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The final report of UNIDO project MP/GEO/02/074
“Phase-out of Methyl Bromide use in Grain and Storage Facilities and Technical Assistance for the Elimination of Methyl Bromide in Mill Facilities, Amendment No.2 to Contract No. 2004/247”

Prepared by Dr. Koba Khutsishvili, Chair person,
Civil Society of Peasants Associations

J-system installation and Demonstration

J-system installation and demonstration was done in the mill "Tavtavi 2003". The size of Silo: diameter - 13,5 meters, height - 13,2 meters up to the basis of a cone, capacity - 1700-1800 tons of a wheat. Here is the drawing where are specified the basic details for realization of fumigation (see Figure 1). As it can be seen on the drawing, Silo has technological air gaps at the basis of a cone. The gap is a necessary component for ventilation of wheat. At the bottom of the Silo the fan is located (see Picture 1) which is blowing air in the heap of a wheat from down and this air leaves

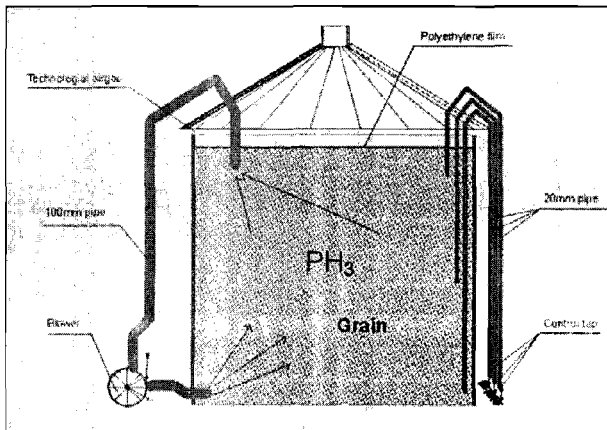


Figure 1

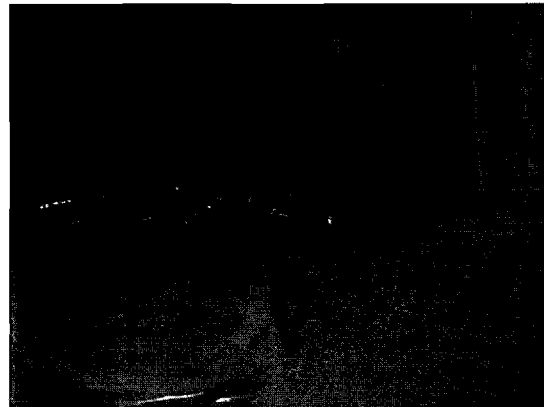


Picture 1

through technological gaps. It is an obstacle for hermetic sealing of wheat during fumigation. Therefore it is necessary to cover a wheat heap in Silo with a polyethylene film, which thickness we have selected 150 microns. The operator who got down from the top of Silo on a special cable with fastenings and did covering of wheat by a polyethylene film. Two people supported the operator in order to prevent a failure of the operator in heap of wheat. It corresponds to the standards of safety.

