VISUAL INSPECTION AND AHERA CLEARANCE AT ASBESTOS ABATEMENT SITES

by

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The NJDOH-ACS inspector first visually examined all substrate surfaces to ensure that no asbestos-containing material (ACM) remained. Special attention was given to pipes, structural members, and irregular surfaces with corners and hard-to-reach areas. If any quantity of ACM remained, the site failed the visual inspection, and additional removal was conducted before another visual inspection was conducted. The ACS inspector then determined if the worksite had been adequately cleaned. All surfaces were examined for dust and debris, especially overhead areas (such as the

tops of suspended light fixtures) and areas under stationary fixtures. One or both of the following techniques were used for examining surfaces to establish that a "no-dust" criterion had been achieved:

1. Use of a damp cloth to collect dust from the surface and then inspecting the cloth for evidence of dust.

2. Darkening of the room and shining a flashlight so that the light beam just glances any smooth horizontal or vertical surface. A gloved finger is then run across the illuminated area; if a line is left on the surface, dust is still present.

If either of these techniques showed that dust still remained, the ACS inspector required that the entire work area be recleaned before its reinspection.

Air Sampling

After the site passed the NJDOH-ACS visual inspection, an Asbestos Safety Technician (AST) collected AHERA clearance air samples (which were used to declare the site clean and to release the abatement contractor). The AST is certified by the New Jersey Department of Community Affairs and is an employee of an Asbestos Safety Control Monitor (ASCM) firm, that is employed by the School District or Local Education Agency.

Concomitant air sampling was conducted by the EPA at approximately the same time and location (within a radius of 5 feet) of the ASCM firm's sampling. The EPA collected five area air samples in each of three locations: the abatement work area, the perimeter area outside the abatement area but inside the building, and outdoors. In the abatement work area, the samples were collected under the sampling conditions created by the ASCM for AHERA clearance. The perimeter area samples

were collected under static conditions (i.e., the activity in the area was minimal, and the heating, ventilation, and air-conditioning system was not operating).

Sampling Methodology

The 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 feet above the floor on tripods, with the filter face at an approximately 45-degree angle toward the floor. The filter assembly was attached to a 1/6-hp electric-powered vacuum pump operating at a flow rate of approximately 9 L/min. The sampling pumps were calibrated with a precision rotameter both before and after sampling. The precision rotameter was calibrated in the field with a primary air flow standard.

Analytical Methodology

The MCE membrane filters were prepared and analyzed in accordance with the nonmandatory TEM method, as described in the AHERA rule. For each sample, a sufficient number of grid openings were analyzed to ensure a sensitivity (the concentration represented by a single structure) of no greater than 0.005 asbestos structure per cubic centimeter (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.

AHERA TEM Clearance Test

The AHERA TEM clearance criterion is primarily comparative in nature; i.e., it is

based on a comparison of airborne asbestos concentrations inside the abatement work area with those outside the abatement work area but not necessarily outside the building.[4] Although inside samples may be collected as a basis for comparison when air intake to the abatement site is primarily from other areas of the building, outdoor samples are normally recommended because they are less likely to be affected by work practices that might contaminate other areas inside the building.

The AHERA clearance test requires the collection of a minimum of five samples inside and five samples outside the abatement work area. A statistical test (the Z-test) is then used to determine if the average concentration inside the abatement area is higher than the average concentration outside. The Z-test is carried out by the following equation:

$$Z = \frac{Y_i - Y_o}{0.8\sqrt{1/n_i + 1/n_o}}$$

where Y_i = the average of the natural log of the inside samples

Y_o = the average of the natural log of the outside samples

n_i = the number of samples collected inside the work area

n_o = the number of samples collected outside the work area

If the Z statistic is less than or equal to 1.65, the site passes the AHERA clearance test and is considered acceptable for reoccupancy.

The AHERA Z-test is preceded by two preliminary tests--an initial screening test

and a blank contamination test. The initial screening test compares the average concentration of the five samples collected inside the abatement area against a value of 70 structures per square millimeter (s/mm^2). If the average concentration is less than or equal to 70 s/mm^2, the work area passes the clearance test without the analysis of the outside samples being required. If the work area samples do not pass this initial screening test, a minimum of three blanks (filters through which no air has been drawn) are analyzed to check for the possibility of filter contamination that would distort the test results. If the filter concentrations are less than or equal to 70 s/mm^2, they are considered indistinguishable from blank contamination levels. If the three blanks pass the 70 s/mm^2 criterion, the outside samples are then analyzed and the Z-test is used to compare the results with those of the samples collected inside the work area.

