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Assessment of Strippable Coatings for Decontamination and Decommissioning

Topical Report
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Disclaimer

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ACRONYMS

ASTM	American Society for Testing and Materials
CMU	concrete masonry units
D&D	decontamination and decommissioning
DF	decontamination factor
DOE	U.S. Department of Energy
FIU	Florida International University
FY97	fiscal year 1997
FY98	fiscal year 1998
HCET	Hemispheric Center for Environmental Technology
INEL	Idaho National Engineering Laboratory
LANL	Los Alamos National Laboratory
MISD	multimedia information system for decontamination
MSDS	material safety data sheet
ORNL	Oak Ridge National Laboratory
RAPIC	Remedial Action Program Information Center
SEM	scanning electron microscopy
SIMCON	simulated contamination
STCG	site technology coordination group
TMI	Three Mile Island
XRF	x-ray fluorescence

EXECUTIVE SUMMARY

Strippable or temporary coatings were developed to assist in the decontamination of the Three Mile Island (TMI-2) reactor. These coatings have become a viable option during the decontamination and decommissioning (D&D) of both U.S. Department of Energy (DOE) and commercial nuclear facilities to remove or fix loose contamination on both vertical and horizontal surfaces. A variety of strippable coatings are available to D&D professionals. However, these products exhibit a wide range of performance criteria and uses. For instance, some strippable coatings were designed to protect spray paint booths or small tools only, while others can be used for decontaminating or fixing loose contamination on floors and walls. As a result of the lack of comprehensive and comparable performance data regarding these products, D&D professionals tend to make decisions using limited information.

The Hemispheric Center for Environmental Technology (HCET) at Florida International University (FIU) was commissioned to perform a 2-year investigation into strippable coatings. This investigation was divided into four parts: (1) identification of commercially available strippable coating products; (2) survey of D&D professionals to determine current uses of these coatings and performance criteria; (3) design and implementation of a non-radiological testing program to evaluate the physical properties of these coatings; and (4) design and implementation of a radiological testing program to determine decontamination factors and effects of exposure to ionizing radiation.

During fiscal year 1997 (FY97), the following activities were completed:

- Information about strippable coating products was requested from over 30 companies. Nineteen responses were received with six of these companies selling products that could be used for radiological decontamination.
- D&D professionals were surveyed about current and future uses of strippable coatings as well as performance criteria to be considered when choosing a product. Over 20 surveys were distributed across the DOE Complex, and seven of these facilities provided responses. Performance criteria ranged from a need for the product to be strong and pliable to needs for the product to be non-organic based and not produce a mixed waste.
- A laboratory-scale non-radiological testing program was designed for the evaluation of the physical properties of the selected strippable coating products. Testing included tensile strength, resistance to abrasion, hardness testing, and ease of application and removal.

The objective for fiscal year 1998 (FY98) is to complete the non-radiological testing program and design and implement a radiological testing program. The search will also continue for existing commercially available strippable coating products that could be used at the DOE Complex. Finally, the results of both the radiological and non-radiological testing will be incorporated into the HCET multimedia information system for decontamination (MISD).

1.0 INTRODUCTION

Strippable coatings are polymer mixtures, such as water-based organic polymers, that are applied to a surface by paint brush, roller, or spray applicator. As the polymer reacts, it attracts, absorbs, and chemically binds the contaminants; then, during the curing process, it mechanically locks the contaminants into the polymer matrix. The strength of these coatings may be enhanced by incorporating a fiber reinforcement (such as a cotton scrim) into the coating. Once the coating dries, it can be stripped manually from the surface. In the case of auto-release coatings, the mixture cracks, flakes, and is collected by vacuuming.

The surface properties of these coatings may be modified by applying a thin top coat (e.g., polyvinyl alcohol), which may provide a smoother, less permeable surface that would become less severely contaminated. In such a duplex, the thicker basis layer provides the required mechanical properties (e.g., strength and abrasion resistance) while the top layer provides protection from contamination. Once the strippable coating is removed, the loose surface contamination is removed with the coating, producing a dry, hard, non-airborne waste product.

The use of strippable coatings during D&D operations has proved a viable option. These coatings can be used in the following three functions:

- As a protective coating when applied to an uncontaminated surface in an area where contamination is present so that on its removal the surface remains uncontaminated.
- As a decontamination agent when applied to a contaminated surface so that on its removal a significant decontamination of loose particulate activity is achieved.
- As a fixative or tie-down coating when applied to a contaminated surface so that any loose contamination is tied down, thus preventing the spread of contamination during subsequent handling.

A variety of strippable coatings are available commercially; however, not all of these products would be suitable for use in a nuclear facility. Many of the coating products were designed to protect a spray booth during painting operations. Of the dozens of strippable coatings available, only a handful were designed for use with radioactivity. These coatings can vary widely in their performance characteristics. Because of the lack of comprehensive and comparable data on these strippable coatings, (1) the D&D professional may ignore strippable coatings with which they have no prior experience or (2) new coatings may be used without adequate performance data, which can increase the duration and cost of the D&D tasks as well as increase the potential for personnel exposure to hazards.

1.1 PURPOSE OF THIS INVESTIGATION

The purpose of this investigation is to identify and laboratory-scale test strippable coatings that may be used in the D&D of DOE environmental restoration sites.

Assessments of selected strippable coating products will be conducted by HCET on the campus of FIU in Miami, Florida. Comprehensive and comparable data will be collected on the physical characteristics (e.g., tensile strength, abrasion resistance, and adhesion) of each coating as well as the ease of applying and removing (i.e., stripping) each product.

The data gathered as part of the testing of commercially available strippable coating products will be used to provide D&D professionals with a single source of comparable information of data relating to physical characteristics, health and safety issues, waste generation, and performance.

2.0 PROJECT DESCRIPTION

The overall project goals for this 2-year project are to (1) identify commercially available strippable coating products and vendors; (2) determine performance-based criteria for laboratory-scale testing of strippable coatings; and (3) perform the laboratory-scale testing of the selected products.

To facilitate the completion of these project goals, the following tasks were performed:

- Determine commercially available strippable coating products and vendors (FY97 and FY98).
- Perform a survey of DOE D&D professionals to determine current uses of strippable coatings and suggested performance-based criteria for evaluation of strippable coating products (completed in FY97).
- Non-radiologically field test the strippable coatings that show the greatest promise of meeting the required performance parameters. Test coatings against the DOE survey performance-based criteria, ensuring the data is directly comparable (FY97 and FY98).
- Develop a radiological testing program for strippable coating products. Testing parameters will include determining decontamination factors and testing the coatings' ability to hold up in a radiation area (FY98).
- Field test the strippable coatings at a DOE facility. A minimum of six strippable coating products will be evaluated in FY98.
- Document the results of both radiological and non-radiological testing of strippable coatings (FY98).
- Enter performance data on strippable coatings into a multimedia information system (FY98).

