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Objectives:

To create an awareness of the problems associated with the handling and storage of grain and cereal foods. Throughout the seminar the comments were directed to storage and handling at port and warehouse levels. Although information on village and farm storage was not included since a seminar on that topic was scheduled for the Sahel area during December of 1974, it was a recommendation of the attendees that this topic be covered in future seminars.

To enumerate the quality control procedures that are available to determine the safety and nutritional value of food.

To review the research and development of specialized packaging materials and handling procedures.

To illustrate the problems and conditions that could contribute to the deterioration of foods.

To demonstrate the methods, equipment and chemicals that are presently available to aid in the reduction of food losses.

To instill a desire to improve food storage conditions and handling practices.

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SEMINAR IN

FOOD STORAGE AND HANDLING PRACTICES

DAKAR, SENEGAL

November 4-8, 1974

Co-sponsored by the Office of Food For Peace
and the
Office of Nutrition with the Office of Agriculture,
Technical Assistance Bureau of the
Agency for International Development
Washington, D.C.

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FOOD STORAGE AND HANDLING PRACTICES

DAKAR, SENEGAL
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OBJECTIVES

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PROCEDURES

SEMINAR HEADQUARTERS — Hotel Teranga, Dakar, Senegal.

REGISTRATION — Starting on November 2 and continuing through November 7.

THE PROGRAM — The seminar combined lectures and demonstrations. During the first three days of the seminar the mornings were devoted to lectures and the afternoons to demonstrations of the procedures that were discussed in the morning. On the fourth day there was a field trip in the morning and a panel discussion in the afternoon.

SEMINAR INSTRUCTORS — The agenda and illustrated material were prepared and presented by the following four persons. Many others contributed to the program and we have listed their names at the appropriate place in this report. We realize that a number of other persons also contributed in the preparation of materials prior to and during the seminar. The omission of their names does not mean to imply that their assistance was not appreciated. Without such fine cooperation and teamwork the seminar would not have been successful. The Agency for International Development realizes this, but also wishes to acknowledge special appreciation for the efforts of the following four gentlemen:

Dr. Samuel M. Weisberg, Executive Director
(Biochemist and Food Technologist)
League for International Food Education (LIFE)
1155 Sixteenth St., N.W.
Washington, D.C. 20036

William H. Schoenherr, Vice President
(Entomologist and Program Specialist)
Lauhoff Grain Company
P.O. Box 571
Danville, Illinois 61832

Donald A. Wilbur, Jr., President
(Consultant and Festicide Specialist)
The Industrial Fumigant Company
923 State Line Ave.
Kansas City, Missouri 64101

Dr. Henry A. Highland, Research Entomologist
(Entomologist and Packaging Specialist)
United States Department of Agriculture
P.O. Box 5125
Savannah, Georgia 31403

ACKNOWLEDGEMENTS

The following companies or individuals contributed to the lectures and demonstrations. Without their assistance and the equipment and chemicals they furnished, the demonstrations would not have been as meaningful. The warehouse space, chemicals, equipment and labor were furnished at no cost.

Mr. Paul Lanoe
Socopao Senegal
47, Av. Albert Sarraut
Dakar

Mr. J. Glacer
38, rue Mohamed U
x Jules-Ferry
Dakar

Mr. Malick Leye
Chimie Afrique
11, Au Jean Jaures
Dakar

Mrs. M. Basse
Institute de Technologie Alimentaire
Route de Peres Maristes
Dakar

The United States Department of State furnished two translators, Mr. Alex Toumayan and Mrs. Stephanie van Reigersberg. They were excellent and with most of the attendees speaking French, their instantaneous translation was an important and necessary part of the seminar.

DAKAR SEMINAR HANDOUT MATERIALS

The companies listed below furnished literature for distribution at the seminar. A total of 275 pages were distributed to each attendee. The literature represented some of the chemicals and equipment that is available to aid in the control of insects, rodents and birds in warehouses and grain storage facilities. The presentation of this material is not an endorsement of the chemicals or equipment. It was the intent to indicate the type of materials available.

Dow Chemical Company
Midland, Michigan 48640
product: Dursban
purpose: insect control
language: French & English

McLaughlin Gormley King Company (MGK)
8810 Tenth Avenue N.
Minneapolis, Minnesota 55427
product: MGK 264
purpose: insect control
language: English

CIBA - GEIGY Corporation
Greensboro, North Carolina 27409
product: Diazanone (4E & 4S)
purpose: insect control
language: English

Virginia Chemical Company
3340 W. Norfolk Road
Portsmouth, Virginia 23703
product: Lethalaire
purpose: insect control
language: English

(Perma-Guard) Bower Industries
P.O. Box 21024
1701 E. Elwood Street
Phoenix, Arizona 85036
product: Perma-guard
purpose: insect control (dust)
language: English

Chemagro Company
Kansas City, Missouri 64120
product: Baygon
purpose: insect control
language: English

Phostoxin Sales, Inc.
Southdale Office Centre
6800 France Avenue South, Suite 665
Minneapolis, Minnesota 55435
product(s): 1. Phostoxin 2. Auer tester
purpose(s): 1. fumigant for insect control
2. Safety
language: French & English

Degesch
Postfach 2644
D6 Frankfurt AM Main 1
Germany
product: Phostoxin, methyl bromide
purpose: fumigation
language: French

Spraying Systems Company
3201 Randolph Street
Bellwood, Illinois 60104
product: spraying equipment
purpose: insect control
language: English

The Industrial Fumigant Company
923 State Line
Kansas City, Missouri 64101
product: spot application equipment
purpose: insect control
language: English

Micro-Gen Corporation
4438 Centerview Road
San Antonio, Texas 78228
product: Micro-Gen application equipment
purpose: insect control
language: English & French

Electronics for Industry, Inc.
6780 S.W. 131st Street
Miami, Florida 33156
product: Rat-I-Cator
purpose: rodent control
language: English & French

Chempar Chemical Company
260 Madison Avenue
New York, N.Y. 10016
product: Rosol
purpose: rodent control
language: English

Kness Manufacturing Company
Albia, Iowa
product: Ketch-all traps
purpose: rodent control
language: English

Solvit Chemical Company
7001 Raymond Road
Madison, Wisconsin 53713
product: metal feeding stations
purpose: rodent control
langauge: English

