

THE EVALUATION OF BARRIER COATINGS IN FARM SILOS WHICH WERE PCB-CONTAMINATED

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From the early 1940's through 1970, many silos throughout the Mideast and Midwest were treated with a coating material called Cumar¹ which contained polychlorinated biphenyls (PCB's). Residues of the PCB's from this coating will contaminate silage and in turn the body fat and milk of animals consuming feed from a silo treated with this Cumar coating. A detailed description of this contamination process is presented in the following article.

During the past 2 years, 12 coating systems have been tested in the OARDC Department of Dairy Science to determine if they will form a barrier to PCB residues. Five of these coatings were tested with three fillings of silage in sections of a PCB-contaminated silo. The remaining coatings were tested on PCB-contaminated concrete stave blocks which were placed in 55-gallon drums of chopped corn. These were allowed to ensile for 4 months. Two stave block trials were conducted.

The results of these trials indicated that some coating systems were totally ineffective, while others provided an effective barrier to PCB residues.

Based on the results of the silo and block trials and commercial availability, two coating materials were selected for use on two dairy farm silos. Both silos were known to contain sufficient PCB's to cause the residue level in the herd milk to be above the actionable level.

Silo 1 (Fig. 1) was built in 1957 and coated at that time with the PCB-containing Cumar coating. All traces of the original coating were gone and the silo had never been recoated. The concentrations of the PCB residues in scrapings from the wall and in silage collected near the base of the silo are shown in Fig. 1.

In May 1972, the silo was thoroughly cleaned with a wire brush and two coats of hydraulic cement² with an acrylic bonder^{3,4} were applied. Twelve days later, the silo was filled with chopped grass. In October, the silo was filled with chopped corn.

¹The silo coating called Cumar which contained Aroclor 1254 (Monsanto) should not be confused with Neville R-1-6A resin, which has the same name.

²Thorseal -- Standard Dry Wall, Inc., Miami, Fla.

³Acryl 60 -- Standard Dry Wall, Inc., Miami, Fla.

⁴The use of trade names is only to identify the products used. The use of trade names is not an endorsement of the product used nor meant to discriminate against similar products not used.

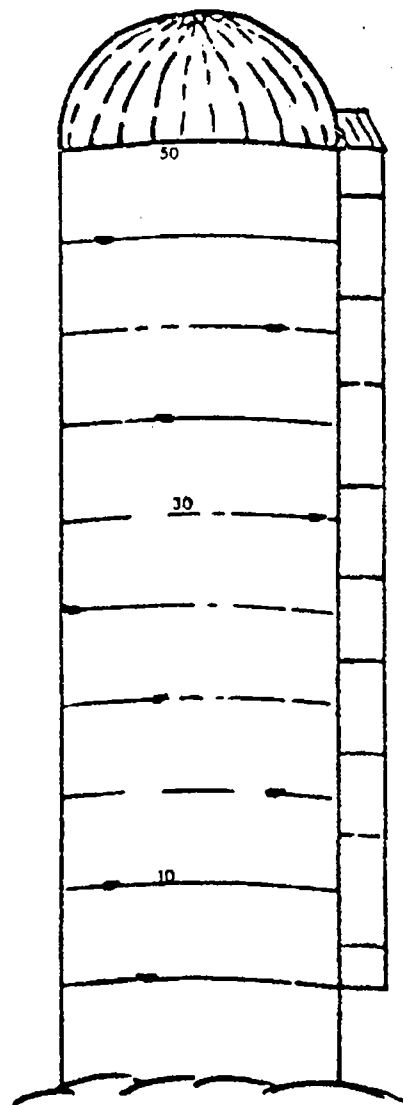
BEFORE

ppm

20,155.00 ☆

103.02

7,131.88



☆ WALL SURFACE

AFTER RECOATING

TRIAL-1
ppm

0.13

0.13

0.08

0.27

0.38

0.42

0.24

0.29

TRIAL-2
ppm

0.06

0.05

0.07

0.02

0.07

0.08

0.10

FIG. 1.--Levels of PCB (ppm Aroclor 1254) in silo wall surface (*) and silage collected before treatment and after recoating with hydraulic cement with an acrylic bonder.

Samples were collected at intervals of approximately 2 weeks. Each sample was a composite of silage collected within 2 inches of the silo wall from four locations.

Following recoating with the hydraulic cement barrier coating, the levels of PCB residues in the silage adjacent to the wall were maintained below 0.5 p.p.m. Samples of milk from the farm bulk tank were collected on the same days that silage samples were collected. The PCB concentration in the milk continued to decline throughout the experiment.

Silo 2 (Fig. 2) was built and treated with a material containing PCB's in 1954. All traces of the original coating had come off the silo walls. In 1966, the lower 8 feet and the pit were coated with a furfuryl alcohol resin⁵ coating. Scrapings of the silo wall and silage samples collected adjacent to the furfuryl coating were low in PCB concentration. However, those collected above this recoated area were considerably higher.

In Sept. 1972, the silo was thoroughly cleaned with high-pressure water. Then it was recoated from the base of the pit to 37 feet above ground level with two applications of water-based epoxy.⁶ The silo was filled with chopped corn 19 days after coating. A second filling occurred in Feb. 1973, when corn silage from a stack silo was used. Samples were collected in the same manner as described for Silo 1.

The levels of PCB residues in the silage collected above the coating were very high. However, PCB residues were significantly reduced when collected adjacent to the surfaces coated with the water-based epoxy (Fig. 2). The high PCB concentrations observed near the top of the coated area probably resulted from settling of the silage and the downward migration of silage juice.

The results of these studies indicates that barrier coatings can effectively reduce the levels of PCB residues in silage when used under actual dairy farm conditions. Two trials on each silo have been completed and evidence of coating failure has not been observed. Mechanical unloaders are used in both silos.

Studies on these silos are continuing in order to determine how long the coating materials will continue to be effective barriers to PCB residues. The coatings also will be studied for signs of failure and loss of bonding to the wall.

⁵Silenzcrete -- Universal Cooperatives, Alliance, Ohio.

⁶009 Epoxy -- Action Plastic! Inc., Charlotte, Mich.