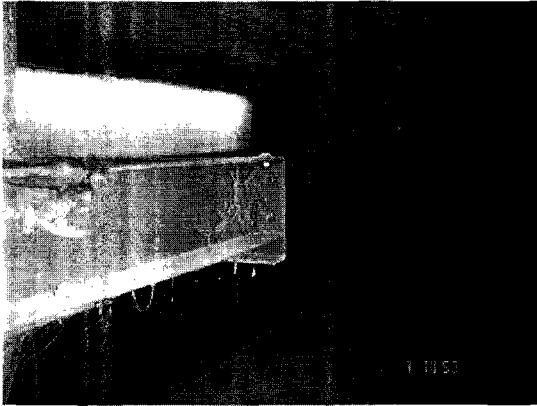


Picture 2

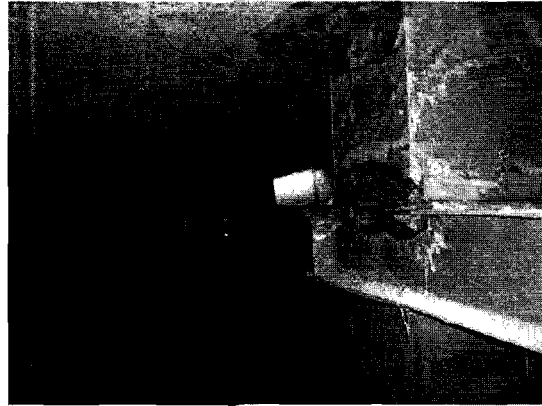


Picture 3

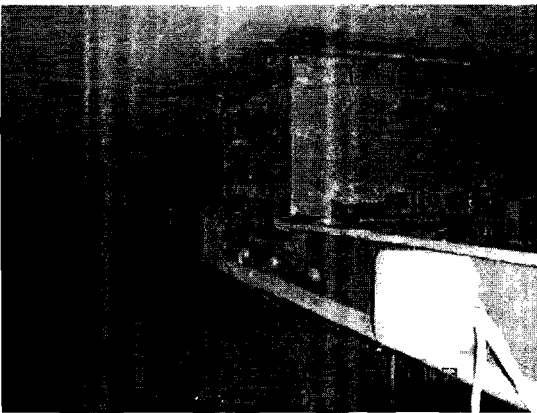
Then the operator installed a PVC pipe (diameter of 100 mm) in a polyethylene film and sealing a polyethylene film (see Pictures 2 and 3). With it a problem of hermetic sealing of wheat heap was arranged. The sealing of transporter of wheat from Silo to mill which is located underground tunnel below the Silo also was done. Here are seven bunkers (outlet) for each Silo and all three Silos have the same tunnel. The fan at the bottom of silo was also sealed (see Pictures 4, 5, 6 and 7).



Picture 4



Picture 5

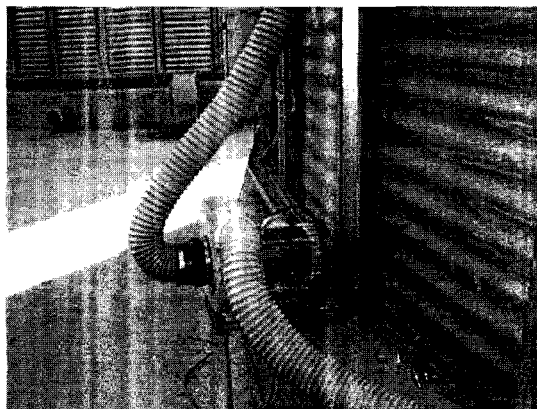


Picture 6

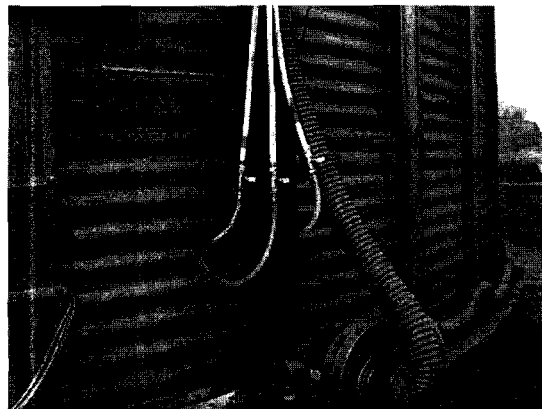


Picture 7

100-mm PVC pipe fasten outside on all height of the Silo and was connected to the Blower. The second outlet of the Blower was connected to an aperture from the fan at the basis of Silo from the external party and the hermetic sealing of hole is done (see Pictures 7, 8 and 9).



