Does your silo contain PCB residues?

Subtitle

Early detection and elimination of these residues could save you dollars.

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Does your silo contain PCB residues?

Residues of chemical compounds identified as polychlorinated biphenyls (PCBs) have recently been detected in livestock feedstuffs and subsequently in meat, eggs, poultry, milk and fish.

These compounds have a chemical structure very similar to DDT. Because they are lipid soluble, PCBs readily accumulate in the body fat of animals which consume contaminated feed. When this occurs food products produced by these animals contain PCB residues.

PCBs, like all synthetic chlorinated hydrocarbons, are illegal contaminants of human food. Therefore, the discovery of these compounds has caused considerable concern among those associated with animal agriculture and substantial financial losses to producers who have been directly affected by this contaminant.

PCB in silo coating . . .

A major source of PCB contamination of milk and meat has been silos which were coated to prevent leakage and erosion of the walls with a material called "Cumar"[1]. Cumar is responsible

1 The Aroclor containing silo coating called Cumar should not be confused with Neville R-1-6A resin that has the same name.

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for most, if not all, of the PCB-contaminated silos. The Cumar silo coating contained the PCB called Aroclor[2] 1254. Aroclors were not specifically produced for incorporation into silo coatings, but were used because they are good plasticizers. Since the 1930's, Aroclors have been adapted to more than 50 different industrial and agricultural uses.

The first silos to be coated with Cumar were built in the 1940's and its use continued through 1970. The exact number or location of the silos that contain PCB contamination is not known since some of the silo companies that used Cumar are no longer operating, and records are no longer available. However, it has been estimated that 5,000-6,000 silos were built which may contain PCBs. Some of these silos are not presently being used or have been torn down.

Most of the silos that are contaminated with PCBs are located in Indiana, Kentucky, Ohio and Tennessee. Research work and information supplied by silo companies indicate that silos containing PCB residues have also been found in Alabama, Georgia, Illinois, Maryland, Michigan, New York, North Carolina, South Carolina, Pennsylvania, Virginia and West Virginia.

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[2] Aroclor is a trademark of Monsanto Chemical Company.

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Not a health hazard to general public . . .

Even though the number of contaminated silos is high, it is not likely that residues detected in milk resulting from these silos present a health hazard to the general public. Since these contaminated silos are dispersed within milksheds, the mixed milk supplies do not have significant quantities of PCB residues to pose a health hazard. Surveys of the FDA have confirmed this conclusion.

If a PCB-contaminated silo is on a farm and the farm family consumes the milk produced, their consumption of the residue will be many times greater than that of the general public. It is not known if long term exposure to these residues represents a health hazard to the farm family.

PCBs financial hazard to dairymen . . .

There is a serious economic hazard to the dairyman who has a silo that contains PCB residues exceeding the FDA tolerance. This tolerance or "actionable level" is 2.5 parts per million (ppm) on a fat basis or 0.1 ppm on a whole milk basis (4% fat). If a regulatory agency detects greater than tolerance levels of this residue, the milk from a dairyman's farm can be excluded from the market until the residue decreases to below the actionable level.

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The dairyman will not only suffer from the lost income but will also need to replace the contaminated feed and eliminate the PCB residue from the silo.

When the cows are producing unmarketable milk, the residue in their body fat is too high for the cattle to be sold for beef. Therefore, the dairyman can not reduce his losses by selling the contaminated cows and replacing them.

To exemplify the financial losses that dairymen might suffer as a result of a PCB-contaminated silo, let's consider the following hypothetical example. The dairyman has a 14 x 50 concrete-stave silo that is PCB contaminated and contains 150 tons of silage. A residue level of 10 ppm fat basis is detected in the milk from his 50 cows which are averaging 40 pounds of milk per day.

With this level of residue it will probably require about 10 weeks for the residue to decrease below the "actionable level." Therefore, lost milk sales would total $8,400 if the milk price were $6 per cwt. Replacement of the contaminated silage with hay would cost an additional $2,500 if hay could be obtained at $50 per ton. On top of these expenses, the dairyman would need to replace the silo or possibly have it cleaned and recoated with a suitable material.

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Have silage and milk tested . . .

If you suspect that your silo may have been contaminated, even if it was many years ago, arrangements should be made to have your silage and milk tested for PCBs. The cost of these tests is very small considering the cost of being excluded from the milk market.

If PCB residues are detected in silage and the residue in milk is above the tolerance level, feeding of the contaminated silage should be stopped immediately. The corral and feeding area should be thoroughly cleaned. Continued feeding of the cows to maintain high production, and continued milking of the cows is necessary. When these procedures are following the amount of PCB in milk should decrease about 50% in 15 days. Thereafter, the decrease should be about 1% per day. If feeding is restricted, in order to remove body fat from the animals, it will take much longer for the milk levels of PCB to decrease.

