AD NUMBER
AD642759
CLASSIFICATION CHANGES
TO: unclassified
FROM: confidential
LIMITATION CHANGES
TO: Approved for public release, distribution unlimited
FROM: Distribution authorized to DoD only; Administrative/Operational Use; 31 MAR 1949. Other requests shall be referred to US Naval Radiological Defense Laboratory, Naval Shipyard, San Francisco, CA. Pre-dates formal DoD distribution statements. Treat as DoD only.
AUTHORITY
16 Dec 1958, USNRDL ltr; USNRDL ltr, 16 Dec 1958

This document consist of 11 pages. This is copy 9 of 25

ADO-87, Series B

CONFIDENTIAL UNCLASSIFIED

NAVAL RADIOLOGICAL DEFENSE LABORATORY
SAN FRANCISCO NAVAL SHIPYARD
SAN FRANCISCO 24, CALIFORNIA

William H Sullivan
Scientific Director

* * * * *

Engineering Applications Division

* * * * *

Problem Assignment 1020

* * * * *

USNRDL UNCLASSIFIED Memorandum

PHYSICAL DECONTAMINATION OF PAINTED CONCRETE SPECIMENS

John E. Howell, Richard R. Soule,
and Leon Shafer

CAUTION

Date Received:

Date Issued: March 31, 1949

CONFIDENTIAL UNCLASSIFIED

Distribution

Copies

1-2	Chemistry Division
3-4	Technical Information & Materials Division
5	Health Physics Division
6	BuDocks Projects Officer
7	Engineering Applications Division

NAVAL RADIOLOGICAL DEFENSE LABORATORY
SAN FRANCISCO NAVAL SHIPYARD
SAN FRANCISCO 24, CALIFORNIA

UNCLASSIFIED

MEMORANDUM

ADO-87

From: Engineering Applications Division
To: Chemistry Division
Via: Scientific Director

Subj: Physical Decontamination of Painted Concrete Specimens

The problem of decontaminating painted concrete can be attacked by chemical or physical means. In compliance with a request made by the Chemistry Division, the Engineering Applications Division investigated the physical means of removing the contamination from the surfaces of concrete blocks. Giving due regard to such practical considerations as time required for the operation, efficiency in removal of the contamination, and the collection and disposal of the contaminated material removed, the following means were investigated:

(a) Wire brushing
(b) Sanding
(c) Steaming
(d) Washing with hot lye solution
(e) Burning
(f) Sandblasting

Only one process or operation in each general method of removal was investigated, but the advantages and disadvantages of the method in general are pointed out. Therefore, if any general method is particulary suited to a special situation, the process used may be improved by improving the equipment and techniques.

These painted concrete blocks were removed from the YOG 83, which was a target ship at Bikini. The edges of the blocks were very irregular, but the area of painted surface on each block was somewhat greater than one square foot. The painted surface contained cracks, bubbles, and many other irregularities; therefore, the decontamination varied on some spots unless a severe method, which removed all the paint, was used.

Five spots, each corner, and the middle on each block were counted before and after the decontamination process. The same Geiger tube that was used in the chemical decontamination was connected to a Berkeley Scaler and placed against the surface to count these five spots. The counting characteristics

UNCLASSIFIED

that prevailed during the chemical decontamination were duplicated as nearly as possible in the physical decontamination. Since only a measure of the relative removal was desired, the counts recorded (see Appendix) were those registered by the counter after subtraction of background without geometry corrections, etc.

Radioautographs were made of each block before and after each process. The radioautographs show very clearly the irregular distribution of the contamination on the surfaces and the effects of each process tried. The inch squares where the chemical decontamination was conducted are also visible. The radioautographs were accomplished by placing the x-ray film on the top of the concrete block and leaving it there for forty-eight hours. The film were then processed by the Dosimetry Section of NRDL and sent to the Yard photographer for printing.

(a) A standard cup type wire brush driven by a pneumatic tool was used in the wire brushing. The dry painted surface of the concrete was uniformly brushed down through the base coat, leaving only traces of paint. A strip of paint, approximately an inch in width, could be efficiently removed by each pass with the wire brush. The operation took approximately 180 seconds per square foot, and the average removal of contamination was ninety-eight percent. As shown by the radioautographs, the contamination was uniformly removed except where there were cracks in the concrete blocks. A straight pass was made which did not remove the contamination from the cracks.

