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Project Summary

An Evaluation of Asbestos Management Programs in 17 New Jersey Schools: A Case Studies Report

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From 1988 through 1992, the U.S. Environmental Protection Agency's Risk Reduction Engineering Laboratory (EPA-RREL) and the New Jersey Department of Health's Environmental Health Service (NJDOH-EHS) conducted air monitoring in 17 schools in New Jersey to evaluate their asbestos management programs.

Findings of a study conducted in 1988, to document Asbestos Hazard Emergency Response Act (AHERA) final clearance levels of asbestos at these 17 schools, prompted a followup study in 1990 to determine the airborne asbestos levels 2 yr after the abatements. Although the 1990 study provided data regarding airborne asbestos levels during simulated occupancy conditions 2 yr after abatements, whether these data were representative of levels during actual occupancy was uncertain.

Another followup study conducted in May 1991 during actual occupied conditions showed airborne asbestos levels to be above the AHERA criterion of 70 structures per square millimeter (s/mm^2) at 8 of the 17 schools. Reentrainment of residual asbestos-containing debris from the 1988 abatement activities or from operations and maintenance activities may have contributed to these elevated airborne asbestos levels.

In 1992, EPA/NJDOH conducted a final study at the 17 schools to measure airborne asbestos levels during actual occupied conditions 4 yr after abatement activities were completed. The full report presents the results of the 1992 study and integrates the results of the previous studies to evaluate the asbestos management programs in these schools. It also presents case histories of each study site that summarize the findings of the 1988, 1990, 1991, and 1992 studies.

This Project Summary was developed by EPA's Risk Reduction Engineering Laboratory, Cincinnati, OH, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

The EPA recommends a proactive, inplace management program whenever asbestos-containing material (ACM) is present in buildings. Asbestos removal is required only when necessary to prevent significant public exposure to airborne asbestos during building demolition or renovation activities. The ultimate goal of every asbestos abatement project is to eliminate, or reduce to the extent possible, the actual or potential hazard airborne asbestos may present to building occupants. If all safeguards are not properly applied, asbestos removals may actually elevate airborne levels of asbestos in a building.

EPA-RREL and NJDOH-EHS conducted a series of studies to measure airborne asbestos levels immediately after and 2 to 4 yr after abatements in 17 New Jersey schools. The primary purpose of these studies was to evaluate the schools' asbestos management programs.

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In 1988, EPA-RREL and NJDOH-EHS conducted a study to document AHERA air-sampling practices during final clearance and to measure final clearance levels of airborne asbestos at 20 projects (20 sites at 17 schools) involving removal of ACM in 17 New Jersey schools. In 1990, EPA/NJDOH conducted a study at the same 17 schools to measure airborne asbestos levels 2 yr after the abatements in 1988. Although the 1990 study provided data regarding the residual levels of asbestos 2 yr after abatements, the extent to which these data represented conditions of actual occupancy remained uncertain. In 1991, EPA/NJDOH measured airborne asbestos levels under occupied conditions at the 17 schools 3 yr after abatements. In 1992, EPA/NJDOH conducted a final study at the 17 schools to measure airborne asbestos levels under actual occupied conditions 4 yr after abatements.

Objectives

The objectives of the 1992 study were to (1) determine the airborne asbestos levels measured during occupied conditions in 17 schools that underwent abatements in 1988; (2) evaluate the airborne asbestos levels measured in the 17 schools over the 4-yr period (1988, 1990, 1991, and 1992); (3) determine the accuracy of each school's Asbestos Management Plan (AMP) for the areas monitored; and (4) determine the possible sources of airborne asbestos in schools with elevated levels.

Study Design

The 1992 study was conducted at the same 17 schools involved in the 1988, 1990, and 1991 EPA/NJDOH studies. Area airborne asbestos levels were measured at each site in the same three areas as in the previous studies: the previously abated area, the perimeter area (outside the abated area but inside the building), and outdoors. The actual abatement areas and perimeter areas could not be separated because the containment barriers present during the 1988 abatements had been removed.