3.0 RESULTS

The following activities were completed in FY97:

- Identification of commercially available strippable coating products
- Survey of DOE D&D professionals
- Design of non-radiological laboratory-scale testing of strippable coatings

3.1 IDENTIFICATION OF COMMERCIALLY AVAILABLE STRIPPABLE COATING PRODUCTS

Vendors of strippable coating products were identified using sources such as the *Nuclear News Buyer's Guide,* the *Thomas Register,* the Internet, and literature obtained from the DOE Remedial Action Program Information Center (RAPIC) database. Each identified vendor was sent a survey form (Appendix A) requesting the purpose or uses of the strippable coating product and application and removal information. In addition to the survey form, literature and material safety data sheets (MSDSs) were obtained for each product.

Survey forms were sent to over 30 vendors, and responses were received from 15 stating that they did sell strippable coating products (Appendix B). Six vendors either no longer distribute or were not distributors of strippable coatings, and 14 vendors did not reply to the survey form. The vendors that distribute strippable coatings, their products, and the products' uses are presented in Table 1.

Table 1.
Strippable Coatings and Their Uses

Vendor	Strippable Coating Product	Protective Coating	Decontamination	Fixative
A.P. Nonweiler	33701 Blue/White Peelable	Yes	No	No
Barry & Sewall	Proxpeel	Yes	No	No
Bartlett Services, Inc.	Stripcoat TLC	Yes	Yes	Yes
Bartlett Services, Inc.	Stripcoat TLC Free	Yes	Yes	Yes
Dip Seal Plastics, Inc.	Dip Seal	Yes	No	No
Evans Manufacturing	Peel Coat System	Yes	No	No
Fluid-Air Products, Inc.	G-116	Yes	No	No
FrHam Safety Products, Inc.	J.D.L. #GP-RDM	No	Yes	No
Master-Lee Decon Services	InstaCote®-ML	Yes	Yes	Yes
Pentek, Inc.	Pentek 603/604	No	Yes	No

Table 1.
Strippable Coatings and Their Uses (Continued)

Vendor	Strippable Coating Product	Protective Coating	Decontamination	Fixative
Spraylat Corp.	Spraylat SC-1074A-1 and B-1 SC-1090 top coating Coverlac SC-247-2	Yes	No	No
Technical Solutions & Systems, Inc.	Tech Sol 8001 Reinforced Peelable Coating	Yes	Yes	Yes
Technical Solutions & Systems, Inc.	Tech Sol 8002 Peelable Coating	Yes	Yes	Yes
Technical Solutions & Systems, Inc.	Tech Sol 8830 Fixative	Yes	No	Yes
Thermo-Cote, Inc.	Protexo Cote V-12 White	Yes	No	No
Wampler Industrial Coatings	1331 Nanapeel	Yes	No	No
Williams Power Corp.	Carboline 1146 ALARA Cavity Decon or Strippable	Yes	Yes	Yes

From the information collected from the vendor surveys, the following eight strippable coatings from five vendors were selected for the laboratory-scale testing:

- Carboline 1146 ALARA Strippable
- J.D.L. # GP-RDM
- Pentek 603/604
- Stripcoat TLC
- Stripcoat TLC Free
- TechSol 8001 Reinforced Peelable Coating
- Tech Sol 8002 Peelable Coating
- TechSol 8830 Fixative

These coatings were determined to be the most likely to meet the DOE Complex needs and the performance-based criteria established from the DOE D&D professionals survey (see Section 3.2).

MasterDecon coating was not chosen for testing in FY97 because of the concern of working with isocyanates. HCET will attempt to test this coating during FY98.

3.2 SURVEY OF DOE D&D PROFESSIONALS

A survey form was generated by HCET for DOE D&D professionals (Appendix C) to complete requesting information about the current use of strippable coatings, future possible uses of these coatings, and the performance criteria these coatings should meet. The survey was distributed by

the Deactivation and Decommissioning Focus Area Manager at FETC to both DOE and site technology coordination group (STCG) personnel at over a dozen DOE facilities.

Responses were received from the following locations:

- Fluor Daniel Fernald
- Idaho/Lockheed Martin Idaho Technologies Company
- Los Alamos National Laboratory (LANL)
- Y-12, MK-Ferguson of Oak Ridge
- DOE Nevada Operations
- Rocky Flats Environmental Technology Site/RFFO
- Westinghouse Savannah River Company

A complete listing of the information gathered from these surveys can be found in Appendix D; however, the summary below highlights some of the more important information.

The following strippable coating products are currently being used at DOE facilities (or have been used in the past):

- Bartlett Stripcoat TLC and TLC Free
- Carboline 1146 ALARA Cavity Decon (previously Imperial)
- Sensor Coat (developed at LANL, not commercially available)
- PeelAway

The substrate materials that the strippable coatings were applied to include:

- metals—stainless steel, carbon steel, and painted metals
- concrete
- concrete masonry units (CMU)—block or brick
- galvanized steel
- electrical wiring
- plastics
- rubber

Examples of the performance criteria considered important by these facilities in using a strippable coating product include:

- The decontamination factor for removal of loose contamination. Must reduce airborne activity.
- Fast cure time before either second coat can be applied or the coating can be removed.
- Must be easy to apply and remove.
- Must be able to be applied at temperatures ranging from 20° to 80°F. Should be able to cure at 45°F.
- Must be strong and pliable—strong enough to be removed in reasonably sized sheets.

- Cannot be made with organic solvents.
- Must not create a mixed waste for disposal. Must be applied and removed with minimal waste generation.
- Should be able to leave product on surface for at least 30 days.
- Should remain stable during its use to contain the contamination.

Parts of the performance criteria listed above can be determined from the vendor survey information (e.g., temperature range for application) or the product's MSDS (e.g., organic solvents and mixed waste). The remaining criteria were used in the development of the HCET laboratory-scale testing program described in Section 3.3 below.

3.3 DESIGN OF NON-RADIOLOGICAL LABORATORY-SCALE TESTING OF STRIPPABLE COATINGS

To establish a testing program that would provide fair, comparable results for each of the strippable coating products, American Society for Testing and Materials (ASTM) standards for the testing of paints and coatings were reviewed. Testing standards relating to material application, strength, adhesion, and hardness were chosen for the HCET laboratory-scale testing program.

