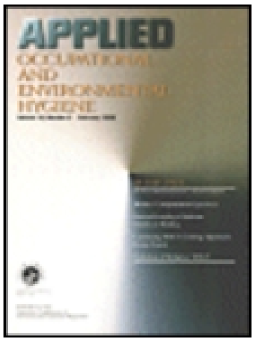

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ELPAT Program: Background and Current Status

Paul C. Schlecht Column Editors & Jensen H. Groff Column Editors

ELPAT Program

Background and Current Status

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

Introduction

The Environmental Lead Proficiency Analytical Testing (ELPAT) Program is administered by the American Industrial Hygiene Association (AIHA), in cooperation with researchers at the Centers for Disease Control and Prevention (CDC), National Institute for Occupational Safety and Health (NIOSH), and the U.S. Environmental Protection Agency (EPA) Office of Pollution Prevention and Toxics to evaluate and improve the performance of laboratories conducting analyses associated with lead abatement.[1,2] Proficiency test samples are prepared by an AIHA contractor, Research Triangle Institute (RTI), using real-world paint chips, dusts, and soils. Quarterly samples are sent to participating laboratories by RTI and the performance of the laboratories is evaluated at NIOSH with sufficient time for laboratories to obtain repeat samples and to correct analytical problems before the next round of samples is sent.

The ELPAT Program is open to *all* interested laboratories, including laboratories outside the United States, laboratories seeking accreditation by various private or state laboratory accreditation systems, and laboratories that do not intend to seek laboratory accreditation. The ELPAT Program is part of an EPA Program, the National Lead Laboratory Accreditation Program (NLLAP), to recognize private and state laboratory accreditation systems.[3] NLLAP requirements include successful participation in the ELPAT Program for EPA recognition of accreditation. Two organizations, the American Association for Laboratory Accreditation (A2LA)[4] and AIHA,[5] are recognized as accrediting organizations under NLLAP and have in place environmental lead laboratory accreditation systems. Each of these accreditation systems requires participation in ELPAT for environmental lead analysis of paint chips, dusts, and soils. Information on specific A2LA or AIHA laboratory accreditation requirements can be obtained from A2LA and AIHA at the addresses listed at the end of this column.

ELPAT Performance Evaluation

The evaluation of the individual laboratories in the ELPAT Program is based upon consensus values from reference laboratories and is modeled after the evaluation procedures currently used in an industrial hygiene proficiency testing program, the Proficiency Analytical Testing (PAT) Program. Reference laboratories are preselected to provide the performance limits for each sample. These laboratories must meet the following criteria: the laboratory was proficient in the previous ELPAT round for paint chips, soils, and/or dust wipes, and the laboratory must be accredited by an EPA NLLAP-recognized accrediting organization.[6] ELPAT round 10 is the first ELPAT round in which a sufficient number of participating laboratories (over 40) had achieved NLLAP recognition, so that reference laboratory selection could be limited to NLLAP-recognized laboratories.

After data from reference laboratories are collected and extreme reference laboratory data have been statistically treated, the mean $\pm$ 3 standard deviations of the treated reference laboratory data become the acceptable performance range. Laboratory results are acceptable if they fall within the performance limits. Results falling outside the performance limits are designated as outliers. This is the same criterion used by NIOSH to establish acceptable and outlier performance of industrial hygiene laboratories in the PAT Program.[6]

Laboratories are rated based upon performances in the ELPAT Program over the last year (i.e., four rounds) for each lead matrix—paint chips, soil, and dust wipes. The laboratory is proficient for each lead matrix if the following occurs:

1. all four results have been reported and all are designated as acceptable for the last two consecutive rounds; or
2. three-fourths or more of the results reported in the last four consecutive rounds are designated as acceptable.

However, if a laboratory does not report values for the lead matrix on the round being evaluated, the laboratory is not rated.

Criteria for proficient performance are similar to the procedure used in the PAT Program.[6] However, the ELPAT statistical protocol and related computer programs have been designed to permit future change to harmonize these proficiency test requirements with internationally harmonized proficiency test protocols. The international protocol for consensus values from reference laboratories using z-scores has been developed and published by the Association of Official Analytical Chemists International, the International Organization for Standardization, and the International Union of Pure and Applied Chemistry.[7]

ELPAT Round 10, February 1995

Paint samples for round 10 were prepared from paint chips collected from a variety of sites, including commercial lead abatement, building renovation, and demolition sites. The chips were ground to a maximum particle size of 120 μm.

