Chapter 13: Encapsulation

Encapsulation: How To Do It

1. Determine if encapsulants can be used. Do not encapsulate the following surfaces:
   - Friction surfaces, such as window jambs and door jambs.
   - Surfaces that fail patch tests.
   - Surfaces with substrates or existing coatings that have a high level of deterioration.
   - Surfaces in which there is a known incompatibility between two existing paint layers.
   - Surfaces that cannot support the additional weight stress of encapsulation due to existing paint thickness.
   - Metal surfaces that are prone to rust or corrosion.
2. Conduct field tests of surfaces to be encapsulated for paint film integrity.
3. Consider special use and environmental requirements (e.g., abrasion resistance and ability to span base substrate cracks).
4. Examine encapsulant performance test data supplied by the manufacturer.
5. Conduct at least one test patch on each type of building component where the encapsulant will be used.
6. For both nonreinforced and reinforced *coatings*, use a 6- by 6-inch test patch area. Prepare the surface in the manner selected for the complete job. Prepared surfaces for patch testing should be at least 2 inches larger in each direction than the patch area.
7. For fiber-reinforced wall *coverings*, use a 3- by 3-inch patch. For rigid coatings that cannot be cut with a knife, use a soundness test.
8. For liquid coating encapsulants, allow coating to cure and then visually examine it for wrinkling, blistering, cracking, bubbling, or other chemical reaction with the underlying paint. For all encapsulants, carry out the appropriate adhesion tests.
9. Record the results of all patch tests on Form 13.1.
10. Develop job specifications.
11. Implement a proper Worksite Preparation Level (see Chapter 8).
12. Repair all building components and substrates as needed, e.g., caulk cracks and repair sources of water leaks.
13. Prepare surfaces. Remove all dirt, grease, chalking paint, mildew and other surface contaminants, remnants of cleaning solutions, and loose paint. All surfaces should be deglossed, as needed.
14. Ventilate the containment area whenever volatile solvents or chemicals are used.
15. During encapsulant application or installation, monitor temperature and humidity. For liquid coatings, monitor coating thickness to ensure that the encapsulant manufacturer's specifications are met.

16. Conduct cleanup and clearance.
17. The owner should monitor the condition of the encapsulant after the first 6 months and at least annually thereafter. Repairs should be made as necessary. Reevaluations should be completed according to the schedule in Chapter 6.
18. Provide information to residents on how to care for the encapsulation system properly and how to contact the owner to get repairs completed safely and quickly.
19. Maintain records on the exact detailed locations of encapsulant applications, concentration of lead in the paint underneath the encapsulant, patch test specifications and results, reevaluations, product name, contractor, and date of application or installation, along with a copy of the product label and a material safety data sheet (MSDS) for the product. Record failures and corrective measures, signs of wear and tear, and the identity of the certified risk assessor.

Chapter 13: Encapsulation

I. Introduction

This chapter provides information on (1) assessment of the suitability of a surface (i.e., the existing paint film) and the building component substrate for encapsulation; (2) types of encapsulant systems; (3) considerations for selection and use of encapsulants; (4) field patch testing; (5) general surface preparation and application procedures; and (6) procedures for ongoing monitoring by the owner and reevaluation by a risk assessor.

A. Definition

Encapsulation is the process that makes lead-based paint inaccessible by providing a barrier between the lead-based paint and the environment. This barrier is formed using a liquid-applied coating (with or without reinforcement materials) or an adhesively bonded covering material. While encapsulant systems may also be attached to a surface using mechanical fasteners, the primary means of attachment for an encapsulant is bonding of the product to the surface (either by itself or through the use of an adhesive).

Encapsulants should not be confused with enclosures, which are rigid barriers fastened by mechanical means to the base substrate (or the structural members). Enclosures rely on mechanical fasteners as the primary method of attachment. Enclosures are addressed in Chapter 12, Section II.

Encapsulation depends upon a successful bond between the surface of the existing paint film and the encapsulant for performance. However, this condition alone is not sufficient for encapsulation system success. All layers of the existing paint film must adhere well to each other, as well as to the base substrate. If not, the encapsulation system may fail. Thus, proper assessment of the suitability of the surface and substrate for encapsulation is essential prior to the application and installation of the product.

The success of an encapsulation application also depends on successful patch testing in the field, proper completion of surface preparation and application procedures, ongoing monitoring by the owner and resident, and periodic reevaluation by a risk assessor. These procedures are discussed in detail in subsequent sections of this chapter.

B. Standards and Acceptance

At this time, there are no approved or prohibited encapsulants and no standards for their use. Standards for minimum performance characteristics are now being developed under the auspices of the American Society for Testing and Materials (ASTM) Committee E06.23.30. At least one State (Massachusetts, 1994), already has such lead standards in place. Title X requires that encapsulant standards be completed by April 1996. In the interim, until such standards are developed, encapsulation is considered an acceptable method of federally supported lead-based paint abatement or federally supported lead-based paint hazard abatement, provided the following conditions, procedures, and precautions exist or are followed:

- The encapsulation product or system is warranted by the manufacturer to perform for at least 20 years as a durable barrier between the lead-based paint and the environment in locations or conditions similar to those of the planned application.
- Selection and use of encapsulation products or systems follow the manufacturer's recommendations and the procedures and precautions described in this chapter of the *Guidelines* and in other relevant chapters, including those on occupant protection, worker protection, cleanup, clearance, and waste disposal.
- Patch testing is completed successfully.
- The property owner or local government agency conducts surface-by-surface visual

monitoring of all encapsulant applications 1 month and 6 months from the date of completion of the application and at other times as specified for encapsulation in Chapter 6 of these *Guidelines* and records those results.

- Failures are repaired as soon as possible, and repairs are made according to manufacturers' recommendations and the procedures and precautions recommended in this chapter and other relevant chapters of these *Guidelines*, including those pertaining to resident protection, worker protection, cleanup, clearance, and waste disposal.

C. Background

Encapsulation technologies can offer safe and effective control of lead-based paint hazards. Encapsulation can be less expensive than other options and may be one of the only alternatives that can be used in certain situations. Encapsulants may also be used in combination with other methods. Encapsulants can be applied with only a moderate degree of training and, unless there is significant surface deterioration, may generate low amounts of leaded dust. However, if the encapsulation system fails, repairing the damage, as well as covering the exposed lead-based paint surfaces, may result in high maintenance costs. The advantages and disadvantages of using encapsulants are listed in Table 13.1.

