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SERVICE (ABRASION) TESTING OF SELECTED PROTECTIVE COATINGS

C.D.WATSON, G.A.WEST

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CHEMICAL TECHNOLOGY DIVISION

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C. D. Watson, G. A. West

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TABLE OF CONTENTS

	Page Number
1.0 Introduction	4
2.0 Summary	5
3.0 Procedure	6
4.0 Conclusions	7
5.0 Recommendations	9

1.0 Introduction

It was concluded from corrosion resistance and decontamination studies* of eighty protective coatings that thirteen paints and three strippable coatings excelled the others under chemical and radioactive contamination conditions similar to those encountered in radiochemical facilities. For this reason, these coatings were subjected to service wear tests to further define their usefulness.

A portion of the concrete floor (208 sq. ft.) in the work area of the Unit Operations (Semi-Works) Section of the Chemical Technology Division was selected as the test site. This was a strip 4 ft. wide of old patched concrete which comprised the central aisle of Rooms 1 and 2, Building 706-A, and was chosen because of prevailing heavy foot traffic conditions plus additional light traffic from wheeled slug carriers (800 lbs.) and an electric transporter (1 ton). Tests were conducted over a period of 75 days.

* ORNL-381 and 382, Tompkins, P. C., Bizzell, O. M., Watson, C. D.
ORNL-732, Watson, C. D., Handley, T. H., West, G. A.

2.0 Summary

All paints were still useable at the end of the test period. Prufcoat appeared to suffer slightly more traffic damage than the other paints when under the combined attack of acids, but none of the paints were badly deteriorated. Two "vinyl-base" coatings, Nukemite-40 and Corrosite-22, appeared to be least effected by the traffic conditions; therefore, their ultimate service life is probably much greater than the others.

Considering ease of application (no primer for concrete and fast drying) along with resistance to traffic, the following "vinyl-base" coatings were outstanding: (1) Corrosite-22, (2) Pyroflex Lacquer, and (3) Amercoat-33.

Nukemite-40 is equally good, but it may not be as desirable as the other paints listed bacause of the long drying time (6-8 hours) between Nukemite-40 concrete primer coats.

The strippable coatings withstood the traffic conditions for periods of only two to four weeks. Tygofilm strip coat had fewer ruptures and withstood abrasion better than Brevon or A89A.

3.0 Procedure

A heavily traveled concrete floor area (estimated traffic - 1000 passages per day) in the Unit Operations Section was divided into thirteen sections (4 ft. x 4 ft.) which were prepared and painted with protective coatings as follows:

(1) Removal of old paint with a Tennant Floor Machine. This machine is equipped with rotary "hammer-mill" type steel cutters which scarifies and completely removes old paint from concrete surfaces. Concrete, so treated, is levelled and smoothed.

(2) Concrete degreased with trichloroethylene (Tri-Klene, DuPont).

(3) Concrete etched with 15% hydrochloric acid and allowed to dry out for eight hours.

(4) Four coats of each coating were applied and dried according to the manufacturers specification.

All test patches were washed and "squeegeed" daily using Santomerse #1 detergent, and their condition visually studied until failure or until the end of the test period (seventy-five days). The test patches, after being in service for five days, were observed through a 60 power portable field microscope.

At the end of seventy-five days service, the test patches were judged by fifteen persons unfamilar with any of the coatings.

4.0 Conclusions

It was concluded that none of the paints, with the possible exception of Prufcoat, completely failed under traffic during the seventy-five day test. Moreover, it was observed* that all paints at the beginning of the test contained tiny pen holes from solvent escapement and had pulled away from some of the tiny peaks in the concrete leaving them exposed. The coatings that had fewer faults were (1) Corrosite-22, (2) Nukemite-40, (3) Pyroflex Lacquer and (4) R-Mir-Dek. More pits were observed in the Bisonite coatings than in the other paints tested. The strippable coatings had no observable pin holes, but had numerous entrapped air bubbles.

It was possible to rate all coatings according to three general groups- see Table I - (1) those that showed little or no abrasive wear are rated as excellent, (2) those that showed some abrasive wear, but notenough to destroy their usefulness as protective coatings are rated as good, and (3) those that showed excessive wear were rated as poor. It was estimated that coatings in this group (3) in all probability would fail in thirty additional days.

