PLAINTIFF'S EXHIBIT
ATT-344

Case: 43106-8

Bell Laboratories

subject Evaluation of the K^2 Asbestos Screening Kit for OTC Use

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MEMORANDUM FOR RECORD

Introduction

Recently a method for the quick identification of asbestos incorporated into a package called the "K^2 Asbestos Test Kit" has been developed by a group working at the National Institute For Occupational Safety and Health (NIOSH).[1] The K^2 Test is a method for determining the presence of asbestos in samples of bulk material. Mr. David Rainer and Mr. Charles Lichtenwalner of the Bell Laboratories Environmental Health and Safety Department have conducted a study to evaluate the ease of use and reliability of the K^2 Test as it applies to the needs of operating telephone companies.

How the K^2 Test Kit Works

The K^2 Test is a colorimetric test for magnesium (Mg^{+2}) and Iron (Fe^{+2}) and is not specific for asbestos. Magnesium and iron are contained in all types of asbestos (Table 1). The Mg^{+2} from chrysctile is complexed with p-nitrobenzene azonaphthol and forms a blue color. The Fe^{+2} from the amphiboles is complexed with 1, 10-phenanthroline and forms a red color. A positive test is indicated by the formation of these colored complexes and indicates the possible presence of asbestos.[2] A positive test must be confirmed by means other than the K^2 kit.

Table 1: Classification of Asbestos

TYPE	COMPOSITION	CRYSTAL STRUCTURE
SERPENTINE		
Chrysotile	$3MgO \cdot 2SiO_2 \cdot 2H_2O$	monoclinic
AMPHIBOLES		
Tremolite	$2CaO \cdot 5MgO \cdot 8SiO_2 \cdot H_2O$	monoclinic
Actinolite	$2CaO \cdot 4MgO \cdot FeO \cdot 8SiO_2 \cdot H_2O$	monoclinic
Anthophyllite	$7MgO \cdot 8SiO \cdot H_2O$	orthorhombic
Amosite	$5.5FeO \cdot 1.5MgO \cdot 8SiO_2 \cdot H_2O$	monoclinic
Crocidolite	$Na_2O \cdot Fe_2O_3 \cdot 3FeO \cdot 8SiO_2 \cdot H_2O$	monoclinic

The National Institute for Occupational Safety and Health (NIOSH), has reported that in its test of 70 field samples, 52 samples or 74% were correctly identified by the K^2 Test. Eighteen samples, or 26%, gave false positive results. The lowest quantities of asbestos contained in the NIOSH samples were 3% chrysotile and 1% amosite.

METHOD

A "K^2 Asbestos Test Kit" was purchased from Anatole J. Sipin Co., Inc. of New York, one of two manufacturers making the kit available to the public. The contents of the K^2 kit was adapted wholesale from the NIOSH group and includes the exact NIOSH issued directions (Appendix I).

Six insulation samples known to contain asbestos (5 chrysotile, 1 amphibole) and 2 prepared samples, one containing 1% by weight chrysotile and one containing 1% by weight amosite were tested using the K^2 Kit. The instructions in the kit were followed directly (Appendix I).

On one occasion the K^2 Kit was used in the field to try to determine the presence or absence of asbestos.

Results

The five samples known to contain chrysotile asbestos all gave a positive response to the magnesium test. All these samples contained more than 10% chrysotile. The results of the 1% chrysotile by weight in a bulk sample were ambiguous because it could not be determined with certainty if a color change had occurred or not. A clear positive response was given for the 1% by weight amosite test. A clear positive response was also given for the amosite sample collected from the field. This sample contained more than 10% amosite.

The field trial for the K^2 test was not successful. In this particular instance, two operating company safety personnel who had used the kit under laboratory conditions used the kit in the field. Results of the three samples tested were ambiguous and a color change could not be positively identified. An x-ray diffraction scan of the three samples showed one contained about 10% chrysotile while two contained no asbestos.

Discussion

Properly equiped Laboratory personnel familiar with chemicals and laboratory safety would probably not have too much trouble using the K^2 Kit. The instructions included with the K^2 Kit are not altogether clear but three trials were adequate to aquaint a trained laboratory technician with the methods involved.

The results of the 5 chrysotile tests performed were often very difficult to interpret. The main problem is that the magnesium reagent is purple and a positive test is indicated by a color change to blue. The amphibole test was easier to interpret and an accurate positive identification was made at 1% amosite by weight in a bulk sample.

Results of the field testing of the K^2 Kit were ambiguous. Some of the problems with field use of the Kit involve the use of items not always available in a field situation, such as:

1. a good light source is necessary,
2. running water is needed,
3. an adequate supply of distilled water is necessary,
4. counter space is needed, and
5. protective equipment such as goggles and impervious gloves and an apron must be worn.

No safety data sheets were included with the K^2 Kit evaluated. Another manufacturer is supplying safety data sheets with the K^2 kit. Some of the chemicals included in the Kit are extremely dangerous and the following warning data is suggested for inclusion in kits distributed to OTC personnel.

Sodium Hydroxide (NaOH)

Corrosive to body tissue; mists and vapors may cause burns, eye hazard.

Phosphoric Acid (H_3PO_4)

Causes irritation to upper respiratory tract; contact may cause burns to the skin.