A number of products currently being marketed specifically for lead-based paint abatement have been used as specialty coatings and coverings for many years. However, there is limited field experience in their use as lead-based paint encapsulants. Ongoing, but limited, field reexamination and evaluation of coating systems are being conducted by the Massachusetts Department of Public Health and the Maryland Department of the Environment with funding from the U.S. Environmental Protection Agency (EPA). Some sites with interior and exterior coatings have been found to remain intact for up to 3 years. On the other hand, the same systems have been observed to fail immediately after application or within a period of months due to inadequate surface preparation or improper selection. Some failures have been widespread, in which the coating system separates completely from the substrate. Some have been more limited, in which cracks appear in the coating or the product is abraded (rubbed away) through normal wear and tear. The limited failures have been attributed to use of encapsulants on surfaces that were not suitable for encapsulation, inadequate surface preparation, or improper selection of product type.

The standards for minimum performance now being developed by ASTM involve laboratory testing of products applied to bare substrates under controlled settings. Most commercial products have not been tested using the ASTM protocols. Consequently, encapsulant systems have not yet been subjected to rigorous performance testing. The ASTM standards, when they become available, specify minimum performance requirements. Specific use situations may warrant more stringent performance requirements for certain properties. The encapsulant user will need to determine whether more rigorous performance is needed. Product selection and use considerations are addressed later in this chapter.

II. Assessment of Surfaces and Components for Suitability

Some surfaces and components are not suitable candidates for encapsulation. In these situations, a decision not to encapsulate can be made without further consideration or testing. For all other surfaces and components, more extensive field testing is recommended for encapsulation. Once the determination is made that encapsulation is suitable, patch testing of candidate encapsulant systems (including use of the manufacturer's recommended materials, surface preparation procedures, and application procedures) is essential.

A. Specific Surfaces and Components Not Suitable for Encapsulation

Friction surfaces. These surfaces include window jambs and exterior wood flooring or stairs

Table 13.1 Advantages and Disadvantages of Using Encapsulants

Advantages	Disadvantages
Residents may not need to be relocated. Minimal generation of leaded dust if surface preparation is minimal. Moderate application training requirements. Less costly and more timesaving than some other control techniques if surface preparation is minimal. Wide range of product types available to meet special needs. Finish carpentry work may not be required.	Experience and information on long-term durability is limited. Use on friction surfaces is inappropriate. Durability depends on condition of previous paint layers. Field compatibility testing of encapsulant with particular lead-based painted surface is essential (patch testing). Encapsulant system success depends on proper surface preparation. Periodic monitoring and maintenance by the owner is required, since lead has not been removed. Susceptible to water damage; system failure can be extensive. Application may be weather- and temperature-dependent and may require several coats. Some systems may contain toxic ingredients.

covered with lead-based paint. Some interior floor and stair surfaces may be suitable for encapsulating with a rigid floor covering (e.g., vinyl tile) that is adhesively bonded to the surface.

Deteriorated components or paint films. Components must be sound and essentially free of deterioration to be suitable for encapsulation. Deteriorated components include rotten wood, rusted steel, spalled plaster, and masonry in need of repointing. Use of encapsulants on steel structures is especially difficult, since most do not have corrosion inhibitors and will fail if the steel underneath rusts. Also, components affected by water leaks, poor moisture venting, or other moisture-associated problems should not be encapsulated unless the moisture problem is corrected first. Additional information on inspection of components for damage associated with water penetration can be found in Chapter 11.

Severely deteriorated paint films. Lead-based paint films that are severely deteriorated (e.g., cracked and peeling over most of the surface) are not suitable for encapsulation.

Surfaces in which there is a known incompatibility between two existing coating layers. Usually this determination cannot be made without field testing. However, if available, historic records may reveal conditions known to cause poor interlayer adhesion. For example, use of a flat latex paint over an improperly prepared, glossy oil-based enamel will likely result in an existing paint system that is not suitable for encapsulation.

B. All Other Surfaces

Surfaces of nondeteriorated substrates having reasonably stable lead-based paint films can be considered for encapsulation. However, a decision to encapsulate should be made only after a field evaluation of the condition of these films is conducted, using patch tests. A patch test is a field test procedure in which a small area of the existing lead-based paint film is prepared and the encapsulant product is applied or installed and cured in the manner intended for the large-scale job. A field evaluation should determine the extent of deterioration, the condition of the surface, and the integrity of the underlying paint layers. These factors should be considered because an encapsulant is not mechanically fastened to the underlying base substrate. Some paint films cannot support the additional weight or stress of an encapsulant, because of existing film thickness, poor adhesion between paint layers, or low cohesive strength within a layer. Existing film thickness can be measured using a dry film thickness gauge, such as a Tooke gauge or a micrometer. Information on the thickness of existing coatings can be provided to an encapsulant manufacturer's or distributor's technical representative to help in making appropriate recommendations.

The visual extent of deterioration, surface deterioration, and interfacial or cohesive film weaknesses should be evaluated, before use of encapsulants, in the following ways:

Visual Evaluation. Visual deterioration includes peeling, flaking, blistering, and cracking of paint films. The level can be rated based on ASTM photographic standards, such as ASTM D 610 for rusting, D 770 for blistering, etc. An entire surface can usually be inspected for these defects. Often, both the extent of the surface that is deteriorated and level of deterioration are assessed. For example, 5 percent of the surface may be deteriorated to a rating level of one (i.e., severe) or the entire surface may have slight deterioration. Quantitative rating in this fashion may be required by the encapsulant manufacturer, but not by HUD at this time.

Surface Deterioration. Surface deterioration includes chalking, mildewing, and soiling. Standard ASTM procedures can be used to rate the degree of these conditions. Enough determinations need to be made to properly characterize the surface. However, since this type of deterioration tends to be widespread and is usually rather uniform over large surface areas, determination of two or three locations may adequately describe the condition.

Interfacial and Other Film Integrity Properties. Since most lead-based paint films are made up of many paint layers, up to 1 or more millimeters in thickness, a measure of how well the layers are adhering to each other and the base substrate is needed prior to the use of an encapsulant. Also related to interfilm adhesion is cohesive strength within films. These properties are usually assessed using a field adhesion test, such as a crosshatch or "x-cut" test with tape, a pulloff adhesion test, or a probe of the film with a knife. Interfacial deterioration may not be uniform over a large surface area (since it may be defect-related) and will vary from location to location across a surface. Thus, it is important to conduct enough interfacial integrity tests to obtain a representative sampling of the entire area.

Surfaces with intact paint and good interfacial adhesion are good candidates for nonreinforced encapsulants. Surfaces with peeling, flaking, or cracking paint films are usually not good candidates for nonreinforced encapsulants unless the loose coating can be removed. However, reinforced encapsulants may be suitable if the areas of deterioration are localized and reasonably small. In these cases, the reinforced coating can span the deteriorated areas. Adhesively bonded encapsulants may be suitable for either surface type.