Wire brushing, as proven by these results, is time consuming and adaptable for efficient decontamination to a smooth or regular surface only. The dry painted surface was investigated in this survey with the investigator wearing a respirator. Although contaminated material would be more difficult to remove if the surface were kept wet, because of reduced friction, the health hazard from the contaminated dust would be drastically reduced and the problem of the disposal of the contaminated material removed would be simplified to the problem of disposal of contaminated liquid rather than the collection and disposal of contaminated dust.

(b) In the sanding operation a #24-10" sanding disc driven by a pneumatic tool was used, and the surface was uniformly sanded down through the base coat, again leaving only traces of paint. This operation took approximately 180 sec./sq.ft., and the average removal of the contamination was ninety-eight percent. Except where there were cracks in the surface the contamination was reduced to a uniform level as in the case of the wire brushing.

The advantages and disadvantages of this operation are similar to the wire brushing in that the time required and percent removal are approximately the same. In addition, the same hazards in removal exist and the wet surface process is necessary to minimize the hazard.

(c) In the steaming process a jet of steam at yard pressure, approximately 70 lbs. was played onto the surface of the concrete blocks. This operation required approximately 60 sec./sq.ft. and the average removal of contamination was eighty-eight percent. The base coat of paint was intact after the steaming, but most of the upper coat was removed. The radioautographs showed that decontamination to a uniform level was not achieved. The results from this process may have been better had superheated steam at higher pressures been used, because it was evident that the heat and the sweeping action of the steam caused the top layer of paint to curl and break its bond.

The contamination from this process would exist partially in the vapors and the water leaving the surface of the block. This would complicate the disposal aspect, because both a liquid retaining system and an air collection and filtering system would be needed.

(d) In the washing with a hot lye solution, a five percent lye solution was heated to eighty degrees centigrade and applied liberally with a paint brush. The solution was allowed to stand on the surface for thirty seconds only, and then it was wiped off with a cloth. Only a small amount of paint was removed by this process as compared to the others that were investigated, and the average removal of the contamination was eighty-eight percent. On a large scale the time for the operation would be about 25 sec./sq.ft., and the surface would be hosed down with water instead of wiping it with a cloth.

The use of the lye solution in this process indicates the possibilities of decontamination by any controlled liquid paint removers. The proper paint remover could be sprayed on a surface and by controlling the conditions all of the paint would not be removed. This would be similar to the processes used for industrial cleaning and paint removing. There would be no radioactive dust hazards, but the operators would have to be protected from the radioactive mist and the cleaning agent. The waste disposal problem would be similar to other liquid waste disposal problems.

(e) In the burning operation the blocks were burned in four separate spots with a standard oxygen-acetylene cutting torch. The characteristics of the burning at each spot were varied to give a complete picture of the burning operation. These four variations can be summarized as follows:

(1) The torch was held about five inches from the surface and played on the paint. The charred scale resulting from the operation was not removed.

(2) The torch was held about one inch from the surface and played on the paint. The charred scale resulting from the operation was not removed.

(3) The torch was held about two inches from the surface and played on the paint using excess oxygen. No paint or scale was present after this procedure.

(4) The torch was held about two inches from the surface and played on the paint. This was followed by light wire brushing to remove the charred scale resulting from this procedure.

All of these operations were performed at the rate of 15 seconds/square foot and decontamination to a uniform level was accomplished in all cases except where there were cracks in the paint. It was particularly noticeable that when excess oxygen was used in Procedure No. 3, the paint and the surface flaked off explosively. The results are contained in the tabulation of results.

This method would present the disposal problems that are encountered in working with radioactive dust and vapors. Some sort of air collection and filtering system would have to be set over the operator as well as providing the proper mask for the operator to wear. As is evident, the heating of bulkheads, overheads, decks, and so forth, would create a serious fire hazard to the areas nearby. Therefore, this method appears to be more feasible for specific areas rather than for overall large scale work.

(f) In the sandblasting operation the concrete blocks were blasted dry with a standard yard sandblasting unit. The sandblaster made uniform passes over the surface of the blocks and he cleaned a square foot in about seven seconds. Decontamination to a uniform level was achieved, except where there were cracks in the surface. These cracks could have been cleaned by concentrating on the particular areas occupied by them. The average removal of contamination was ninety-nine percent which was the highest percent removal by any of the methods.

Sandblasting has the advantage of being very applicable to large scale industrial cleaning and it can be accomplished with little damage to a surface such as steel or even concrete. On the other hand, it presents the dust hazards and the problem of collecting and removing the contaminated abrasive. These disadvantages could be minimized by using wet-blasting or vacu-blasting.