Hydrochloric Acid (HCl)

a. Causes irritation to skin, eyes and mucous membranes via oral and inhalation routes.

b. Will react with water or steam to produce toxic and corrosive fumes.

Hydrofluoric Acid (HF)

a. Causes marked irritation of the eyes, nose and throat; acute lung damage; cumulative bone damage.

b. Unlike HCL, HF is readily absorbed by the skin and may cause severe corrosive effects and systemic effects.

Chemical goggles which completely cover the eyes should be worn as well as rubber gloves when handling these materials. Clothing should be protected by a plastic apron.

Conclusions

The K^2 kit is not recommended for use by OTC employees unless they are adequately trained in the use of the kit and laboratory safety. The hazards associated with improper use of the chemicals in the K^2 kit are severe and the possibility of misinterpretation of results are high by untrained personnel.

When used in the laboratory by trained personnel using appropriate safety precautions the K^2 kit was relatively easy to use although results of the chrystolite test were sometimes very difficult to interpret. The test for the amphiboles was accurate and easy to interpret even when concentrations were less than 10% by weight.

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REFERENCES

1. Kupel, Richard 1979. K^2 Test For Screening Asbestos Paper presented at Symposium on Asbestos Identification and Measurement. Des Plaines, IL. Available from: American Conference of Governmental Industrial Hygienists, Inc. P.O. Box 1937 Cincinnati, Ohio 45201.

Appendix 1

Iron Test

1. To determine the presence of an iron interference, add a few drops of Iron Reagent directly to the sample. If a reddish color appears, wash the sample before the test with acetic acid and sulfuric acid according to the procedure described below. Samples containing fiberglass or mineral wool are also washed with the acids. For greatest reliability it is best to perform the acid wash routinely.

Acid Wash

a. Place a small portion of the sample, about the size of a large pea, in a clean plastic beaker.

b. Add 5 drops of acetic acid to the sample with a clean dropping pipet.

c. Also add 5 drops of sulfuric acid to the sample with a clean dropping pipet.

d. Mix the sample and acids well with a clean glass rod. Let the mixture stand for 5 minutes.

e. Place a polyvinyl chloride membrane filter (iron test) on the perforated face of the disassembled Swinnex filter holder

f. Empty the contents of the plastic beaker onto the membrane filter.

g. Add the gasket and assemble the Swinnex filter holder.

h. Fill a clean plastic syringe with 10 milliliters of de-ionized water, attach the syringe to the filter holder and empty the syringe to wash the filter.

i. Repeat the wash 4 times for a total of 50 ml. of water.

j. Transfer the sample from the filter to the test plate and proceed with the iron test (alternatively, the entire membrane filter can be transferred).

2. Add a drop of Hydrofluoric Acid (HF) solution from a clean plastic pipet to the sample and mix well.

3. Add 5 drops of Iron Reagent (Fe Reagent) and observe the development of a reddish color.

4. A reddish color indicates that asbestos (amosite or crocidolite)may be present).

5. Samples giving a positive iron indication (i.e. reddish color) may be sent to a laboratory for confirmation.

C. Notes

If both parts of the test give negative responses, there is a low probability that any asbestos is present. Once the presence of magnesium and/or iron is indicated, further analysis, if needed, is done in the laboratory to confirm, identify the type, and quantitate the percentage of asbestos.

Magnesium Test

1. To determine the presence of magnesium interference, add a few drops of Magnesium Reagent directly to the sample with a clean (new or washed) dropping pipet. If a blue color appears wash the sample with glycerin, as described below, before the test. Any sample known to contain plaster is also washed with glycerin. For greatest reliability it is best to perform the glycerin wash routinely.

   Glycerin Wash

   a. Place a small portion of the sample, about the size of a large pea, in a clean plastic beaker.

   b. Add 5 drops of glycerin to the sample with a clean dropping pipet and mix well with a clean glass rod.

   c. Rinse the glass rod with a small amount of water into the beaker.

   d. Place a cellulose ester membrane filter (magnesium test) on the perforated face of the disassembled Swinnex filter holder.

   e. Empty the contents of the plastic beaker onto the membrane filter.

   f. Add the gasket and assemble the Swinnex filter holder.

   g. Fill a clean plastic syringe with 10 milliliters de-ionized water, attach the syringe to the filter holder and empty the syringe to wash the filter.

   h. Repeat the wash 4 times for a total of 50 ml of water.

   i. Transfer the sample from the filter to the test plate and proceed with the Magnesium Test (alternatively, the entire membrane filter can be transferred).

2. Add a drop of Phosphoric Acid (H_3PO_4) from a clean plastic pipet to the sample and mix well by grinding the sample with a clean glass rod.

3. Add 2 drops of 10N Sodium Hydroxide (10N NaOH) from a clean pipet to the sample and mix well.

4. Add 5 drops of Magnesium Reagent (Mg Reagent) from a clean pipet to the sample and stir briefly. Note any color change.

5. Add 5 drops of Magnesium Reagent to the sample, as in (4) above, and observe the final color.

6. A blue color indicates the asbestos (chrysotile) may be present.

7. Samples giving a positibe magnesium indication (i.e. blue color) may be sent to a laboratory for confirmation. If the magnesium test is negative the sample must be tested for iron.