFICIENT, - = ANALYSIS NOT PERFORMED OR NOT RATED)
OUTLIER SUMMARY: (BLANK=ANALYSIS ACCEPTABLE, - = ANALYSIS NOT RATED)

PROFICIENCY ANALYTICAL TESTING PROGRAM
 ROUNDS 96 - 99 STANDARD DEVIATION PLOTS

ROUND	SAMPLE	LEAD		CADMIUM		ZINC		SILICA		ASBESTOS		SOLVENT1		SOLVENT2		SOLVENT3	
		-SD	+SD														
		54321012345	54321012345	54321012345	54321012345	54321012345	54321012345	54321012345	54321012345	54321012345	54321012345	54321012345	54321012345	54321012345	54321012345	54321012345	54321012345
96	1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
97	1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
98	1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
99	1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	3	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
	4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

SOLVENTS USED - R 96: CTC DCE TCE
 R 97: CFM CTC DCE
 R 98: BNZ OXY TOL
 R 99: CTC DCE TCE

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