RESULTS

Site Descriptions

Fourteen of the 15 abatement projects involved general occupancy areas (classrooms, offices, recreational rooms, and corridors), and one involved both general occupancy areas and a boiler room. The ACM abated at nine of the sites involved surfacing material (sprayed- or troweled-on), three involved thermal system insulation, two involved both surfacing material and thermal system insulation, and one involved suspended ceiling tiles. The ACM contained chrysotile asbestos (from 2% to 93%) at 14 sites and amosite asbestos (from 5% to 10%) at one site.

Final Visual Inspection

From one to seven visual inspections were conducted at the 15 abatement sites. Figure 1 shows the percentage of sites that passed the NJDOH-ACS visual inspection per given attempt. The largest percentage (33.5%) of sites passed the visual inspection on the second attempt. It should be noted that final cleaning activities were completed by the abatement contractor at all of the sites. The data clearly indicates that the visual inspection by the NJDOH-ACS revealed the inadequacy of the final cleaning activities for the first attempt. Additional attempts were necessary to successfully pass the NJDOH-ACS visual inspection. The cumulative percentages of sites passing the visual inspection were as follows: 40% by the first and second attempts, 66.7% by the third attempt, and 93.4% by the fourth attempt.

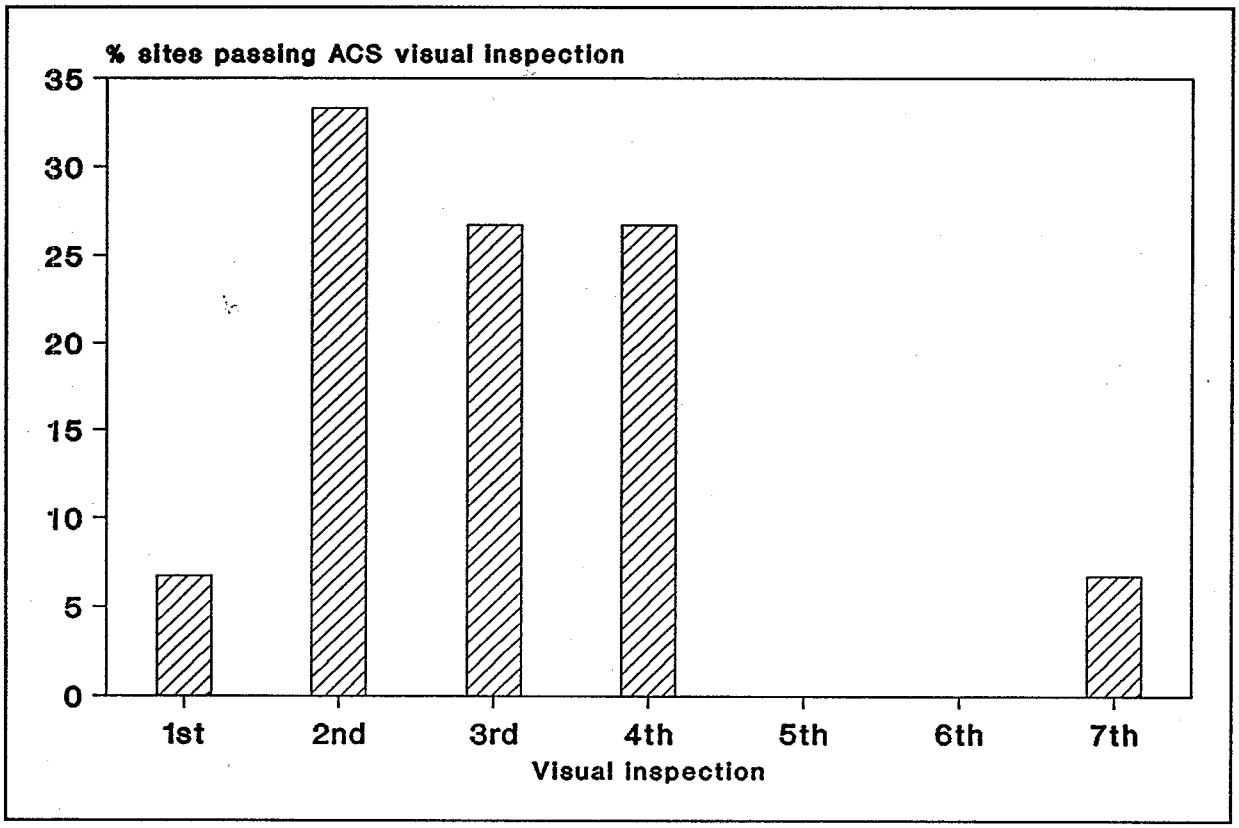

Figure 1. Percentage of 15 sites passing NJDOH-ACS visual inspection for each attempt.