Picture 8

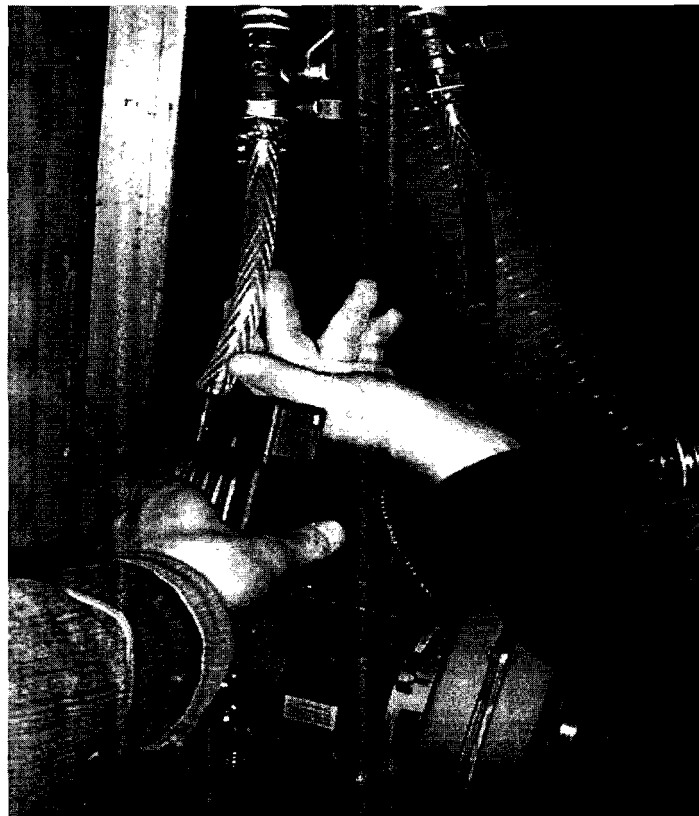


Picture 9

Also three 20-mm pipes at three levels: top, middle and bottom was installed (see Picture 9). So for realization of high quality fumigation the control of gas concentration at three levels was done. On the end of each pipe outside of Silo the tap also was installed. During fumigation the concentration of gas at all three levels was supervised. It gave us an opportunity to determine duration of Blower work before uniform concentration of gas was achieved. All these correspond to the modern requirements (Bremen, Fumigants and Pheromones, Technical Conference. March 2007). In such system the application of Phosphine generator also is possible.

As fumigant the Phostoxin tablets was used (Detia Degesch) 5 tablets 3 gr. each with 1 gr of PH_3 per ton. The operator with a gas mask distributed tablets of Phostoxin under a polyethylene film on edges of this film. After 6 hours Blower was turned on and worked about 20 hours. Then the Blower was switched off before uniform concentration of gas in whole Silo was approached.

The measuring data are the following (fumigation started at 11:00 and Blower started at 15:00) (see Picture 10):



Picture 10

Measuring point: silo head

Days	Time	Approximate concentration of PH ₃ (ppm)
Day 1	15:00	more then 1000
Day 1	21:00	800
Day 2	11:00	650
Day 2	15:00	650
Day 3	17:00	600
Day 3	21:00	600

Measuring point: silo middle

Days	Time	Approximate concentration of PH ₃ (ppm)
Day 1	15:00	--
Day 1	21:00	250
Day 2	11:00	600
Day 2	15:00	600
Day 3	17:00	600
Day 3	21:00	650

Measuring point: silo bottom

Days	Time	Approximate concentration of PH ₃ (ppm)
Day 1	15:00	--
Day 1	21:00	400
Day 2	11:00	700
Day 2	15:00	700
Day 3	17:00	650
Day 3	21:00	700

Institutional activity

In 24-th of October 2008, in the Ministry of Environment Protection and Natural Resources of Georgia within the framework of program “Activities on the performance of the Montreal Protocol obligations in Georgia” in the context of Phase-out of Methyl Bromide the workshop was held.

The workshop was organized by National Ozone Unit and CSP. Experts and specialists from mills, governmental and non-governmental organizations took part in the workshop. There were specialists from the Agro Committee of Parliament of Georgia, from the Ministry of Agriculture of Georgia from Food Safety, Veterinary and Plant Department.

A g e n d a

09:30 Registration of participants

10:00 Welcome address, International obligations of Georgia in the context of Phase-out of Methyl Bromide.