Soil samples came from driplines around older houses in North Carolina and from industrial sites in Colorado and Louisiana. Soil samples were dried and then sterilized by heating the soil to 325°F for a minimum of 2 hours, and finally sieved to a maximum particle size of 150 μm.

Round 10 dust wipes were prepared by gravimetrically loading Whatman 40 filter paper with sterilized (gamma-irradiated) household and postabatement dust, sieved to a maximum particle size of 150 μm. The loaded filters were moistened with 0.5 ml of 3 percent hydrogen peroxide solution. The blank wipe was prepared from a Whatman filter moistened with the same hydrogen peroxide solution. Whatman filters are easier to digest than other wipe media (e.g., baby wipes, hand wipes) used by many laboratories. In the future, the wipe medium may be changed from the Whatman filter to a commercially available wipe that more closely represents field sample media, if a single sample medium is recommended by various lead methods.

TABLE 1. ELPAT Program Summary Statistics of Reference Laboratories for Round 010

Sample Type	Sample	N	Mean	Minimum	Maximum	STD	RSD (%)	Acceptable Range
Paint chips (%)	1	39	0.1094	0.0964	0.12	.007	6.7	0.0875–0.1312
	2	39	0.9577	0.842	1.09	.076	7.9	0.731–1.1843
	3	39	3.5754	3.09	4.053	.246	6.9	2.8367–4.3141
	4	39	0.5628	0.504	0.628	.037	6.5	0.4525–0.673
Soil (mg/kg)	1	38	423.8	367.7	480	31.6	7.5	328.9–518.8
	2	38	1517.4	1287	1684	109	7.2	1190–1844.8
	3	38	196	172	222.5	14.9	7.6	151.1–240.8
	4	38	783.7	713	848	44.8	5.7	649.3–918.1
Dust wipes (μg)	1	39	236.5	206	264.8	16.2	6.9	187.8–285.2
	2	39	69.5	56.4	82.2	7.22	10.4	47.8–91.2
	3	39	869.5	696	986.4	82.0	9.4	623.6–1115.4
	4	39	471.9	382.1	529.3	40.1	8.5	351.4–592.4

A total of 368 laboratories were enrolled for round 10 of the ELPAT Program, with 346 (94%) laboratories submitting results either by paper or by the automated data entry system. Table 1 lists summary statistics of reference laboratories for each matrix and sample number. Agreement among reference laboratories is demonstrated by relative standard deviations ranging from 6.5 to 7.9 percent for paint chips, 5.7 to 7.6 percent for soils, and 6.9 to 10.4 percent for dust wipes. This is similar to the agreement among reference laboratories on previous ELPAT rounds for each matrix.

Table 2 shows the number of all participating laboratory analyses that were identified as outliers. The percentage of outliers for all analyses was under 8.0 percent (5.6 to 7.1% for paint chips, 3.5 to 6.3% for soils, and 2.9 to 8.0% for dust wipes). This is also similar to the frequency of outliers reported on the earlier rounds of ELPAT for each matrix.

TABLE 2. ELPAT Round Program Summary of Performance—All Laboratories Participated for Round 010

Sample Type	Sample No.	No. of Labs Rated	Acceptable Labs	Low Outlier	High Outlier
Paint chips (%)	1	337	318	11	8
	2	337	314	17	6
	3	337	316	13	8
	4	337	313	17	7
Soil (mg/kg)	1	288	278	3	7
	2	288	275	6	7
	3	288	270	5	13
	4	288	278	4	6
Dust wipes (μg)	1	311	286	12	13
	2	311	296	9	6
	3	311	302	6	3
	4	311	301	4	6

Sample digestion techniques are grouped into hotplate, microwave, and all other techniques reported by participants. Hotplate digestion categories are: NIOSH 7082/7105 (a nitric acid/hydrogen peroxide digestion method modified from NIOSH Manual of Analytical Methods Method 7082[8]), EPA SW846-3050A[9] (an EPA nitric acid/hydrogen peroxide method), and other hotplate techniques. Microwave digestion categories are: EPA SW846-3051[10] (a nitric acid digestion method), EPA AREAL[11] [a nitric/hydrochloric acid digestion method from AREAL (RTP-MRDD-037) standard operating procedure], and other microwave techniques. The "other" category includes nonmicrowave and nonhotplate techniques such as X-ray fluorescence sample preparation, leaching techniques, muffle furnace, and Parr bomb.