Rid-A-Bird, Inc.
Box 22
Muscatine, Iowa 52761
product: perches
purpose: bird control
language: English

Avitrol Corporation
P.O. Box 45141
Tulsa, Oklahoma 74145
product: Avitrol
purpose: bird control
language: English

Bernz-O-Matic
740 Driving Park Avenue
Rochester, New York 14613
product: Halide leak detector
purpose: safety
language: English

Mine Safety Appliances Company
International Division
201 Penn Central Boulevard
Pittsburgh, Pennsylvania 15235
product: gas masks
purpose: safety
language: English

St. Regis Paper Company
West Nyack Road
West Nyack, New York 10994
product: sealer closing equipment for multi-wall paper bags
language: English

SEMINAR

IN

FOOD STORAGE AND HANDLING PRACTICES

Dakar, Senegal

November 4-8, 1974

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MONDAY, NOVEMBER 4

08:30 - 09:30 Call to Order by James A. Maher, Food for Peace Officer, USAID, Chairman of Seminar

Opening of Seminar by the Honorable Rudolph Aggrey, United States Ambassador to Senegal

Welcoming address by Mr. Saliou Sarr, Director General of ONCAD

Review of Food Shortages and Losses; Objectives of the Seminar by Peggy A. Sheehan, Chief, Program Operations Division, Office of Food For Peace, AID/Washington.

Introduction of Seminar Staff by Mr. Maher.

09:30 - 12:30 *LECTURES*

(1) How to Extend the World's Food Supply Through Improved Packaging Storage and Handling (8 mm film) — William H. Schoenherr.

COFFEE BREAK (15 minutes)

(2) Quality Assurance Programs in the United States — William H. Schoenherr.

(3) Fumigation Procedures — Donald A. Wilbur.
"The Enemy With-in" (16 mm film: Fumigation with Phostoxin)

LUNCH BREAK

AFTERNOON

14:30 Buses Depart from Hotel Teranga

15:00 - 17:00 *Visit to CIED Warehouse. Dakar Port.*

I. Proper Procedures Prior to Fumigation
   a) Clean
   b) Spray (with approved insecticide)
   c) Stack
   d) Cover (gas tight tarp)

II. Demonstrate Proper Fumigation
   a) Methyl Bromide
      Monitor (Halide Detector)
   b) Phostoxin (Chimie Afrique, Dakar, Senegal)
      Monitor, (Auer Gas Detector)

17:00 Buses Return to Hotel

TUESDAY, NOVEMBER 5

08:30 - 12:30 *LECTURES*

(4) Rodent Control — D. Wilbur

(5) Insect Pests of Processed Cereals and Bagged Grain — Henry A. Highland.

COFFEE BREAK (15 minutes)

(6) Application of Insecticide Sprays and Fogs — D. Wilbur

(7) Types of Damage to Packaged Food Commodities — W. Schoenherr.

LUNCH BREAK

AFTERNOON

14:30 Buses Depart from Hotel Teranga

15:00 - 17:00 *Visit to CIED Warehouse. Dakar Port.*

I. Cleaning Techniques

II. Application of Insecticides
- a) Sprayer
- b) Foggers
  1. SOCIETE D'ETUDES D'APPLICATIONS CHIMIQUES (S.E.A.C.)
     - Wet Fog
     - Smoke Fog
  2. Staff
     - Ultra Low Volume (ULV)
- c) Dust (Diatomaceous Earth)

III. Rodent Control
- a) Tracking Powder
- b) Other methods

IV. Monitor Fumigation

17:00 Buses Return to Hotel

WEDNESDAY, NOVEMBER 6

08:30 - 12:30 *LECTURES*

(8) Protection of Packaged Commodities from Insects — H. Highland

(9) Typical Movement of Commodities in Overseas Programs — W. Schoenherr

COFFEE BREAK (15 minutes)

(10) Warehouse Construction as it Relates to Sanitation — W. Schoenherr

(11) Inspection of a Warehouse — D. Wilbur

LUNCH BREAK

AFTERNOON

14:30 Buses Depart from Hotel Teranga

15:00 - 17:00 *Visit to CIED Warehouse, Dakar Port.*

I. Completion of Fumigation
   a) Open Stacks
   b) Inspect for Results

II. Demonstration of Proper Sampling Techniques

III. Warehouse Inspection

17:00 Buses Return to Hotel

THURSDAY, NOVEMBER 7

07:30 Buses Depart from Hotel

09:00 - 11:00 *Visit to Thies: Demonstration of Fumigation with methyl bromide by Recirculation,* conducted by ONCAD

11:00 Buses Return to Dakar

AFTERNOON

15:00 - 17:00 *Panel Discussions by Staff and Guests* (Questions from attendees)

Closing Statements by Chairman Maher, the Attendees and the Instructors

EVENING

Reception offered by SOCOPAO at Village de Yoff.

FRIDAY, NOVEMBER 8

SEMINAR STAFF AVAILABLE FOR DISCUSSIONS OF SPECIFIC PROBLEMS WITH ATTENDEES.

ATTENDEES

DAKAR, SENEGAL

November 4-8, 1974

COUNTRY	*NAME*	*POSITION*
IVORY COAST		
	B. Gauchou	Chef de Magasin, SOCOPAO
	Djessou ADOH	Officier du Port d'Abidjan
	Ram ARAZI	Expert en Logistique
	Andre BALMA	Directeur d'Exploitation de la RAN
	Philippe BARTH	Fonde de Pouvoir de la SOCOPAO
	Michel DAMY	Chef de Manutention
	Henry HERVE	Fonde de Pouvoir de la SOCOPAO
	Charles KOKRA	Commandant Adjoint du Port de Abidjan
	Anthony ROSSIGNOL	Controleur de Gestion
	E. W. Moore	Regional FFP Coordinator
DAHOMEY		
	Marcel ASSOGBA	Chef de Region — SONADER
	Prosper DJIDJOHO	Directeur General ODAMAP
	Corneille EDOH COFFI	Directeur General SACUTRA
	Keith Williams	Expedite — USAID
UPPER VOLTA		
	Pierre GUIGUEMBE	Chef de Division — CILSS
	Dakisse MARE	Magasinier — CRS Ouagadougou
	Seraphin NAON	Controleur Reginal — Ouagadougou
	Remy SOME	Chef Magasinier — OFNACER
	Thomas KELLY	Directeur CRS Ouagadougou
MALI		
	Bakary CAMARA	Inspecteur OPAM
	Thiemoko COULIBALY	Depute — Director IOPAM
	Mamadou KEITA	Inspecteur Regional — OPAM
	Boubacar TRAORE	Chef — Division Commerciale OPAM
	Samba TRAORE	Intendance Militaire
	Nambala KONE	Inspecteur Regional OPAM — GAO
	Mohamed SYLLA	Conseiller Technique du Ministere du Commerce
MOROCCO		
	Lawrence FLYNN	FFPO/USAID
	Assoui GUEZNAI	Transitaire du Port de Tanger
	Mohamed JAIDI	Transitaire au Port de Casablanca
	Lee SANBORN	CRS — Directeur