PCBs dissolved by silage juice . . .

PCBs from Aroclor-containing coatings were originally thought to contaminate the silage, and in turn the livestock, by flaking off of contaminated chips. It is not uncommon for these chips to contain 5,000 to 10,000 ppm of

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PCB. However, recently it has been learned that the PCB in the coating material is dissolved by the silage juices.

The problems caused by this residue are persistent unless an effective barrier is placed between the silage and the silo wall. Once applied to the silo wall the PCBs penetrate into the concrete and slowly continue to contaminate the silage many years after all traces of the original coating are gone. Silos that were last coated 16 years ago with a material that contained PCBs have been shown to still cause contamination of the silage and in turn the milk produced by animals that consume it. The concentrations of PCB in scrapings from the walls of these old silos have exceeded 600 ppm of Aroclor, and levels in silage adjacent to the wall have exceeded 200 ppm.

Elimination of residue . . .

The most positive way to remove the PCB problem is to stop using the silo or to replace it. This approach is the most positive but is also the most expensive and will probably cost the livestock producer in excess of $4,000 to replace the silo structure.

The results of a research program at the Ohio Agricultural Research and Development Center have indicated that PCB residues in contaminated

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silos can effectively be reduced to tolerable levels. These results have been achieved by carefully cleaning and recoating silos with materials that form a barrier between the silage and the silo wall. The cost of cleaning and recoating a silo is between 10 and 18% of the cost of replacing the silo, depending on the type of coating used.

Possibly the most important aspect of recoating a silo is the cleaning of the silo walls prior to applying the coating. COATINGS WILL NOT BE EFFECTIVE UNLESS A CLEAN AND SOLID SURFACE IS PREPARED. Sandblasting is an ideal means to clean the silo, however, the cost makes this method impractical. Dust must also be controlled when sandblasting is used to prevent widespread contamination. Alternatives to sandblasting are wire brushing and high-pressure water (500 psi). The wire brush method requires a great deal of labor. When high-pressue water is used care must be taken to control the runoff to prevent contamination of streams or other parts of the dairy farm.

Research has provided information about some of the necessary properties of coatings if they are to be used as effective barriers to PCB residues.

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First, it is not desirable to use a coating which contains a solvent in which the PCB is very soluble. The solvent in the new coating can dissolve the PCB from the silo wall and simply make it part of the new coating system. A solvent-based coating may actually make the contamination more severe than if no coating was used at all.

Second, the new coating should provide a thick barrier between the contaminated silo wall and the silage. This means that two or more coats of the materials tested are necessary.

Three coating systems, of 12 tested, appear to be very promising as a means to cover the bare concrete surface of a previously contaminated silo. These are: (1) a hydraulic cement with an acrylic bonder (not a sand and cement plaster but a special cement that forms a watertight barrier); (2) a water-based epoxy; and (3) a furfuryl alcohol resin coating.

The studies are now being continued to determine if silage from these recoated silos can be safely fed without contaminating the milk and also to determine if the coating continues to be an effective barrier when the silo is used con-

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tinually. Tests are also in progress to determine if these coatings will be effective when applied to a silo that still retains an intact Cumar coating.

