FINAL REPORT
Sealing Fumigation Facilities
May 1988

PROJECT LEADER: James F. Thompson

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OBJECTIVES: Long range objectives are to develop sealing methods suitable for dried fruit and nut facilities in California. Objectives for 1987 are to finish sorption penetration and durability tests of selected sealing materials.

PROCEDURE: 1. Continue to visually evaluate wear of sealing materials applied to floors and walls of bulk almond storage facilities (Thompson).

2. Evaluate phosphine (PH_3) penetration and sorption and methyl bromide sorption for sealing materials. Materials are exposed to 300 ppm of PH_3 for 24 hours at 20°C. Penetration and sorption are compared with an epoxy paint which is recommended in the USDA, APHIS PPQ Treatment Manual (Hartsell).

RESULTS: All sealing materials are holding up well in two wear tests. One test is in a large almond storage building that is filled and emptied once per year. The other test is in a small almond storage facility that is filled and emptied four to six times per year. The sealing materials have been in place for almost 3 years. The following is a list of the materials in the test:

1. Neoprene sheet (NC621 Gaco Western): applied to wall
2. Liquid neoprene (N100 Gaco Western): applied to floor
3. Liquid rubber (P5000 Gaco Western): applied to floor
4. Liquid aliphatic urethane (UA6500 Gaco Western): applied to floor
5. Epoxy paint (Rustoleum): applied to floor

The attached table summarizes the phosphene sorption and penetration tests for 11 sealing and wall panel materials. The sorption data shows that the materials we tested sorb approximately as much methyl bromide and phosphine as the epoxy did, with the exception of the Gacoflex brand urethane sealer that sorbed considerably less methyl bromide than the epoxy. The penetration tests indicated that only the Gacoflex brand liquid

neoprene performed as well as the epoxy sealer. All of the other materials allowed one or two orders of magnitude more penetration than the epoxy sealer.

Summary of Methyl Bromide and Phosphine Sorption and Penetration Tests 1986 - 1987

	Methyl Bromide Sorption %	Phosphine Sorption ppm PH^3	Phosphine Penetration ppm PH^3
Rustoleum			
Epoxy, 9331 & 9306 activator	3.5±1.3	2.6±0.4	0.02±0
Gacoflex			
Neoprene sheet	3.7±0.4	6.2±2.4	0.41±0.05
Liquid neoprene, N-110	2.4±0.1	6.2±3.8	0.03±0.02
Aliphatic urethane, UA-6500	0.4±0.6	8.6±2.4	7.60±0.05
Polyolefin, P-5000	2.2±0.5	4.7±1.9	0.52±0.28
Chemseco			
Vinyl sealer, SM904 grey	----------	6.0±2.1	5.3±0.9
Vinyl sealer, SM904 white	----------	3.5±4.0	15.2±2.3
Essex			
Vinyl sealer, 30mil 0006587 white over 0.25 mil 000044160 white	2.0±0.6	----------	----------
Zerolock			
Coated metal panel interior QC462	1.1±0.9	----------	----------
Coated metal panel exterior QC317	2.5±0.5	----------	----------
Fiberglass panel (.090 thick)	2.7±1.1	----------	----------

On the basis of these results, the best methods of sealing a fumigation facility would be to 1) use an epoxy paint/sealer on porous interior surfaces (coated metal and plastic panels should not need to be sealed) and use any one of the neoprene or polyolefin sealers for joints and large cracks or 2) seal all of the porous inside surfaces, joints, and cracks with the Gacoflex liquid neoprene or material with equivalent sorption and penetration properties. Option 1 is especially useful for facilities that have already been

painted with epoxy paint. It takes advantage of epoxy paint's ability to prevent fumigants penetrating through it and the ability of the flexible sealants to maintain a seal over joints and large cracks. Option 2 is useful for a facility were it is convenient to use just one type of sealer. For both options 1 and 2, special application procedures (such as embedding walnut shells in the sealer) may be needed to produce a durable seal on a floor with a lot of traffic. We expect that there may be other sealing materials that will perform as well as the ones we used, even though they were not included in the testing.