Instrumental methods are categorized into flame atomic absorption (FAA), graphite furnace atomic absorption (GFAA), inductively coupled plasma-atomic emission spectroscopy (ICP-AES), laboratory X-ray fluorescence (lab XRF), and "other," which includes ICP-mass spectroscopy (ICP-MS) and anodic stripping voltametry (ASV). The American Society for Testing Materials (ASTM) has recently released a new publication of ASTM standards on lead-based paint abatement in buildings, which includes standards for the collection, digestion, and analysis of paint, soil, and dust samples for lead determination using FAA, GFAA, and ICP-AES techniques. Information on ordering this publication can be obtained from ASTM at the address listed at the end of this column.

Table 3 shows a summary of failures (outliers) for the three lead matrices by digestion technique and analytical method used by participating laboratories. A series of Fischer's exact tests (nonparametric tests) were used to compare the various combinations of digestion techniques (hotplate and microwave) and analytical methods (FAA, GFAA, ICP-AES) for statistically significant differences in the ability of the digestion techniques/analytical method combinations to meet ELPAT performance limits.[12] To detect differences in performance, a criterion was then used where participating laboratories are classified into two groups: those that had no outliers on the four ELPAT samples of the matrix and those that had one or more outliers. Fischer's exact test was then repeated for each ELPAT matrix. No statistically significant differences were detected for paint chips, soils, or dust wipes.

Inspection of Table 3 shows that the

TABLE 3. ELPAT Program Labs Performance Summary for Round 010

Instrument	Digestion	Method	Paint Chips (%) Acceptable N	%	Failures N	%	Soil (mg/kg) Acceptable N	%	Failures N	%	Dust Wipes (µg) Acceptable N	%	Failures N	%
FAA	Hotplate	NIOSH-7082/7105	163	93	13	7	81	96	3	4	255	95	13	5
		EPA-SW846-3050A	394	92	34	8	453	94	27	6	311	93	25	7
		Other-hotplate	99	95	5	5	36	100	0	0	40	100	0	0
	Microwave	EPA AREAL	4	100	0	0	7	88	1	13	4	100	0	0
		EPA-SW846-3051	44	92	4	8	43	83	9	17	38	95	2	5
		Other-microwave	20	100	0	0	4	100	0	0	20	100	0	0
	Other	All other	32	100	0	0	12	100	0	0	31	86	5	14
	—	—	3	75	1	25	0	0	0	0	0	0	0	0
GFAA	Hotplate	NIOSH-7082/7105	3	75	1	25	0	0	0	0	7	88	1	13
		EPA-SW846-3050A	12	100	0	0	16	100	0	0	23	96	1	4
	Microwave	EPA-SW846-3051	4	100	0	0	4	100	0	0	4	100	0	0
ICP-AES	Hotplate	NIOSH-7082/7105	36	90	4	10	20	100	0	0	60	100	0	0
		EPA-SW846-3050A	280	95	16	5	294	98	6	2	254	99	2	1
		Other-hotplate	32	100	0	0	16	100	0	0	47	98	1	2
	Microwave	EPA AREAL	8	100	0	0	12	100	0	0	8	100	0	0
		EPA-SW846-3051	52	100	0	0	50	96	2	4	42	95	2	5
		Other-microwave	20	100	0	0	8	100	0	0	12	100	0	0
	Other	All other	8	100	0	0	4	100	0	0	0	0	0	0
	—	—	3	75	1	25	8	100	0	0	0	0	4	100
LAB-XRF	Hotplate	Other-hotplate	1	25	3	75	0	0	0	0	0	0	0	0
	Other	All other	6	75	2	25	4	100	0	0	0	0	0	0
	—	—	4	100	0	0	4	100	0	0	0	0	0	0
Others	Hotplate	NIOSH-7082/7105	0	0	0	0	0	0	0	0	3	75	1	25
		EPA-SW846-3050A	11	92	1	8	12	100	0	0	8	100	0	0
	Microwave	EPA-SW846-3051	3	75	1	25	4	100	0	0	3	75	1	25
		Other-microwave	8	100	0	0	0	0	0	0	0	0	0	0
	Other	All other	7	88	1	13	5	63	3	38	4	100	0	0
—	Hotplate	Other-hotplate	4	100	0	0	4	100	0	0	3	75	1	25
	—	—	0	0	0	0	0	0	0	0	8	100	0	0
Total			1261	94	87	6	1101	96	51	4	1185	95	59	5

