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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 (CDC), National Institute for Occupational Safety and Health (NIOSH). 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.

TABLE 1. Current Sets of Samples in Proficiency Analytical Testing (PAT) Program

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

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 tubes. The organic solvent set also includes five blank charcoal 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 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 ± 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 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; 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. Overall laboratory performance is rated as 1) proficient if two-thirds or more of the individual PAT contaminants are rated proficient; but 2) nonproficient if any individual PAT contaminants are rated nonproficient for more than four consecutive times (i.e., one year).[1]

PAT Round 119, October 1994

A total of 1425 laboratories were enrolled in the PAT Program, with 1306 laboratories submitting results on Round 119. Table 2 lists the reference values, performance limits, and participants for each sample type in the PAT Program. A total of 93.2 percent of the 1379 laboratories evaluated were rated overall proficient this time. There were no significant changes in the samples provided to the laboratories or any unusual problems encountered for this evaluation period. An automated data entry system allows laboratories to submit analytical results over a modem using a computer and software developed at NIOSH.

Proficiency Ratings—PAT Rounds 116–119, January 1994–December 1994

A total of 1379 laboratories were rated based upon their performance over the last four rounds (one year). Table 3 presents the PAT proficiency ratings by analytical area and overall.

PAT Round 120, January 1995

PAT Round 120 was sent to participating laboratories on January 3, 1995. There was a major change made to the organic solvents of the PAT Program. The organic solvent in this round was methanol on silica gel tubes. Laboratories were evaluated on only one organic solvent instead of the normal three for this PAT round. The analysts in the laboratories were told that a suggested method for analysis for methanol on silica gel tubes was NIOSH Method 2000,[2] which requires using water as the desorbing medium. Metals in this round included cadmium, chromium, and lead. Also, silica had a coal mine dust background and the asbestos was amosite.

TABLE 2. Reference Values, Performance Limits, and Participants for Each Sample Type; PAT Round 119 (October 1994)

Contaminant	Sample Number	Number of Reference Labs	Reference Value	Relative Std. Dev. (%)	Performance Limits	Number of Labs	Number of Outliers
Cadmium	1	62	0.0119 mg	2.9	0.0109–0.0129 mg	393	66
	2	62	0.0148 mg	3.4	0.0133–0.0162 mg	393	42
	3	62	0.0050 mg	4.4	0.0044–0.0056 mg	393	49
	4	62	0.0069 mg	4.3	0.0061–0.0077 mg	393	52
Lead	1	62	0.0404 mg	3.9	0.0357–0.0451 mg	402	45
	2	62	0.0880 mg	4.0	0.0775–0.0985 mg	402	31
	3	62	0.0639 mg	4.5	0.0553–0.0726 mg	402	28
	4	62	0.0193 mg	5.5	0.0161–0.0224 mg	402	38
Zinc	1	62	0.2135 mg	4.5	0.1845–0.2425 mg	392	36
	2	62	0.1208 mg	5.0	0.1028–0.1387 mg	392	30
	3	62	0.1625 mg	5.0	0.1382–0.1867 mg	392	34
	4	62	0.0925 mg	5.2	0.0783–0.1068 mg	392	29
Silica	1	61	0.0542 mg	22.1	0.0183–0.0901 mg	93	3
	2	61	0.0904 mg	18.1	0.0414–0.1394 mg	93	2
	3	61	0.1161 mg	19.5	0.0484–0.1838 mg	93	3
	4	61	0.0603 mg	24.8	0.0154–0.1051 mg	93	2
Asbestos (chrysotile)	1	62	373 f/mm^2	30.4	114–782 f/mm^2	1110	45
	2	62	420 f/mm^2	30.6	120–902 f/mm^2	1110	37
	3	62	221 f/mm^2	31.8	60–484 f/mm^2	1110	37
	4	62	274 f/mm^2	36.7	53–664 f/mm^2	1110	20
Carbon tetrachloride	1	62	0.1189 mg	7.4	0.0927–0.1452 mg	352	48
	2	62	0.2428 mg	4.9	0.2072–0.2785 mg	352	38
	3	62	0.7224 mg	3.6	0.6447–0.8002 mg	352	37
	4	62	0.8954 mg	3.3	0.8071–0.9837 mg	352	29
1,2 Dichloroethane	1	62	0.6044 mg	2.6	0.5579–0.6508 mg	353	47
	2	62	0.8472 mg	3.2	0.7647–0.9298 mg	353	24
	3	62	0.2172 mg	2.8	0.1988–0.2357 mg	353	51
	4	62	0.4793 mg	3.2	0.4333–0.5253 mg	353	29
Trichloroethylene	1	62	0.9178 mg	3.1	0.8336–1.0020 mg	353	32
	2	62	0.3611 mg	3.3	0.3256–0.3966 mg	353	30
	3	62	0.6242 mg	3.1	0.5665–0.6818 mg	353	34
	4	62	0.4111 mg	3.0	0.3736–0.4486 mg	353	35

TABLE 3. PAT Proficiency Ratings Based Upon Rounds 116 to 119 (January 1994–December 1994)

Contaminant	Number of Labs Rated	Number of Labs Rated Nonproficient	Percent Labs Rated Nonproficient
Metals	415	32	7.7
Silica	97	2	2.1
Asbestos	1170	44	3.8
Organic Solvents	375	45	12.0
Overall	1379	94	6.8

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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, Ohio 45226-1998.