COUNTRY	*NAME*	*POSITION*
MAURITANIA		
	Ould Baha	
	Ahmed IBABIM	Chef de Magasin SOMACAT
	Ould H'Meida MAHFOUD	Chef de Section — SOMACAT
NEW YORK		
	Edward KINNEY	Directeur du CRS
ETHIOPIA		
	Cmdr. Feleke	Logistics Officer, R & R
	Major Mulushewa	Storage Officer
	Ato Mekuria	Silo Engineer
NIGER		
	Paul PERRON	Conseiller en Formation
	Djibo MAILAFIA	Directeur d'Exploitation OPVN
	Saidou Kimba CISSE	Controleur OPVN Zinder
	Ide WADIBI	Controleur OPVN Dosso
	Boubacar MAAZOU	Controleu OPVN Niamey
	Ide MAIFADA	Controleur OPVN Tahoua
	Jack SOLDATE	Directeur de la Mission CARE
NIGERIA		
	Henri-Luc SIMON	Directeur — Adjoint de l'Agence TRANSCAP
	George CLYTSIS	Directeur General "Southern Star Shipping Co."
	Robert LINDER	Directeur CARE
ROME (NATIONS UNIS — FAO)		
	Trevor PAGE	Chief Logistics Officer OSRO
R.C.A.		
	Louis Bekamba	Co-Director WFP Project
	Charles Yanganda Devreux	Chef du Service Min. Education
SIERRA LEONE		
	Phillip Johnston	Directeur de la Mission CARE
	A.S. Dian TURAY	Chef Assistant en Agriculture
GHANA		
	Lynn MARSHALL	Directeur CRS Accra Nort
TCHAD		
	Peter REITZ	Directeur de CARE-CHAD
TOGO		
	Joseph ANYINEFA	Chef Debarcadere
	Remy HOLONOU	Surveillant CRS
	Kossi AGBOLI	Transitaire Magasinier

COUNTRY	*NAME*	*POSITION*
TUNISIA		
	Bamri Naceur	Deputy Dir. N.C.S.S.
	Moncef Achour	Warehouse Manager N.C.S.S.
SENEGAL		
	Moise SAGNA	Coordinateur des Equipes Nationales de traitement/ONCAI
	Sayfour BALL	Responsable de la qualite — THIES/ONCAD
	Papa Demba SARR	Responsable de la qualite — ONCAD Sine-Saloum
	Mademba DIAGNE	Responsable de la qualite — ONCAD Senegal-Oriental
	Guillaume DIOUF	Agent pour les cereales — ONCAD
	GARCONNET	Sous-Directeur SOAEM Dakar
	DELBOSE	Assistant Technique — IRHO Dakar
	HANDANE	Responsable du Service des Semences SODEVA
	CHEVILLOTTE Roger	Directeur General S.S.E.P.C.
	Moussa DIOP	Charge des relations techniques SSEPC
	Monsieur HERBER	Ambassade du CANADA
	Knud Christensen	Representant de l'UNICEF
	Ray Panczyk	Director, CRS/Dakar
UNITED STATES (Instructors)		
	Henry A. HIGHLAND	Entomologist with USDA, Savannah, Georgia
	William H. SCHOENHERR	Vice President of the LAUHOFF Grain Company, Danville Illinois
	Don A. WILBUR, JR.	President "The Industrial Fumigant Company", KANSAS City, Missouri
AID/WASHINGTON — Staff		
	Peggy A. Sheehan	Chief Program Operations Division, OFFP
	J. R. JOHNSON	Program Operations Division, OFFP
	James KELLY	Sahel Operations
AID/DAKAR — Staff		
	Norman Schoonover	Regional Development Officer/AID
	James A. MAHER	Food For Peace Officer
	George G. WOOD	Food For Peace Officer
	Robert FISHBEIN	
	Edmund SULLIVAN	
	Julia OWEN	
	Sally FENSTERMACHER	
	Leila DUSSAUT	
TRANSLATORS		
	Stephanie Van Reigersburg	U.S. State Department
	Alec Toumayan	U.S. State Department

Address by The Honorable Ambassador Rudolph Aggrey

SPEECH OPENING THE FOOD STORAGE SEMINAR

DAKAR, NOVEMBER 4, 1974

I am most pleased to be with you this morning to see the opening of this seminar on food storage practices, which has been made possible through the joint sponsorship of the Ministry of Rural Development of Senegal and the U.S. Agency for International Development. I know many of you have traveled long distances to be here and you did not come to listen to speeches, so I'll be brief.

On behalf of the United States Government, I want you to know how much we appreciate your valuable time and effort in attending these sessions. My government attaches a great deal of importance to proper techniques for bulk storage of cereals, and it is easy to understand the reasons.

As we meet in Dakar, the World Food Conference is about to begin in Rome to study ways to assure adequate nourishment for the earth's growing population. The United States is fortunate to be one of those nations which can produce and export food beyond the needs of our own people. But even this year the amount our farmers expected to grow was reduced by the effects of drought in our agricultural states. We know we can not expect each year's crop to fulfill the demand, and that we need a buffer between the lean and abundant years. For this reason, the United States will be backing a proposal in Rome to form a world stockpile of food reserves as a cushion between supply and demand. However, in order for such a plan to be successful, we must perfect our methods of transportation, handling, storage and distribution to insure that the food we are able to produce reaches the consumer with the least possible loss. For economists, agronomists and demographers are agreed that there is no food to waste, and that the productive capacity of all our economies will be severely tested in the coming years.