— = Not reported.

predominant analytical methods were FAA and ICP-AES. A total of 5 laboratories analyzed paint chips, 5 laboratories analyzed soils, and 9 laboratories analyzed dust wipes with GFAA. Two laboratories used ICP-MS, one used direct current plasma-atomic emission spectroscopy, one used dithizone spectrophotometry, and two used ASV. Three laboratories used lab XRF, with one of the three laboratories unable to successfully analyze paint chip samples. The one laboratory analyzing soil with lab XRF was successful with no outliers identified.

A more complete comparison of biases and interlaboratory precision differences among digestion techniques and instrumental methods is being undertaken at NIOSH.

ELPAT Rounds 9 and 10 Bias Analysis

Statistical significance tests are performed for investigating differences in bias among the principal sample preparation and instrumental methods and among the combinations of these two factors. The tests are performed for each matrix (paint chips, soils, and dust wipes) and ELPAT sample (sample numbers 1, 2, 3, and 4) whenever at least three laboratories use the sample preparation and instrumental method.

Analysis of variance (ANOVA) is used if the data meet the general assumptions of the ANOVA procedure, homogeneity of variances and normality. Bartlett's test is used for testing homogeneity of variance and the Shapiro-Wilk test is used for testing normality.[13,14] If the ANOVA assumptions are violated, the Box-Cox transformation procedure is used to examine the data for possible transformations to correct the problem.[13] If the transformed data meet the ANOVA assumptions, then the ANOVA tests are performed on the transformed data. If homogeneity of variance and normality are not achieved by transformation of the data, then a nonparametric approach is used.

In instances where variances are homogeneous and data are normally distributed (either before or after transformation), a one-way ANOVA followed by the Scheffe's multiple comparison test procedure is performed to test for differences in bias among the combinations of the principal sample preparation techniques and instrumental methods.[15] A two-way ANOVA followed by Scheffe's multiple comparison test procedure to test for any difference among principal sample preparation techniques and principal instrumental methods is also performed. Two-way ANOVAs separate bias that may be the result of sample preparation, instrumental method, or interaction of these two factors.

In instances where ANOVA cannot be performed on either the original data or transformed data, one of two nonparametric tests is performed. If transformed data meet the homogeneity of variances but not the normality assumptions, then the Kruskal-Wallis rank sums test followed by the Mann-Whitney-Wilcoxon test with a Bonferroni adjustment is used.[16] If no transformation can equalize the variances, then the median scores test followed by the sign test with Bonferroni adjustment is used.[17]

Sufficient data were reported to make comparisons among four digestion techniques: NIOSH 7082/7105 (a nitric/hydrogen peroxide hotplate digestion), EPA SW846-3050A (a nitric/hydrogen peroxide hotplate digestion), EPA SW846-3051 (a nitric/hydrochloric microwave digestion), and EPA AREAL (a nitric/hydrochloric microwave digestion), and three instrumental methods: FAA, GFAA, and ICP-AES.

Two-way ANOVA procedures separate bias that may be the result of sample preparation, instrumental method, or interaction of these two factors. Two-way ANOVAs found two instances where bias was statistically significant: round 9 paint chip sample 2 and round 10 paint chip sample 1. Subsequent multiple comparison tests attributed both of these biases to ICP-AES, giving 5 to 16 percent (of the corresponding reference laboratory mean) lower results than FAA.

The biases found on rounds 9 and 10 are similar to previous results. For paint chips on the first 10 rounds (40 ELPAT samples) NIOSH studies have found that ICP-AES gave lower results than FAA on 10 samples, or about 25 percent of the samples provided to laboratories since the program began. However, the bias is small, averaging 7 percent and ranging from 1 to 16 percent of the corresponding reference laboratory mean. Also, biases occurred only occasionally at levels above the HUD action limit of 0.5 percent.