III. Encapsulant Classification

Encapsulation technology is developing rapidly, and new material types and systems are continually being introduced commercially, making it difficult to classify encapsulants (Table 13.2). Within each of the three general classifications, there is a wide range of material types and properties. Manufacturer's data must be consulted to obtain specific information.

Residential paints, such as latex and alkyd-based paints and canvas-backed vinyl wallpaper, do not constitute encapsulant systems unless they pass the patch test and meet the performance requirements of this chapter and any quantitative performance standards defined by ASTM or other local, State, or Federal agency.

IV. Minimum Performance Requirements for Encapsulants

Four general performance requirements for encapsulants are as follows:

- The encapsulant must be capable of being applied safely and must not contain toxic substances.
- The encapsulant must adhere to existing paint films.
- The encapsulant must have the ability to remain intact for an extended period of time when exposed to the expected environmental conditions and use patterns.
- The encapsulant and its application procedure must comply with fire, health, and environmental regulations.

A. Safe Application

All encapsulants must be able to be applied safely, without excessive worker or occupant exposure to hazardous solvents, curing agents, or other chemicals in the encapsulant, either by inhalation or by contact with the skin.

B. Adhesion

An encapsulant must adhere to the existing paint film. Adhesion can be measured using peel, tensile, or shear tests. However, adhesion of an encapsulant to the lead-based paint film is not sufficient for success of the encapsulant system; the integrity of the underlying paint layers is also crucial. Each of these layers must adhere well to other layers *and* the base substrate. In addition, each layer must have sufficient cohesive strength to support the increased internal stresses caused by the addition of an encapsulant layer.

Table 13.2 Categories of Encapsulants

Encapsulant Category	Application and Installation Method	Characteristics
Nonreinforced liquid coatings.	Usually applied with brush, roller, or spray.	Interior and exterior products. Some properties vary widely, such as elongation (e.g., elastomeric with high elongation to rigid with limited elongation), dry film thickness (0.05 mm to greater than 0.5 mm), hardness, dry/cure time, and compatibility with existing painted surfaces.
Liquid coatings reinforced with cloth, mat, fibers, etc.	Applied with brush, roller, spray, or trowel. Usually applied in two steps.	Interior and exterior products. Properties vary widely.
Materials adhered with an adhesive (e.g., fibermat, vinyl floor tile).	System is usually installed in two steps: (1) adhesive application and (2) encapsulant product installation.	Classification includes sheet vinyl systems, floor tile, wall systems, and other adhesively bonded systems.

C. Ability To Remain Intact

The ability of a film to remain intact depends on many factors, some of which are specific to the conditions in which the encapsulant is used. For example, an encapsulant may suffer impact and abrasion damage. It may also be exposed to water and other household chemicals, changing temperatures, changing substrate dimensions, and other degrading environmental conditions. Laboratory procedures used to investigate these properties are loosely grouped into tests for mechanical, chemical resistance, and durability properties.

1. Mechanical Properties

Mechanical properties include tensile properties (elongation, tensile strength, modulus), flexibility, abrasion resistance, and impact resistance. Most of these properties are interrelated and may depend on temperature.

Mechanical properties of coatings should be considered in selecting an appropriate material. For example, more flexible materials may be more likely to resist cracking when the substrate moves because of vibration, changes in temperature, changes in moisture content, or settling. If this mode of performance is important, the encapsulant must remain flexible over the complete range of exposure temperatures. Some elastomeric encapsulants have failed by cracking because they became brittle at low temperatures. Reinforced encapsulants may be more likely to resist cracking over existing substrate cracks or new substrate cracks than nonreinforced encapsulants. This is because stresses produced in a reinforced encapsulant as a result of substrate cracking or other movement are distributed over a larger area than for nonreinforced materials.

Abrasion resistance refers to the ability to resist wearing, such as from rubbing against a surface or from cleaning with abrasives. Examples of surfaces where abrasion is likely to occur include railings, walls, moldings around door and window openings, and interior window sills where air conditioner units are installed and removed.

Impact resistance is the ability of a coating to resist cracking or loss of adhesion upon direct impact by an object, such as a toy or tool. Good impact resistance is needed for surfaces adjacent to door openings and for walls in recreation rooms and entryways.

2. Chemical Resistance Properties

Chemical and water resistance is essential for long-term stability of an encapsulant. Interior encapsulants may be exposed for extended periods of time to both water (steam, vapor, and liquid) and, in limited situations, chemicals. For example, on horizontal surfaces, water or chemicals (e.g., cola, cleaning solutions) may stand until evaporated. An encapsulant must be able to withstand such exposures without blistering, peeling, cracking, or losing film integrity.

3. Durability

For all encapsulants, it is essential that the mechanical and chemical properties of the material remain essentially constant over time. For exterior exposures, this means that an encapsulant must also be resistant to degradation by sunlight, moisture, and temperature variations. Until specific criteria are available, manufacturers should be asked to supply information and warranties on the durability of their products.

D. Fire, Health, and Environmental Requirements

Encapsulants must meet all local fire code requirements. Since their film thicknesses are often much greater than that of paints, there may be additional fire-related requirements. Building codes and material safety data sheets (MSDS) must be consulted to ensure safe application and to provide information on when residents can safely reenter the area. The MSDS will also provide information on toxic substance content. In addition, environmental volatile organic compound (VOC) regulations limit the VOC content of paints in many local regions.

V. Factors To Consider in Selecting and Using Encapsulant Systems

When encapsulation is suitable and is the desired control strategy, a user has a wide range of systems from which to select. In addition to the requirements of Section IV, the decision to select a specific type or system should take into account several other factors, including those related to the type of lead-based paint film and base substrate, service conditions, cost, liveability, and health and safety issues.

A. Base Substrate

The base substrate can be wood, plaster, steel, cement, masonry, stucco, or some other material. Thus, the movement and possible deterioration of the substrate vary and should be considered. For example, wood will expand and contract with changing water content and perhaps check and crack as it ages. Wood rot could also occur if water leaks or other moisture problems are ignored. Stucco may develop cracks as it ages or the building settles. An encapsulant must be able to move with the base substrate without cracking or otherwise deteriorating.

Walls with extensive cracks and gaps that cannot be bridged by nonreinforced coatings may be good candidates for reinforced coatings or wall coverings. For situations in which nonreinforced coatings can be used, cracks must be filled with a caulking or sealing compound compatible with the encapsulant and the substrate to which it is applied.

Corrosion of metal substrates must be controlled by a proper primer prior to the use of an encapsulant. Uncontrolled rusting will quickly lead to delamination of an encapsulant. Thus, a corrosion-control primer is an essential part of an encapsulant system for metal.

