

Characterizing PCB contamination in Painted Concrete and Substrates: The “Painted History” at Army Industrial Sites

Chris Griggs

ERDC-EL Environmental Engineering



US Army Corps of Engineers
BUILDING STRONG®



Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 31 MAR 2011		2. REPORT TYPE		3. DATES COVERED 00-00-2011 to 00-00-2011	
4. TITLE AND SUBTITLE Characterizing PCB contamination in Painted Concrete and Substrates: The 'Painted History' at Army Industrial Sites				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army Engineer Research and Development Center,Environmental Laboratory,3909 Halls Ferry Road,Vicksburg,MS,39180-6199				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES Presented at the 2011 DoD Environmental Monitoring & Data Quality Workshop (EMDQ 2011), 28 Mar ? 1 Apr, Arlington, VA.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 20	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

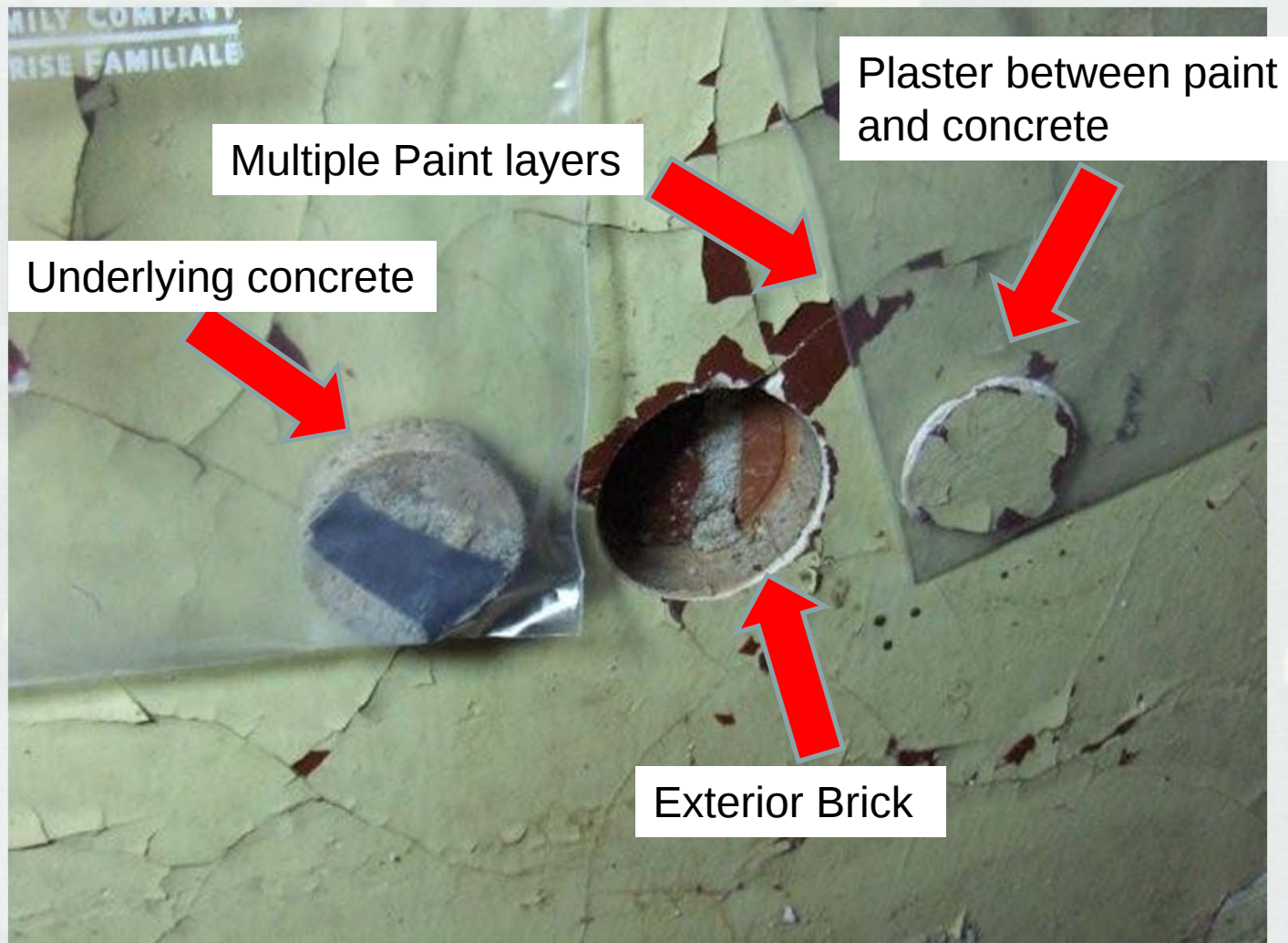
Paint History Defined:

- PCB's have been historically used as a plasticizer in building materials.
- Principally arochlor 1254 was used in the past in paint when thermal and chemical resistance was desired. Paint and lacquer formulations specified up to 10% Aroclor 1254 yielding possible dry weights of up to 25% or 250,000 mg/kg.
- The paint histories of the building lines have be defined by EPA as each paint color per building per building material/substrate. (i.e. the paint is the source)
- For buildings that have painted walls up to and over 1 foot thick, representative core samples are required in order to accurately represent the PCB levels in the substrate and combined media



BUILDING STRONG®

ERDC Composite Defined:



BUILDING STRONG®

PCB in Paint and Substrate



Some of these building materials were over 1 foot thick.



BUILDING STRONG®

Other Porous Media (wood, gypsum, chipboard)



BUILDING STRONG®

The “Painted History”

- **July 2008** –Collected paint and substrate samples of 3 inactive non-explosive building lines slated for demolition, in order to determine if the buildings contained PCBs
- **July 2009** – The July 2008 sample results indicated that some of the buildings contain paint with levels of PCBs greater than 50 mg/kg. Therefore “**composite**” (paint and painted substrate) were collected and analyzed “.
- **April 2010** – Only buildings with “composite” levels less than 50 mg/kg were demolished. For **Buildings** with composite results above 50 mg/kg it was ascertained that PCBs were released “migrated” to the substrate and became considered to be PCB Remediation Waste, halting demolition and be disposal on in a Municipal Solid Waste Landfill.
- **May 2010** –EPA site visit to see the demolition efforts and remaining structures with regulatory issues. During this visit, the EPA was shown that previous sample collection efforts were not representative.



2009 Composites Samples Not Representative



BUILDING STRONG®

Samples Not Representative

Problem(s):

- The 2008 and 2009 concrete samples were not representative of the waste stream.
- The 2009 composite sampling report states that 1 inch in diameter by $\frac{1}{2}$ to $\frac{3}{4}$ inch deep core samples were collected. However, some of these building materials were over 1 foot thick.
- A site visit was conducted to assess the 2008 sampling locations and it was discovered that the substrate samples had only the first couple of milliliters of material collected, apparently by hammer and chisel.



BUILDING STRONG®

Data Irregularity

- Example, composite sample of concrete building material in building 9-62. The composite sample result is 606 ppm PCB, which is higher than the paint sample result of 117 ppm.
- Bottom Line: The data is suspect.
- Impact: These data are at the heart of an EPA/Army informal dispute that is over 2 years old, has been elevated to both party's headquarters, and is still not resolved.
- **This conflict has made the site ineligible for millions of dollars in FRP funds!**



BUILDING STRONG®

PCB bulk waste product OR PCB remediation waste?