We hope this week's sessions will generate an understanding of the best methods of storing cereals under the kinds of conditions encountered in Africa. This would be a significant contribution to the world-wide goal of having food available when and where it is needed.

In that spirit I bid you welcome to the seminar, and wish you great success in applying the techniques you will be discussing here.

Address of Mr. Sallou Sarr
Director General of ONCAD

UNOFFICIAL TRANSLATION

OPENING SPEECH

Ladies and Gentlemen:

This seminar that I have the honor and pleasure to open today offers me the opportunity to restate the interest the Senegalese Government takes in training programs.

On the other hand, the Government of Senegal, always faithful to its tradition of welcome, has the honor of hosting the seminar.

For the General Director of ONCAD, in charge of the marketing of agricultural products and training in rural areas, this occasion represents additional promise.

For a number of years the fight against malnutrition in underdeveloped and developing countries has been a topic of the day. These efforts are all the more important because the situation is aggravated by the fact that in most of these countries, food production increases less rapidly than population.

To this end, two priority objectives have been proposed.

Steps must be taken therefore to first increase food production to fight against under-nutrition and secondly to diversify food production to combat malnutrition.

It is towards these two goals that our efforts are directed in Agronomic Research.

But it would be useless to increase our production by better cultivation practices, better seeds, improved machinery, and to fight against disease and crop depredators if the food harvested could not be kept under good storage conditions. Several studies have demonstrated the inefficacy of the present storage means, especially at the producer level. Based on the latest FAO statistics, weight losses may reach 8 to 10% over a few month period in the most optimistic of views, not including the deterioration in the quality of the harvested products.

Thus, conscious of the seriousness of the dangers which threaten food products which must be stored under the best conditions, my Government has a particular interest in this seminar on Food Storage and Handling Practices for harvested products, organized by the Ministry of the Rural Development and A.I.D.

Therefore, I wish to confirm that my Government will do its utmost to assure the success of this seminar.

It is for this reason that ONCAD which is in charge of food storage has assigned five of its most competent officials to participate in this seminar whose subject deals with our own preoccupation in the field of grain storage.

The theoretical and practical courses offered are:

Theory

- Food shortages and losses at the world level
- The program control standards adopted in the U.S. for converted cereals and grain in sacks.
- Fumigation methods
- Parasitic insects affecting converted cereals and grains in sacks
- Foreign programs for dispatching types of food supplies
- Insecticide use by Pulverization and vaporization
- Protection of packed food against insects
- • Insecticide use by pulverization and vaporization
- Protection of packed food against insects
- Fight against rodents
- Construction of hygienic warehouses
- Packed food: Storage and Handling Practices

Practice:

- Warehouse demonstrations
  - Fumigation
  - Pulverization and vaporization of insecticides
  - Protection against rodents
- Discussions
- Questions and answers by the participants in the Seminar.

SPEECH AT FOOD STORAGE SEMINAR, DAKAR, SENEGAL

November 4-8, 1974

By Ms. Peggy A. Sheehan, Chief, Program Operations Division
Office of Food For Peace, AID/Washington

I'm sure that everyone in this room is acutely aware of the worldwide shortage of food. As we meet here today, world leaders are enroute to Rome for the World Food Conference to discuss this problem.

What can be done to solve the problem of food shortages? Our first response is to grow more food. But what about the protection and conservation of food that is already being produced? Experts estimate that 200 million tons of grain is destroyed each year by insects, molds, rodents, birds and other pests. This is enough grain to feed one billion people a year. Think about that — one billion people. FAO also estimates that 55 million Africans could be fed for one year from food being consumed by rats, insects, etc.

Food losses occur at all stages in the food delivery chain — in the fields, in transport and in warehouses.

We cannot explore all of these problems at one conference, but one area where the members of this conference can make an impact on the food crisis is in the area of food handling and storage. Over $2 billion worth of grain is lost each year in storage and in transit.

With this in mind, let me outline the goals of the seminar:

1. To create an awareness of the problems associated with the handling and storage of grain and cereal foods.
2. To illustrate quality control procedures that are available to ensure the safety and nutritional value of food.
3. To review the research and development of specialized packaging materials and handling procedures.
4. To recognize the problems or conditions that contribute to deterioration of foods by insects, rodents and moistures.
5. To acquaint you with the methods and tools that are available to prevent or correct problems.

Hopefully you can use this information to:

1. Institute your own sanitation and pest control programs.
2. Obtain the services of commercial pest control firms where available.
3. Examine the effectiveness of the control programs.
4. Teach the sanitation and control measures to the personnel of these attendees organizations.

Our program combines lectures, visual aids and demonstrations. The demonstrations each afternoon, will relate to the subjects discussed during the morning, and are a vital part of the seminar.

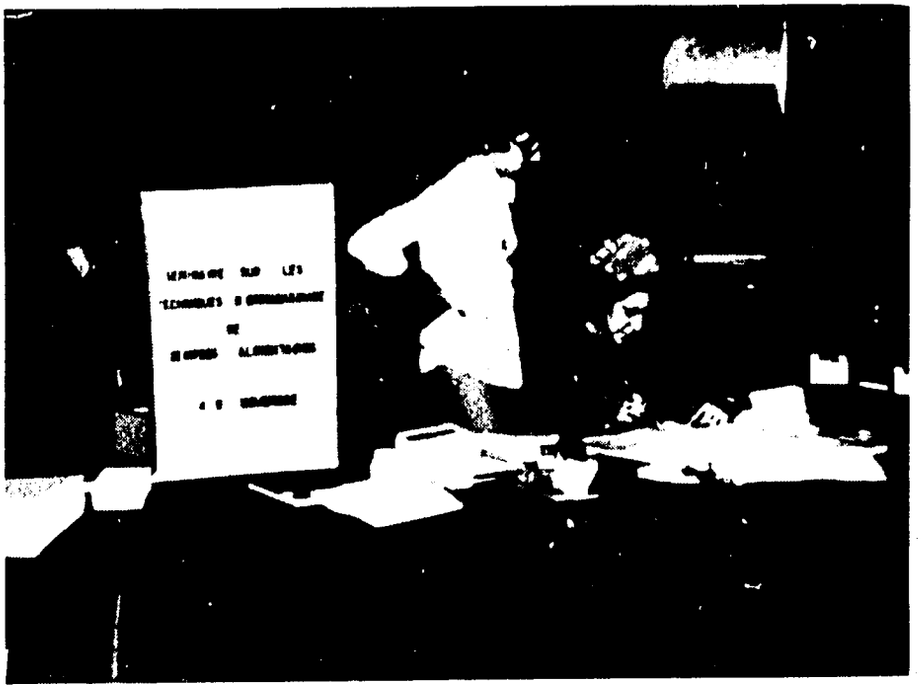
Thank you for your attention.