Table 2 provides a comparison of the performance-based criteria identified by the DOE D&D professionals survey (see Section 3.2) and the ASTM standards chosen for the HCET testing. Where ASTM standards did not exist, (e.g., testing the removal of coatings), procedures were developed by HCET.

Nine internal HCET procedures were written for the laboratory-scale testing of strippable coatings. The procedure names and a brief description of each are as follows:

3.3.1 Use of the Super Nova SP Spray Applicator

This procedure describes the proper operation, safety, cleanup, and storage of the Super Nova SP airless paint sprayer. This unit will be used for the application of strippable coatings on test panels.

Table 2.
Comparison of Performance-based Criteria with Testing Methods

Performance-based Criteria	ASTM #	ASTM Method Name
Must be easy to apply and remove.	D 823-95	Producing Films of Uniform Thickness of Paint, Varnish, and Related Products on Test Panels (Practice D)
(a)	D 4414-84	Measurement of Wet Film Thickness by Notch Gages (Procedure A)
(a)	D 1400-87	Nondestructive Measurement of Dry Film Thickness of Nonconductive Coatings Applied to a Nonferrous Metal Base
(a)	D 1005-84	Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers
Fast cure time before second coat can be applied or the coating can be removed.	D 1640-95	Drying, Curing, or Film Formation of Organic Coatings at Room Temperature
Product must be strong and pliable.	D 3363-92a	Film Hardness by Pencil Test
Product must be strong and pliable.	D 2370-92	Tensile Properties of Organic Coatings
Product must be strong and pliable.	D 4060-95	Abrasion Resistance of Organic Coatings by the Taber Abraser
Should be able to leave in place for at least 30 days.	D 3359-93	Measuring Adhesion by Tape Test (Method A)
Should be able to leave in place for at least 30 days.	D 4141-82	Conducting Accelerated Outdoor Exposure Tests of Coatings (Procedure A)
(b)	D 660-93	Evaluating Degree of Checking of Exterior Paints
(b)	D 661-93	Evaluating Degree of Cracking of Exterior Paints
(b)	D 714-87	Evaluating Degree of Blistering of Paints
Decontamination factors.	(INEL method)	Simulated Determination of Decontamination Factors

(a) These methods combined with D 823-95 constitute the application procedure.

(b) These methods combined with D 4141-82 constitute the exposure testing procedure.

3.3.2 Testing the Application of Organic Coatings

This procedure describes the evaluation of the application, drying, and curing process for strippable coatings. Testing collects information such as:

- Application method (e.g., spraying, rolling, paint brush) of strippable coating to a 1 ft × 1 ft stainless steel test panel (Figure 1)
- Ease of application (e.g., recording problems such as clogging of spray applicator nozzle and whether the coating runs or drips off of test panels at application)
- Ease of obtaining proper thickness of coating
- Timing for various stages of dryness or curing for each coating (e.g., set-to-touch time vs. dry-hard time)
- Visual appearance of coating once applied
- Ease of removal of strippable coating from stainless steel test panel

Figure 1. Spray application of strippable coatings.

3.3.3 Application and Removal of Strippable Coatings on Difficult Materials

This procedure describes the evaluation of the application and removal of strippable coatings on a variety of materials and shapes including the following:

- wood
- concrete floor (painted and unpainted – see Figure 2)
- galvanized piping
- brick wall (painted)
- carbon steel (painted plates and I-beam)

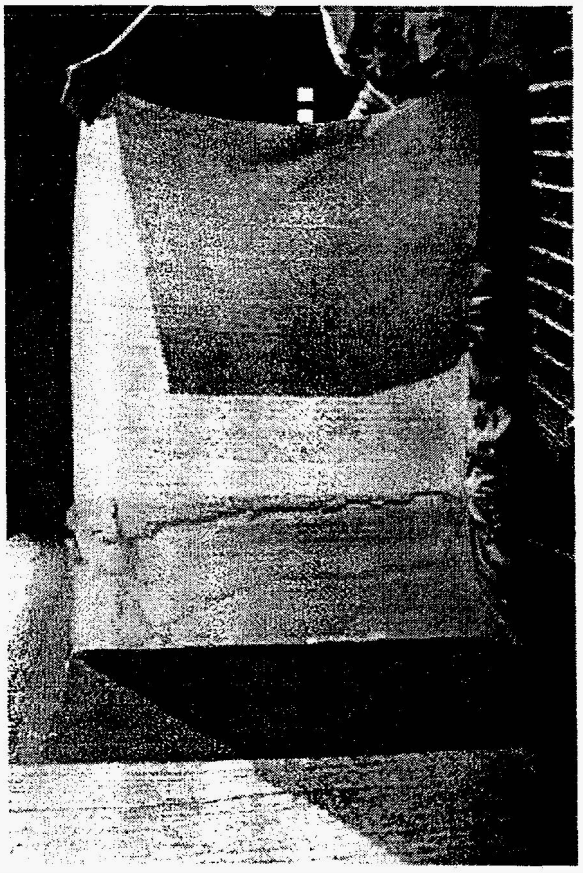

Figure 2. Removal of strippable coating from painted and unpainted concrete.

3.3.4 Conducting Accelerated Outdoor Exposure Testing of Organic Coatings

This procedure describes the evaluation of the exterior durability of coatings applied to metal substrates over a period of time (e.g., one month). The coatings are applied to metal panels,

which are then held in place on a black metal box and left outside exposed to the elements and facing the equator at a 5-degree angle (Figure 3). The black box is a good conductor of heat, producing greater panel temperatures during irradiation by the sun and longer time of wetness during rain. This testing was performed to evaluate the durability of strippable coatings that may be used as protective barriers on materials that may be used outdoors.