The results are consistent with the 3 to 18 percent bias found by RTI in an EPA-sponsored collaborative test. In the EPA collaborative test, RTI followed up with participating laboratories and determined that some FAA laboratories failed to perform background corrections, which one would expect to result in a positive bias, and some ICP-AES laboratories failed to take matrix effects into account, which one would expect to result in a negative bias. NIOSH does not follow up with participating laboratories to determine if each participating ELPAT laboratory has performed all of the steps of the analytical method reported by the laboratory, and most ELPAT participating laboratories have not been accredited by a cooperating laboratory accreditation organization, A2LA or AIHA. Therefore, a portion of this bias may be due to a failure of some participating laboratories to follow all the steps of the analytical method. Laboratories should refer to the RTI collaborative test for a more complete discussion on how FAA and ICP-AES bias can be minimized.[11]

For soils, only 3 of the first 40 soil samples (7.5% of the soil samples used in the first 10 ELPAT rounds) demonstrated bias, and these biases were small, ranging from 5 to 9 percent of the corresponding reference laboratory mean. Two of the biases are attributed to differences in instrumental methods. In both of these instances, ICP-AES gave lower results than FAA. However, since this bias was identified in only two instances, and in both instances the bias was small, evidence that ICP-AES gives lower results than FAA for soils is limited. In one instance, ELPAT round 8 soil sample 4, ICP-AES also gave lower results than GFAA; however, this evidence of ICP-AES/GFAA bias is even more limited than ICP-AES/FAA soil evidence.

In round 5 soil sample 5, the two-way ANOVA identified a small bias (5% of the corresponding reference laboratory mean) among three sample preparation techniques: EPA SW846-3050A (hotplate), EPA SW846-3051 (microwave), and NIOSH 7082/7105 (hotplate). However, a subsequent Scheffe's multiple comparison test could not separate which techniques were different from the others, so the result is not conclusive. In summary, analysis of the first ten rounds of ELPAT soil data shows that small bias (5 to 9%) among sample preparation and instrumental methods has occasionally occurred, but there is no evidence that bias among methods is a major problem. Of the biases that have been identified, the evidence is strongest that ICP-AES gives lower results than FAA, but that evidence is very limited.

For dust wipes in the first ten rounds (40 ELPAT samples) NIOSH studies have found ten instances, 25 percent of the samples, where bias was statistically significant. As one might expect, there is a tendency for biases to occur more frequently at lower lead levels. All of the biases are attributed to differences in instrumental methods. The magnitude of dust wipe biases is somewhat higher than the biases found on paint chip and soil matrix samples and averages around 14 percent of the corresponding reference laboratory means. (The range of dust wipe biases is 8 to 25%, with biases above 15% occurring only at lead levels below 100 μg, well below the HUD interior floor standard, assuming 1 ft^2 of surface area is wiped.) Eight of the ten statistically significant dust wipe biases involve ICP-AES giving lower results than FAA. As with paint chips, failure to perform FAA background corrections and ICP-AES matrix minimization steps of the published methods may increase the bias between ICP-AES and FAA reported for dust wipes. Four of the ten statistically significant dust wipe biases involve differences between GFAA and other instrument techniques. GFAA gave lower results than FAA in three instances and GFAA gave higher results than ICP-AES in one instance. However, the evidence that GFAA gives higher results than ICP-AES and lower results than FAA is limited because only 10 percent of ELPAT dust wipe samples have shown GFAA bias and the analysis is based upon only a few laboratories (five to nine GFAA laboratories).

