10.11 Safe Insulation Analysis

10.11.1 Introduction

Safe insulation is that material found in the doors and walls of fire safes. Its purpose is to protect the contents of the safe from burning. The composition of the insulation is formulated to provide this thermal protection. The insulating materials are held in some form of solid matrix to prevent later shifting or settling.

Matrix materials can include:

- Portland cement
- Natural cement (many particulate impurities)
- Frothy cement (filled with air bubbles)
- Gypsum

Insulating materials can include:

- Vermiculite
- Diatoms
- Sawdust or wood chips
- Fiberglass
- Air bubbles within cement

Other possible contents:

- Hairs
- Fibers
- Miscellaneous debris

Particles of safe insulation can be found on tools or clothing, in vehicles used to transport safes, and in locations where safes have been broken into.

Known samples of safe insulation should be collected from the door and walls of the safe in question for comparison to the questioned sample.

A safe insulation reference collection should be kept at each laboratory performing this type of examination.

10.11.2 Safety Considerations

Standard Laboratory Precautions - See FSD Health & Safety Manual

10.11.3 Preparations

Obtain the necessary knowns before a comparison is made. Review in-house safe insulation standards.

10.11.4 Minimum Standards & Controls

The examination of safe insulation begins with a stereomicroscope. Determine the presence of any insulating materials and recover samples for identification with the light microscope and instrumental methods, where applicable.

If a known sample is submitted, stereomicroscopic comparisons should be conducted at varying magnifications.

The polarized light microscope and microchemical tests can be used for preliminary identification with SEM/EDAX used for a confirmatory test. Diatoms, fiberglass, glass wool, cork and sawdust can be identified by microscopic means.

10.11.5 Instrumentation

- Microscopes
- SEM/EDS
- u-XRF

10.11.6 Procedure or Analysis

In general initial examination of a safe insulation case should not be considered until adequate specimens of the safe involved have been submitted for comparison purposes.

Comparison of items such as fibers, fiberglass, etc. can be performed using protocols for those evidence types.

Upon receiving evidence for safe insulation examinations, the following steps should be taken:

10.11.6.1
Follow general evidence handling procedures.

10.11.6.2
Visual examination of the standards and questioned exhibits.

10.11.6.3
Stereoscopic examination of tools, standards, and debris from suspect's clothing and/or vehicle.

10.11.6.4
The question and standard samples must be compared using their physical, optical, and chemical properties.

10.11.6.4.1
Physical properties are compared using visual and stereoscopic methods.

10.11.6.4.2
Optical properties are compared using high-power microscopes, i.e., polarized light and phase contrast microscopes.

10.11.6.4.3
Chemical properties are compared by (1) microchemical tests with confirmation by instrumental methods, or (2) instrumental methods alone. The available instrumental methods are u-XRF, SEM/EDX or FTIR. Care should be taken in identifying by chemical name without an identification being made by the appropriate instrumental method.

10.11.6.5
A safe insulation reference collection should be kept at each laboratory performing this type of examination.

10.11.7 Report Wording

If the material consists of vermiculite, diatoms and Portland cement, it can be stated that the material, even in very small particles, is characteristic of having originated from a safe.

10.11.8 References

"Safe Insulation and Its Value in Crime Detection"; FBI Law Enforcement Bulletin, Novembeer 1974, pgs 23-25

"Safe Insulation" - Informational paper given out by Elmer T. Miller at the NEAFS meeting October 29, 1977 (available at the Northville Lab)

Dignan, S.J. "The Effects of Moisture on Safe Insulations Containing Portland Cement", Can. Soc. Forens. Sci. J. Vol. 19 No. 1 (1986)

Campbell, Donald H. "Microscopical Examination and Interpretation of Portland Cement and Clinker", Construction Technologies Laboratories, A Division of the Portland Cement Association (paper available at the Northville Lab)