SEMINAR HEADQUARTERS
Hotel Teranga — Dakar

The meeting room was excellent for classroom type seating. The acoustics were good. No public address system with loud speakers was used since there was instantaneous translation. About half of the attendees spoke and understood only French. About one-third of the attendees spoke only English. The remainder were bilingual in French and English.

Each attendee was given a loose-leaf binder containing 275 pages of descriptive and illustrated information pertinent to the subjects covered during the seminar. The binder also included 20 ruled pages for notes. A total of 100 copies were distributed.

At the close of the seminar when the Certificates of Attendance were presented, each attendee was also given a small battery powered magnifier. This was to help them to recognize some of the forms of spoilage that can occur in grain and food. These were called to their attention during the lectures and warehouse demonstrations.



Registration desk in the lobby of the Hotel Teranga. US/AID Dakar office staffed the desk November 2 through 8.

Mr. James A. Maher, Chairman of the Dakar Seminar

Opening of the Seminar from left to right: Dr. H. A. Highland and D. A. Wilbur, Jr. (seminar staff), Director General of ONCAD Saliou Sarr, The Honorable Ambassador Rudolph Aggrey and Norman Schoonover, the Regional Development Offices, USAID/Dakar

The seating arrangement provided adequate space for taking notes and placement of the battery powered translation receiving devices.

All sessions were well attended and included representation from 15 African countries, the United Nations and United States Voluntary Agencies.

The discussions continued during the breaks between lectures
From left: Mr. J. R. Johnson (Program Operations Division, Office of Food for Peace USAID/Washington), Dr. H. A. Highland (Seminar Staff), Edmund Sullivan (Ex Peace Corps assigned to seminar), Stephanie Van Reigersberg (U.S. State Department — Translator)

FUMIGATION
November 4

It is difficult to store grain and dry foods in the temperate and tropical parts of the world without an insect problem developing. Long periods of storage increases the potential of spoilage caused by insects. Multiple handling of the commodities, inadequate storage facilities and the packaging materials all contribute to the problem. We should assume that the ideal conditions of handling, storage and packaging will not exist in most parts of the world where food is stored.

An insect free commodity placed in an insect proof package could be the objective, however such a package or container would cost more than the food to be placed into it. The multi-wall paper bag that is in use for some commodities will give adequate protection against moisture and invasion by insects as long as the closure remains intact and the body of the bag is not punctured. It is realized that the special paper bag is not available in all parts of the world. Therefore, jute, cotton, woven plastic and other materials are commonly used. Most of these give little protection against either moisture or insects.

Temperature during storage can prevent or at least reduce the insect problem. Above 100°F. or 38°C. most insects will not be a problem, unfortunately it is difficult to attain this range of temperature throughout a pile of grain or a stack of bags. If extremely high temperature is reached, all insects and some micro-biological contamination would be killed, however there would also be loss of nutritional values, especially the vitamins. Small amounts of grain or dry food can be exposed to the sun for a few hours and the temperature should correct the insect problem, however it is realized this is not practical for a large volume of material.

Storage at low temperature can also prevent an insect problem. Insect activity is slow below 60°F. or 16°C. A temperature of 32°F. or 0°C. for a prolonged period will kill most insects. Again it is realized that refrigerated storage facilities are not readily available. As in the case with high temperature, the chill must go throughout the material being treated to receive full benefit.

A time-tested method of killing insects in bulk grain or packaged commodities is with fumigation. Considerable emphasis was placed on this procedure during both the lecture and demonstration at the Dakar seminar.

The purpose of a fumigation is to destroy all stages of insect development that are present in the material to be treated. An atmosphere that is toxic to insects would also kill rodents or other forms of animal life. Fumigation, as described here, will not eliminate mold or bacteria. There is no residual kill, therefore insects or rodents may recontaminate the grain or commodity immediately after fumigation. This is one of the reasons for the placing of so much emphasis on cleaning and the use of sprays and insecticide fogs.

There are ten conditions to be considered in order to conduct a safe and beneficial fumigation:

1. *Temperature.* Best results should be obtained when the temperature is above 70°F. or 21°C. This is the grain or commodity temperature, however this should not be a problem in the warmer parts of the world. The label on the formulation selected should give the dosage and time exosure recommendations relative to temperature.

2. *Tarpaulin.* Bulk materials in a tight bin or bagged or bulk materials in a well constructed building may not require the use of a tarpaulin. The purpose of the tarpaulin is to form a seal around the material to be fumigated. *Plain canvas will not confine fumigants.* Plastic such as polyethylene or rubber coated canvas should serve the purpose. *Any holes in the tarpaulin must be sealed. If more than one tarpaulin is required to cover the material that is to be fumigated, the over-lap should be rolled and clipped together or the seams taped. There is no use attempting a fumigation if a gas-tight seal is not attained.*

3. *Sealing.* If tarpaulin fumigation is to be done in the open on soil or in a building over dirt floors, the tarapulin should be placed under as well as over the grain or commodity to be fumigated. Where concrete or other hard surface is beneath the food, then the tarpaulin should be sealed to the surface. This may be done by means of sand-snakes or other heavy objects. Tape may also do the job but it may be difficult to get adhesion. The sealing must be complete to assure retention of the toxic gas.

4. *Formulation.* Two formulations were demonstrated at Dakar. They were methyl bromide (CH_3 BR) and phosphine (PH_3). Other chemicals may be available and if so, the manufacturers' recommendations should be followed. The two materials demonstrated both have the ability of penetrating through a considerable volume of material. Methyl bromide is a quick acting fumigant but does not have the penetrating ability of phosphine, however in a vacuum vault methyl bromide will penetrate very well. Phosphine must *not* be used in vacuum fumigation. Phosphine will penetrate most commodities but acts slowly. In either case a tight seal is required. Methyl bromide will give a chemical reaction with certain commodities resulting in an objectionable odor. A permanent residue of inorganic bromide will result in certain commodities if they are fumigated several times with methyl bromide. Tolerance levels have been established for grain and food in the United States. This may not be significant in other countries but should be investigated prior to the use of this chemical. Phosphine does not leave a permanent chemical residue but solids remain after release of the gas and it may be advisable to remove these when treating certain materials.