B. Lead-Based Paint Film Properties

An encapsulant must be compatible with the existing lead-based paint film. Both chemical and physical properties of the film are important. A compatible encapsulant must form a strong bond with the lead-based paint film but not degrade the existing paint layers. Epoxies, polyurethanes, and other coatings having strong solvents are often incompatible with oil/alkyds and latex paint films.

Physical properties of old films also affect performance of coatings and adhesives applied over them. Water-based products tend to bond less successfully to glossy, smooth, chalky, dirty, or oily paint film surfaces than do compatible solvent-based materials.

Field patch testing is the best procedure for determining compatibility with the existing lead-based paint surface and early performance properties of the encapsulant.

C. Application and Installation Constraints

Application constraints include the skill required for application, the method of application and acceptable range of environmental conditions, and regulations for worker safety and environmental protection.

1. Skill Level

Different levels of skill are required for application of the various classes of encapsulants. Generally, liquid nonreinforced coatings require the lowest skill level. Coatings having two components (requiring rapid, efficient application), or those incorporating a mat, require more experience and skill. Use of adhesively bonded materials, such as tile and flexible wall coverings, also require an intermediate skill level for application (HUD, 1990b). Overall, skills required for encapsulation are lower than those for enclosure and replacement. Nevertheless, specific knowledge and skills are critical for success in the application of any encapsulant.

2. Method and Environmental Conditions

Depending on the specific encapsulant, application of the coating or adhesive may be by brush, roller, spray, or trowel; however, in certain situations, some of these methods may not be feasible. For example, if spraying is not practical; an encapsulant that can be applied by another technique will be required. The acceptable environmental conditions vary depending on the type of encapsulant. For instance, temperatures above 40 °F and below 95 °F and relative humidity less than 85 percent are generally required for water-based coatings. Moisture-cure polyurethanes may require a minimum relative humidity. A manufacturer's technical specifications should be consulted for specific requirements.

3. Regulations

Worker safety requirements vary depending upon the material being applied. The manufacturer's MSDS should be consulted for appropriate controls. The VOC content of coatings is regulated in many regions of the country. In addition, a national EPA VOC rule for all architectural coatings is expected to become effective in 1996. Consequently both local and national rules may place VOC limits on encapsulants.

D. Environmental Service Conditions

The conditions under which the encapsulant will be used are important when selecting an encapsulant. For exterior exposures, consideration must be given to an encapsulant's ability to withstand varying weather conditions, including temperature changes, temperature extremes, water, moisture vapor, air pollutants, and ultraviolet radiation. For example, some elastomeric products can become brittle when exposed to cold temperatures and may shatter on impact. Other materials, such as epoxies, prematurely chalk and erode because of ultraviolet deterioration.

Since some exterior—and even some interior—environments may be quite wet, encapsulants must not fail due to moisture. The water vapor permeability should be considered, along with the permeability of the component to be encapsulated. An encapsulant with a low water vapor permeability may peel because of a moisture gradient across the component. For example, in climates with cold winters, an impermeable encapsulant applied to exterior walls lacking an internal vapor barrier may blister and fail because of interior moisture passing through the building envelope.

E. Use Conditions

If a lead-based paint surface is subject to frequent abuse (e.g., abrasion, impact, and rubbing), especially careful consideration must be given to selecting an encapsulant product. Also, the tolerance for increased coating thickness varies depending upon the component type. For example, reinforced coatings or fiber-reinforced wall coverings having high abrasion resistance are potential candidates for walls subject to extensive abrasion and impact wear, such as in entrance hallways. Coatings having excellent chemical resistance (e.g., some epoxies) can be good candidates for surfaces containing large amounts of hand oil, such as handrails and surfaces around doorknobs. When use factors are not considered, premature failures are likely. For example, elastomerics, which typically have poorer chemical resistances than two-component coatings, have been reported to fail prematurely when used on handrails (Maryland, 1993).

F. Encapsulant Service Life

Epoxy paints, cementitious encapsulants, floor tile, and flexible adhesively bonded wall coverings have been used for other purposes and tend to have relatively long lifespans. Some coatings have qualities that may make them more durable than ordinary residential paints, e.g., a polyurethane binder is usually more abrasion-resistant than an oil binder. Since some encapsulants have been in use for a few years, field data may be available for some products. Also, the manufacturer's warranty or guarantee is an important consideration in product selection. When the product is used for lead-based paint encapsulation, conditions of the warranty may require prework inspections, surface preparation inspections, in-process inspections, and a final inspection.

G. Safety Constraints and Information

Each encapsulation product has an MSDS available from the manufacturer, which should be obtained, reviewed, and filed as part of the recordkeeping procedure. The MSDS provides information on hazardous ingredients (specific chemical identities and common names); physical and chemical characteristics (boiling point, water solubility, melting point, evaporation rate, specific gravity, vapor pressure); fire and explosion hazard data (flashpoint, extinguishing media and firefighting procedures, and any unusual fire/explosion hazards); reactivity (stability and incompatibility, hazardous decomposition, or products); health hazard data (routes of entry, acute and chronic health hazards, carcinogenicity, signs and symptoms of exposure, medical conditions generally aggravated by exposure, and emergency and first-aid procedures); precautions for safe handling (waste disposal, handling, and storing); and use and control measures (respiratory protection, eye protection, protective gloves, ventilation, and other protective measures and hygiene practices).

Some MSDSs do not disclose the presence of toxic substances under trade secret provisions. If an MSDS does not show chemical ingredients and claims no hazardous ingredients are present, but still indicates eye and skin protection or ventilation is necessary, the MSDS may be deficient. Occupational Safety and Health Administration regulations require employers to maintain current MSDSs for all products containing hazardous chemicals that are used by employees.

Until there are national performance standards, it may be useful to have a toxicologist or industrial hygienist review the MSDS and/or consult any of the available toxicology database systems, such as the Hazardous Substance Database, Integrated Risk Information System (EPA), and Registry of Toxic Effects of Chemical Exposures National Insitute of Occupational Safety and Health (NIOSH). Both worker and resident safety should be taken into consideration. For example, residents and pets may be exposed to VOCs during the drying or curing process.

H. Esthetics

To maintain an acceptable appearance, the finished product should be capable of being painted, or otherwise coated, and maintained. Consideration should also be given to the importance of having a finished surface that is smooth or rough (textured) or soft or hard. For example, encapsulants that are either soft or have a rough finish are not appropriate for handrails and floors and may make cleaning of wall surfaces more difficult. Also, soft coatings have a greater tendency to adhere to or be imprinted by objects placed on them than do harder coatings. The final thickness of the encapsulant also affects the appearance of the product. For example, the final thickness of many elastomeric encapsulants (10 to 20 mil) is about 10 times greater than a single layer of paint and can conceal desired detail on wood trim and moldings.