Air Sampling Strategy

The air sampling strategy for this study consisted of monitoring during periods of occupancy at the 17 schools (i.e., during school hours, 8:00 a.m. to 3:00 p.m.). Response actions were conducted at sites with average airborne asbestos levels above 0.02 s/cm^3. The 0.02 s/cm^3 criterion was derived from the AHERA initial screening criterion of 70 s/mm^2 (40 CFR 763 (Code of Federal Regulations)) and was used by NJDOH-EHS as a level that, if exceeded, required the school to initiate a response action to reduce the airborne asbestos level to below 0.02 s/cm^3. A modified aggressive air sampling protocol was used to conduct followup sampling to determine the completion of the response actions. Table 1 summarizes the air sampling strategy for this study and those for the three preceding studies in 1988, 1990, and 1991.

At each site in May 1992, five area air samples were collected in each of three areas at approximately the same locations as those collected during the 1988, 1990, and 1991 studies.

July through August 1992

Based on the May 1992 sampling, five schools representing six sites were required to conduct a response action in the 1988 abatement areas and/or perimeter areas to reduce the risk of exposure to airborne asbestos in these school buildings. The response action taken at each of the schools primarily involved cleaning the areas to remove all visible dust and debris. After the response actions, EPA/NJDOH collected additional area air samples in the affected areas to establish that they were below 0.02 s/cm^3. The number and locations of the samples were the same as those collected in May 1992.

NJDOH Inspections

In 1991, a certified AHERA building inspector from NJDOH-EHS conducted an inspection at each of these schools. The inspection included a review of the school's AMP relating to the 1988 abatement areas and perimeter areas and a visual inspection of these areas. In July through August 1992, a followup visual inspection was conducted at four schools with elevated airborne asbestos levels (i.e., ≥0.02 s/cm^3) based on monitoring conducted in May 1992.

Management Plan Review

Before conducting the visual inspection, each school's AMP was reviewed. The review included (1) recording the material category, material type, amount of material, and condition of material remaining in the 1988 abatement areas and perimeter areas; (2) recording response actions; and (3) recording renovations or asbestos abatements that occurred after the 1988 abatements. This information was then compared with that obtained during the visual inspection of the 1988 abatement areas and perimeter areas to determine the accuracy of the original AHERA inspection regarding the identification, assessment, and location of ACM in these areas.

Visual Inspections

The visual inspection was not intended to be a comprehensive assessment of the ACM in the school; rather, it was designed to focus on the areas monitored (i.e., 1988 abatement areas and perimeter areas) in an attempt to locate the possible sources of the airborne asbestos measured in May

Table 1. *Summary of Air Sampling Strategies*

Period of Study	*No. of Sites*	*Conditions of Sampling*	*Monitoring Criteria*
June-July 1988	*11*	*Passive**	*Determine preabatement levels*
July-Sept. 1988	*16*	*Abatement conditions*	*Determine pre-final cleanup levels*
July-Sept. 1988	*20*	*Aggressive†/ passive*	*AHERA final clearance*
July-Aug. 1990	*20*	*Modified aggressive‡*	*2-yr followup*
May 1991	*20*	*Occupied*	*3-yr followup*
August 1991	*10*	*Modified aggressive*	*Confirm if levels exceeded 0.02 s/cm^3*
August 1991	*4*	*Modified aggressive*	*Verify completion of followup response action*
Sept. 1991	*1*	*Modified aggressive*	*Verify completion of followup response action*
May 1992	*20*	*Occupied*	*4-yr followup*
July-Aug. 1992	*6*	*Modified aggressive*	*Verify completion of response action*

* *Minimal occupant activity in the area.*
† *Aggressive sampling protocol in accordance with AHERA - 40 CFR 763.*
‡ *Sampling protocol to simulate normal occupant activity, including air sweeping of floors with exhaust of 1-hp leaf blower and positioning of 1 stationary fan/10,000 ft^3.*

1991 and 1992. The visual inspection included (1) identification and condition of the ACM recorded as well as not recorded in the AMP and (2) documentation of the presence of asbestos-containing debris in the 1988 abatement areas and perimeter areas. These areas were inspected for the presence of debris, as well as residual ACM on the substrate-surface using procedures in accordance with those specified in ASTM Standard E1368-90.

Sampling Methods

Fixed-Station Area Air Samples

Air samples were collected on open-face, 25-mm-diameter, 0.45-µm-pore-size, mixed cellulose ester (MCE) membrane filters with a 5-µm-pore-size, MCE, backup diffusing filter and cellulose support pad contained in a three-piece cassette. The filter cassettes were positioned approximately 5 ft above the floor on tripods, with the filter face at approximately a 45° angle toward the floor. The filter assembly was attached to a 1/6-hp electrically powered vacuum pump operating at a flow rate of approximately 6 L/min. Air volumes ranged from 1488 to 2500 L.