Building #	Composite Sample Result for PCBs (mg/kg or ppm)	Substrate Material	2008 Paint Result	2008 Substrate Result
5A-25	408 N	Concrete	7770	18
5A-26	143	Concrete	2670	76
5A-55	195.4 J	Plaster	4290	ND
5B-21	68.2	Plaster	1930	ND
5B-55 (Red)	64.5 J	Plaster	2710	19
5B-55 (Green)	366 N	Plaster	2820	12
5B-137 (Blue)	194 N	Gypsum	1040	139
5B-137(Yellow)	198 N	Chipboard	1100	52
5B-137(Blue)	660 J	Chipboard	605	15
9-62	606 J	Concrete	117	ND
9-64 (green)	1365	Wood	3190	ND
9-64(Green o Red)	462.2 J	Concrete	7960	218

Samples Not Representative - The 2008 and 2009 concrete samples were not representative of the waste stream.



BUILDING STRONG®



Impact:

- Site ineligible for millions of dollars in FRP funds
- Buildings remain at site



BUILDING STRONG®

PCB bulk waste product OR PCB remediation waste?

- EPA TSCA guidance states painted demolition debris as PCB bulk waste product and may be disposed of in a municipal solid waste
- EPA region 7 claims PCB remediation waste as PCB's from the paint may have migrated into the substrate constituting a "spill"
- Army does not agree that painting a building material constitutes a spill or release, nor does the physical processes of paint drying and settling into the pores of a structural material



BUILDING STRONG®

Site Investigation at IAAAP

- A case study at Iowa Army Ammunition Plant IAAAP was performed with the “Paint Histories” in which the walls of industrial concrete and porous building materials were sampled and analyzed for PCB contamination
- **November 2010** ERDC re-sampled the buildings using a coring machine, as opposed to previous sampling efforts that used hand tools. The 2008 and 2009 concrete samples were not representative of the waste stream.



ERDC Sampling Strategy



Through providing an accurate representation of the extent of PCB contamination on painted building materials, a scientifically valid characterization can be provided



BUILDING STRONG®

PCB in Paint and Substrate

The 2009 composite sampling report states that 1 inch in diameter by $\frac{1}{2}$ to $\frac{3}{4}$ inch deep core samples were collected.



2010
Representative
Sample



BUILDING STRONG®

2008 Results (4 Buildings)

Building #	Paint Result (mg/kg or ppm)	Substrate Result (mg/kg or ppm)	Substrate Material	Paint Color
5A-21	795	210	plaster	Beige on Red on Green
5A-26	2670	76	concrete	Yellow
5B-137-2	1040	139	gypsum	Blue
5B-137-2	1100	52	chipboard	yellow
9-64	7960	218	concrete	Green



BUILDING STRONG®

2008 Results vs. 2010 Results (3 of 4 Buildings Below 50mg/kg action limit)

Building #	2008 Paint PCB Result (mg/kg)	2008 Substrate Result (mg/kg)	Substrate Material	Paint Color	2010 Paint Result (mg/kg)	2010 Substrate Result (mg.kg)
5A-21	795	210	plaster	Beige on Red on Green	240	0.35
5A-26	2670	76	concrete	Yellow	10,000	9.6
5B-137-2	1040	139	gypsum	Blue	210	260
5B-137-2	1100	52	chipboard	yellow	450	170
9-64	7960	218	concrete	Green	950	0.99



BUILDING STRONG®

Project Summary



Where surface paint concentrations of 290 mg/kg were observed, only 2 mg/Kg was present in the plaster directly beneath the paint.

gradients in concentration with depth were not observed in the data

- **All 2010 substrate sampling results for plaster and concrete are less than 50 mg/kg**
- The 2010 results are orders of magnitude less than the 2008
- Bottom line, no indication of migration



BUILDING STRONG®

Conclusions

- True sample cores were taken that revealed surface paint as the source of PCB contamination with negligible diffusion into underlying concrete, as declining gradients in concentration with depth were not observed in the data.
- Consequently the potential for migration into the underlying Substrate differs considerably from a scenario such as transformer oil spills onto a concrete slab.
- However samples from wood and other porous materials (e.g. gypsum, chipboard) indicated diffusion into the substrate.
- Such information has considerable regulatory and financial significance in assessing whether the site is classified as PCB bulk waste product or PCB remediation waste.



BUILDING STRONG®

Questions?



BUILDING STRONG®