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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, 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 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 is rotated for each round. Fibers alternate between amosite and chrysotile asbestos and man-made fibers; no fiber mixtures are provided. Each set consists of four concentrations and a blank. The metal, silica, and fiber 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 the last PAT evaluation of all the contaminants in the program; and (2) the laboratory, if located in the United States, is AIHA accredited.

TABLE 1. Current Sets of Samples in the PAT Program

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

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. Individual contaminants are metals, silica, asbestos/fibers, 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.[1]

PAT Round 124, January 1996

A total of 1399 laboratories were enrolled in the PAT Program, with 1297 laboratories submitting results on round 124. Table 2 presents the summary of the PAT proficiency ratings for each analytical area. Table 3 lists the reference values, performance limits, and participants for each sample type in the PAT Program.

There will be several changes to the PAT Program in the future. Starting with round 126, cadmium levels will be lowered to comply with Occupational Safety and Health Administration regulations. Also, there will be one man-made fiber sample included with every asbestos/fibers kit. Laboratories should use the "A" rules when counting man-made fibers. Round 126 will also be the first practice round for passive monitors. Monitors from three different manufacturers will be used. The organic solvents will be benzene, toluene, and *o*-xylene.

TABLE 2. PAT Proficiency Ratings Based on Rounds 121 to 124 (April 1995–March 1996)

Contaminant	No. of Labs Rated	No. of Labs Rated Proficient	Percent Labs Rated Proficient
Metals	378	352	93.1
Silica	85	83	97.6
Asbestos/fibers	1062	1002	94.3
Organic solvents	339	301	88.8

TABLE 3. Reference Values, Performance Limits, and Participants for Each Sample Type: PAT Round 124 (January 1996)

Contaminant	Sample Number	No. of Reference Labs	Reference Value	RSD (%)	Performance Limits	No. of Labs	No. of Outliers
Cadmium	1	57	0.0048 mg	4.6	0.0041–0.0055 mg	381	36
	2	57	0.0096 mg	3.9	0.0085–0.0108 mg	381	31
	3	57	0.0078 mg	3.6	0.0070–0.0086 mg	381	42
	4	57	0.0127 mg	4.1	0.0112–0.0143 mg	381	30
Chromium	1	57	0.0502 mg	5.0	0.0427–0.0577 mg	378	36
	2	57	0.0993 mg	4.5	0.0859–0.1126 mg	378	37
	3	57	0.2296 mg	5.4	0.1922–0.2671 mg	378	37
	4	57	0.1768 mg	6.2	0.1440–0.2096 mg	378	27
Lead	1	57	0.0332 mg	4.3	0.0289–0.0375 mg	386	26
	2	57	0.0216 mg	5.3	0.0182–0.0250 mg	386	24
	3	57	0.0899 mg	3.9	0.0795–0.1004 mg	386	30
	4	57	0.0649 mg	4.7	0.0558–0.0740 mg	386	27
Silica	1	57	0.1043 mg	21.0	0.0387–0.1700 mg	85	2
	2	57	0.1472 mg	20.5	0.0566–0.2378 mg	85	1
	3	57	0.0753 mg	22.7	0.0240–0.1265 mg	85	2
	4	57	0.0950 mg	24.6	0.0249–0.1650 mg	85	1
Asbestos/fibers (amosite)	1	57	250 f/mm^2	20.9	118–432 f/mm^2	1062	54
	2	57	639 f/mm^2	15.1	383–961 f/mm^2	1062	85
	3	57	503 f/mm^2	18.4	264–818 f/mm^2	1062	44
	4	57	423 f/mm^2	19.8	209–712 f/mm^2	1062	52
1,2-Dichloroethane	1	57	0.6281 mg	3.3	0.5657–0.6904 mg	339	44
	2	57	0.8483 mg	4.3	0.7378–0.9588 mg	339	26
	3	57	0.1630 mg	5.0	0.1387–0.1872 mg	339	39
	4	57	0.9664 mg	5.1	0.8178–1.1151 mg	339	24
Tetrachloroethylene	1	57	0.2361 mg	6.8	0.1879–0.2843 mg	339	30
	2	57	0.4733 mg	5.3	0.3974–0.5492 mg	339	25
	3	57	0.3579 mg	6.2	0.2912–0.4246 mg	339	35
	4	57	0.6602 mg	4.1	0.5785–0.7418 mg	339	36
Trichloroethylene	1	57	0.5246 mg	4.1	0.4605–0.5888 mg	339	32
	2	57	0.4288 mg	4.0	0.3772–0.4804 mg	339	31
	3	57	0.8828 mg	3.9	0.7804–0.9852 mg	339	34
	4	57	0.1945 mg	5.5	0.1621–0.2268 mg	339	25

PAT Round 125, April 1996

PAT round 125 was sent to participating laboratories on April 1, 1996. The organic solvent in this round was methanol on silica gel tubes. Metals in this round included cadmium, lead, and zinc. Silica had a calcite background and asbestos/fibers were chrysotile.

References

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 (EL-PAT) Programs. DHHS (NIOSH) Pub. No. 95-104. National Institute for Occupational Safety and Health, Cincinnati, OH (1994).