Bulk Samples

Bulk samples were collected of suspect ACM or suspect asbestos-containing debris for laboratory analysis to determine the asbestos content. A standard coring tool or chipping tool was used to collect in-place materials, hand pickup was used for debris, and wipe samples were used for dust.

Analytical Methods

Air Samples

The MCE filters were prepared by the direct transfer technique and were analyzed in accordance with the nonmandatory transmission electron microscopy (TEM) method, as described in the AHERA Final Rule. A sufficient number of grid openings were analyzed for each sample to ensure an analytical sensitivity of no greater than 0.005 s/cm^3 of air sampled. In addition to the requirements of the nonmandatory TEM method, the specific length and width of each structure were measured and recorded.

Bulk Samples

The type and percentage of asbestos in the bulk samples were determined by polarized light microscopy (PLM) and X-ray diffraction (XRD). The samples were prepared and analyzed in accordance with the "Interim Method for Determination of Asbestos in Bulk Insulation Samples" (EPA 600/M4-82-020).

Statistical Methods

Although the 17 schools did not represent a statistical random sample and were likely to differ in abatement history and current status with respect to the presence of ACM, the 1992 data were combined across all sites to examine overall trends in airborne asbestos levels at these schools. Analysis of variance (ANOVA) techniques were used to compare airborne asbestos levels measured in 1992. ANOVA techniques were also used to compare the airborne asbestos levels measured in 1988, 1990, 1991, and 1992. If the ANOVA p-value was less than 0.05, the Tukey multiple comparison procedure was used to evaluate pairwise differences. All statistical comparisons were performed at the 0.05 level of significance.

Quality Assurance

Specific quality assurance procedures specified in AHERA were used to ensure the precision of the collection and analysis of air samples, including filter lot blanks, open and closed field blanks, and repeated sample analyses.

Results and Discussion

Airborne Asbestos Levels During Occupied Conditions in May 1992

Six of the 20 sites showed levels above the AHERA initial screening criterion of 70 s/mm^2 and above the NJDOH-EHS response action criterion of 0.02 s/cm^3. A two-factor ANOVA was used to examine overall differences in airborne asbestos levels measured at the 20 sites in 1992. When averaged across all sites, the airborne asbestos levels measured in the 1988 abatement areas and the 1988 perimeter areas were numerically greater than the levels measured outdoors, but the difference was not statistically significant ($p = 0.1161$). The overall average levels measured in the 1988 abatement areas, the 1988 perimeter areas, and outdoors were 0.008 s/cm^3, 0.007 s/cm^3, and 0.003 s/cm^3, respectively. Although individually the overall airborne asbestos levels measured in the abatement areas and perimeter areas were not significantly different from levels measured outdoors, when combined, the indoor airborne asbestos levels at these 20 sites (overall average = 0.008 s/cm^3) were significantly greater ($p = 0.0408$) than levels measured outdoors (overall average = 0.003 s/cm^3).

Overall Structure Morphology and Length Distributions

The TEM analysis of the samples collected in May 1992 yielded a total of 1552 asbestos structures, of which 99.7% were chrysotile asbestos and 0.3% were amphibole. Overall, the asbestos structures were primarily fibers (87%), and to a lesser extent, matrices, bundles, and clusters. Overall, 99% of the measured asbestos structures were less than 5 µm in length; most of the structures (97%) were less than 2 µm in length.

NJDOH Inspections

In 1991, NJDOH-EHS conducted an inspection at each of the 17 schools. In July through August 1992, a followup visual inspection was conducted at three schools with elevated airborne asbestos levels based on monitoring conducted in May 1992. (The information from the 1991 and 1992 inspections was provided to the respective school officials.)

Management Plan Review

At 16 of the 20 sites, the schools' AMP contained at least one error relating to the areas of the schools inspected by the NJDOH-EHS. The errors related to material identification or material location.

Fourteen of the sites contained at least one ACM not identified in the original AHERA inspection conducted by the school. The most consistently unidentified material was thermal system insulation (TSI), which was not identified at 14 of the 20 sites inspected.

At five sites, the AMP misidentified materials. At three of the sites the materials did not contain >1% asbestos based on bulk sample analysis by the NJDOH-EHS. At one of the sites, the ACM identified in the AMP was spray-on surfacing material, but inspections by NJDOH-EHS showed it to be TSI. At the same site, the AMP did not identify the presence of asbestos-containing TSI in the boiler. At one of the sites, the school's AMP did not identify the resilient floor tile as asbestos-containing.