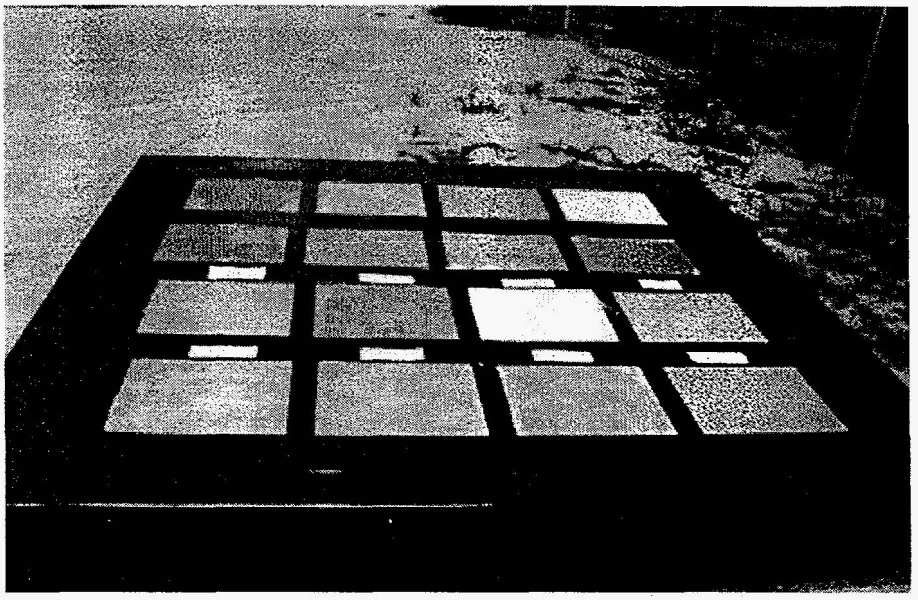

Figure 3. Exposure testing.

3.3.5 Measuring Abrasion Resistance of Organic Coatings

This procedure describes the evaluation of the resistance of surfaces to rubbing abrasion. The instrument used for this testing is a Taber Abraser (Figure 4). The characteristic rub-wear action is produced by the contact of a test sample turning on a vertical axis against the sliding rotation of two abrading wheels. One abrading wheel rubs the specimen outward toward the periphery and the other, inward, toward the center. The resulting abrasion marks form a pattern of crossed arcs over an area of approximately 30 cm^2. This testing was performed to evaluate the durability of a strippable coating that would be used as a protective barrier or fixative and is expected to remain in place and withstand normal handling.

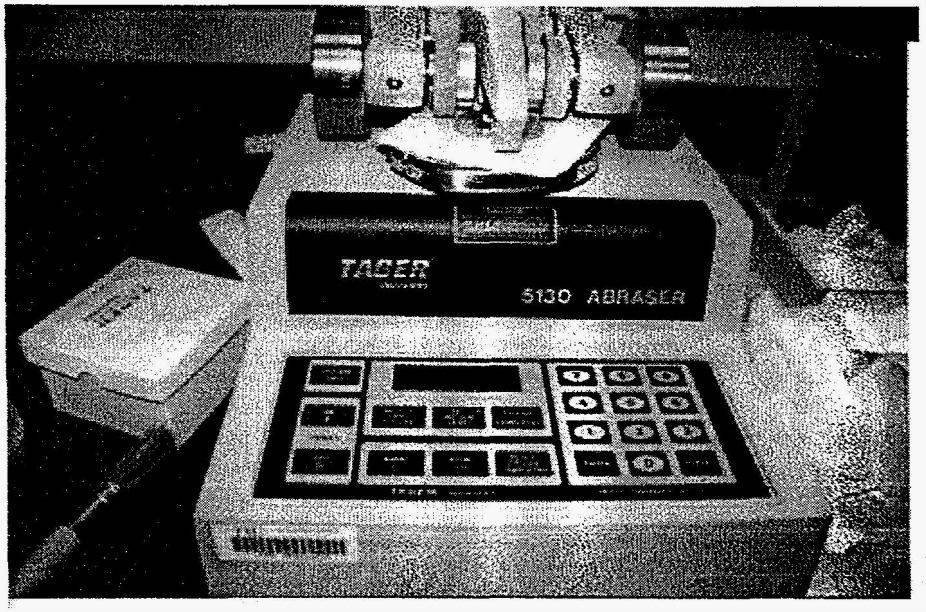

Figure 4. Taber Abraser.

3.3.6 Measuring Adhesion of Organic Coatings

This procedure describes the evaluation of the adhesion properties of the strippable coatings to metallic substrates by applying and removing pressure-sensitive tape over cuts made in the film (Figure 5). This testing was performed to evaluate the ability of the strippable coating to remain fixed to the substrate until the time to remove the coating but to come off when the operator chooses.

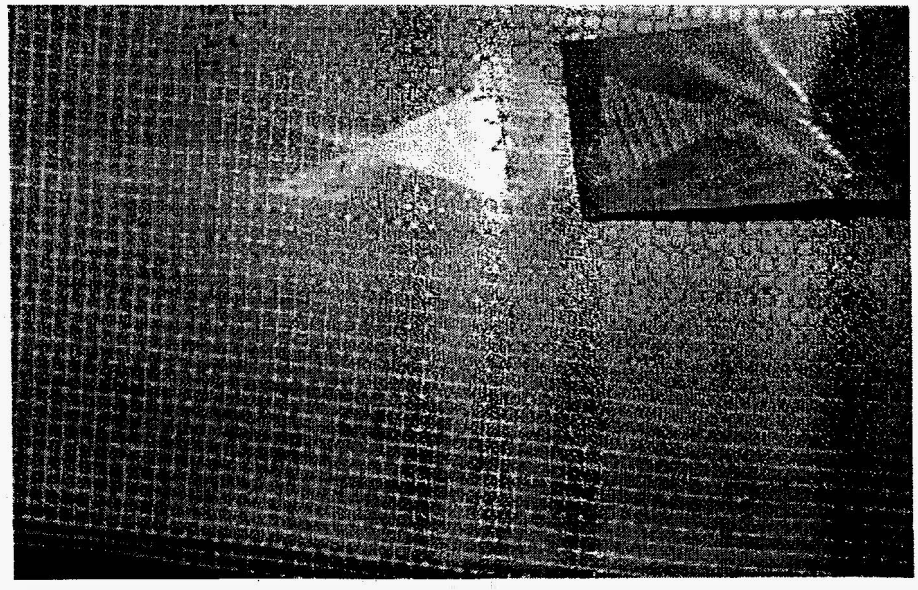

Figure 5. Adhesion testing.

3.3.7 Measuring Film Hardness of Organic Coatings

This procedure describes the evaluation of the resistance of the strippable coatings to surface scratching. This test uses pencil leads of various hardness, which are drawn along the coated panel starting with the hardest pencil and continuing down the hardness scale (Figure 6). This procedure is continued until (1) the pencil does not cut into or gouge the film (pencil hardness) or (2) the pencil does not scratch the film (scratch hardness). This testing was performed to evaluate the durability of a strippable coating that would be used as a protective barrier or fixative and is expected to remain in place and withstand normal handling.