Lead Reference Materials

The ELPAT Program is designed to supplement, but not replace, a laboratory's internal quality control program. Use of materials of known lead content in suit-

TABLE 4. Certified Reference Materials

NIST Standard Reference Materials (SRMs)	Lead
SRM 1579a Powdered paint	11.995 ± 0.031%
SRM 2580 Powdered paint (to be released in 1995)	nominal value 4%
SRM 2581 Powdered paint (to be released in 1995)	nominal value 0.5%
SRM 2582 Powdered paint (total lead by weight)	208.8 ± 4.9 ppm
SRM 2709 Lead in soil	18.9 ± 0.5 ppm
SRM 2710 Lead in soil	5532 ± 80 ppm
SRM 2711 Lead in soil	1162 ± 31 ppm
SRM 2583 Lead in household dust (to be released in 1995)	nominal value 100–200 ppm
SRM 2579 Lead paint film on Mylar (set of 5)	3.53 ± 0.24 mg/cm^2
	1.63 ± 0.08 mg/cm^2
	1.02 ± 0.04 mg/cm^2
	0.29 ± 0.01 mg/cm^2
	less than 0.001 mg/cm^2
(Intended for checking the calibration of portable X-ray fluorescence analyzers when testing for lead in paint coatings on interior and exterior building surfaces in the field.)	
SRM 1648 Urban particulate matter	0.655 ± 0.008%
SRM 2704 Buffalo River sediment (total lead by weight)	161 ± 17 ppm
EPA/A2LA Certified Reference Materials	
Commercial supplier: RT Corporation through Fisher Scientific	
SRS014-50 Bag house dust	1914 ± 180 ppm*
SRS013-50 Paint blasting waste	643 ± 56 ppm*
SRS006-50 Paint sludge	753 ± 51 ppm*

*The concentrations of lead determined in a sample following digestion by EPA methods 3010, 3020, or 3050. All concentrations expressed on dry weight basis. The 50-g samples should be mixed well before removing subsamples.

able matrices is important in obtaining accurate and reliable lead results. Such materials should be used to validate methods when sample preparation techniques or instrumental methods are adopted or modified. In addition, the materials should be used for daily quality control charting of laboratory/analyst performance. ELPAT paint chip, soil, and dust wipe samples from completed ELPAT rounds are available from AIHA at the address listed at the end of this column. ELPAT materials differ from the certified reference materials listed below in Table 4. Either ELPAT materials are destroyed in one analysis (dust wipes), or the amount of material in bottles is limited to reduce the number of times that analyses can be repeated by laboratories reporting in the proficiency test round. National Institute of Standards and Technology (NIST) standard reference material (SRM) values report lead as total lead, whereas ELPAT- and EPA-certified reference materials report extractable lead.

Certified reference materials are commercially available from NIST and from commercial reference material suppliers participating in the EPA/A2LA environmental reference material certification program.[18] The materials listed in Table 4 are useful for daily quality control of analyses and initial evaluation of methods associated with residential or steel structure lead abatement. Since work continues on developing additional reference materials, this list of certified reference materials is subject to change. Updated lists of available certified reference materials are available from NIST, EPA-EMSL Cincinnati, and A2LA at the addresses listed at the end of this column.

EPA NLLAP

Under Title X of the Housing and Community Development Act of 1992, EPA, in consultation with the Department of Health and Human Services, has the responsibility to review and determine if effective voluntary laboratory accreditation systems are in place. If EPA determines effective voluntary laboratory accreditation systems are not in place, EPA is responsible to establish a federal laboratory certification system.[19]

The EPA has established an NLLAP to recognize laboratories performing analysis associated with lead abatement. NLLAP recognition of laboratories analyzing lead in paint chips, soils, and dusts has two requirements: (1) successful participation in proficiency testing using real-world matrices; and (2) laboratory accreditation including on-site assessment of laboratory operations. NLLAP requirements are based upon the recommendations of a Federal Interagency Taskforce on Lead Based Paint, a group of 17 federal agencies involved with lead issues, that recognition should be based upon both proficiency testing and laboratory accreditation.[20] Similarly, proficiency testing and laboratory accreditation requirements were also part of the recommendations for environmental laboratories of a 1991 National Conference on Laboratory Issues in Childhood Lead Poisoning Prevention sponsored by the Association of State and Territorial Public Health Laboratory Directors, the CDC, and EPA. NLLAP requirements for laboratories are based upon Guide 25-1990, "General Requirements for the Competence of Calibration and Testing Laboratories,"[21] a guide already in use by many national laboratory accreditation systems worldwide.

The ELPAT Program began providing paint chip, soil, and dust audit samples to evaluate laboratory performance in the fall of 1992 and has grown to over 300 participating laboratories. In December 1993 the first two laboratory accreditation organizations, A2LA and AIHA, were recognized by NLLAP. Laboratories interested in obtaining accreditation information such as the program requirements, time needed to complete the process, and cost should contact the recognized laboratory accreditation organizations. If other laboratory accreditation organizations are recognized, this information will be included in subsequent ELPAT columns.