At one site, the AMP was in error regarding both the identification and location of an ACM. The AMP indicated the presence of spray-on materials in an area where no spray-on materials were present.

Nine of the 16 sites with AMP errors had elevated airborne asbestos levels in either May 1991 or May 1992. At two of these sites, Operations and Maintenance (O&M) activities involving ACM that was not identified in the AMP may have contributed to the elevated airborne asbestos levels.

Residual Asbestos-Containing Debris

Each site was inspected to determine the presence of asbestos-containing debris from the 1988 abatement activities and/or asbestos-containing debris from other activities. The visual inspections revealed the presence of asbestos-containing debris at 18 sites. At 14 sites, the debris was present in the 1988 abatement areas. Eight of these 14 sites also failed the AHERA initial screening criterion of 70 s/mm^2 during the 1988 clearance test (based on the EPA/NJDOH monitoring data), which indicated that asbestos-containing debris remained in the abatement areas. The debris was believed to be from the 1988 abatements based on bulk sample analysis, location of the material, and residual debris on the original substrates abated. Other asbestos-containing debris present at 12 of the sites generally resulted from damaged TSI, fireproofing, and acoustical plaster. At one site, the debris resulted from efflorescence of concrete-masonry block and/or mortar resulting in a white powdery material (containing chrysotile asbestos) along the base of the wall.

In May 1991, elevated airborne asbestos levels were measured at eight of the sites measured by EPA/NJDOH in the 1988 abatement areas and/or perimeter areas; in 1992, six sites measured had elevated levels. The potential sources of the elevated levels were believed to be primarily the debris identified during the visual inspections conducted in 1991 and/or 1992. In addition, other sources such as floor care maintenance activities could also contribute to the airborne asbestos levels present in these school buildings.

Response Action Evaluation

1991 Response Action

In May 1991, 8 of the 20 sites had average airborne asbestos levels above 0.02 s/cm^3. In August 1991, EPA/NJDOH conducted followup monitoring at these sites to determine if the elevated levels still existed. Results of the followup monitoring indicated that four sites showed average levels exceeding 0.02 s/cm^3. The NJDOH-EHS required each of these schools to conduct response actions to reduce the asbestos levels below the 0.02 s/cm^3 criterion. The most appropriate response action was determined by each school's AMP and/or its consultant and included dry-vacuuming of horizontal surfaces with a HEPA-filtered vacuum cleaner, wet-wiping of horizontal surfaces, or encapsulation. After the response actions by the schools, monitoring conducted by EPA/NJDOH showed that one of the four sites had an average airborne asbestos level above 0.02 s/cm^3. Further response actions were required at this site, and the airborne asbestos levels were reduced to below 0.02 s/cm^3.

1992 Response Action

In May 1992, 6 of the 20 sites had average airborne asbestos levels above 0.02 s/cm^3. The NJDOH-EHS required each of the five schools (representing the six sites) to conduct response actions to reduce the airborne asbestos levels below the 0.02 s/cm^3 criterion. After the response actions at these five schools, air monitoring conducted by EPA/NJDOH showed that the asbestos levels were below the 0.02 s/cm^3 criterion, and no further response action was required at four of the schools. One school required additional cleaning to bring asbestos levels below the 0.02 s/cm^3 criterion.

Comparison of 1988, 1990, 1991, and 1992 Airborne Asbestos Levels

A two-factor ANOVA was used to examine overall differences between the three sampling locations. Each year was analyzed separately. The results of the ANOVAs are summarized in Table 2.

A two-factor ANOVA was used to examine overall differences between the 4 yr of sampling results. Each sampling location was analyzed separately. The results of the ANOVAs are summarized in Table 3.

General Observations from the 1988, 1990, 1991, and 1992 Studies

Table 4 presents an overall summary of the air monitoring results from the four EPA/NJDOH studies conducted during the period of 1988 through 1992. The table also summarizes AHERA clearance test results based on the EPA/NJDOH data and information regarding the visual inspections conducted at these sites.

