

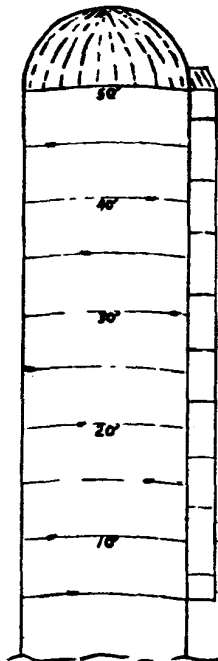
BEFORE RECOATING

AFTER RECOATING

DATE PPM OF PCB MATERIAL

MATERIAL PPM OF PCB DATE PPM OF PCB DATE

MONS 044240



5-3-72 20,155.000 Scrapings
5-3-72 7,131.885 Silage
5-3-72 103.017 Silage

Silage 0.132 6-28-72

Silage 0.128 7-26-72 0.061 11-25-72
Silage 0.081 8-9-72 0.051 12-16-72
Silage 0.081 8-9-72 0.065 12-27-72
Silage 0.271 8-18-72 0.020 1-10-73
Silage 0.271 8-18-72 0.072 1-23-73

Silage 0.382 8-29-72 0.080 2-3-73
Silage 0.424 9-12-72 0.099 2-16-73

Silage 0.237 9-26-72
Silage 0.286 10-10-72

1. Silo was built and coated with a material that contained PCBs in 1957.
2. The silo cleaned with a wire brush, coating was Thoroseal_R hydraulic cement with an Acryl-60_R bonder on 6-5-72. - Standard Dry Wall Inc., Miami, Florida

3. The silo was filled with chopped grass 6-17-72 and opened 6-24-72
4. The silo was refilled with chopped corn in late October 1972.

THE DECONTAMINATION OF SILOS CONTAMINATED WITH
POLYCHLORINATED BIPHENYLS (PCBs) -
SOME IMPORTANT CONSIDERATIONS

1. Concrete silos, whether of poured or stave construction are porous and are subject to attack by the organic acids produced during the ensiling process.
2. For many years various coating materials have been used to lessen this erosion of the silo wall. Generally these coatings have taken the form of:
 - A. An "expendable" concrete plaster.
 - B. A material to fill the pores in the concrete which reduced the surface subject to acid attack.
 - C. And barrier coatings which prevent the contact of organic acids with the silo wall.
3. One such barrier coating was "Cumar", which contained polychlorinated biphenyls and terphenyls. This material was first used in the early 1940's, with application as a protection for the grouting between stave blocks and as a coating.
 - A. When "Cumar" was applied to the silo wall the solvents of the coating penetrated into the concrete, thus carrying the PCB and PCT residues into the silo wall. After the "Cumar" cured there would not appear to be any impetus for further migration of the residue.
 - B. When the silo was filled the organic acids produced, dissolved some of the PCB from the "Cumar" coating thus contaminating the silage. Then this PCB residue diffused through the silage away from the silo wall.
 - C. With time, failure of the "Cumar" coating occurred and flakes of this material, which fall into the silage, caused localized areas to become highly contaminated.
 - D. In areas where the "Cumar" had failed or had completely come off the wall, the organic acids from the silage have now penetrated into the pores of the silo wall and dissolved some of the PCB residues. These residues then are diffused into the silage. Silos, last coated with a PCB containing coating 16 years ago, and long after all traces of the coating were gone, may still cause significant contamination of the silage.

4. Cleaning the surface of a PCB contaminated silo and recoating the surface with a material that will prevent contact between the silage acids and the concrete walls that are PCB contaminated, has been demonstrated to be an effective decontamination method. Where this method was not as positive for removal of the residue as would be destruction and removal of the structure; time, expense and convenience have made recoating a more practical approach.
5. If a silo is to be decontaminated by recoating it must be remembered that no coating will be any better than the surface upon which it is applied. Therefore, dirt, particles of an old coating and/or a deteriorating surface must be removed.
 - A. Sandblasting is an excellent method to prepare a sound silo surface upon which a new coating can be applied. When this method is used care should be taken to control the dust, debris and sand as these can spread PCB contamination to other areas of the farm. The expense involved with sandblasting makes this approach impractical under most circumstances.
 - B. Washing the surface with high-pressure water (500 psi) has proven to be an effective means to clean the silo walls. When this method is used the runoff must be controlled to prevent PCB contamination of waterways. Time for the silo walls to dry must also be considered when water is used. This is particularly important in the winter when frost may build in the silo walls, thus preventing good bonding of the coating.
 - C. Wire brushing of the silo surface is also effective but is dirty work that requires a great deal of time and labor.
 - D. Preparation of a silo for recoating, that still has the "Cumar" coating intact, presents a special problem. Unless this "Cumar" is removed or a rough surface prepared the chances of a good bonding of the new coating are greatly reduced. The "Cumar" should never be removed with an organic solvent, as this method will spread the PCB contamination and may leave the surface unfit for recoating. With solvents there is the danger of fire and/or toxic vapors. Sandblasting may be the best way to remove an intact "Cumar" coating.
6. The coating used as a barrier to PCBs must be a specialized product to withstand the harsh environment inside a silo, plus prevent the acids in silage juices from reaching the silo wall. Some of these coating properties are listed below.

