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# PAT Program Report: Background and Current Status

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# PAT Program Report

## 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 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 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 participating 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 combination of three metals and three organic solvents are rotated for each round. Asbestos is rotated among amosite and chrysotile; no 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 $\pm 3$ 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 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-quarters 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 105, April 1991

A total of 1512 laboratories were enrolled in the PAT Program with 1448 laboratories submitting results on Round 105. Table II lists the reference values, performance limits, and participants for each sample type in the Program. A change in the supplier of PVC filters for silica analysis was made this quarter. The filters used for silica were from Gelman Sciences (GLA-5000 PVC, 37-mm diameter, 5-μm pore size, Product No. 66469). One laboratory had a problem using tetrahydrofuran (THF) to dissolve the filters. This problem has arisen before and laboratories should probably not use THF to dissolve the PVC filters. Another laboratory noticed significant weight differences in redeposited samples. A possible expla-

**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 |
| | | | Hexane |
| | | | Methylene chloride |
| | | | Methyl chloroform |
| | | | Methyl ethyl ketone |
| | | | Methyl isobutyl ketone |
| | | | Octane |
| | | | Tetrachloroethylene |
| | | | Toluene |
| | | | Trichloroethylene |
| | | | o-xylene |

**TABLE II. Reference Values, Performance Limits, and Participants for Each Sample Type; PAT Round 105 (April 1991)**

| Contaminant | Sample Number | Number of Reference Labs | Reference Value | Relative Std. Dev. | Performance Limits | Number of Labs Analyzed | Number of Outliers |
|---|---|---|---|---|---|---|---|
| Cadmium | 1 | 73 | 0.0139 mg | 3.6% | 0.0124–0.0154 mg | 389 | 50 |
| | 2 | 73 | 0.0070 mg | 3.6% | 0.0062–0.0077 mg | 389 | 58 |
| | 3 | 73 | 0.0197 mg | 3.3% | 0.0178–0.0216 mg | 389 | 45 |
| | 4 | 73 | 0.0110 mg | 3.7% | 0.0098–0.0121 mg | 389 | 50 |
| Lead | 1 | 73 | 0.0464 mg | 3.6% | 0.0414–0.0514 mg | 394 | 54 |
| | 2 | 73 | 0.0557 mg | 3.7% | 0.0495–0.0618 mg | 394 | 45 |
| | 3 | 73 | 0.0243 mg | 3.7% | 0.0216–0.0270 mg | 394 | 49 |
| | 4 | 73 | 0.0348 mg | 4.0% | 0.0307–0.0389 mg | 394 | 43 |
| Zinc | 1 | 73 | 0.1356 mg | 3.3% | 0.1223–0.1489 mg | 387 | 64 |
| | 2 | 73 | 0.0779 mg | 4.3% | 0.0678–0.0879 mg | 387 | 50 |
| | 3 | 73 | 0.2064 mg | 4.0% | 0.1815–0.2313 mg | 387 | 41 |
| | 4 | 73 | 0.1627 mg | 4.1% | 0.1429–0.1826 mg | 387 | 45 |
| Silica | 1 | 71 | 0.1010 mg | 23.4% | 0.0457–0.2234 mg | 108 | 6 |
| | 2 | 71 | 0.0685 mg | 23.5% | 0.0329–0.1426 mg | 108 | 6 |
| | 3 | 71 | 0.0674 mg | 25.3% | 0.0305–0.1487 mg | 108 | 4 |
| | 4 | 71 | 0.0837 mg | 25.9% | 0.0355–0.1971 mg | 108 | 4 |
| Asbestos (chrysotile) | 1 | 73 | 746 f/mm$^2$ | 16.8% | 412–1178 f/mm$^2$ | 1302 | 143 |
| | 2 | 73 | 593 f/mm$^2$ | 19.7% | 290–1002 f/mm$^2$ | 1302 | 93 |
| | 3 | 73 | 224 f/mm$^2$ | 22.0% | 100–399 f/mm$^2$ | 1302 | 98 |
| | 4 | 73 | 320 f/mm$^2$ | 20.4% | 154–548 f/mm$^2$ | 1302 | 119 |
| Chloroform | 1 | 73 | 0.4937 mg | 4.7% | 0.4237–0.5637 mg | 374 | 34 |
| | 2 | 73 | 1.1172 mg | 4.2% | 0.9775–1.2568 mg | 374 | 36 |
| | 3 | 73 | 0.6446 mg | 4.2% | 0.5636–0.7255 mg | 374 | 38 |
| | 4 | 73 | 0.8139 mg | 3.8% | 0.7215–0.9064 mg | 374 | 38 |
| Carbon tetrachloride | 1 | 73 | 0.6094 mg | 4.2% | 0.5325–0.6863 mg | 374 | 52 |
| | 2 | 73 | 1.3941 mg | 3.3% | 1.2547–1.5335 mg | 374 | 66 |
| | 3 | 73 | 0.9685 mg | 3.9% | 0.8549–1.0820 mg | 374 | 49 |
| | 4 | 73 | 1.0979 mg | 3.8% | 0.9732–1.2225 mg | 374 | 50 |
| 1,2-Dichloroethane | 1 | 73 | 0.9101 mg | 3.4% | 0.8164–1.0037 mg | 374 | 39 |
| | 2 | 73 | 0.8343 mg | 3.5% | 0.7463–0.9223 mg | 374 | 45 |
| | 3 | 73 | 0.4492 mg | 3.7% | 0.3998–0.4985 mg | 374 | 51 |
| | 4 | 73 | 0.7042 mg | 3.6% | 0.6282–0.7801 mg | 374 | 40 |

nation is that the filters have differences in ash residue. There will be further testing done to see if this is the case or if this was just an isolated incident. A third laboratory had difficulty removing the PVC filters from the cassettes and several of the filters tore during separation from the backup pad. In preparing the cassettes for silica generation, a batch of about 20 cassettes are compressed in a hydraulic press before mounting them in the aerosol generation chamber. This must be done to prevent air leakage around the edges of the cassettes. A cassette slightly higher than the others would be compressed harder and the PVC filter could be pressed into the backup pad making them difficult to separate.

## Proficiency Ratings: PAT Rounds 102–105, July 1990–June 1991

A total of 1478 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.

**TABLE III. Proficiency Ratings Based Upon Rounds 102 to 105 (July 1990–June 1991)**

| Contaminant | Number of Labs Rated | Number of Labs Rated Nonproficient | Percent Labs Rated Nonproficient |
|---|---|---|---|
| Metals | 402 | 62 | 15.4 |
| Silica | 111 | 3 | 2.7 |
| Asbestos | 1337 | 85 | 6.4 |
| Organic solvents | 384 | 57 | 14.8 |
| Overall | 1478 | 151 | 10.2 |

## Upcoming PAT Round 106, July 1991

PAT Round 106 was sent on July 1, 1991. The organic solvents in this round were benzene, o-xylene, and toluene. Metals in this round included cadmium, chromium, and lead. Also, silica had a talc background and the asbestos was amosite.

## References

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. NIOSH, Cincinnati, OH (1990).

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