THE HORN GENERATOR/MAGTOXIN GRANULES SYSTEM

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I'm going to talk to you today about a significant innovation in the field of phosphine fumigation. The device which I'll speak of is called the Horn Phosphine Generator. The Generator was developed by the Degesch subsidiary in Chile and patents for the Generator are held by Degesch de Chile Ltda.

The Generator produces a 0 to 1.8% phosphine-in-air-mixture (18,000 ppm) which is then pumped through a recirculation system into the structure to be fumigated. The Generator can produce over 5000g of phosphine per hour, enough to treat a quarter of a million cubic feet. The

fumigant gas is injected into the structure and circulated at a rate of about 4200 ft3/hr. Many different types of structure from warehouses and silos down to smaller storages may be treated using this device. The Generator has been successfully demonstrated here in States and is being used commercially in Chile and Argentina for large scale fumigations.

It weighs 300 pounds and its dimensions are about 2.6 x 2.6 x 3.6 feet high. It is powered by single phase 115V electricity, 25 amp circuit. A small amount of water is required, less than 55 gallons for a one million cubic foot fumigation. Carbon dioxide is also required. One to two 60 lb. cylinders are required to dispense about 20 kg of phosphine, sufficient to treat one million cubic feet of space.

The product used with the Generator, Magtoxin Granules, are packed in stoppered flasks containing a net weight of 850g of product. Each gram of the Granules will liberate 0.5g of phosphine upon reaction with water. The Generator introduces phosphine gas into the structure to be treated through a recirculation system having a flow rate of 4,200 cu.ft./hr.

The principle of the Generator is as follows:
The internal plumbing of the Generator is flushed with carbon dioxide to remove air. The Generator is then loaded with a specially-designed magnesium phosphide product. This produces one gram of phosphine per two grams of product. Once loaded, the Generator automatically transfers the magnesium phosphide to a reaction chamber where it reacts with water to produce gaseous phosphine. The carbon dioxide/phosphine gas mixture is diluted down to about 1.8% with air taken from the structure being treated. The diluted gas is then injected back into the structure through the recirculation system.

While the magnesium phosphide has not yet been registered with EPA and no approved labeling is available, it is anticipated that they will allow the waste slurry to be disposed of directly into storm sewers. When decanted, the solids may be disposed of at landfills, as is the case with other Degesch phosphine products.

There are a number of advantages to the Horn Generator over conventional fumigations with metal phosphide products.

1. Faster introduction of phosphine.
2. Recirculation to reach effective levels throughout the storage.
3. Add back without re-entry (leaks and peanut fumigations)
4. Tall silos
5. Lower man-hour requirements
6. Mill fumigations in combination with carbon dioxide, high temperatures and low phosphine concentrations and other special atmospheres.
7. Fumigation for rodents
8. Virtually eliminates worker exposure during application

As stated earlier, this technique has just recently been introduced into the country. Six demonstrations have been successfully completed here in the States and others have been scheduled. We anticipate EPA registration in about a year. We don't yet have a firm grasp of the economics of fumigations with the Generator and don't yet know how the device will be marketed.

Data from fumigations of a raisin storage facility and a silo will be shown.

An experimental trial of the Turbo-Horn Phosphine Generator/Magtoxin Granules system was performed at a raisin facility in California. A total of 2,080,000 lbs. of raisins stacked in bins were fumigated. The stack, having a volume of 86,768 cu. ft., was tarped with a reinforced paper-poly laminated tarp.

The fumigation was initiated at 9:30 a.m. when injection of phosphine gas into the stack was begun. A total of 3 - 850g flasks of Magtoxin Granules was added, equivalent to a total of 1275g PH3. This corresponds to a dosage of 14.7g PH3/1000 cu.ft. Injection of the phosphine was completed by about 10:00 a.m. The recirculation fan was stopped at 10:30 a.m. and the generator was disconnected. Adults of trogaderma variabile were added as test insects.

Phosphine gas concentrations as a function of time are given in the table. Lethal concentrations of phosphine were achieved in all parts of the tarped stack in about 45 minutes. More or less even concentrations were found throughout the stack after 24 hours. Results of the bioassay were unavailable at the time of the report.

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FUMIGATION OF RAISINS IN STACKS USING THE TURBO-HORN PHOSPHINE GENERATOR/MAGTOXIN GRANULES SYSTEM (1)

Phosphine Concentration in Stack of Raisins

Time (hrs.)	Front (ppm)	Lt. Side (ppm)	Rt. Side (ppm)	Back (ppm)
0.5	75	2000	1	400
0.75	360	1350	100	1000
1.5	1100	1080	350	510
5.5	400	560	130	340
24	250	330	260	370
29	280	280	230	280
47.5	240	300	300	300

(1)Vol. of stack = 86,768 cu.ft., approx. 104 ft. x 40 ft. x 16 ft. with roof 3 ft. above the front side at the center. Wt. of raisins = 2,080,000 lbs. Dosage = 14.7g PH3/1000 ft.3.

An experimental trial of the Turbo-Horn Phosphine Generator/Magtoxin Granules System was performed on a silo at a grain facility in West Sacramento, California. A total of 36,000 bushels of corn was treated in a bin approximately 24 ft. in diameter and 99 ft. high. Since the fan on the Generator has a capacity of only 70.6 cfm, an external auxiliary fan having a capacity 6 to 8 times greater is used to dilute the phosphine gas stream which is then piped into the aeration system at the bottom of the silo. This enables a concentration of 2000 ppm phosphine to reach the headspace in about 30 to 45 minutes in a filled bin of this size.

With the top of the bin left open, injection of phosphine into the silo was begun at 10:30 a.m. A concentration of 50ppm PH3 was detected in the overhead. The Generator and the auxiliary fan were turned off and the top of the bin sealed at 11:30 a.m. A total of 4 - 850g flasks of Magtoxin Granules were used, equivalent to 1700g of phosphine added to the silo. This is equivalent to a dosage of 38g PH3/1000 cu.ft.

Phosphine readings at four sampling points in the silo were made over a 71 hour period. These readings are given in the Table. With the exception of the peak of the grain and the bottom of the silo, lethal concentrations of phosphine were attained throughout the silo within an hour. More or less uniform concentrations were likely achieved throughout the silo in about 3 to 4 hours during which time diffusion into the overhead, peak and bottom would have occurred.

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FUMIGATION OF A SILO USING THE TURBO-HORN PHOSPHINE GENERATOR/MAGTOXIN GRANULES SYSTEM(1)

Phosphine Concentration in the Silo

Time (hrs.)	Overhead (ppm)	2 M (ppm)	4 M (ppm)	Bottom (ppm)
0.1	0	0	0	>2,000
1	50	0(2)	2,000	2,000
1.5	700	0	2,100	0
23	700	780	800	420
50.5	500	600	650	300
71	500	600	650	300

(1)Silo 24 ft.D x 99 ft.H filled with 36,000 bu. corn. Dosage = 38g PH3/1000 cu.ft.

(2)The 2 meter sampling point was in the peak of the grain and phosphine had just reached the bottom of the peak in about one hour.