Laboratory accreditation takes some time to achieve. Laboratory accreditation involves submittal of a description of a laboratory's quality system and manual to the accrediting organization and the on-site evaluation by NLLAP-qualified assessors of laboratory operations, including equipment, facilities, analytical methods, staff, and internal quality control. As of March 1995, 41 laboratories have been accredited by NLLAP-recognized laboratory accreditation organizations and 75 are in the accreditation process.

Lists of laboratories that have performed successfully (rated proficient) in the ELPAT Program are prepared at NIOSH and are provided upon request to the public via a toll-free number by the Lead Information Clearinghouse (1-800-424-LEAD). Lists of laboratories provided by the Lead Information Clearinghouse include all laboratories that successfully perform in the ELPAT Program and the accreditation status of laboratories. These lists are used by the Lead Information Clearinghouse to recommend laboratories to the public.

Once a sufficient number of laboratories (approximate 100) across the country are recognized by NLLAP, only NLLAP-recognized laboratories will be recommended to the public by the Lead Information Clearinghouse, EPA, and NIOSH. Given the capacity of cooperating laboratory accreditation organizations to perform on-site assessments and the fact that already more than 100 laboratories are in the accreditation process, it is projected that this will occur in late 1995. Participation in the ELPAT proficiency testing program would continue to be open to all interested laboratories. This means that laboratories outside the United States and laboratories that do not wish to be accredited can continue to participate in ELPAT.

Upcoming ELPAT Round Information

Round 11 ELPAT samples were sent to participants on May 1, 1995. The reporting date of the laboratories was June 8, 1995. The dust wipes were preserved with 0.5 ml of 3 percent hydrogen peroxide solution. This is to retard the formation of any fungal growth in the samples, and should not have any effect on the digestion and analysis of them. Also, the ELPAT automated data entry system is available to laboratories that want to submit their laboratory data over a modem for faster and more reliable means of transmittal.

Information

A2LA laboratory accreditation, certified reference materials, and seminars on environmental lead laboratory accreditation:

American Association for Laboratory Accreditation (A2LA)
656 Quince Orchard Road
Gaithersburg, MD 20878
Phone: (301) 670-1377
FAX: (301) 869-1495

AIHA laboratory accreditation, ELPAT Program information, ELPAT sample orders, and seminars on environmental lead laboratory accreditation:

ELPAT Coordinator
American Industrial Hygiene Association (AIHA)
2700 Prosperity Avenue, Suite #250
Fairfax, VA 22031
Phone: (703) 849-8888
FAX: (703) 207-3561

Orders for the ASTM Standards on Lead-Based Paint Abatement in Buildings publication:

ASTM Customer Service
1916 Race Street
Philadelphia, PA 19103
Phone: (215) 299-5585
FAX: (215) 977-9679

Orders for NIST SRMs:

National Institute of Standards and Technology
Standards Reference Materials Program
Room 204, Building 202
Gaithersburg, MD 20899
Phone: (301) 975-6776
FAX: (301) 948-3730

Orders for RT Corporation commercial reference materials:

RT Corporation
2931 Soldier Springs
P.O. Box 1346
Laramie, WY 82070
Phone: (307) 742-5452
FAX: (307) 745-7936
or Fischer Scientific representative at (800) 766-7000.

Information on other EPA-certified reference materials:

Jim Longbottom
EPA-EMSL
Quality Assurance Research Division
26 West Martin Luther King Drive
Cincinnati, OH 45268
Phone: (513) 569-7308
FAX: (513) 569-7115

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Mention of company names or products does not constitute endorsement by the CDC.