If the existing coating is not intact or smooth and requires substantial sanding and feathering, then a nonreinforced liquid encapsulant may not be the appropriate product type. Nonreinforced liquid encapsulants are less likely to hide surface imperfections than reinforced liquid coatings or adhesively bonded wall coverings.

I. Repairability

Repairability refers to the ease of repairs and the appearance of the affected areas. It is important to determine if repairs can be performed only by outside contractors with special equipment or skills or if they can be done by typical maintenance workers. Generally, all encapsulants are repairable, although some types may be more difficult to repair than others.

J. Cost

Depending upon the type of substrate to be treated, the life-cycle costs of encapsulation methods may be less than for enclosure methods (HUD, 1991). Life-cycle costs include both the initial costs and reexamination and maintenance costs. Initial per-unit costs (material plus labor) associated with the various encapsulant products vary. Since labor may be a major part of the cost, encapsulant systems requiring more than one layer or step may be more expensive than those completed in one operation. In addition, the total time required for application and cure is a cost-related factor if occupants need to be housed away from the worksite during this time. The length of time needed for the encapsulant to remain effective should also be included in life-cycle cost considerations.

K. Technical Assistance

For large projects, a technical representative from the product supplier or manufacturer should be involved in the choice and inspection of the surface preparation procedure and the application processes. It is important to clarify the nature and extent of any support that is being offered. If no technical support is offered, consideration might be given to other products where support is available. The manufacturer's involvement in quality assurance activities is desirable, and every effort should be made to cooperate with those involved.

VI. Specific Encapsulant Products and Surface Preparation Procedure

A. Encapsulant Product Selection

Once a surface has been found suitable for encapsulation and a decision has been made to encapsulate, a specific product or product type is selected, together with appropriate surface preparation and application procedures. The procedure for selecting a specific encapsulant product is to (1) obtain information from the manufacturer's literature, users' experiences, and any other credible knowledge base on the products' ability to meet the general performance requirements and the factors listed previously in this chapter; (2) select a group of candidate encapsulant products and surface preparations using this information; and (3) conduct field patch tests with the candidate products on the surfaces to be encapsulated.

B. Surface Preparation

After an encapsulant product or type has been selected, surface preparation procedures need to be identified. All encapsulant manufacturers provide surface preparation recommendations for their products. In some instances, manufacturers provide more than one specific recommendation. Thus, it is essential to select one or more suitable specific procedures prior to application of the encapsulant. Consideration should be given to identifying and testing more than one specific surface preparation procedure because the same encapsulant may be successfully used with one procedure and not another. Cost and time savings may be significant for some encapsulants if more than one surface preparation is tested at the same time. The cure time, and thus the test time, may be long.

General surface preparation requirements, which are similar for all encapsulants, are presented below. Materials used and debris generated during surface preparation may be hazardous and must be treated appropriately.

1. Cleaning

Encapsulants should not be applied over dirt, rust, oil, grease, mildew, chalk, or other surface contaminants. Surfaces should be cleaned with nonsudsy degreasers, such as trisodium phosphate or other appropriate materials. Additional cleaning agents may be needed for mildew or chalk removal. Cleaning can be done by hand with a sponge or rag or with the aid of power washing equipment. In either case, it is essential to rinse the surface thoroughly with water to remove cleaning residue. Job specifications may require that specific standards be met for removal of surface contaminants, e.g., ASTM D 4214 for chalk. In situations where chalk cannot be removed to an acceptable level, the use of a primer or stabilizer may be needed. If a special primer is used, it is essential that it is one recommended by the encapsulant manufacturer.

2. Deglossing

The surface of some lead-based paint films is smooth and glossy. Deglossing to roughen the surface is usually recommended by manufacturers to improve adhesion of the encapsulant coating. Often, specific deglossing materials will be recommended, since they must be compatible with the encapsulant. For some very hard, chemically resistant surfaces, deglossers may not work, and wet sanding may be needed. Since the choice of deglossing materials or methods affects encapsulant adhesion, separate patch tests using different deglossers or methods should be considered.

3. Removal of Loose Paint

Loose paint should be removed by wet scraping.

4. Preparing Exposed Base Substrates

These substrates can warrant different surface preparation requirements than lead-based paint surfaces. For example, the surface of bare wood exposed to sunlight should be wet sanded to remove the degraded surface layer. Corroded metal should be cleaned using HEPA-assisted power tools or HEPA-vacuum blasting to remove surface rust and contaminants. Bare concrete and masonry materials should be washed to remove loose dirt, degraded materials, or other surface contaminants.

C. Field Patch Tests

A patch test evaluates the encapsulant on a small area of the painted surface prior to the start of work. When more than one surface preparation is being tested, each surface preparation procedure, plus the encapsulant, is a separate patch test. An encapsulant/surface preparation system that fails a patch test is not suitable for use in the large-scale job.

Surface preparation and encapsulation applications and installations can be done by certified contractors or knowledgeable workers. After the encapsulant has cured according to the manufacturer's recommendations, an inspector technician performs the evaluation. In at least one State (Maryland), a public agency inspector technician determines where the patches should be placed, based on the plan submitted by the owner or contractor, and inspects the patch test (Maryland, 1988). Since other States may have similar requirements (e.g., Massachusetts has a formal procedure for approving encapsulants), it is important to contact local or State agencies before starting work.

1. Size of Patch Tests

For liquid-applied systems, the recommended test patch size is about 6 by 6 inches. For narrow surfaces such as doorframes, a differently shaped patch may be needed but should be about the same area. Smaller 3- by 3-inch patches may be used for fiber-reinforced wall coverings, since they may be impossible to remove and can be thick enough to show through a completed system.

2. Location of Patches

At least one test patch should be applied to each type of component in each room or exterior location representing different types of paint where the encapsulant is to be used. For example, if the encapsulant is to be used on walls in both the kitchen and the living room, a patch test should be done on one wall in each room. Although the rooms may appear to have the same surface paint, past painting practices may have been different; therefore, both rooms should be tested. The paint testing protocol contained in Chapter 7 also is based on the idea that paint history and type is unique for each room. If localized areas of a surface or component are suspected of having underlying adhesion problems due to moisture, then the patch test should be done in one of these areas. Outer walls are good areas to test since they may be more likely to experience moisture. Similarly, load-bearing walls are good areas for patch testing because they are subject to stress. For thick, reinforced coatings or wall-covering systems, patches should be placed in an inconspicuous place, if possible. If it is known that one type of component has the same paint history in several rooms, only one patch test is needed for that component type.

3. Surface Preparation for Patch Testing

The area prepared for the patch test should be at least 2 inches larger in each direction than the area to be encapsulated for the test, unless the shape of the component makes this impossible. The surfaces should be inspected following preparation to ensure that the preparation was carried out properly. The inspection results should be documented separately for each patch.

