



## PAT Program: Background and Current Status

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## Introduction

The Proficiency Analytical Testing (PAT) Program is a collaborative effort of the American Industrial Hygiene Association (AIHA) and researchers at the Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. The PAT Program provides quality control reference samples to over 1400 occupational health and environmental laboratories in 18 countries. Although one objective of the PAT Program is to evaluate the analytical ability of participating laboratories, the primary objective is to assist these laboratories in improving their laboratory performance.

Each calendar quarter (designated as a round), samples are mailed to participating laboratories and the data are analyzed to evaluate laboratory performance on a series of analyses. Each mailing and subsequent data analysis is completed in time for participants to obtain repeat samples and to correct analytical problems before the next calendar quarter starts. The PAT Program currently includes four sets of samples, as shown in Table 1. A mixture of three of the four possible metals and one to three of the ten possible organic solvents are rotated for each round. Asbestos alternates between amosite and chrysotile; no asbestos fiber mixtures are provided. Each set consists of four concentrations and a blank. The metals, silica, and asbestos samples are on filters, and the organic solvents are on charcoal or silica gel tubes. The organic solvent set also includes five blank charcoal or silica gel tubes for desorption efficiency determination.

Laboratories are evaluated for each analysis by comparing their reported results against an acceptable performance limit for each PAT Program sample the laboratory analyzes. Reference laboratories are preselected to provide the performance limits for each sample. These reference laboratories must meet the following criteria: (1) the laboratory was rated proficient in

TABLE 1. Current Sets of Samples in the PAT Program

Metals	Silica	Asbestos (PCM Fiber Counting)	Organic Solvents
Cadmium	Quartz	Amosite	Benzene
Chromium		Chrysotile	Chloroform
Lead			1,2-Dichloroethane
Zinc			Methanol
			p-Dioxane
			Tetrachloroethylene
			Toluene
			1,1,1-Trichloroethane
			Trichloroethylene
			o-Xylene

the last PAT evaluation of all the contaminants in the program; and (2) the laboratory, if located in the United States, is AIHA accredited. After the data from the reference laboratories are collected and statistically treated, the mean of the collected data is called the reference value and the performance limits equal the mean  $\pm 3$  standard deviations. Data are acceptable if they fall within the performance limits. Data falling outside the performance limits are reported as outliers.

Laboratories are rated based upon performance in the PAT Program over the last year (i.e., four calendar quarters), as well as on individual contaminant 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; and (2) proficient in all other cases if three-fourths or more of the results reported in the last four consecutive rounds are classified as acceptable.<sup>(1)</sup>

## PAT Round 121, April 1995

A total of 1376 laboratories were enrolled in the PAT Program, with 1297 laboratories submitting results on round 121. Table 2 lists the reference values, performance limits, and participants for each sample type in the PAT Program. Table 3 presents the summary of the PAT

proficiency ratings for each analytical area.

The format of the individual laboratory reports was changed this PAT round. The new data format is presented on three pages. The first page contains the laboratory's results as reported, the reference value for each sample, the acceptable performance range, the z score (standard deviations from the reference value) for each sample, and the laboratory's performance on each sample. On the second page is the year-to-date summary for the laboratory and the proficiency rating for each analyte that the laboratory has reported. The ratio of the number of acceptable samples divided by the total number of samples analyzed is also given and the percent passed is given for both the two-round and four-round proficiency criteria. The third page provides more information on the reference laboratory results, including laboratory mean, standard deviation, relative standard deviation, number of laboratories that analyzed each sample, and number of low and high outliers for each sample.

Several changes were also made in the way that a laboratory is evaluated by the PAT Program. There is now no overall proficiency rating given to a laboratory. A proficiency rating is given only for each type of sample (i.e., metals, silica, asbestos, and organics) that a laboratory has analyzed. For a sample type with

TABLE 2. Reference Values, Performance Limits, and Participants for Each Sample Type; PAT Round 121 (April 1995)