5. *Dosage.* It is very important to use the proper amount or dosage. To use too little could mean poor results. To over-dose is costly and may cause odors or residues. When the formulation has been selected, the label on the container should list the amount to be used. If this is not on the container, the manufacturer of the fumigant should be contacted to get the necessary information.

6. *Exposure.* The length of time required to confine the fumigant will be determined by the formulation selected, the depth of material to be treated and the temperature. It is good insurance to consider the maximum exposure time as recommended by the formulator.

7. *Monitoring* for dosage. Devices are available to give an immediate indication of the concentration of a fumigant. Two types were demonstrated at Dakar: a halide detector for methyl bromide and an Auer tester for phosphine. The halide detector is a device that produces a flame in contact with a piece of copper. The color of the flame indicates the presence and concentration of organic halide (methyl bromide). The Auer tester requires the use of tubes that change color and give a reading in parts per million of phosphine. Both devices are inexpensive, accurate enough for field use and give immediate results. Air samples should be pulled from the area being treated to determine if the proper concentration of fumigant is being attained and maintained. It should be required that all fumigations be monitored.

8. *Monitoring* for safety. If it is necessary for workers to be present around commodities under fumigation, the same testing devices should be used. This will indicate if toxic concentrations of the fumigant are present in the working zones. A safety check is also important after the fumigation is completed and personnel re-enter the area. Fumigants are toxic to man and it is important to make the necessary precautionary checks to assure safety. Phosphine can be detected by its odor while methyl bromide is odorless.

9. *Inspection.* As soon after a fumigation as it is safe to examine the material that was treated, it should be carefully inspected to determine if the results were satisfactory. If live insects are found, then the reason for the failure should be determined. A properly conducted fumigation should give a complete kill of all stages of all insects. Anything less than that should not be acceptable.

10. *Reinfestation.* There is no lasting protection from a fumigation. Once the toxic atmosphere is gone, the material is subject to attack by insects. It is recommended that a residual insecticide be used. If the material is moved just prior to fumigation, the surface under the pile should be sprayed first. If the material to be fumigated is not to be moved, then the area around the perimeter of the pile should be sprayed. Cleanliness is always important so the cleaning of the floors and the exterior of bags is necessary to reduce the attraction to insects. Broken bags should be destroyed or moved into distribution as quickly as possible as they are also an attraction to insects and always a potential source for insect infestation. It is advisable to be cautious in leaving tarpaulins over the commodities for extended periods. Condensation may form under the tarpaulin and cause deterioration because of mold.

An excellent reference on this subject is the *Manual of Fumigation for Insect Control* prepared by the Food and Agriculture Organization of the United Nations (F.A.O.). A copy may be available through the sources listed on the next pages.

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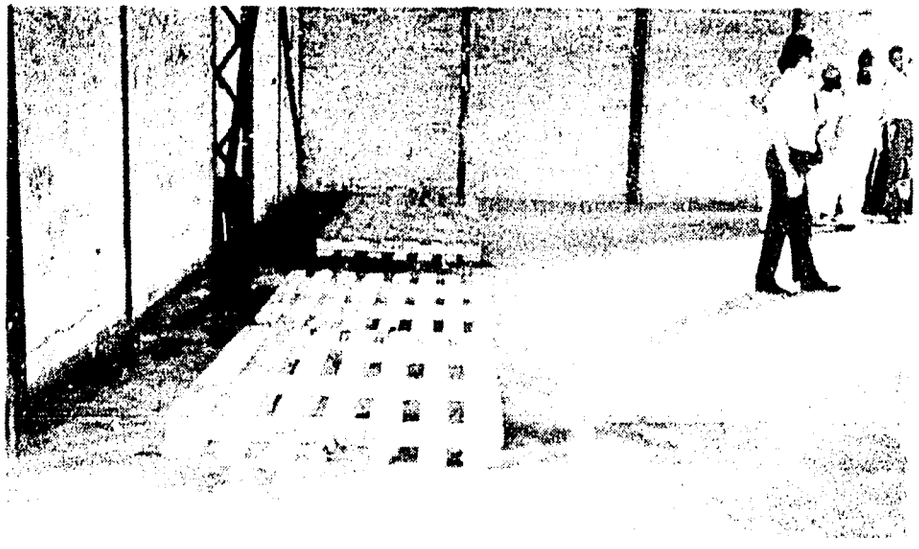
The following photographs illustrate the fumigation demonstrations at the Dakar seminar:

The floors and walls should be cleaned and sprayed prior to fumigation if it can be arranged. A residual insecticide should be used. Note the personnel making the pesticide application are wearing boots, coats and respirators.



Following the cleaning and spraying pallets should be used. By placing bags on pallets the fumigant can circulate under the pile and this allows for better penetration of the toxic gas into the bags.

The commodity to be fumigated is stacked on the pallets. Although a fumigation can be accomplished without moving the bags, it is suggested whenever possible that they be moved. The chances of total success in fumigation are better in bags that have been moved.