Mr. Noe Megrelishvili, Head of National Ozone Unit

10:45 Regulations of Methyl Bromide usage.

Mr. Iveri Akhalbedashvili, Leading specialist of Parliament of Georgia.

11:15 Insects control.

Dr. Zurab Loladze, IPM Expert, CSP.

11:45 Ozone friendly methods in fumigation.

Dr. Koba Khutsishvili, the project coordinator, CSP.

12:15 Coffee break.

12:45 Discussion, Q/A Session and recommendations.

13:30 Workshop closing.

Workshop was opened by Mr. Noe Megrelishvili, Ozone focal point in Georgia in the Ministry of Environment Protection and Natural Resources of Georgia. He has acquainted the participants with the implementation procedure of Montreal Protocol obligations in Georgia. It was emphasized the importance of the workshop for the realization of the Methyl Bromide Phase-out national plan in Georgia.

Mr. Iveri Akhalbedashvili, Leading specialist of Parliament of Georgia, in he's speech has noted that, with the increasing of wheat growing area it can be also increased Methyl Bromide use in the mills. In the year of 2008 wheat-crops area increased with 20% approximately. Hence it's needed to furtherance of more active promotion of Methyl Bromide alternatives. Wheat-production consumer's legal and moral right protection providing them with high quality products also has to be in progress.



Report about Integrated Pest Management System (IPM) was done by Dr. Zurab Loladze CSP IPM expert. He talks about insects and plant pests widely distributed in Georgia, the damage risks they can cause to grain and the pest control methods. He has mentioned that IPM is not only a pest control method, it is more a new style of working for production quality control.



For more clearance it was shown the scientific film about grain damage and pollution by insects. It was demonstrated possible economic damage coming from insects and high necessity of pest control.

Presentation about Ozone-friendly methods was done by Dr. Koba Khutsishvili, the project coordinator. He has introduced the various methods of application of Methyl Bromide alternatives implemented in Georgia in the context of current UNIDO project. Namely, about successful trials realized in three select mills using Methyl Bromide alternatives.

In two mills, there was used automatic pellet dispenser for distribution of solid Phosphine (Phostoxin tablets) in grain storage concrete silos.

In one mill, where are metallic silos about 2000mt capacity each, it was installed J-system. Recirculation of Phosphine was achieved by using Detia Degesch Blower. It should be noted, that during the fumigation process monitoring of gas concentration at three levels (top, middle and bottom of silo) was done.

At the end of session discussion was held. The opinions were uttered and following recommendations were accepted:

- Towards the end of the 2011 it's possible to phase-out Methyl Bromide in grain storage and mill facilities with electrical and electronic equipment. From 2012 Methyl Bromide usage will be possible only for quarantine purposes;
- It is necessary to have Methyl Bromide and Phosphine residues utilization technologies;
- It is desirable to have a phyto sanitary supervision for wheat-production import/export operations and for mill factories;
- It is advisable to establish more clear legislation for the use of Methyl Bromide and its alternatives to fulfill consumer's legal and moral right protection providing them with high quality wheat-production production.

There was noted, that it is necessarily to continue cogitative, institutional and social work.

List of participants:

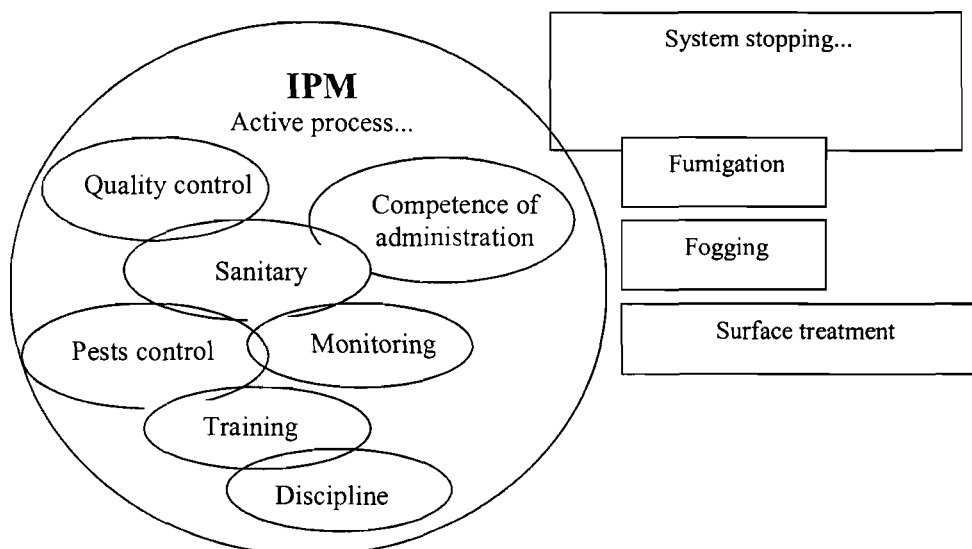
No.	Name	Organization	Position
1	Noe Megrelishvili	Ministry of Environment Protection and Natural Resources of Georgia	Ozone focal point in Georgia
2	Sulkhan Suladze	UNDP	Program Manager
3	Maka Ochigava	UNDP	Program Assistant
4	Zurab Lipartia	Ministry of Agriculture of Georgia	Chief of the Food, Veterinary and Plant (FVP) Department
5	Marina Gvinepadze	Ministry of Agriculture of Georgia	Vice chief of department
6	Nana Chigogidze	Ministry of Agriculture of Georgia	Head of the FVP Phytosanitary Section
7	Otar Skhvitaridze	Ministry of Agriculture of Georgia	Head of the FVP Fumigation Section
8	Irine Tsomaia	Ministry of Agriculture of Georgia	Head of the FVP Pesticides and Agrochemicals Section
9	Iveri Akhalbedashvili	Parliament of Georgia	Leading specialist
10	Zurab Loladze	CSP	IPM Specialist
11	Dr. Koba Khutsishvili	CSP	Project Coordinator
12	Alexander Zaridze	Sami Ltd	Director
13	Teimuraz Gordeladze	Georgian association of Engineers of Refrigerator, Cryogenic and Air Conditioning Systems. Kutaisi Branch	Director
14	Tengiz Tkhlava	Sami Ltd.	Operator
15	Nina Karbelashvili	CSP	Information Manager

16	Alexander Velijanashvili	CSP	Project Assistant
17	Grigol Chikovani	Gordi Ltd.	Director
18	Mikheil Makharashvili	Mill factory Tavitavi 2003 Ltd.	Vice Director
19	Firuz Shiukashvili	Lekson Company	Head of Department

It was done many meetings with mill management and staff about the problems of sanitation, fumigation and product quality improvement. This experience has shown that the usage of IPM causes ambiguous reaction of mill's management and technical staff. In general, they imagined that instead of the Methyl Bromide there should be another chemical with similar effect and even better. Actually, they faced with necessity of work intensification and problems with technical staff depending on this.

Therefore, we had decided to develop wide spectrum training guide for improvement of collaboration and communication between management and technical staff. The program is based on European experience and on the knowledge of our experts.

Main components of training program are:



Graphic scheme of Integrated Pest Management for Grain

Main summary of training program are:

Integrated Pest Management for Grain (IPM)

- What is "IPM"
- Monitoring
- Chemical methods of pest control
- "IPM" in practice

Sanitary

- Construction of building

Suppression of pest intrusion possibility from existing building structures

Mistakes and how to avoid them

Warehousing methods

Sanitation

Documentation

Quality guarantee system

Staff training

Application

Fumigants usage and safety procedures

National legislation

Required equipment and materials for fumigation

Sequence of further works

Phosphine solid compounds and gas

Chemical and other facilities

Available forms of solid Phosphine

Main rules for Phosphine usage

Resistance control

Phosphine gas generator

Function of generator

Generator safety behavior

Usage of generator

Advantages

Cylinderized Phosphine

History

Mixed Phosphine

Comparison with solid Phosphine characteristics

Application

Potential of these techniques

Advantages and disadvantages

Automatic dispenser

Function and usage of automatic dispenser (tablets/pellets)