This last year we evlauated the possibility of using an oxygen absorbing material called 'Ageless' as a method of reduceing oxygen levels in storage facilities. Representatives from Mitsubishi International Co., San Francisco, indicated that they have evaluated this possibility, but have concluded that their material is far too expensive to use for this purpose. Engineers from the company indicated that the product would only be feasible to use if the storage facility were initially flushed with nitrogen and the Ageless used to maintain low oxygen levels. This procedure might be used for fumigating product in a transport container.

RESEARCH RESULTS FOR 1986 YEAR

SEALING FUMIGATION FACILITIES

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OBJECTIVES: Long range objectives are to develop sealing methods suitable for dried fruit and nut facilities in California. Objectives for 1986 are to continue absorption and durability tests of selected sealing materials and continue the survey of storage and fumigation facilities. During the survey, an attempt will be made to identify processors who would like to try controlled atmosphere fumigation on a commercial scale.

PROCEDURE:

1. Continue to visually evaluate wear of sealing materials applied to floors and walls of bulk almond storage facilities (Thompson)

2. Evaluate methyl bromide (MeBr) sorption of nine sealing materials and interior panel materials. Treat sealing materials/panels with 24 g/m^3 MeBr for 4 hours at 27.6°C in 29 liter fiberglass chambers. Percent sorption is corrected for MeBr sorption of empty chambers (Hartsell).

3. Evaluate phosphine (PH_3) transmission and sorption for sealing materials. Materials are exposed to 300 ppm of PH_3 for 24 hours at 20°C.

RESULTS:

All sealing materials are holding up well in wear tests. One almond storage facility has undergone seven load/unload cycles since the test started. The following is a list of the materials in the test:

Neoprene sheet (NC 621 Gaco Western): applied to wall
Liquid neoprene (N 100 Gaco Western): applied to floor
Liquid synthetic rubber (P 5000 Gaco Western): applied to floor
Liquid aliphatic urethane (UA 6500 Gaco Western): applied to floor
Epoxy paint (Rustoleum): applied to floor

MeBr sorption test indicates that all materials tested sorb as much or less than epoxy paint, which is considered a standard. Table 1 is a listing of the data.

TABLE 1 - Methyl Bromide Sorption Tests for Various Sealing materials
February 1986

Tests were conducted by Preston Hartsell at USDA-ARS Fresno

Material	Average % Sorption	Standard Deviation
Rust-Oleum series 9300 epoxy system	3.5	1.3
Gaco Western N-110 liquid neoprene	2.4	0.1
Gaco Western NC-621 cured neoprene sheet	3.7	0.4
Gaco Western P-5000 liquid polyolefin	2.2	0.5
Gaco Western UA-6000 liquid alipatic urethane	0.4	0.6
Essex Speciality Products 65-871 liquid vinyl coating	2.0	0.6
Zerolock QC 462 coated metal panel	1.1	0.9
Zerolock QC 317 coated metal panel	2.5	0.5
Zerolock Fiber reinforced plastic panel	2.7	1.1

Results of the PH_3 sorption and transmission for three sealing materials are listed in Table 2.

TABLE 2

Material	Sorption (%)	Average Transmission (ppm)
Rustoleum series 9300 epoxy system	2.6	0.02
Chemseco SM-904 vinyl sealer (gray)	6.0	5.3
Chemseco Vinyl sealer (white)	3.5	15.3

Additional PH_3 tests on other sealing materials and transmission tests with MeBr will be done in 1987.

During the year, it was decided to not conduct the fumigation facility survey. We already have a fairly good sampling of the range of facilities that are used. Also, we felt it would be easier to interest people in trying the new sealing systems if we could verify that new sealing materials would be suitable for use in certified chambers. We originally believed that new sealing materials would need approval before they could be used.

Discussions with USDA-APHIS and CDFA personnel indicated that both organizations have no regulations which prevent the use of new sealing materials for sealing certified fumigation chambers. EDB fumigation facilities are an exception. They still require epoxy paint as an interior sealer. But, EDB is virtually never used for fumigation in California. Pending the phosphine transmission test, all sealing materials we have been testing should be available for processors to use on their own facilities.