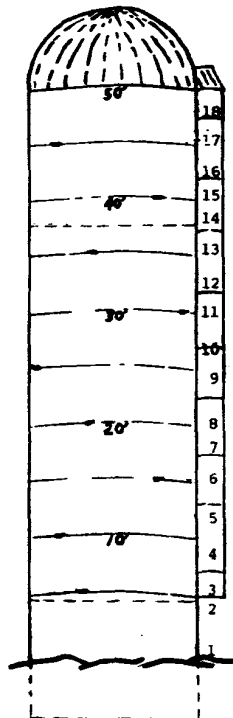
- A. The coating must bond well to concrete.
- B. It must be waterproof, nonporous and cover completely.
- C. It must be acid resistant as pH values as low as 3.5 are encountered.
- D. Temperature ranges from below freezing to 160° F must be withstood without failure.
- E. It should be tough so that machinery, such as unloaders, don't cause it to flake off.
- F. The coating should not contain chlorinated hydrocarbons or toxic chemicals that will contaminate the silage.
- G. The coating should meet the Occupational Safety and Health Act (OSHA) standards to protect the workers applying the material from toxic or flammable vapors. Likewise, the product will need to meet local air pollution control regulations.
- H. The coating should not contain a solvent in which PCB is readily soluble, as PCBs from the silo wall may become a component of the new coating.
- I. Application of the material should be uncomplicated.
- J. The cost of the coating should be low enough so that the entire recoating operation does not exceed 20% of the cost to replace the silo.

L. B. Willett, April 1973.

BEFORE RECOATING

DATE	PPM OF PCB	MATERIAL
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9-7-72	314.017	Scrapings
7-5-72	5.111	Silage
7-5-72	8.037	Silage
9-7-72	175.365	Scrapings
9-7-72	705.236	Scrapings
6-19-70	0.987	Silage
6-19-70	0.033	Silage
9-9-70	4.900	Scrapings
9-9-70	3.600	Scrapings



AFTER RECOATING

MATERIAL	PPM OF PCB	DATE	PPM OF PCB	DATE
Silage	20.677	10-30-72		
Silage	52.536	11-7-72		
Silage	58.997	11-10-72	13.433	2-27-73
Silage	28.798	11-16-72	18.225	3-2-73
Silage	1.909	11-22-72	1.311	3-6-73
Silage	1.171	11-30-72	0.693	3-12-73
Silage	0.855	12-5-72	0.403	3-16-73
Silage	0.843	12-8-72		
Silage	1.062	12-19-72		
Silage	20.569	12-22-72		
Silage	1.007	1-5-73		
Silage	0.883	1-9-73		
Silage	0.615	1-12-73		
Silage	0.351	1-19-73		
Silage	0.373			
Silage	0.481			
Silage	1.564			

1. Silo was built and coated with a material that contained PCBs in 1954.

2. In 1966 lower 8 feet and the pit were coated with Silenzcrete, Universal Cooperatives, Alliance, Ohio.

3. On 9-16-72 the silo was cleaned and recoated with Water based Epoxy - Action! Plastic, Inc. Charlotte, Michigan; from the base of the pit to 37 feet above ground level.

4. The silo was filled with chopped corn 10-5-72 and was opened 10-30-72

5. The silo was filled with corn silage from stack silo 2-9-73.

HONS

044244

ES SILO
8-18-1972

History

Michigan Silo	14 X 50	
Built		1958
Coated	Cumar	1958
	Glazed	1967
	Concrete plaster	1970 (30 ft)

Condition

Plaster coating was hard except for blisters where the surface was not adequately cleaned.
The silo was not adequately cleaned before plastering.
The Cumar was not visible above the concrete plaster.

Comments

The operator has not fed from this silo for one year because he was afraid of possible PCB contamination. Thus the silo was filled only once since the plaster-coating was applied.
Has two other silos available that he now uses.

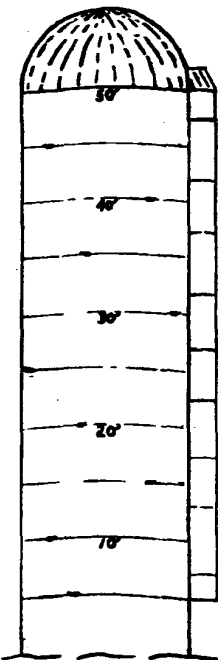
PCB levels, (Aroclor 1254)

Scraping of plaster surface	1.014 ppm
Scraping where plaster failed	178.079 ppm
Scraping above plaster	304.755 ppm
Silage adjacent to wall	33.603 ppm
Milk from bulk tank	0.028 ppm

L. B. Willett January 1973

BEFORE RECOATING

DATE	PPM OF PCB	MATERIAL
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5-3-72	20,155.000	Scrapings
5-3-72	7,131.985	Silage
5-3-72	103.017	Silage

1. Silo was built and coated with a material that contained PCBs in 1957.
2. The silo cleaned with a wire brush, coating was Thoroseal_R hydraulic cement with an Acryl-60_R bonder on 6-5-72. - Standard Dry Wall Inc., Miami, Florida

AFTER RECOATING

MATERIAL	PPM OF PCB	DATE	PPM OF PCB	DWTT
Silage	0.132	6-28-72		
Silage			0.061	11-25
Silage	0.128	7-26-72		
Silage			0.051	12-16-72
Silage	0.081	8-9-72	0.065	12-27-72
Silage			0.020	1-10-73
Silage	0.271	8-18-72	0.072	1-23-73
Silage				
Silage	0.382	8-29-72	0.080	2-3-73
Silage	0.424	9-12-72	0.099	2-16-73
Silage				
Silage	0.237	9-26-72		
Silage	0.286	10-10-72		

3. The silo was filled with chopped grass 6-17-72 and opened 6-24-72
4. The silo was refilled with chopped corn in late October 1972.

MONS 044246