Contaminant	Sample Number	Number of Reference Labs	Reference Value	Relative Std. Dev. (%)	Performance Limits	Number of Labs	Number of Outliers
Cadmium	1	59	0.0049 mg	5.1	0.0041–0.0056 mg	389	35
	2	59	0.0184 mg	3.9	0.0163–0.0206 mg	389	38
	3	59	0.0078 mg	4.2	0.0068–0.0088 mg	389	36
	4	59	0.0155 mg	3.9	0.0136–0.0173 mg	389	36
Lead	1	59	0.0940 mg	4.3	0.0820–0.1061 mg	396	27
	2	59	0.0634 mg	3.8	0.0561–0.0707 mg	396	34
	3	59	0.0317 mg	4.7	0.0273–0.0362 mg	396	29
	4	59	0.0542 mg	3.9	0.0479–0.0605 mg	396	39
Zinc	1	59	0.0869 mg	5.4	0.0728–0.1010 mg	388	19
	2	59	0.0532 mg	5.6	0.0442–0.0621 mg	388	25
	3	59	0.1828 mg	4.0	0.1609–0.2047 mg	388	37
	4	59	0.1201 mg	4.1	0.1055–0.1347 mg	388	28
Silica	1	57	0.0504 mg	21.9	0.0172–0.0835 mg	91	3
	2	57	0.0690 mg	23.1	0.0213–0.1168 mg	91	3
	3	57	0.0971 mg	22.7	0.0310–0.1632 mg	91	3
	4	57	0.1125 mg	21.4	0.0401–0.1848 mg	91	3
Asbestos (chrysotile)	1	58	507 f/mm <sup>2</sup>	26.8	181–998 f/mm <sup>2</sup>	1103	62
	2	58	358 f/mm <sup>2</sup>	32.2	96–787 f/mm <sup>2</sup>	1103	31
	3	58	191 f/mm <sup>2</sup>	39.9	31–487 f/mm <sup>2</sup>	1103	19
	4	58	166 f/mm <sup>2</sup>	39.8	27–423 f/mm <sup>2</sup>	1103	27
1,1,1-Trichloroethane	1	58	0.2012 mg	4.5	0.1738–0.2286 mg	352	45
	2	58	0.9926 mg	3.8	0.8794–1.1059 mg	352	38
	3	58	0.7572 mg	3.8	0.6708–0.8436 mg	352	37
	4	58	0.4361 mg	3.7	0.3876–0.4846 mg	352	39
Tetrachloroethylene	1	58	0.9323 mg	4.2	0.8153–1.0492 mg	352	33
	2	58	0.2047 mg	5.0	0.1739–0.2355 mg	352	51
	3	58	0.7713 mg	4.3	0.6712–0.8713 mg	352	27
	4	58	0.4693 mg	3.7	0.4168–0.5218 mg	352	42
Trichloroethylene	1	58	0.3789 mg	4.3	0.3297–0.4281 mg	351	32
	2	58	0.5298 mg	4.4	0.4595–0.6001 mg	351	33
	3	58	0.9644 mg	3.9	0.8520–1.0769 mg	351	37
	4	58	0.2762 mg	4.2	0.2413–0.3111 mg	351	36

TABLE 3. PAT Proficiency Ratings Based Upon Rounds 118 to 121 (July 1994–June 1995)

Contaminant	Number of Labs Rated	Number of Labs Rated Nonproficient	Percent Labs Rated Nonproficient
Metals	415	30	7.2
Silica	98	1	1.0
Asbestos	1177	34	2.9
Organic solvents	379	35	9.2

more than one analyte (i.e., metals and organics), all samples must be analyzed each round or no rating will be given for that sample type. Also, a missed round with no data reported for a sample type will result in no rating being given.

**PAT Round 122, July 1995**

PAT round 122 was sent to participating laboratories on June 30, 1995. The organic solvents in this round were benzene, o-xylene, and toluene. Metals in this round included cadmium, chro-

mium, and lead. Silica had a talc background and the asbestos was amosite.

**Reference**

1. Esche, C.A.; Groff, J.H.; Schlecht, P.C.; Shulman, S.A.: Laboratory Evaluations and Performance Reports for the Proficiency Analytical Testing (PAT) and Environmental Lead Proficiency Analytical Testing (ELPAT) Programs. DHHS (NIOSH) No. 95-104. National Institute for Occupational Safety and Health, Cincinnati, OH (1994).

**EDITORIAL NOTE:** Paul C. Schlecht and Jensen H. Groff are with the Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, Cincinnati, OH 45226-1998.