The abrasion resistance of (1) Nukemite-40, (2) Corrosite-22, (3) Bisonite-101 and (4) R-Mir-Dek appeared to be equally good. However, Nukemite-40 and Corrosite-22 were particularly outstanding and show more promising wear resistance qualities than the other coatings tested. Corrosite 22, Pyroflex

* 60 power portable microscope was used.

Conclusions (Continued)

Lacquer and Amercoat 33 are easiest to apply in that no primer is required for concrete and are fast drying thus making the painted area available for use more quickly than with Nukemite-40 or Bisonite-101 - see Table I.

None of the strippable coatings possessed abrasion resistance qualities sufficient to last more than two to four weeks under ordinary foot traffic conditions, therefore, their use on floors with heavy traffic should be limited to this period of time. Strippable coating Tygofilm TP-216 had fewer ruptures and withstood abrasion better than the other strippable coatings.

5.0 Recommendations

Three coatings are recommended for general application in radiochemical facilities of Oak Ridge National Laboratory. A summary of their principal characteristics follows:

	Corrosite-22	Nukemite-40	Amercoat-33
1. Resistance to chemicals	Good	Good	Good
2. Resistance to abrasion	Better	Best	Good
3. Decontaminability	Best	Better	Good
4. Prime coat required - concrete	None	Two	None
5. Prime coat required - metal	One	One	None
6. Drying time (between coats)	One hour	6-8 hours	One hour
7. Strip coat available (G. E. Cocoon will not strip from any of these surfaces; will from Aluminum Prufcoat. Special strip coats are available for Corrosite and Amercoat-33).	Yes	No	Yes

Amercoat-33 has been used successfully for painting water-filled canals, duct work, and concrete tanks. All three paints can be applied to floors, walls, ceilings, and hoods.

Recommendations (continued)

The coatings cannot be used in combinations, i.e., one overlaying the other, because of differences in solvents and composition. The coatings recommended herein have excellent resistance to aqueous chemicals, but will not resist the ketone solvents; therefore, their use in solvent areas is limited unless such spillage is contained by metal trays or the like.

Table I

Abrasion Studies of Selected Protective Coatings

Conditions: 1. Four coats of each coating applied and dried according to manufacturers specifications.
2. Condition of coating checked every 5 days for a period of 75 days.
3. Coatings washed and squeeged daily using Santomerse #1 (detergent)

Note: Coatings are listed in a probable order of their wear resistance qualities as determined by this field test.

Manufacturer	Trade Name	Color	Abrasive Rating	Base	Primer (Coats)	Top Coats Recommended (no.)*	Drying Time Between Coats (Hrs.)**
Nukem Products Corp.	Nukemite-40	Gray	E	Vinyl	2	3	6 to 8
Corrosite Corporation	Corrosite-22	Gray	E	Vinyl	0	3	1
Bisonite Company	Bisonite M-101	Gray	G	Vinyl	1	3 to 5	8 to 12
Miracle Adhesive Corp.	R-Mir-Dek	Gray	G	Urea Pheno-Formaldehyde	0	2 to 4	3 to 4
Maurice A. Knight Co.	Pyroflex Lacquer	Gray	G	Vinyl	0	3	1
Proxylin Products, Inc.	Proxcote 19-70-3	Green	G	Vinyl	1	3	2
Bisonite Company	Bisonite- M - 109	White	G	Vinyl	1	3 to 5	8 to 12
Amercoat Div. - American Pipe and Const. Company	Amercoat - 33	Green	G	Vinyl	0	3	1 to 4
The Garland Company	Acanal	White	G	Vinyl	0	3	24
Prufcoat Laboratories	Prufcoat	Green	G	Vinyl	0	3	4
U. S. Stoneware	(Strip coat)	Blue	P	Vinyl	0	3 to 5	0.25
Gordon Lacey Chemical Products Co., Inc.	Tygofilm TP-216 (Strip Coat) A89A	Black	P	Vinyl	0	3 to 5	0.25
Atlas Powder Company	Brevon 536-2-353	Black	P	Vinyl	0	3 to 5	0.25

Abrasive Rating:
E = Excellent, G = Good, P = Poor
* Four top coats applied in each case.
** Maximum recommended drying time allowed for each coat.