4. Encapsulant Application and Installation

The encapsulant(s) should be applied in accordance with the manufacturer's recommendations. The application method, wet film thickness (if appropriate), and environmental conditions should be documented for each patch, since they should be the same when used on the target surface. For encapsulants that cannot be cut with a knife, consideration should be given to substituting the soundness test described below. After the encapsulant has cured, the patch is examined for adhesion and compatibility with the existing lead-based paint film. Since the cure times of encapsulants range from less than 24 hours to a period of months for a *complete* cure, it may not always be possible to perform patch tests on completely cured patches. Nevertheless, the patch test is still a useful method of assessing the likelihood of success with a given product on a given surface.

5. Patch Preparation for Conducting a Lead-Based Paint Soundness Test

The following procedure has been employed in past projects to prepare a patch test for soundness or integrity of the lead-based paint film/ base substrate system. A 3/8- by 3-inch bead of construction adhesive is applied to the central portion of the face of an 8-inch-square piece of gypsum wallboard. The wallboard square is pressed onto a 6- by 6-inch patch. The curing time recommended by the adhesive manufacturer should be observed. Evaluation of results is discussed below.

6. Visual and Adhesive Evaluation of Field Patch Tests

The encapsulant coating should be visually examined for signs of incompatibility with the paint film. These signs include wrinkling, blistering, cracking, cratering, and bubbling of the encapsulant. Solvent-based encapsulants (e.g., epoxies, polyurethanes) may react with the underlying paint layer and cause bubbling, disbonding, or other lead-based paint film deterioration. Bubbling or disbonding may be detected by scraping the *surface* of the patch, using sufficient pressure to break any visible and nonvisible surface bubbles. Surface imperfections may indicate that the encapsulant is incompatible with the existing coating. Bubbles may also form in liquid-coating encapsulants because of foaming during application, solvent entrapment during cure, and other conditions. If it can be established that the bubbles are associated with chemical reactions between the encapsulant and the underlying paint film, or the extent of bubbling is unacceptable, the patch test is a failure. If deeper probing reveals a weakened layer of paint, the patch test is also a failure. If it has failed a patch test, the encapsulant should not be applied to the target surface.

No standard method has been defined for field testing encapsulant adhesion. The "X"-cut adhesion method, used by the Maryland Department of the Environment for some encapsulants since 1988, is described here as an interim method that appears to be effective. A patch-edge method is also suggested for encapsulants that cannot be cut with a knife. Procedures for evaluating the soundness test are also provided in this section. The ASTM or another group or agency may provide additional technical standards or guidelines in the future. While the ASTM has two standard field methods for measuring adhesion of coatings—a tape test using pressure-sensitive tape (ASTM D 3359) and a portable adhesion tester (ASTM D 4541), they have not been technically defined or used for field patch testing of lead-based paint encapsulants.

"X"-Cut Adhesion Method. For the "X"-cut method, the inspector technician should take a sharp cutting tool (e.g., a knife, razor blade, or scapel) in good condition and a hard metal ruler (as a cutting guide) and inscribe an "X" in the center of the patch after the encapsulant system has cured according to the manufacturer's recommendations. Each cut line should be 1 1/2 to 2 inches long and should be made through the coating, the paint, and the patch all the way down to the substrate. A flashlight may be necessary to determine the depth of the cut. If the cut does not go through the patch to the base substrate, a second “X” cut should be made in a different location. The first cut should not be deepened.

To evaluate the adhesion and integrity of the paint film, the inspector technician should use the point of the cutting tool to attempt to peel or lift the patch from the existing topcoat. The point of the tool should be placed below the encapsulant layer at the intersection of the two cut lines. If the inspector technician can lift, peel, or tear a large (more than 1/2 inch- or 1/2 inch-square) portion or section of the patch away from the existing topcoat to which it was applied, then the encapsulant fails the patch test. The inspector technician should expect that a small piece of the patch will separate from the base substrate (up to 1/4 to 1/2 inch). This does not indicate failure of the patch test. Figure 13.1 shows one example of patch test failure.

Patch-Edge Method. For the patch-edge method, the inspector technician should make a cut adjacent to the edge of the patch through to the base substrate. If the thickness of the encapsulant does not change abruptly, but gradually decreases at the edge of the patch, the cut should be made through as thick a layer of the encapsulant as possible to the base substrate. The point of the knife should be placed under the encapsulant at the cut, attempting to peel or lift the patch from the lead-based paint topcoat or locate other delaminated layers within the lead-based paint film. If a large portion of the encapsulant can be lifted easily, then the patch test fails.

Soundness Method. For the soundness method, the inspector technician should attempt to pull the wallboard square away from the painted surface. If the paper backing of the wallboard remains on the adhesive of the painted surface of the patch, the test is a success. The patch test fails if the adhesive is removed from the surface of lead-based paint or if the paint film splits. Failure at the adhesive/wallboard interface can perhaps be overcome by the use of a different surface preparation procedure, as discussed below for the encapsulant patch test.

If failure occurs in any of these procedures, it is important to carefully examine the back of the delaminated portion of the patch in order to determine if the failure occurred at the encapsulant/paint film interface or in an underlying layer of paint. As discussed below, encapsulation may still be suitable—with a different system or surface preparation—when the failure is interfacial but not when the failure is within the old paint film. It may be difficult to determine the locus of failure if the paint layers and the encapsulant coating are similar colors.

If a failure occurs, one of the following courses of action must be taken, depending on the cause of failure:

The adhesion between two underlying layers of paint failed, causing delamination. Check for this condition by examining the back of the delaminated portion of the patch for signs of paint. This result indicates a layer of paint that bonded poorly and does not have sufficient adhesion. Poor bonding between underlying layers may be due to inadequate deglossing, poor-