Preparing of silo

Aeration and removal of residues of solid Phosphine

Recirculation system (J-system)

Required and necessary materials

Installation of the system

Usage of fumigant

Monitoring and safety rules

Aeration

Sulfur fluoride

Description

Specific activities of Sulfur fluoride

Parameters usage and registration

Specific methods of usage

Determination of gas concentration

Staff safety

Low concentration Phosphine, CO₂ and heat

History

Characteristics of technology components

Practical application

Corrosion control

Efficacy and cost estimation

Training-guide will be published as book illustrated with color photos and presentation in PowerPoint and Flash will be prepared also. We schedule to carry out several workshops and seminars with existing materials.

At present we have agreement with mill "Tavtavi 2003" Ltd to carry out demonstration of sanitation + fogging with insecticide.

Fogging device will be the following (see pic. 1)



Pic. 1

With each of such device 116 cub.m. can be fumigated with 1 L of insecticide. Also foresighted that this device can spray the insecticide for 20-25 meters. In our case length is 60 m. and we will use three devices. We think to use synthetic Piretroid, namely Deltametrin.

Also we have arrangement to do trials with low concentration Phosphine (100pm) + natural heat in Kachreti mill "Mkatatve" Ltd. It will be needed to remove all electronic equipment from building. In this case we need 35-40°C during the day and at least 25-30°C during the night. Such conditions in Georgia may be only at the end of July and at the beginning of August.

Also it is needed to be mentioned the following conditions: above mentioned method - low concentration Phosphine (100pm) + natural heat has negative side. This is very small timeframe from the end of July till the middle of August. Most of mills, depending on various commercial and objective reasons can't stop at this time.

Comments

It should be noted, that the certain number of mills coming from the old traditions, when they used MB, even nowadays prefer to use gas and wonder that this gas has to have the efficiency like MB. As is well-known the significant advantage of MB is the fact that there is no need to evacuate or protect electro and electronic equipment and also short time of exposition. This fact cannot be extended to Phosphine.

As a rule, the mills used to do fumigation one time in year and mainly in July and August. Another factor established here is that the gas fumigation is universal and gives warranty for one year without serious increasing of the number of insects. This psychological factor works up today. Usually, management of the mills is not interested in time schedule of fumigation and in chemical it should be used. They settle a budget for fumigation and only interest is that the fumigation has to be done one time in year.

Coming from the above mentioned, we conclude, that using only solid form of the Phosphine is not desirable. Also, from the other hand it is a National Program and there is a need to have various methods for fumigation.

As it was mentioned in training guide Cylinderized Phosphine can be one of the perspective alternative of Methyl Bromide. The most famous are FRISIN and ECOFUME which are the mixture of PH₃ and Nitrogen and PH₃ and Carbon Dioxide consequently. Cylinderized Phosphine can be used almost in the style of Methyl Bromide. It's more safety, because of high pressure balloons are outside and gas delivering is done by pipes into the building. The efficiency of Cylinderized Phosphine practically is the same as Methyl Bromide and we hope that there has not to be the copper corrosion. However, it must be mentioned that this chemicals have high-cost. Also, the State registration of these chemicals is required. Another problem is that the empty cylinders (60kg each) must be returned to producer for to refill them again. In whole world there is restricted quantity of PH₃ cylinders and it costs around 600USD.

Activity

All of above mentioned conditioned our search for cheaper and suitable for local conditions MB alternatives outwardly similar to MB.

Finally in cooperation with the UNIDO officers involved in the project implementation, with Mrs. Rodica Morohoi and Mr. Riccardo Savigliano we agreed to purchase Phosphine gas generator. Given equipment can produce Phosphine gas from the solid forms of Phosphine directly on the site before the fumigation process. The solid forms of Phosphine are registered in the country and are

not so expensive. Founded out generator has also big advantage because it can mix generated gas of Phosphine with CO₂ in proportion 2% of Phosphine + 98% of CO₂. Also high performance of working mixture of gas allow us to fumigate big mill in short time. Thanking such features we can provide Phosphine concentration at 100ppm level. This avoids the problem electro and electronic equipment evacuation or their protection (covering with gas tight sheets). Also it solves psychological problems: we have again gas, which can thoroughly fumigate mill. However, comparatively long time of exposition is still stayed.