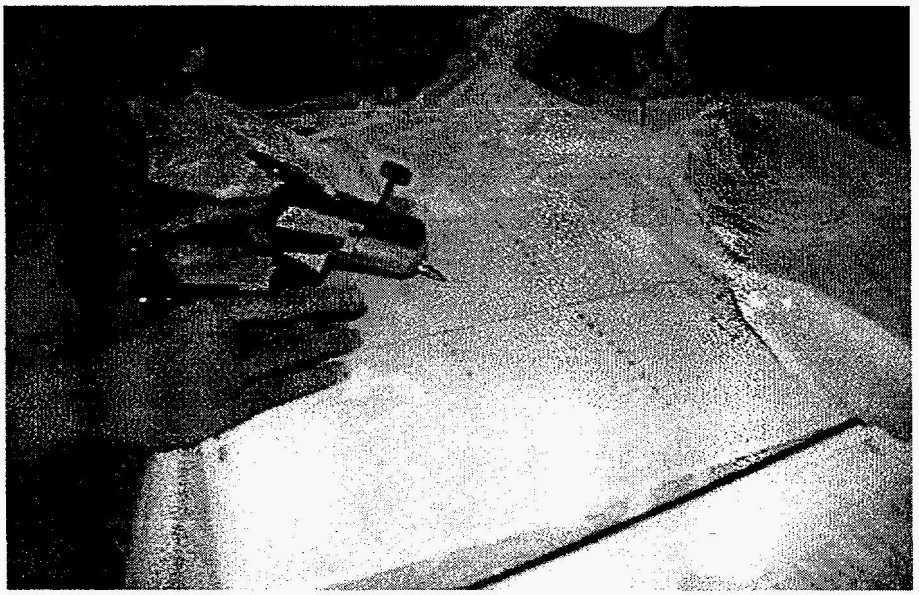

Figure 6. Pencil hardness testing.

3.3.8 Measuring Tensile Strength of Organic Coatings

To evaluate the elongation, tensile strength, and stiffness of strippable coatings when tested as free films. This testing is performed to evaluate the strength of the strippable coating especially if the coating is expected to be removed (e.g., stripped) from the substrate in a single piece.

3.3.9 Determination of Decontamination Factors for Strippable Coatings

This procedure is based on the paper *Development of Simulated Contamination (SIMCON) and Miscellaneous Decontamination Scoping Tests,* WINCO-1188, written by R. L. Demmer in January 1994 at Westinghouse Idaho Nuclear Company, Inc. to measure the ability of strippable coating products to remove loose contamination from substrates using simulated contaminants (e.g., using cesium and zirconium salts). Analytical determination of the "before and after" results were measured using a Spectrace 9000 portable x-ray fluorescence (XRF) unit. This test

was performed as a side-by-side comparison of the decontamination ability of the strippable coating products.

Additional testing expected to be performed by the HCET analytical laboratory includes the evaluation of each strippable coating by scanning electron microscopy (SEM) and thermal analysis.

4.0 ACTIVITIES PLANNED FOR FY98

4.1 COMPLETION OF NON-RADIOLOGICAL TESTING

The non-radiological testing plan that was designed in FY97 will be used to evaluate strippable coatings from five vendors. See Section 3.0 for a description of this testing.

4.2 DESIGN OF RADIOLOGICAL TESTING PLAN

This task involves the review of ASTM methods for testing materials such as strippable coatings in radiation environments (e.g., method E 1420 *Standard Practice for Specifying Polymeric Materials for Service in Ionizing Radiation Environments*) as well as literature describing prior radiological testing of strippable coating products to establish the radiological testing program for HCET. This program will be documented in the form of a test plan.

4.3 IDENTIFICATION OF RADIOLOGICAL FACILITY(IES) TO PERFORM TESTING

Once the radiological testing procedures have been identified in 4.2, the facility or facilities that will perform each of these procedures will be identified and procured. It is expected that part of the testing for determining decontamination factors will be performed at HCET and part at a DOE facility or other radiological testing facility. The ionizing radiation exposure testing will be performed at either a DOE facility or another radiological facility.

4.4 RADIOLOGICAL TESTING OF TARGETED STRIPPABLE COATING PRODUCTS

Using the radiological test plan prepared in 4.2, a minimum of six (6) strippable coating products will be tested during FY98. Testing is expected to include the determination of decontamination factors for each strippable coating product and the effect of exposure to ionizing radiation on the physical and chemical properties of the coatings.

4.5 NON-RADIOLOGICAL TESTING OF NEWLY IDENTIFIED STRIPPABLE COATING PRODUCTS

Any new strippable coating product identified in FY98 that shows the promise of meeting the required performance parameters will be tested using the non-radiological testing plan developed in FY97. If possible, this newly identified product will also be included in the radiological test plan as identified in 4.2.

4.6 GENERATION AND POPULATION OF MULTIMEDIA INFORMATION SYSTEM FOR STRIPPABLE COATING DATA

The HCET multimedia information system will be updated to reflect the additional data fields that result from the testing of strippable coating products. Modifications to the multimedia information system database scheme will be performed by the D&D software analyst or his or her designee, and subsequent population of the testing information will be performed by data entry personnel at HCET.

5.0 CONCLUSIONS

The preliminary activities needed to begin the evaluation of strippable coatings are complete. These activities include the following:

- Identification of commercially available strippable coating products and vendors
- Determination of performance-based criteria that are of concern to DOE D&D professionals
- Design of the laboratory-scale testing for strippable coating products that is based on the above performance-based criteria

Procedures were written and equipment was purchased for the laboratory-scale testing program. Testing began in November 1997 and is expected to be completed in early January 1998.

Second-year activities include the completion of the non-radiological testing and the design and implementation of a radiological testing program. Radiological testing is expected to include the determination of decontamination factors using radiological material (e.g., uranium, cesium) and radiological exposure testing. The results of both testing programs will be incorporated in the HCET multimedia information system for D&D professionals to access.

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APPENDIX A

VENDOR SURVEY FORM

Vendor Information:

Contact Name:	
Company Name:	
Address:	
Phone:	Fax:

1. Name of strippable coating product: _____

2. Cost of coating: _____/per_____

3. Strippable coating is effective on what media: (circle all that apply)
   a. metal: ___smooth and/or ___rough
   b. concrete: ___wall and/or ___floor
   c. transite
   d. equipment
   e. other:_____

4. Coating is applied using: (circle all that apply)
   a. spray
   b. brush
   c. roller
   d. other:_____

5. Coating is removed by:
   a. removing in whole strip
   b. becoming brittle, breaking off in small pieces, vacuuming
   c. other:_____

6. Coating is typically used to: (circle all that apply)
   a. remove paint
   b. decontaminate
   c. act as a barrier against contamination (e.g. rad, metals)
   d. fix contamination to surface
   e. other:_____

7. If coating removes contaminants, which contaminants: (circle all that apply)
   a. radionuclides: ___ all or ___ individual
   if individual, list:_____

b. metals: ___ all or ___ individual
if individual, list:_____

c. organics: ___all or ___ individual
if individual, list:_____

8. Protective equipment required when applying strippable coating: (circle all that apply)

a. safety glasses
b. safety shoes
c. gloves
d. respirator
e. personnel protective clothing
f. other:_____

9. Coating can be applied to surfaces when the external temperature is in what range: _____°F

10. Rate ability of strippable coating to resist scuffs and abrasions:

none				strong
1	2	3	4	5

11. Additional information:

Please include a copy of a Material Safety Data Sheet (MSDS) and literature describing strippable coating product.