Table 1 lists the reasons why sites failed the NJDOH-ACS inspectors's visual inspections at the 15 sites. Fourteen of the 15 sites failed the visual inspection for more than one reason. The most commonly identified reason (cited at 8 of the 15 sites) was the presence of debris on pipes, pipe fittings, and hangers. The next most common reason was debris on floors, on horizontal surfaces, and in wall penetrations.

TABLE 1. REASONS FOR FAILING NJDOH-ACS VISUAL INSPECTION AT 15 ASBESTOS ABATEMENT PROJECTS

Reasons for failing NJDOH visual inspection	Abatement Site															Total
	A	B	C	H	I	K	L	M	N	O	P	Q	R	S	T	
Debris on horizontal surfaces	X	X	X			X							X	X		6
Debris on vertical surfaces						X										1
Debris on light fixtures				X							X	X		X	X	5
Debris in wall penetrations	X							X			X	X	X		X	6
Debris on floors		X			X			X	X				X	X	X	7
Debris at floor-wall junctions		X		X		X			X	X						5
Debris at ceiling-wall junctions		X		X							X	X			X	5
Debris on pipes, pipe fittings, pipe hangers			X	X		X		X		X	X		X		X	8
Debris on walls	X				X				X						X	4
Debris on skylights	X													X		2
Debris on windows	X	X										X				3
Debris on structural beams		X										X				2
Debris on electrical wires/fixtures				X	X									X		3
Debris in storage closets		X										X				2
Debris on shelves						X								X		2
Debris on scaffolding equipment/auxiliary equipment		X				X	X									3
Debris on ventilation ducts				X									X			2
Debris on clocks		X														1
Debris on exit signs														X		1
Debris on blackboards		X														1
Debris on heating units				X												1
Debris on ceiling gridwork										X						1
Debris on door jambs												X				1
Debris on counters														X		1
Debris behind lockers														X		1
Debris behind floor molding															X	1
Debris on immovable objects						X										1

Relationship Between Visual Inspection and AHERA Clearance Test

Table 2 summarizes the number of visual inspections and AHERA TEM clearance test results based on the U.S. EPA air sampling for each of the 15 sites. The clearance results are presented based on the initial screening criterion, and based on the Z-test comparison of the airborne concentration of asbestos in the abatement area to that in the perimeter area (outside the abatement area, but inside the building) and outdoors.

After passing a final visual inspection by the NJDOH-ACS, 27 percent (4 of 15) of the sites passed the AHERA clearance test based on the initial screening criterion, i.e., the average filter concentration for the five samples collected inside the abatement area was ≤ 70 s/mm^2. Including these four sites, 53 percent (8 of 15) passed using the perimeter area and 46 percent (7 of 15 sites) passed using outdoors as the clearance reference point for the Z-test, respectively. It's apparent that failing the initial screening test does not infer that the site would fail the Z-test. This situation was observed at Sites B, C, H, and S.

These data demonstrate that final visual inspection is necessary to determine the completeness of an abatement action and the thoroughness of cleaning the worksite; i.e., the absence of debris, residue, or dust on surfaces. As noted in the low pass rate of the initial visual inspection, the meticulous and conscientious inspection of surfaces is necessary to determine the absence of debris, residue, and dust. Presumably, if such an inspection had not been conducted at these 15 abatement sites, a higher percentage of sites would have failed the AHERA TEM clearance test on the first

attempt. Final clearance air sampling, as described in the AHERA rule, is ultimately necessary to determine that an abatement site is acceptable for re-occupancy.

TABLE 2. RELATIONSHIP BETWEEN VISUAL INSPECTION AND AHERA CLEARANCE TEST

Site	Number of Visual Inspections	Initial Screening Test	Z-test	
			Perimeter	Outdoor
A	4	PASS	PASS	PASS
B	3	FAIL	PASS	FAIL
C	1	FAIL	PASS	PASS
H	2	FAIL	PASS	PASS
I	4	FAIL	FAIL	PASS
K	4	FAIL	FAIL	FAIL
L	2	FAIL	FAIL	FAIL
M	3	FAIL	FAIL	FAIL
N	2	FAIL	FAIL	FAIL
O	2	PASS	PASS	PASS
P	3	PASS	PASS	PASS
Q	4	FAIL	FAIL	FAIL
R	7	PASS	PASS	PASS
S	3	FAIL	PASS	FAIL
T	2	FAIL	FAIL	FAIL

CONCLUSION

This paper examined the relationship between passing a thorough final visual inspection and the AHERA TEM clearance Z-test. A final visual inspection is necessary to determine completeness of an abatement action and thoroughness of the cleaning of the worksite, but can not be substituted in lieu of final clearance air sampling.

REFERENCES

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