In conclusion, it can be stated that from consideration of all factors, sandblasting is the best and most positive method of decontamination. It is also the most economical industrially. If success is attained in improving the waste disposal methods in connection with sandblasting, this method will be even more satisfactory.

Chemical paint removers are quite useful, but they are not as positive in their action as sandblasting. On the other hand, the problem of waste disposal in this method is much simpler in that it is just the disposal of contaminated liquids.

The other methods, such as abrasion, steaming, and burning, can be used for special areas and under certain conditions. For instance, steaming could serve as a standby method, because in any shore installation, steam is available. Steam can also be used on machined surfaces which cannot be subjected to severe methods. Abrasion and burning are adaptable to detailed or localized removal.

APPENDIX

Table No. 1, which contains the tabulation of results, was made up to give a brief picture of all the methods. Only the average counts are included.

Table No. 2 contains the complete counting data before and after decontamination. All counts are given as counts minus background. In addition, incidental remarks are included in the table.

TABLE NO. 1

TABULATION OF RESULTS

(1) Decontamination Method	(2) Manner of Treatment	(3) Time Required	(4) Average Count before Decontamination Above Background (counts/minute)	(5) Average Count after Decontamination Above Background (counts/minute)	(6) Average Contamination Removed col (4)-(5) / (4) x 100
(a) Wire brushing	Uniform Pass	180 sec/ft^2	1385	59	98%
(b) Sanding	Uniform Pass	180 sec/ft^2	2103	46	98%
(c) Steaming	Uniform Pass	60 sec/ft^2	1755 2151	159 315	91% 85%
(d) Washing With Hot Lye Solution	Applied by brush—Removed after 30 sec. by wiping	25 sec/ft^2	919	116	88%
(e) Burning with Acetylene Torch	Spot burning.....	15 sec/ft^2			
	Lgt flaming		2614	2256	14%
	Hvy flaming		1703	637	62%
	Mod. flaming--Excess O_2.....		764	17	9 [illegible]
	Mod. flaming, then wire brushed		324	44	86%
(f) Sand Blasting	Uniform Pass	7 sec/ft^2	3475 5448	31 27	99% 99%

Average background -- 45 counts/minute.

TABLE NO. 2

(1) Decontamination Method	(2) Block No. and Spot No.	(3) Count Before Decontamination Above Background (counts/minute)	(4) Count After Decontamination Above Background (counts/minute)	(5) Remarks
(a) Wire Brushing	Block #1			
	1	4419	92	
	2	1015	28	
	3	3717	12	
	4	7991	26	
	5	3289	140	
	Background	48	46	
(b) Sanding	Block #5			
	1	1409	3	
	2	1794	165	
	3	1293	40	
	4	3165	13	
	5	2855	7	
	Background	45	45	
(c) Steaming	Block #6			
	1	2445	1697	Surface coat not removed.
	2	2595	32	
	3	2969	37	
	4	2690	2325	Surface coat not removed.
	5	3284	66	
	Background	45	54	
				Results from this block not included in tabulation of results because of erratic nature.
	Block #7			
	1	2098	297	
	2	450	85	
	3	2751	161	
	4	1903	40	
	5	1574	214	
	Background	41	39	
	Block #8			
	1	1754	170	
	2	1053	80	
	3	1557	47	
	4	3133	348	
	5	3257	934	
	Background	46	39	

(continued)

(1) Decontamination Method	(2) Block No. and Spot No.	(3) Count Before Decontamination Above Background (counts/minute)	(4) Count After Decontamination Above Background (counts/minute)	(5) Remarks
(d) Washing with Hot Lye Solution	Block #4			
	1	2614		
	2	1703		
	3	764		Only Position #5 was treated.
	4	324		
	5	919	116	
	Background	46	44	
(e) Burning	Block #4			
	1	2614	2256	Flamed lightly; scale not removed.
	2	1703	637	Flamed heavily; scale not removed.
	3	764	17	Flamed heavily; excess O_2.
	4	324	44	Flamed moderately; wire brushed.
	5	919		(Not used in this test.)
	Background	46	46	
(f) Sandblasting	Block #2			
	1	1624	0	
	2	4458	62	
	3	2717	21	
	4	4254	66	
	5	4325	8	
	Background	45	44	
	Block #3			
	1	4332	21	
	2	6274	15	
	3	6386	9	
	4	4285	47	
	5	5965	46	
	Background	45	44	

Average background -- 45 counts/minute.