APPENDIX B

Table B.1. Strippable Coating Vendor Information

Strippable Coating Product Name	Vendor Name	Vendor Address	Vendor Phone Number	Vendor Fax Number	Contact Person
33701 Blue/White Peelable	A.P. Nonweiler	3321 North Shore Dr. Oshkosh, WI 54901	(414) 231-0850	(414) 231-8085	Dennis Lewandowski
Proxpeel	Barry & Sewell	2001 Broadway N.E. Minneapolis, MN 55413	(612) 331-6170	(612) 378-6340	Dan Krawczyk
Stripcoat TLC Stripcoat TLC free	Bartlett Services, Inc.	60 Industrial Park Road Plymouth, MA 02560	(508) 746-6464 ext. 305	(508) 830-3616	Paul Lovendale
Dip Seal	Dip Seal Plastics, Inc.	231 23 Ave. Rockford, IL 61104	(815) 398-3533	(815) 398-0353	Stan Jones
Peel Coat System (200 Top Coat/912 Base)	Evans Manufacturing	1330 Souter Troy MI 48083	(810) 583-9890	(810) 583-2050	Tom Evans
G-116	Fluid-Air Products, Inc.	719 Rudder Rd. Fenton, MO 63026	(314) 349-4900	(314) 349-4942	-----
J.D.L. # GP-RDM	FrHam Safety Products, Inc.	295 Parker St. P.O. Box 51957 Springfield, MA 01151	(413) 543-6911	(413) 543-6989	Fred H. Nance, Jr.
InstaCote®-ML	Master-Lee Decon Services	350 Miller Rd. Medford, NJ 08055	(609) 654-6161	(609) 654-1404	Bob Burns
Pentek 603/604	Pentek, Inc.	1026 Fourth Ave. Coraopolis, PA 15108	(412) 262-0725	(412) 262-0731	Nancy Moore
Spraylat Preservation System	Spraylat Corporation	716 South Columbus Avenue Mount Vernon, NY 10550	(914) 699-3030	(914) 699-3035	Jeanette T. Leissler

Table B.1. Strippable Coating Vendor Information (Continued)

Strippable Coating Product Name	Vendor Name	Vendor Address	Vendor Phone Number	Vendor Fax Number	Contact Person
1) Tech Sol 8001 Reinforced Peelable Coating 2) Tech Sol 8002 Peelable Coating 3) Tech Sol 8830 Fixative	Technical Solutions & Systems, Inc.	P.O. Box 357 Elizabethton, TN 37644	1-888-275-4877	(423) 926-0768	Bill Reynolds
Protexo Cote V-12 White	Thermo-Cote, Inc.	295 Vreeland Ave. Paterson, NJ 07543	(201) 345-6206	(201) 278-7512	Larry Kersen
1331 Nanapeel	Wampler Industrial Coatings	3333 Willow Spring Rd. Harrisonburg, VA 22801	(540) 434-4201	(540) 434-1958	Todd or Tariq
Carboline 1146 ALARA Cavity Decon or Strippable	Williams Power Corp.	2076 West Park Place Stone Mountain, GA 30087	(770) 879-2455	(717) 275-3285	T.J. McNamara

STRIPPABLE COATING PRODUCT INFORMATION

Table B.2. Application and Removal

Strippable Coating Product Name	Applicable Media	Application Method	Removal Method	Purpose of Coating	Loose Surface Contaminants Removed
33701 Blue/White Peelable	Metal Concrete Transite Equipment	Spray Brush Roller	Removed in whole strips	Protective barrier for shipping material	-----
Proxpeel	Metal Concrete Equipment Spray Booth	Spray Brush	Removed in whole strips	Spray booth coating	-----
Stripcoat TLC Stripcoat TLC free	Metal Concrete Transite Equipment Any non-oily surface	Spray Brush Roller	Removed in whole strips or can be scored with knife for smaller strips	Decontamination Fixative Protective Barrier	All radionuclides All metals All organics
Dip Seal	Surfaces that can withstand 350°F	Brush Dipping	Removed in whole strips	Protects against corrosion, nicking, scratching	------
Peel Coat System (200 Top Coat/912 Base)	Metal	Hot dip	Removed in whole strips	Protects cutting tools from rust and abrasion	-----
G-116	Smooth metal	Spray	Removed in whole strips	Protective barrier	-----
J.D.L. # GP-RDM	Metal Concrete	Spray Brush Roller	Removed in whole strips	Decontaminate	All radionuclides
InstaCote®-ML	Metal Concrete Transite Equipment Wood Gloveboxes	Spray	Removed in whole strips Cut into small strips	Decontaminate Fixative Protective barrier Remove loose paint Leak protection	All radionuclides All metals All organics
Pentek 603/604	Metal (603 for carbon steel only) Concrete	Brush Roller	Brittle, breaks off in small pieces	Decontaminate	All radionuclides All metals

Table B.2. Application and Removal (Continued)

Strippable Coating Product Name	Applicable Media	Application Method	Removal Method	Purpose of Coating	Loose Surface Contaminants Removed
Spraylat Preservation System	Metal Equipment Plastic Porcelain Paint	Spray	Removed in whole strips	Protection of equipment (e.g., nuclear powerhouse) during shipment and storage.	-----
1) Tech Sol 8001 Reinforced Peelable Coating 2) Tech Sol 8002 Peelable Coating 3) Tech Sol 8830 Fixative	Metal Concrete Transite Equipment	Spray Brush Roller	Removed in whole strips	Decontaminate Fixative Protective barrier	Alpha/Beta Emitters Metal Oxides
Protexo Cote V-12 White	Metal Concrete Equipment Glass	Spray Brush Roller Dip	Removed in whole strips	Protective barrier	-----
1331 Nanapeel	Metal Concrete Equipment	Spray	Removed in whole strips	Protective barrier	------
Carboline 1146 ALARA Cavity Decon or Strippable	Metal Concrete Transite Equipment Plastic	Spray Brush Roller Squeeqee/ Pour	Removed in whole strips	Decontaminate Fixative Protective barrier Removes paint if coating is loose	Water soluble and transit radionuclides and metals Organics