Conclusions

1. Overall, when all of the 20 sites were considered collectively, there was no apparent trend toward progressively increasing airborne asbestos concentrations 2 to 4 yr after the 1988 abatements. At a number of sites, however, airborne asbestos concentrations were elevated immediately after and 2 to 4 yr after the 1988 abatements.
2. Response actions conducted by the schools in 1991 and 1992 demonstrated that elevated airborne asbestos levels can be reduced to acceptable levels (i.e., <0.02 s/cm^3); however, five of the eight schools requiring a response action in 1991, again required a response action in 1992.
3. Asbestos-containing debris from the 1988 abatement activities and from postabatement O&M activities may have contributed to the elevated airborne asbestos levels (>0.02 s/cm^3) present in 1991 or 1992, or both at nine sites.
4. Errors in the AMPs relating to material identification or material location were documented at 13 of the 17 schools. The errors at three schools may have resulted in the accidental disturbance of ACM.
5. A standardized visual inspection is an effective tool to determine the presence of residual asbestos-containing debris that may potentially become reentrained.
6. When the AHERA Z-test is used to clear an abatement project, it is generally more appropriate to use the outdoor samples as the reference point rather than the perimeter samples collected inside the building. At nine schools, airborne asbestos levels in the perimeter areas after the 1988 abatements were significantly higher than those measured before the abatements. (Results of preabatement samples collected in the perimeter areas and outdoors did not differ significantly).
7. Consultants who conducted the schools' clearance air monitoring in 1988 often did not completely understand and follow the AHERA sampling and analytical requirements and recommendations. Practices observed during clearance monitoring included inadequate drying of the abatement areas before sampling, use of improper sampling medium and flow rates, inadequate aggressive air sweeping of surfaces, and insufficient use of circulating fans to maintain air movement during sampling.

Recommendations

1. A study should be conducted to evaluate the long-term effectiveness of asbestos response actions in schools. This information would assist EPA in evaluating the need for issuance of guidance on response actions.

Table 2. *Comparison of Sampling Locations for Airborne Asbestos Levels Measured in 1988, 1990, 1991, and 1992*

Year	ANOVA p-value	Statistically Significant Differences in Airborne Asbestos Concentrations*,†		
1988	0.0001	A(0.020)	P(0.006)	O(0.002)
1990	0.0030	P(0.003)	A(0.002)	O(0.001)
1991	0.0001	A(0.008)	P(0.004)	O(0.001)
1992	0.1161	P(0.008)	A(0.007)	O(0.003)

* A = 1988 abatement area; P = 1988 perimeter area; O = Outdoors.
† Parenthetical entries are average airborne asbestos concentrations (s/cm^3)associated with that sampling location. Sampling locations (averages) connected by a line are not significantly different.

Table 3. *Comparison of Yearly Levels of Airborne Asbestos*

Sampling Location	ANOVA p-value	Statistically Significant Differences in Airborne Asbestos Concentrations*			
1988 Abatement area	0.0001	1988(0.020)	1991(0.009)	1992(0.007)	1990(0.002)
1988 Perimeter area	0.2725	1992(0.008)	1988(0.006)	1991(0.004)	1990(0.003)
Outdoors	0.0369	1992(0.003)	1988(0.002)	1991(0.002)	1990(0.001)

* Parenthetical entries are average airborne asbestos concentrations (s/cm^3) associated with that year. Years (averages) connected by a line are not significantly different.

2. Although not specifically required by AHERA, schools should evaluate the effectiveness of their O&M program and periodic surveillance. Areas of the buildings that have undergone asbestos-removal or O&M activity (involving ACM) should be thoroughly reinspected for the presence of residual asbestos-containing debris. If asbestos-containing debris are observed, thorough cleaning and followup air monitoring should be conducted.
3. Each school should maintain and update its AMP to keep it current with ongoing O&M, periodic surveillance, inspection, reinspection, response actions, and post-response action activities. The school should ensure that workers who may disturb ACM are aware of changes in the AMP.
4. EPA, cooperatively with state agencies, need to provide further outreach and education to all responsible parties such as local education agencies, AHERA designated persons, and consultants to enhance their understanding of the intent and requirements of AHERA. Thorough regulatory oversight is necessary to ensure compliance within the requirements of AHERA.
5. Outdoor air samples should be used as the "outside values" in the AHERA Z-test because they are less likely to be affected by work practices that may contaminate other areas inside the building.
6. A standardized visual inspection technique (e.g., ASTM Standard E1368) should be included in the AHERA final clearance procedure. Furthermore, this type of standardized visual inspection procedure (or a variation thereof) should be incorporated into the 3-yr AHERA AMP reinspections.
7. A comprehensive guidance document should be developed that addresses the procedures and protocols for conducting a standardized visual inspection and AHERA clearance air sampling.