Now intensive work for purchasing and delivering gas generator to Georgia is in progress by UNIDO. It should be noted, that size and weight of this generator makes possible to transport it to site easily. This is most significant advantage. At the site we need also CO₂ balloons. We think that it is not a difficult task.

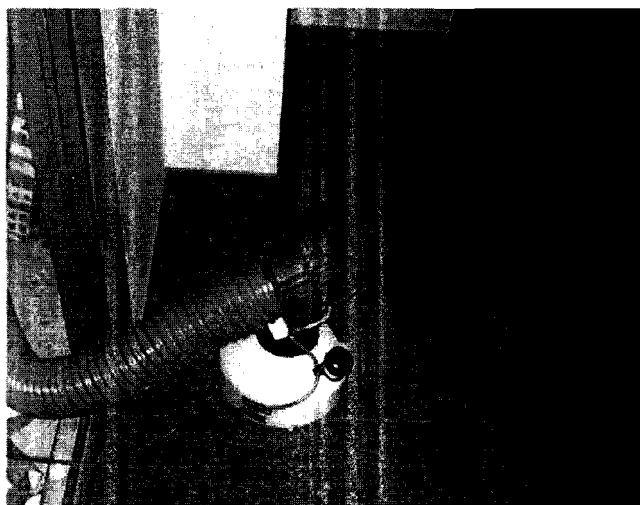
Regarding to avoid a long time exposition it is option to use insecticide fogging. In this case small equipment – foggers (Aniliator) will be used. This equipment was purchased by UNIDO earlier. Demonstration of this method was done at “Tavtavi 2003” mill.



Approximately of 116m³ volume was processed with phosphoroorganic insecticide “Actellic”. Because of small amount of foggers there was spent one day for fogging. During demonstration high density of fog was reached.



During this process it was identified that is preferable to implement fresh air intake from outside using 100mm diameter pipes.



The most preferable advantage of this method is:

1. Short time of process
2. No interference with normal functioning of mill (e.g. weekend), when the mill normally is stopped
3. No need of hermetization (sealing), which sharply reduces expenses and time

Only disadvantage of fogging can be that it needs to be processed more frequently than fumigation with gas.

According our assessment fogging several times per year will be cheaper than one fumigation with gas.

It seems to be good solution to make gas fumigation once per 2-3 years and in between period several times of fogging per year.

In activities it has to be mentioned study tour in Italy, in Molise University with prof. Pasquale Trematerra hosting. The tour was organized thanking on the efforts of the above mentioned UNIDO officers. As one of the result of this tour, we think that scientists cooperation in fumigation process for solving the problem of sanitary and hygienic standards is very attractive on this way. It has to be mentioned such expression as "exact fumigation", which means exact diagnostic of infection and exact time of fumigation. We hope that it can lead us to avoid "blind" usage of high dosage of chemicals, which is important for the evolution environmentally friendly methods of fumigation.

During study-tour several visits to fumigation companies were done. In discussions it was arisen one more possible fumigation method. Namely, Phosphine tablets + so called "dry ice", which produce CO₂ after melting. However, it have to be mentioned that in structures with electric and electronic equipment it is not easy task to calculate exact dosage of "dry ice" and Phosphine tablets to get 100ppm Phosphine concentration + 98% CO₂. Agreement for the information exchange in future is done.

At the end it should be mentioned that the following results were reached:

1. Clear idea about the fumigation methods to be used in Georgia depending on the local conditions, traditions and human factor is established
2. Automatic pellet dispenser and J-system were demonstrated in silos with gas concentration monitoring system
3. Insecticide fog application was demonstrated
4. Phosphine gas generator purchasing and delivering to Georgia is in progress
5. International relations for the future elaboration for fumigation technologies were established