PAT Program

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PAT PROGRAM Background and Current Status

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Introduction

The American Industrial Hygiene Association (AIHA) manages the Proficiency Analytical Testing (PAT) Program, including sample kit distribution and data processing. The National Institute for Occupational Safety and Health (NIOSH) performs research and advises the program on an as-needed basis. The PAT Program provides quality control reference samples to over 1200 occupational health and environmental laboratories in 17 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 includes four sets of samples as shown in Table 1, plus diffusive samplers mailed to participants every other PATs round. A mixture of three of the four possible metals, and one to three of the 15 possible organic solvents are 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 metals, silica, and fiber samples are on filters and the organic solvents are on charcoal, carbon molecular sieve, or silica gel tubes. The organic solvent set also includes five blank charcoal, carbon molecular sieve, or silica gel tubes for desorption efficiency determination. Diffusive samplers from three manufacturers are exposed to an environment of three organic solvents (benzene, *o*-xylene, and toluene).

Laboratories are evaluated for each analysis by comparing their reported results against an acceptable performance limit for each PAT Program sample the laboratory analyzes. After the data from all laboratories are collected and statistically treated, the mean of the collected data is calculated and the performance limits equal to 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. Diffusive samplers are exposed to an environment of three organic solvents while monitoring the concentration of the organic solvents with charcoal tube sampling and calculated vapor concentrations. The acceptable performance limit for the diffusive sampler program is the calculated vapor concentration ±18 percent.

Laboratories are rated based on 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, organic solvents, and diffusive samplers. 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] However, laboratories participating in the diffusive sampler program are rated proficient if three-fourths or more of the results reported in the last two consecutive rounds (one year) are classified as acceptable.

PAT Round 133, April 1998

A total of 1201 laboratories were enrolled in the PAT Program, with 1097 laboratories submitting results on round 133. Of the 1097 laboratories submitting results, 630 submitted them via the Internet (www.aiha.org/proftest.htm). 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.

PAT Round 134, July 1998

PAT round 134 was sent to participating laboratories on July 1, 1998. In the PAT program, the organic solvents were ethyl acetate, *n*-butyl acetate, and 2-propanol. Metals in this round included cadmium, chromium, and lead. Silica had a coal mine dust background, and asbestos/fibers were amosite with one man-made fiber sample. Results for PAT round 134 were the last to be sent to NIOSH. Diffusive sampler round 134 was also sent to participating laboratories in July 1998. The organic solvents were benzene, *o*-xylene, and toluene. Starting with PAT round 135 in October 1998, results for all proficiency testing programs must be sent to AIHA in Fairfax, Virginia.

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

TABLE 1. Current Sets of Samples in the PAT Program

Metals	Cadmium
	Chromium
	Lead
	Zinc
Silica	Quartz
Asbestos/Fibers	Amosite
	Chrysotile
	Manmade fibers
Organic Solvents	Benzene
	n-Butyl acetate
	Chloroform
	1,2-Dichloroethane
	p-Dioxane
	Ethyl acetate
	Isopropanol
	Methanol
	Methyl ethyl ketone
	Methyl isobutyl ketone
	Tetrachloroethylene
	Toluene
	1,1,1-Trichloroethane
	Trichlorethylene
	o-Xylene

TABLE 2. References Values, Performance Limits, and Participants for Each Sample Type: PAT Round 133 (April 1998)

Contaminant	Sample Number	No. of Labs	Reference Value	RSD (%)	Performance Limits		No. of Outliers
					Lower	Upper	
Cadmium (mg)	1	318	0.0019	6.7	0.0015	0.0023	35
	2	318	0.0038	5.4	0.0032	0.0044	17
	3	318	0.0075	4.6	0.0065	0.0086	24
	4	318	0.0113	4.3	0.0099	0.0128	21
Lead (mg)	1	323	0.0193	5.4	0.0162	0.0225	21
	2	323	0.0481	4.3	0.0419	0.0544	20
	3	323	0.0766	4.0	0.0674	0.0858	27
	4	323	0.1050	4.0	0.0929	0.1171	19
Zinc (mg)	1	315	0.0592	5.2	0.0499	0.0685	22
	2	315	0.0868	4.9	0.0741	0.0995	21
	3	315	0.1173	4.7	0.1008	0.1338	27
	4	315	0.1562	4.5	0.1350	0.1773	24
Silica (mg)	1	82	0.0588	19.1	0.0251	0.0925	3
	2	82	0.0865	17.2	0.0420	0.1310	4
	3	82	0.0917	16.9	0.0452	0.1381	2
	4	82	0.1236	15.8	0.0651	0.1821	1
Asbestos/fibers (chrysotile) (f/mm^2)	1	942	95	20.0	28	202	59
	2	942	128	20.0	41	262	84
	3	942	210	20.0	75	412	86
	4	942	144	20.0	48	291	29
Chloroform (mg)	1	279	0.5003	4.7	0.4291	0.5714	23
	2	279	0.7703	4.4	0.6683	0.8723	16
	3	279	1.0336	4.3	0.9018	1.1655	23
	4	279	1.2352	4.2	1.0806	1.3899	20
1,1,1-Trichloroethane (mg)	1	279	0.5062	4.9	0.4313	0.5810	17
	2	279	0.7638	4.7	0.6564	0.8711	22
	3	279	1.0386	4.6	0.8968	1.1805	22
	4	279	1.2432	4.5	1.0758	1.4106	29
Trichloroethylene (mg)	1	279	0.5084	4.3	0.4420	0.5747	20
	2	279	0.8080	4.2	0.7057	0.9102	19
	3	279	0.9964	4.2	0.8716	1.1213	19
	4	279	1.4015	4.1	1.2281	1.5749	27

TABLE 3. PAT Proficiency Ratings Based on Rounds 130 to 133 (July 1997–June 1998)

Contaminant	No. of Labs Rated	No. of Labs Rated Proficient	Percent Labs Rated Proficient
Metals	315	293	93.0
Silica	82	77	93.9
Asbestos/fibers	942	904	96.0
Organic solvents	279	255	91.4