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Background and Current Status

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Jensen H. Groff and Paul C. Schlecht, Column Editors

Introduction

The Proficiency Analytical Testing (PAT) Program is a collaborative effort of the American Industrial Hygiene Association (AIHA) and researchers at the National Institute for Occupational Safety and Health (NIOSH), Centers for Disease Control and Prevention (CDC). The PAT Program provides quality control reference samples to over 1400 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 these laboratories in improving their laboratory performance.

Each calendar quarter (designated 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 are 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 I.

A mixture of three of the four possible metals, and three of the fifteen possible organic solvents, are rotated for each round. Asbestos alternates between asmosite and chrysotile; no asbestos fiber mixtures are provided. Each set consists of four concentration levels 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]

TABLE I. 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

PAT Round 114, July 1993

A total of 1451 laboratories were enrolled in the PAT Program with 1352 laboratories submitting results on Round 114. Table II lists the reference values, performance limits, and participants for each sample type in the PAT Program. A total of 91.1 percent of the 1404 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.

Proficiency Ratings—PAT Rounds 111–114, October 1992–September 1993

A total of 1404 laboratories were rated based upon their performance over the last four rounds (one year). Table III presents the PAT proficiency ratings by analytical area and overall.

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TABLE II. Reference Values, Performance Limits, and Participants for Each Sample Type; PAT Round 114 (July 1993)

Contaminant	Sample Number	Number of Reference Labs	Reference Value	Relative Std. Dev. (%)	Performance Limits	Number of Labs	Number of Outliers
Cadmium	1	64	0.0088 mg	4.8	0.0076–0.0100 mg	391	24
	2	64	0.0156 mg	4.2	0.0137–0.0175 mg	391	20
	3	64	0.0167 mg	4.1	0.0146–0.0187 mg	391	22
	4	64	0.0068 mg	4.4	0.0060–0.0077 mg	391	31
Chromium	1	64	0.2094 mg	5.7	0.1736–0.2452 mg	388	20
	2	64	0.1177 mg	5.6	0.0981–0.1373 mg	388	23
	3	64	0.0543 mg	5.3	0.0456–0.0629 mg	388	26
	4	64	0.0936 mg	6.0	0.0768–0.1103 mg	388	18
Lead	1	64	0.0314 mg	4.3	0.0274–0.0354 mg	398	32
	2	64	0.0525 mg	3.7	0.0467–0.0584 mg	398	31
	3	64	0.0936 mg	4.1	0.0822–0.1050 mg	398	21
	4	64	0.0735 mg	4.6	0.0635–0.0834 mg	398	20
Silica	1	61	0.0545 mg	37.0	0.0059–0.1150 mg	93	2
	2	61	0.1183 mg	26.9	0.0230–0.2135 mg	93	3
	3	61	0.0935 mg	19.7	0.0382–0.1487 mg	93	3
	4	61	0.1145 mg	22.4	0.0376–0.1914 mg	93	2
Asbestos (amosite)	1	63	245 f/mm^2	21.2	115–423 f/mm^2	1167	84
	2	63	958 f/mm^2	14.5	589–1415 f/mm^2	1167	88
	3	63	446 f/mm^2	17.6	244–709 f/mm^2	1167	53
	4	63	548 f/mm^2	15.5	324–830 f/mm^2	1167	88
Benzene	1	64	0.4295 mg	3.1	0.3902–0.4687 mg	366	47
	2	64	0.2181 mg	3.5	0.1951–0.2411 mg	366	46
	3	64	0.0938 mg	5.4	0.0786–0.1090 mg	366	46
	4	64	0.3574 mg	3.4	0.3208–0.3940 mg	366	42
o-Xylene	1	64	1.9439 mg	4.8	1.6655–2.2222 mg	366	38
	2	64	0.6207 mg	4.1	0.5437–0.6977 mg	366	46
	3	64	1.3459 mg	4.1	1.1801–1.5116 mg	366	45
	4	64	1.1074 mg	4.8	0.9473–1.2675 mg	366	37
Toluene	1	64	0.5816 mg	3.8	0.5148–0.6483 mg	366	39
	2	64	1.7180 mg	3.6	1.5319–1.9041 mg	366	41
	3	64	1.0811 mg	3.1	0.9813–1.1809 mg	366	52
	4	64	0.8841 mg	3.8	0.7830–0.9852 mg	366	42

TABLE III. PAT Proficiency Ratings Based Upon Rounds 111 to 114 (October 1992–September 1993)

Contaminant	Number of Labs Rated	Number of Labs Rated Nonproficient	Percent Labs Rated Nonproficient (%)
Metals	409	33	8.1
Silica	97	1	1.0
Asbestos	1215	71	5.8
Organic Solvents	379	58	15.3
Overall	1404	125	8.9

Upcoming PAT Round 115, October 1993

PAT Round 115 was sent on October 1, 1993. The organic solvents in this round were carbon tetrachloride, 1,2-dichloroethane, and trichloroethylene. Metals in this round included cadmium, lead, and zinc. Also, silica had a talc and coal mine dust background and the asbestos was chrysotile.

Reference

1. Groff, J.H.; Schlecht, P.C.; Shulman, S.: Laboratory Reports and Rating Criteria for the Proficiency Analytical Testing (PAT) Program. DHHS (NIOSH) Pub. No. 91-102. National Institute for Occupational Safety and Health, Cincinnati, OH (1990).

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