References

1. American Industrial Hygiene Association and National Institute for Occupational Safety and Health: Cooperative Research and Development Agreement (CRADA) Between the American Industrial Hygiene Association (AIHA) and the National Institute for Occupational Safety and Health (NIOSH). CRADA NIO. C92.001.00. AIHA, Fairfax, VA; and U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, NIOSH, Cincinnati, OH (1992).
2. U.S. Environmental Protection Agency and National Institute for Occupational Safety and Health: Memorandum of Understanding, project officers J.J. Breen (EPA), J.V. Scalera (EPA), and P. Schlecht (NIOSH). MOU No. PW75935570-01-0. U.S. EPA, Office of Pollution Prevention and Toxics, Washington, DC; and Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, NIOSH, Atlanta, GA (1992).
3. National Lead Laboratory Accreditation Program: Model Memorandum of Understanding (MOU), collaborative effort among U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics; Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, Division of Physical Sciences and Engineering; and Accreditation Organizations (1993).
4. American Association for Laboratory Accreditation: A2LA Environmental Lead Program Requirements. A2LA, Gaithersburg, MD (1992).
5. American Industrial Hygiene Association: AIHA Environmental Lead Program Policies. AIHA, Fairfax, VA (1992).
6. National Institute for Occupational Safety and Health: 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. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, NIOSH, Cincinnati, OH (1995).
7. Thompson, M.; Wood, R.: International Harmonized Protocol for the Proficiency Testing of (Chemical) Analytical Laboratories. Journal of AOAC International 76(4):926–940 (1993).
8. National Institute for Occupational Safety and Health: Method 7082. In: NIOSH Manual of Analytical Methods, 4th ed. P.M. Eller, Ed. DHHS (NIOSH) Pub. No. 94-113. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, NIOSH, Cincinnati, OH (1994).
9. U.S. Environmental Protection Agency: Method SW846-3050A, Acid Digestion of Sediments, Sludges and Soils (Metals). In: U.S. EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Method SW846. 3rd Rev ed. EPA, Washington, DC (1990).
10. U.S. Environmental Protection Agency: Method SW876-3051, Microwave Assisted Acid Digestion of Sediments, Sludges, Soils and Oils (Metals). In: U.S. EPA Test Methods for Evaluating Solid Waste, Physical/Chemical Method SW846. 3rd Rev ed. EPA, Washington, DC (1990).
11. Binstock, D.A.; Hardison, D.L.; Grohse, P.M.; Gutknecht, W.F.: Standard Operating Procedures for Lead in Paint by Hotplate- or Microwave-Based Acid Digestion and Atomic Absorption or Inductively Coupled Plasma Emission Spectrometry. EPA 600/8-91/213. U.S. Environmental Protection Agency, Research Triangle Park, NC (1991). Available from NTIS, Springfield, VA, PB 92-114172.
12. Fleiss, J.: Statistical Methods for Rates and Proportions, 2nd ed., pp. 24–25. John Wiley and Sons, New York (1981).
13. Neter, J.; Wasserman, W.; Hunter, M.H.: Applied Linear Statistical Models, pp. 141–151, 614–617. Irwin, Inc., Boston (1990).
14. Shapiro, S.S.; Wilk, M.B.: An Analysis of Variance Test for Normality (Complete Samples). Biometricka 52:591–611 (1965).
15. Sachs, L.: Statistics: A Handbook of Techniques, pp. 509–512, 533–537. Springer-Verlag, New York (1982).
16. Hollander, M.; Wolfe, D.A.: Nonparametric Statistical Methods, pp. 27–33. John Wiley & Sons, New York (1973).
17. SAS Institute Inc.: SAS/STAT User's Guide, Version 6, 4th ed., Vol. 2, pp. 1195–1203 (1993).
18. U.S. Environmental Protection Agency and American Association for Laboratory Accreditation: Memorandum of Understanding Between Environmental Monitoring Systems Laboratory. U.S. EPA, Cincinnati, OH; and A2LA, Cincinnati, OH (1991).
19. United States Code: Title X, Residential Lead-Based Paint Hazard Reduction Act of 1992. 42 USC 4851 (1992). In: Housing and Community Development Act of 1992. Public Law 102-550 (1992).
20. U.S. Environmental Protection Agency: Task Group on Methods and Standards of the Federal Interagency Lead-Based Paint Task Force. In: Laboratory Accreditation Program Guidelines: Measurement of Lead in Paint, Dust and Soil. Final Report (EPA 747-R-92-001). U.S. EPA, Washington, DC (1992).
21. International Standards Organization/International Electrochemical Commission: (E) General Requirements for the Competence of Calibration and Testing Laboratories. In: ISO/IEC Guide 25 1990. ISO/IEC, Geneva (1990).

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.