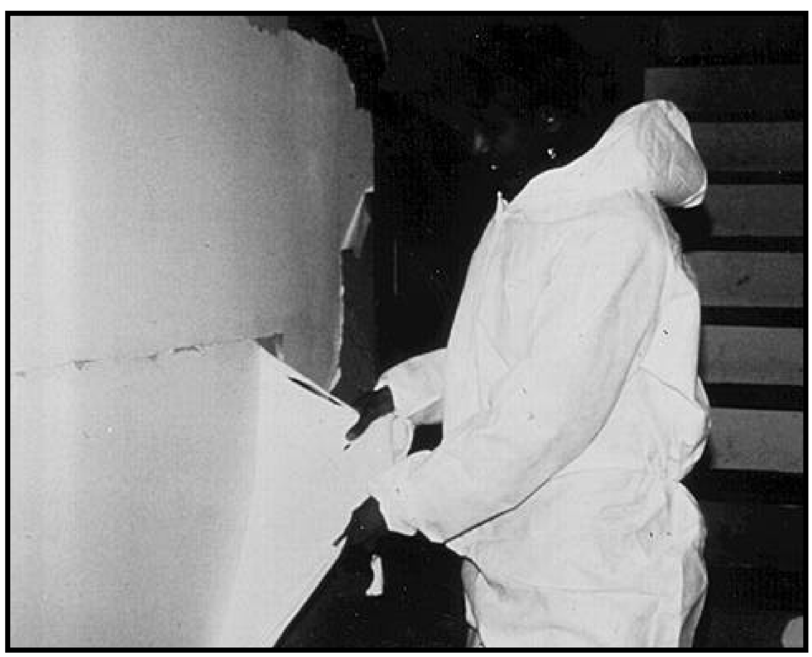

Figure 13.1 Encapsulant Failure.

quality paint, or incompatible coatings. These conditions are usually not correctable. Since multiple patch tests are recommended, complete all patch tests before deciding upon a plan of action. The encapsulant should not be used on a surface or component that has failed patch tests.

The adhesion between the paint and the base substrate failed. Check for this by looking for signs of bare substrate and paint adhering to the back of the delaminated portion of the patch. Failure may be due to a painting history that has included so many layers of paint that the weight of the paint plus the encapsulant has begun to weaken the bond between the paint and the substrate. Moisture can also cause this type of failure. This is usually not correctable, and the encapsulant should not be used.

The adhesion between the encapsulant coating and the top layer failed. Check for this by examining the back of the delaminated portion of the patch for lack of paint. Failure may be due to:

- Application of the encapsulant to a glossy surface without adequate deglossing. It may be possible to degloss the surface using a different technique and apply a second patch test to a different area on the same component. Wet sanding is permitted to degloss but not dry sanding.
- Inadequate curing time or improper curing conditions. Manufacturer's recommendations for curing and application conditions should be consulted.
- Application of the encapsulant to a dirty or greasy surface. The surface must be recleaned, and possibly deglossed before a second patch test is tried.
- Application of material to excessive thickness. This can cause failure due to internal stresses that cause the coating to pull away from the substrate. The applicator should be trained according to the manufacturer's instructions and a wet film or dry film thickness gauge (sometimes referred to as a "mil" gauge) should be used during application.

Evaluation of Adhesively Bonded Flexible Surface Covering Tests. A successful patch is one that cannot be easily removed. If the patch cannot be removed, the covering will have to be installed over the patch. In such a case, a smaller patch in an inconspicuous place will minimize the irregularity in the appearance of the finished product.

7. Documentation of Patch Test Results

Patch testing may involve multiple patches on multiple surfaces. Therefore, documentation is very important to be sure that the correct encapsulant systems (including surface preparation) are applied to the target surfaces. If multiple patch tests are performed in a dwelling, it is recommended that a schematic drawing be used to indicate the locations of the patches. Form 13.1 can be completed for this purpose.

VII. Application and Installation of the Encapsulation Systems

Upon successful completion of a patch test, the encapsulant system can be applied or installed to the targeted surface. The steps for a proper application of an encapsulant system are summarized in Table 13.2.

A. Surface Preparation for Job

The surface preparation must be the same one that was used in the successful patch test and should be conducted with the same thoroughness and level of effort. The process of repairing components and preparing surfaces for the application and installation of encapsulants can generate leaded dust and debris, so precautions must be taken. The type of precautions needed will depend upon the methods used. The appropriate Worksite Preparation Level should be selected from Chapter 8.

Repair of defective surfaces or components may also be necessary. The encapsulant manufacturer should be asked to provide recommendations for caulk and other filling compounds that are compatible with the encapsulant. To minimize future crack formation in the encapsulant, these materials should match the expansion characteristics of the encapsulant and be compatible with the existing coatings.

For large jobs, it is advisable to have an encapsulant manufacturer's representative onsite to provide additional information on repair and surface preparation. When the repair work and the surface preparation have been completed, the surface should be inspected prior to application and installation of the encapsulant. Once the encapsulant is applied, it becomes impossible to fix a poor surface preparation or, in the case of a failure, to confirm that surface preparation was done properly.

B. Installation and Application of Encapsulant System

1. Nonreinforced and Reinforced Coatings

The application procedures and requirements depend upon the specific product type. The same application method should be used for the targeted surface that was used in the patch test.

Several safety considerations are important in application: the applicator must have the appropriate MSDS documentation; personal protective equipment may be needed and must be in compliance with NIOSH or OSHA regulations; and areas need to be properly ventilated.

Masking procedures should be carried out, as needed. Surfaces to receive masking tape or other masking materials should be clean and free from dirt, dust, grease, and oil to ensure good contact. Loose edges of masking materials should be secured to avoid "flyaway," if spray application is being used. The time between coating application and masking material removal may depend upon the specific encapsulant being used.

The required environmental conditions for application depend upon the specific encapsulant being used. The manufacturer's specifications should be followed. As noted previously, water-based systems generally should not be applied to substrates when temperatures are below 40 °F or above 95 °F and the relative humidity is above 85 percent. For all encapsulants, application should be done only when the surface is dry and the temperature of the target surface is above the dewpoint.

Additional mixing and/or thinning of liquid encapsulants may be needed and should be done in accordance with the manufacturer's directions. Excessive thinning can cause premature failure. For two-component coatings, it is essential that the proper ratio of materials be mixed according to the manufacturer's directions. Not all two-component products are to be mixed together in the same ratio. Two-component materials will have a limited "pot life." That is, once the two components are mixed, a chemical reaction begins that can be slowed, but not stopped, by cooling. This means that the user has a limited period of time, i.e., pot life, in which to apply the product and to clean tools. Two-component coatings may also have an "induction time" requirement. This is a period required after mixing but before application to allow time for initiation of the reaction between the two components.

Encapsulants should be applied according to the manufacturer's recommended thicknesses. Wet film thickness gauges (sometimes called mil gauges) should be used to ensure proper film thickness. An encapsulant layer that is either too thick or too thin can cause premature failure.

Reinforced liquid encapsulants can require the use of a fabric. The manufacturer's recommendations for application of the fabric and procedures for seaming should be followed.

For liquid coatings, cure times vary from product to product and can depend upon atmospheric conditions. Thick elastomeric coatings may take only a few hours to be dry to the touch, but it may take several weeks for their mechanical properties to reach optimum values. The time for two-component coatings to cure depends upon temperature but is generally about a day.