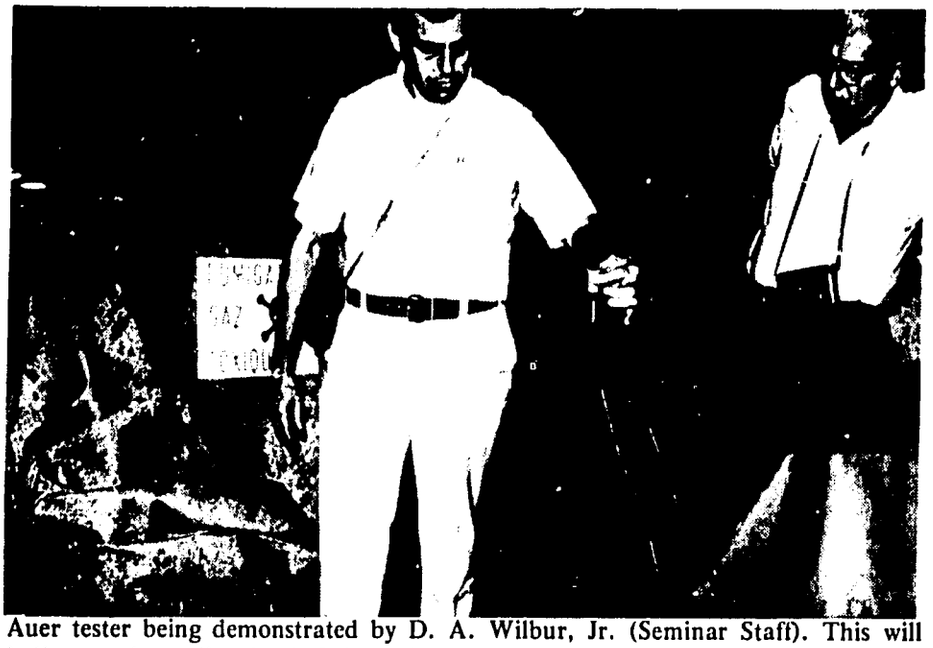
The demonstration involved two separate piles. One was treated with methyl bromide and one with phosphine. Two types of bag construction were included. One was the multi-wall paper bag and the second was woven polypropelene.

"Read the label." W. H. Schoenherr (Seminar Staff) talking with Eugene Moore (FFP/Abijan). Recommendations for proper usage are given on the label. The instructions should be understood and followed. The chemical in the can is phosphine and it was used to treat one of the stacks.

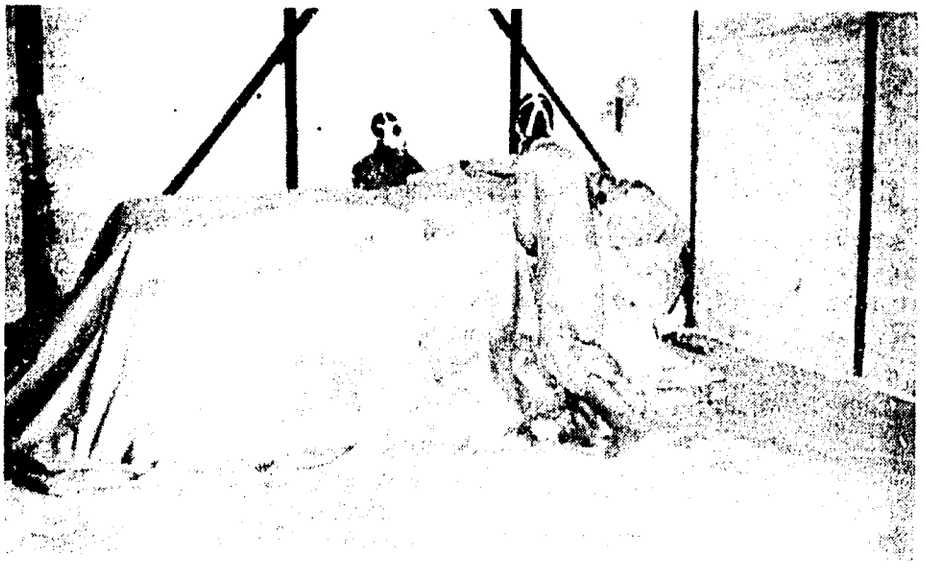
If spraying cannot be done prior to starting the fumigation, then a residual insecticide should be applied prior to the completion of the fumigation. The purpose of this precaution is to kill insects that may crawl over the floor and attempt to re-infest the commodities. Note the warning signs placed on each pile that is under fumigation.

1. Plastic bags filled with sand were used to seal the tarpaulin to the floor. 2. Plastic tube delivered the methyl bromide from the can to the top of the pile of bags. Since methyl bromide reacts so quickly, it must be applied in this manner.

A plastic tube was inserted under each pile prior to the release of the fumigant. The tube was used to pull gas samples from the pile to monitor the concentration of fumigant. Note the flame at the top of the Halide detector. It should be mandatory to monitor all fumigations to assure the proper concentration of gas is maintained. A rapid loss of the gas would indicate a leak which should be sealed and additional fumigant added. Poor insect kills can be avoided if attention is given to the pile during the actual fumigation.



Auer tester being demonstrated by D. A. Wilbur, Jr. (Seminar Staff). This will indicate an immediate level of phosphine in parts per million. Both the halide and the Auer testers should be used to determine the concentration of the gas under the tarpaulins and also used to sample the atmosphere around the exterior of the pile if workers are to be in the area.



Removal of the tarpaulin. At Dakar the fumigation exposure period was 48 hours. In actual practice it is advisable to extend the time. Note the workers are wearing gas masks. There could be a high level of toxic gas in the atmosphere as the tarapulin is removed. As soon as the gas is gone, then the bags should be inspected to determine if any insects survived.

CLEANING TECHNIQUES
November 5

The seminar staff demonstrated the use of brooms and brushes for cleaning. The importance of cleaning the corners, walls, beams and exterior of bags was stressed. A small amount of grain or dust will support a large number of insects. A clean area reduces the attractiveness to insects, rodents and birds.

The demonstrations were well attended. In the foreground is Peggy A. Sheehan, Chief, Program Operations Division, Office of Food for Peace, AID/Washington and Phillip Johnston, Director of the CARE Mission at Sierra Leone.