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Table 4. Summary Observations from 1988, 1990, 1991, and 1992 EPA/NJDOH Studies

			Average Airborne Asbestos Concentration, s/cm³								1988 AHERA Clearance				1991/1992 Visual Inspection	
			1988 Abatement Area				1988 Perimeter Area						AHERA Z-test Comparison††			
Site	Preabatement*	Pre-final cleaning†	1988	1990	1991	1992	1988	1990	1991	1992	No. of NJDOH Visual Inspections‡	AHERA Initial Screening Test**	Perimeter	Outdoor	Debris Present from 1988 Abatement	Error in Management Plan
A	-	0.130	0.002	0.007	0.001	0.001	0.001	0.011	0.003	0.001	4	Pass	Pass	Pass	No	Yes
B	0.001	-	0.016	0.015	0.027	0.044	0.008	0.010	0.012	0.438	3	Fail	Pass	Fail	Yes	Yes
C	0.001	0.405	0.060	0.001	0.005	0.008	0.002	0.001	0.001	0.003	1	Fail	Fail	Fail	Yes	Yes
D	0	-	0.070	0.001	0.020	0.025	0.062	0.001	0.004	0.001	0	Fail	Pass	Pass	Yes	No
E	0.001	0.013	0	0.004	0.037	0.009	0	0.006	0.010	0.007	0	Pass	Pass	Pass	Yes	Yes
F	0.003	0.022	0.024	0.001	0.043	0.036	0.002	0.005	0.036	0.037	0	Fail	Fail	Fail	Yes	Yes
G	0	0.171	0.007	0.001	0.027	0.148	0.010	0.001	0.005	0.011	0	Pass	Pass	Pass	Yes	No
H	-	0.245	0.016	0	0.030	0.007	0.062	0	0.005	0.025	2	Fail	Pass	Pass	Yes	No
I	-	0.116	0	0.001	0.003	0.001	0	0.011	0.005	0.001	4	Pass	Pass	Pass	No	No
J	-	1.711	0.004	0	0.003	0.003	0.001	0.003	0	0.012	0	Pass	Pass	Pass	Yes	‡‡
K	-	0.378	0.063	0	0.041	0.007	0.008	0.007	0.003	0.002	4	Fail	Fail	Fail	No	Yes
L	-	0.894	0.118	0.002	0.006	0.003	0.060	0.001	0.003	0.002	2	Fail	Fail	Fail	No	Yes
M	0.001	0.745	0.322	0	0.023	0.003	0.002	0	0.004	0.004	3	Fail	Fail	Fail	No	Yes
N	-	0.978	0.100	0.007	0.004	0.004	0.003	0.004	0.015	0.006	2	Fail	Fail	Fail	No	Yes
O	-	0.013	0.040	0.001	0.005	0.002	0.003	0.018	0	0.001	2	Pass	Pass	Pass	Yes	Yes
P	0.001	0.230	0.005	0.005	0.004	0.003	0.007	0	0.001	0.006	3	Pass	Pass	Pass	Yes	Yes
Q	0.001	-	0.099	0.019	0.009	0.053	0.055	0.010	0.012	0.438	4	Fail	Fail	Fail	Yes	Yes
R	-	0.372	0.002	0	0.005	0.001	0	0.011	0.001	0.003	7	Pass	Pass	Pass	Yes	Yes
S	0.001	0.624	0.012	0.003	0.001	0	0.003	0.001	0.003	0.001	3	Fail	Pass	Fail	Yes	Yes
T	0.001	-	0.049	0.001	0.001	0	0.030	0.001	0.001	0.001	2	Fail	Fail	Fail	Yes	Yes

* Preabatement samples were not collected at Sites A, H through O, and R; all reabatement samples wsere collected in perimeter area, except at Site M.

† Pre-final cleaning samples were not collected at Sites B, D, Q , and T.

‡ NJDOH did not conduct a visual inspection at Sites D, E, F, G, and J.

** If the average concentration in the abatement area was less than 70 s/mm², the site passed the AHERA initial screening test.

†† If the average concentration in the abatement area was statistically greater than the average concentration in the perimeter area and/or outdoors, the site failed.

‡‡ No AMP was prepared. (Site J was a community college and was not covered by AHERA).