2. Adhesively Bonded Coverings

Adhesively bonded wall coverings are installed in a manner similar to that used for vinyl wall coverings (NBS, 1973). No special tools are required. The typical three-step procedure is to apply adhesive with a roller; align and trowel the covering over the adhesive; and apply the topcoat, if needed. There are two options for coloring. The adhesive can be tinted the same color as the topcoat, which ensures two coatings with color, or two topcoats with color can be applied over untinted adhesive.

Some product manufacturers do not supply specific adhesive and topcoat products but only provide recommendations for choosing these products. Generally, there are two types of adhesives—"permanent" clay-based adhesives and water-based, heavy-duty, but strippable adhesives. Since the permanent clay-based adhesive is more durable, it is preferred for lead-based paint encapsulation. However, removal of a wall system is difficult, if not impossible, when the permanent adhesive is used. Water-based adhesives are more easily removed than permanent adhesives but may blister and fail when they come in contact with moisture.

Form 13.1
Encapsulant Patch Test Documentation

Name of Person Performing Patch Test ____________________________________

License or Certificate Number (If Applicable) _______________________________

Complete Address of Dwelling ____

Date Patch Test Applied __________________ Curing Time ___________________

Date of Patch Test Evaluation ____________________

Temperature During Application and Curing _________

Humidity During Application and Curing ____________

Room	Surface Location	Substrate	Type of Patch Test (X-cut or Adhesive Wallboard)	Surface Preparation	Name and Formulation of Encapsulant	Observations	Pass/ Fail

Adhesively bonded floor tile should be installed according to the manufacturer's directions. If new subflooring is installed, then the tile/subfloor system constitutes an enclosure. If adhesion alone is used, the tiles constitute an encapsulant.

C. Inspection of Encapsulant Systems

Proper application and installation of encapsulant systems requires that the surface preparation and application procedures are carried out according to the manufacturer's recommendations and in accordance with the job specifications, if any. Monitoring of surface preparation and application is essential, in addition to conducting the final clearance examination.

1. Tools

Tools that may be required are a dark cloth to check for chalk removal, copies of referenced surface preparation standards, wet film and dry film thickness gauges, a moisture meter, surface and air thermometers, a relative-humidity meter, pressure gauges, a timepiece, and an illuminated viewing device. A logbook should be used to record all inspection data.

2. Procedures

Surface preparation and application inspection checkpoints and procedures are listed below:

- Prior to start of job—check equipment and encapsulant material.
- After preliminary cleanup and readying of the area prior to surface preparation—check for containment, protection of belongings and property, and completion of surface repairs, such as caulking.
- After surface preparation—ensure that the surface has been prepared in accordance with the specification and in the same manner as used in the patch test.

Table 13.3 Steps for Obtaining Proper Application and Installation of an Encapsulant System

Step	Description
Identify hazard.	Complete patch test and other prejob procedures.
Develop job specification.	Prepare complete job specifications. Describe all work to be done. Include all job requirements (e.g., quality of surface preparation, dry film thickness). Reference standard procedures or equipment to the extent possible to avoid misunderstandings.
Hold prejob conference.	Establish common understanding of amount and quality of work to be done among owner/specifier, contractor, and inspector technician. For example, all parties should agree on the extent of surface preparation. Document any changes in writing to avoid future disputes. The contractor should be prepared to provide work (scheduling) plans, worker safety plans, lists of materials and the amounts to be used, material manufacturer's written technical data sheets, application instructions, MSDS, test reports, and other information required in the job specification.
Conduct inspection.	Inspect coating operations. This is essential in obtaining a durable encapsulant system. All inspection data should be recorded by the inspector technician in a daily logbook. Suggested "inspection checkpoints" are described in Section C.2.
Perform final clearance inspection.	Conduct final clearance testing as described in Chapter 15.

- For liquid encapsulants, just prior to material application—observe mixing and thinning, if any, for compliance with manufacturer's written instructions. Ensure that mixing ratio of two-component coatings is correct.
- During application of encapsulant—check environmental conditions (temperature, relative humidity, etc.). For liquid coatings, check wet film thickness, color of material (different colors should be required for different coats), and cure of previous coat before application of next coat for compliance with manufacturer's written instructions.
- After job completion—check dry film thickness and cure of liquid-applied coatings and appearance for all encapsulants.

VIII. Periodic Monitoring and Reevaluation

Because of the limited experience with the use of encapsulant systems and because of their dependence upon the integrity of a lead-based paint film, the property owner or manager must arrange for regular monitoring and repairs, as needed. Visual monitoring should be performed 1 month and 6 months after application and at the schedule specified in Chapter 6. If signs of wear or deterioration are apparent during any reevaluation examination, the monitoring should be increased to a quarterly basis for the next 6 months, then annually thereafter. In addition, residents should be instructed to notify management of the need for repairs on a timely basis. In some cities and States, regulatory reexaminations may be required, including sampling of settled dust for lead analysis. For example, the Maryland Department of the Environment has the authority to inspect dwellings for a period of 1 year following application of an encapsulant. This is because encapsulants are approved on a case-by-case basis, and the reevaluation provides a means of documenting their performance (Maryland, 1988).

IX. Recordkeeping

The owner and contractor should both maintain documentation of interim control or abatement measures. Since the lead is not removed, appropriate protective measures must be taken if the encapsulant fails or if the building is renovated or demolished. Although it would be possible to label existing lead-based painted surfaces prior to encapsulation, the warning would likely be hidden, since it would be covered by the encapsulant. A chemical reaction between the marking substance and the encapsulant could cause the encapsulant to fail. Therefore, drawings showing locations of lead-based paint should be mounted on a wall of a basement, storage closet, or utility room. Records of both the initial installation and reexaminations should be provided to a new owner at the time of property transfer.

The following information describing the initial application should be included with the drawings kept in the building:

- Type of encapsulant and product name.
- Exact location of encapsulant.
- Product label and/or copy of manufacturer's technical product information.
- MSDS for all products used.
- Contractor name.
- Date of application.

The visual monitoring document should be kept by the owner or local agency. Each document should include the name of the person performing the periodic visual monitoring, the date of the visual monitoring, the condition of coating and signs of wear or deterioration, and results of any leaded dust tests performed. If failure was observed or encapsulant had been repaired, the reasons for failure (if known), corrective actions recommended or taken to repair failures, and any other information pertinent to the maintenance of the encapsulant should be included. Form 13.2 may be used for this purpose.

Form 13.2
Lead-Based Paint Encapsulation Visual Monitoring Form

Name of Person Performing Visual Monitoring ____________________________________

License or Certificate Number (If Applicable) ______________________________________

Complete Address of Dwelling ____

Date Encapsulant was Applied ____________________

Date of Last Evaluation __________________________

Today's Date ____________________________________

Room	Surface Location	Substrate	Name and/or Formulation of Encapsulation	Observations	Pass/Fail

Signature ____