END

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COST ESTIMATES FOR RECOATING CONTAMINATED SILOS

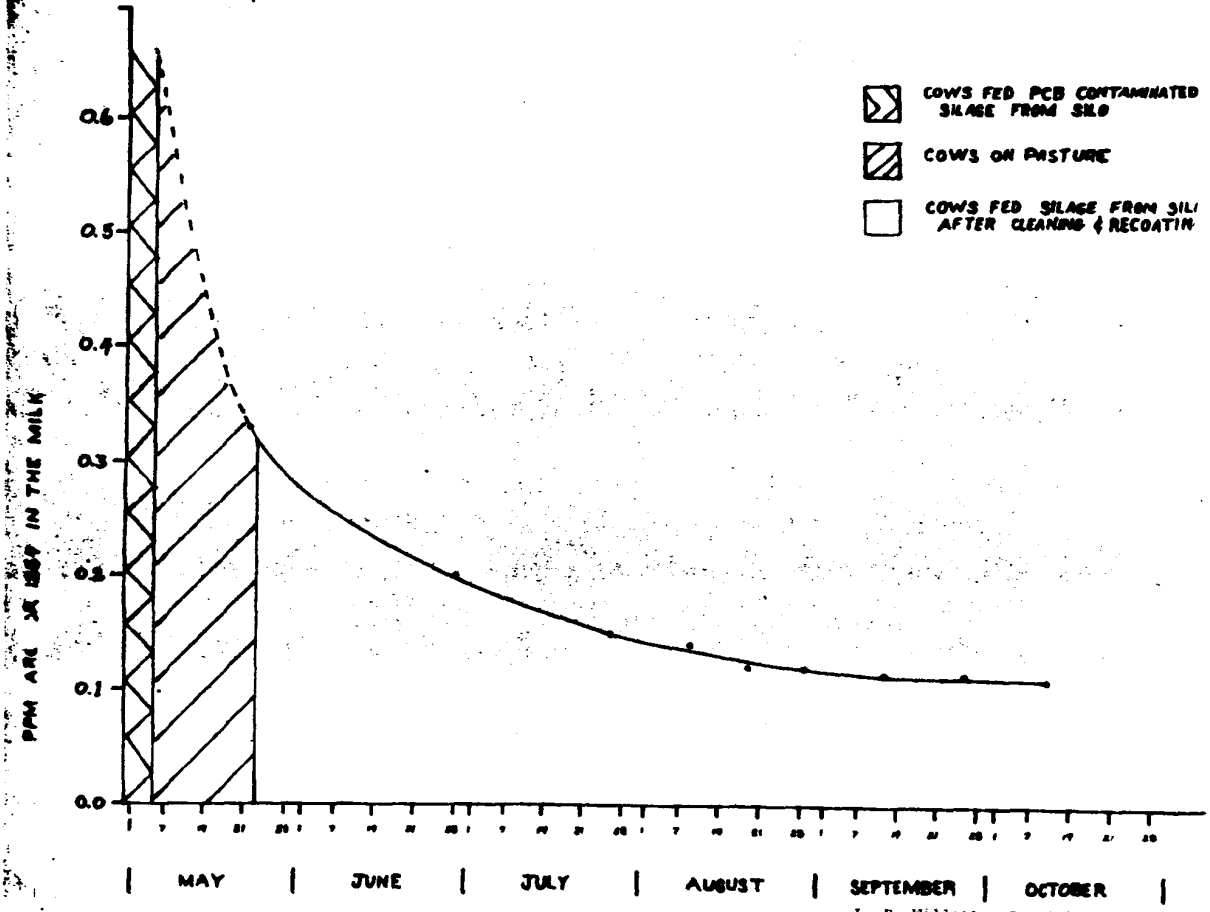
Silo Size	Area	Replacement[h] Cost	Hydraulic Cement[a] Item	Amount	Cost	Furfuryl Alcohol[c] Item	Amount	Cost	Water Based Epoxy[d] Item	Amount	Cost
(ft)	(sq ft)										
10x50	1750		Clean[e]		$ 50.00	Clean[e]		$ 50.00	Clean[e]		$ 50.00
			Coating	400 #	65.00	Coating	23 gal	230.00	Coating	23 gal	230.00
			Bonder[b]	8 gal	38.00						
			Apply[f]		150.00	Apply[f]		150.00	Apply[g]		175.00
			TOTAL		$303.00	TOTAL		$430.00			$501.00
14x50	2198	$3400.00	Clean		$ 50.00	Clean		$ 50.00	Clean		$ 50.00
			Coating	500 #	81.00	Coating	30 gal	300.00	Coating	30 gal	352.00
			Bonder	10 gal	47.00						
			Apply		200.00	Apply		200.00	Apply		250.00
			TOTAL		$378.00	TOTAL		$550.00	TOTAL		$652.00
20x70	4396	$7000.00	Clean		$100.00	Clean		$100.00	Clean		$ 100.00
			Coating	1000 #	162.00	Coating	60 gal	600.00	Coating	60 gal	720.00
			Bonder	20 gal	94.00						
			Apply		350.00	Apply		350.00	Apply		420.00
			TOTAL		$706.00	TOTAL		$1050.00	TOTAL		$1240.00
Approximate Percent of Replacement Cost				10%			16%			18%	

[a] Thoroseal $16.20/100# - 2 # /sq yd.
[b] Acryl 60 $ 4.70/gal - 2 gal/100# Thoroseal
[c] Silenzcrete $10.00/gal - 75 sq ft/gal
[d] 009 Epoxy $12.00/gal - 75 sq ft/gal

[e] $10.00/hr cleaning with high pressure water. $2.00-$3.50/ft with wire brush.
[f] $3.00-$5.00/ft to apply
[g] $3.50-$6.00/ft to apply
[h] Structure only - no hardware, roof, unloader, etc.

L. B. Willett - O.A.R.D.C. Nov. 1972

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