STRIPPABLE COATING PRODUCT INFORMATION

Table B.3. Miscellaneous Information

Strippable Coating Product Name	Respirator Required for Use?	Temperature Range for Use (°F)	Scuff and Abrasions Rating (1-5)	Additional Information
33701 Blue/White Peelable	No	32-118	5	-----
Proxpeel	No	65-77	----	----
Stripcoat TLC Stripcoat TLC free	Yes	45-100	3	Exclusive product of Bartlett.
Dip Seal	No	----	5	Dip Seal is a non-toxic, strippable, thermal plastic coating that has been used in the machine tool, aerospace, and woodworking industries for the past 48 years. Most recently it has gained new use in the bottling industries...
Peel Coat System (200 Top Coat/912 Base)	No	less than 100	4	Peel Coat is a strippable protective coating for the cutting tool industry. It is comprised of a two part system: a base coat and a top coat.
G-116	Yes	40-110	4	-----
J.D.L. #GP-RDM	Yes	above 50	3	-----
InstaCote®-ML	Yes (supplied air)	above 45	4	Contains isocyanates. Has shielding properties. Is water impervious. Has gone through irradiation testing at the University of Michigan. Tested for various ASTMs. Authorized for burial. Cures to touch in 2-5 seconds (can be walked on almost immediately).
Pentek 603/604	No	at least 55	2	-----
Spraylat Preservation System	No	above 45	----	The top coat applied over a wet base coat dries in two hours to a rain resistant coating. Used as a multicoat system. Two base coats are used, each a different color to provide a color contrast. A topcoat is applied over the base coats and finally a coverlac which is used to seal any pinholes or tears in the topcoat.

Table B.3. Miscellaneous Information (Continued)

Strippable Coating Product Name	Respirator Required for Use?	Temperature Range for Use (°F)	Scuff and Abrasions Rating (1-5)	Additional Information
Spraylat Preservation System	No	above 45	----	The top coat applied over a wet base coat dries in two hours to a rain resistant coating. Used as a multicoat system. Two base coats are used, each a different color to provide a color contrast. A topcoat is applied over the base coats and finally a coverlac which is used to seal any pinholes or tears in the topcoat.
1) Tech Sol 8001 Reinforced Peelable Coating 2) Tech Sol 8002 Peelable Coating 3) Tech Sol 8830 Fixative	Yes (for Tech Sol 8830 only)	50-100	5	-----
Protexo Cote V-12 White	Yes	ambient	4	----
1331 Nanapeel	Yes	above 50	5	This strippable coating has excellent Fire Retardant/Flame Spread Index. This product is also available in Water Borne. Also available in both clear and pigmented.
Carboline 1146 ALARA Cavity Decon or Strippable	No	35-100	5	Available in two forms: yellow for cavity decontamination and blue for general purposes. The cavity decon ALARA meets certification requirements.

APPENDIX C

DOE D&D SURVEY FORM

Contact Name:	
Title:	
DOE Site/Company Name:	
Mailing Address:	
Phone No.:	Fax No.:

Please fill out the above table as much as possible.

1. Have you ever used a strippable coating project for decontamination and/or decommissioning?
   a. Yes, continue with Question 2 (do not miss 13 and 14)
   b. No, skip to Question 11

2. What strippable coating product or products have you tried?

   Product 1)_____

   Product 2)_____

   Product 3)_____

For *multiple* products please check the boxes for the representative product number.

[ ] (Product 1) [ ] (Product 2) [ ] (Product 3)

3. What type of material did you use the strippable coating on?

a. [ ] [ ] [ ] Stainless steel

b. [ ] [ ] [ ] Carbon steel

c. [ ] [ ] [ ] Concrete

d. [ ] [ ] [ ] Transite

e. [ ] [ ] [ ] Painted metals or sufaces

f. [ ] [ ] [ ] Other: _____

4. Where did you use the strippable coating on?

a. [ ] [ ] [ ] Floors

b. [ ] [ ] [ ] Walls

c. [ ] [ ] [ ] Ceilings

d. [ ] [ ] [ ] Equipment

e. [ ] [ ] [ ] Other: _____

5. What method was used to apply the strippable coating?

a. [ ] [ ] [ ] Sprayed

b. [ ] [ ] [ ] Brushed

c. [ ] [ ] [ ] Rolled

d. [ ] [ ] [ ] Other: _____

6. What method was used to remove the strippable coating?

a. [ ] [ ] [ ] Removed in whole or large strips

b. [ ] [ ] [ ] Broke off in small, brittle pieces, and vacuumed off

c. [ ] [ ] [ ] Other: _____

7. How long did you leave the strippable coating on?

a. [ ] [ ] [ ] Followed the manufacturer's guidelines

b. [ ] [ ] [ ] For several days over the manufacturer's guidelines

c. [ ] [ ] [ ] For several weeks

d. [ ] [ ] [ ] For months

8. What was the purpose of using the strippable coating?

a. [ ] [ ] [ ] Remove loose radiological contamination from surface

b. [ ] [ ] [ ] Remove loose metal contamination from surface

c. [ ] [ ] [ ] Fix a contaminant to the surface to prevent the spread of contaminant

d. [ ] [ ] [ ] Prevention of airborne radioactive contamination

e. [ ] [ ] [ ] Prevent personnel contamination or minimize the use of protective clothing

f. [ ] [ ] [ ] Act as a barrier against possible contamination

g. [ ] [ ] [ ] Remove paint from surface

h. [ ] [ ] [ ] Other: _____

9. What is your opinion about the performance of the strippable coating product(s) you have used? What did you like, or not like, about the product(s)?

10. Were there strippable coating products that you considered but decided not to try? If so, why?

_____

11. For what purpose (or previously untried purpose) would you consider using strippable coatings?

a. Remove loose radiological contamination from surface

b. Remove loose metal contamination from surface

c. Fix a contaminant to the surface

d. Act as a barrier against possible contamination

e. Remove paint from surface

f. Other: _____

12. On what type of material?

a. Stainless steel

b. Carbon steel

c. Other metal: _____

d. Concrete

e. Other: _____

13. Where would you consider using strippable coatings?

a. Walls

b. Floors

c. Ceilings

d. Equipment

e. Other: _____

14. For your site to use strippable coatings in your D&D effort, what performance criteria do you consider important for the strippable coating product to have to meet?

Examples:

Product must be able to be applied in 90 degree heat with 90 percent humidity.

Product must be strong enough for people to walk on for several days.

Product must be able to be left on a wall for 30 days or more.

Product must be strong and pliable so that it can be removed easily.

Product cannot contain/use organic solvents.

Product cannot generate mixed waste.

Please list as many of the performance criteria that are important to your site as you can. These will be compiled and used to develop the performance-based criteria used in the laboratory-scale testing of several strippable coating products.

15. Please add any additional comments concerning strippable coatings or information you would like to see tested by HCET during the laboratory-scale testing of strippable coatings:

Thank you very much for completing this survey. Your assistance is very much appreciated and the information you have supplied us will be used in the design of the laboratory-scale testing of strippable coatings. Feel free to call.

APPENDIX D

DOE D&D SURVEY RESULTS

Table D.1. DOE Contact Information

DOE Site/Company Name	Contact Name and Title	Phone Number	Fax Number
Fluor Daniel Fernald	Jeff Bowers Project Engineer	(513) 648-5155	(513) 648-5234
Idaho/Lockheed Martin Idaho Technologies Company	Richard H. Maservey Consulting Engineer/Scientist	(208) 526-1834	(208) 526-5142
Los Alamos National Laboratory	John Elliott Lead Radiological Control Technician, TA 21 D&D Project	-----	-----
Y-12, Oak Ridge MK-Ferguson of Oak Ridge	Michael H. Waldroop Construction Superintendent	(423) 576-4134	(423) 574-3829
DOE Nevada Operations	Clayton W. Barrow D&D Task Manager	(702) 295-7960	(702) 295-1113
Rocky Flats Environmental Technology Site RFFO	Gary N. Huffman Technical Program Officer	(303) 966-7490	(303) 966-6713
Savannah River Site Westinghouse Savannah River Co.	Cecil May Principal Engineer	(803) 725-5813	(803) 725-4704

DOE SURVEY RESULTS

Table D.2. Current Uses of Strippable Coatings

DOE Site/Company Name	Coating Currently Using	Substrate Material	Substrate	Purpose of Use
Fluor Daniel Fernald	Bartlett Stripcoat	Concrete	Floors	Protective barrier against contamination
Idaho/Lockheed Martin Idaho Technologies Company	None used	-----	----	-----
Los Alamos National Laboratory	ALARA Cavity Decon Sensor Coat [1]	Stainless and carbon steel Concrete Painted metal or surfaces	Floors Walls Ceilings Equipment	Remove loose radiological and metal contamination. Fixative. Prevention of airborne contamination.
Y-12, Oak Ridge MK-Ferguson of Oak Ridge	Peel Away #1, 2, and 7	Carbon steel Concrete Painted metals or surfaces CMU (block or brick)	Floors Walls Ceilings Equipment	Lead and asbestos paint removal
DOE Nevada Operations	Stripcoat TLC free	Concrete Galvanized steel	Floors	Remove loose radiological contamination.
Rocky Flats Environmental Technology Site RFFO	ALARA 1146 Stripcoat TLC	Stainless and carbon steel Concrete Painted metal or surfaces	Floors Walls Ceilings Equipment	Remove loose radiological contamination. Fixative Prevention of airborne radioactive contamination. Act as a barrier against possible contamination.
Savannah River Site Westinghouse Savannah River Co.	Stripcoat TLC ALARA	Stainless and carbon steel Concrete Painted metals or surfaces Electrical wiring Plastics Rubber	Walls Equipment	Remove loose radiological contamination. Fixative Prevention of airborne radioactive contamination. Prevent personnel contamination to minimize PPE. Act as a barrier against possible contamination

[1] Developed at LANL, not currently commercially available. This coating changes color to indicate the presence of contamination.

DOE SURVEY RESULTS

Table D.3. Performance Criteria

DOE Site/Company Name	Performance Criteria Identified	Additional Information Requested
Fluor Daniel Fernald	Product must be able to be applied between 20 and 80 degree, F. Product must be strong and pliable.	----
Idaho/Lockheed Martin Idaho Technologies Company	Must be sprayed or painted on. No organic solvents. Not create a mixed waste. Strong enough to come off in reasonably sized sheets. Easy to apply (no expensive or hard to obtain equipment). Should set at temperature down to about 45°F. Must remain stable to contain the contamination. Should be able to leave it on for at least 30 days.	Test on smooth and rough concrete (with some cracks). Get good photos during removal. Be careful to get good (and comparable) data on decon factors. Compile cost per ft^2 of application and removal. Test after 4 hours and after 30 days.
Los Alamos National Laboratory	Ease of use. Performance-decon level. Ease of application. Ease of removal. Ability to penetrate a crust to fix (encapsulate) contamination below. Cannot generate a mixed waste.	-----
Y-12, Oak Ridge MK-Ferguson of Oak Ridge	Product must be able to be applied in 90 degree heat with 90 percent humidity. Product must be strong and pliable so that it can be removed easily. Product cannot contain/use organic solvents. Product cannot generate mixed waste.	-----

Table D.3. Performance Criteria (Continued)

DOE Site/Company Name	Performance Criteria Identified	Additional Information Requested
DOE Nevada Operations	Product must be strong and pliable so that it can be removed easily. Product cannot contain/use organic solvents. Product cannot generate mixed waste. Easy to apply with minimal waste generation. Fast cure time. Ability to reduce airborne activity.	Testing of coatings on various types of metal surfaces. Testing of coatings in direct sunlight.
Rocky Flats Environmental Technology Site RFFO	Product must be strong enough for people to walk on for several days. Product must be able to be left on a wall for 30 days or more. Product must be strong and pliable so that it can be removed easily. Product cannot contain/use organic solvents. Product cannot generate mixed waste.	Decontamination factors (DF) for removal of smearable contamination. Ease of application/removal from various substrates. Capable of having multiple coats removed as one ("sandwich").
Savannah River Site Westinghouse Savannah River Co.	Effect of heat, humidity, direct sun, and time on the drying and removal characteristics. Drying/curing time required before additional coating (2^{nd} coat) or the intended use. Ease/cost of application and removal. Durability of coating during use.	What is the characterization of the substrate being decontaminated? Both in terms of isotopes, chemical form (metal, high-fired oxide, etc.), and contamination level. What is waste characterization of the resultant stripped coating? What is the cost of the application? (Detail desired to assess whether procedures, rad protection, etc. were included in unit cost.) Please include InstaCote ML1 and ML2 as test coatings.