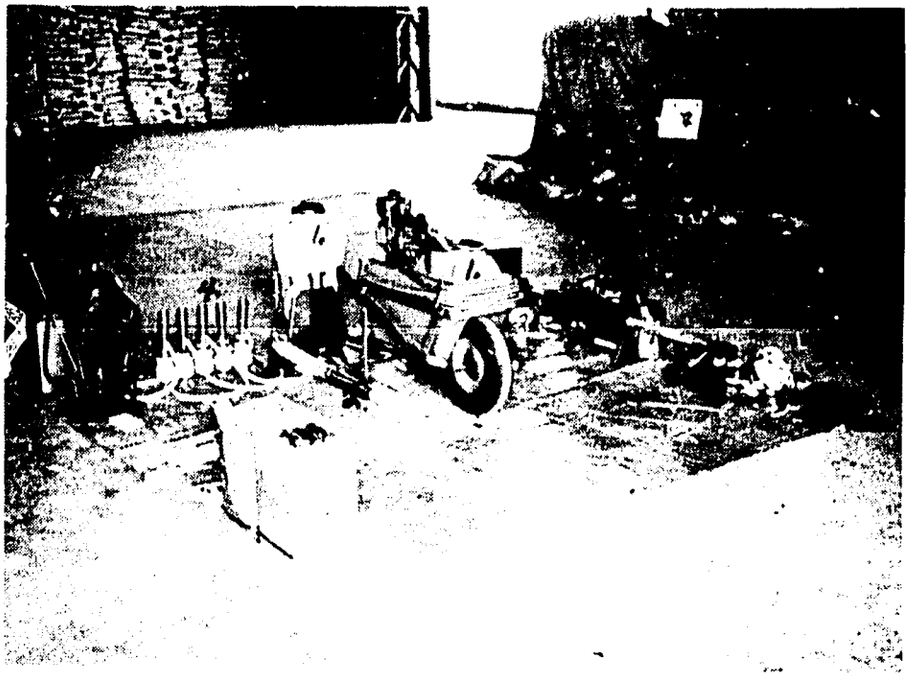
APPLICATION OF SPRAYS, FOGS AND DUST
November 5

It was stressed throughout the seminar that pesticides should not be considered as a replacement for good housekeeping. They should only be used in support of thorough cleaning. In addition to fumigants that have already been discussed, the use of sprays and fogs should be considered.

Spraying is the application of an insecticide to surfaces. The formulation usually leaves a residue after it has dried. The residue will continue to kill insects that come in contact with it. The period of effectiveness is determined by the formulation and environmental conditions, however some will continue to kill for several weeks. Mixtures that are permitted for use around food should be safe to humans.

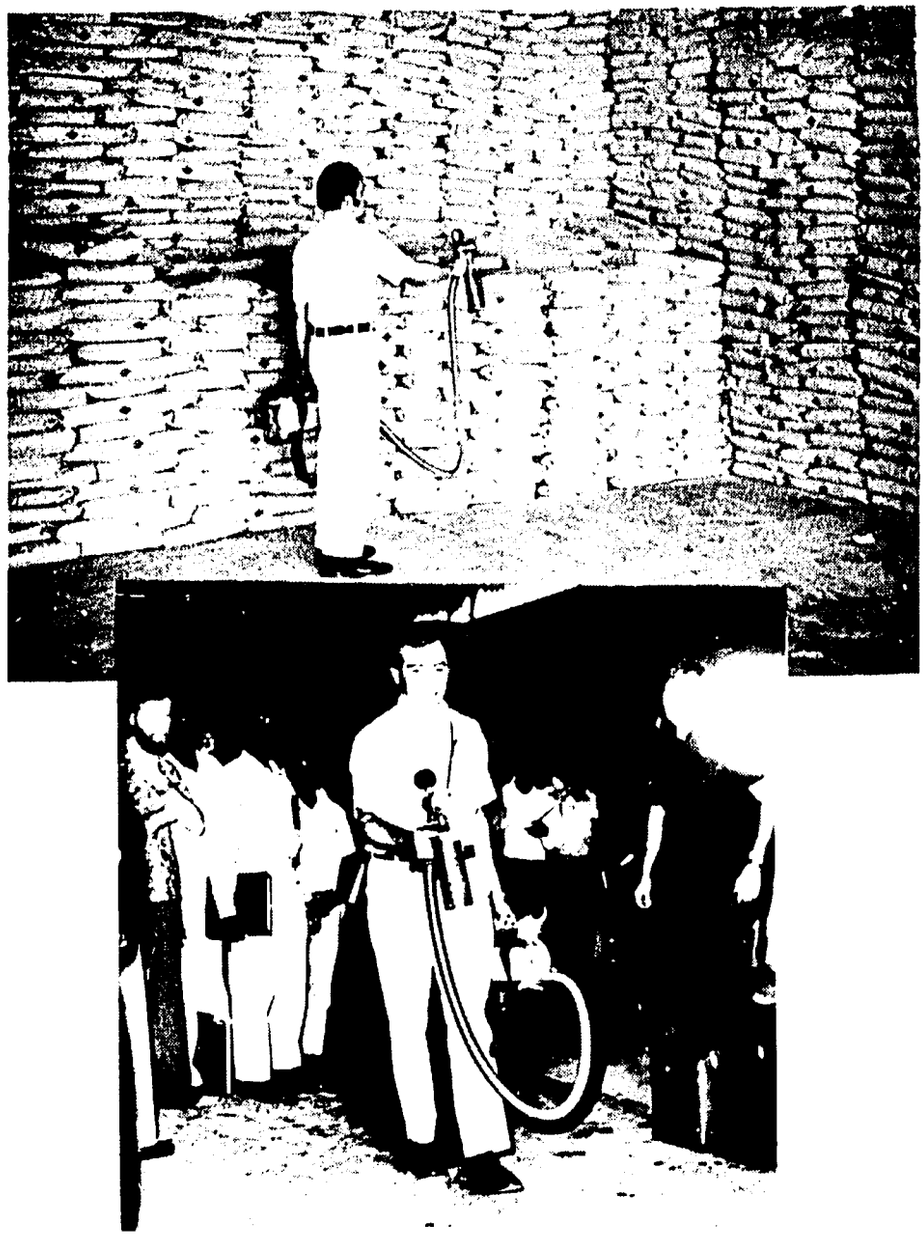
There are times that the application of an insecticide in the form of a fog is beneficial. The fog will drift through the air and should reach insects that are not easily reached by the spray method. Large areas such as warehouses can be fogged. Since the insecticide will move with air currents, it will not be fully effective if doors, windows and ventilators are left open during and immediately following the application.

Sprays and fogs will not penetrate, therefore they will not do the same job as a fumigant. However the proper use of sprays and fogs along with good cleaning and stock rotation may eliminate the need for a fumigation.



A display of the equipment demonstrated at the Dakar seminar.

1. Spraying equipment
2. Fogging and ULV equipment
3. Personal protection, respirators, gas mask, gloves
4. Halide detectors
5. Inert dust



A demonstration of the use of ULV equipment. This is a gasoline powered unit. A food-type insecticide is used so it will not contaminate food or injure humans. The insecticide is nearly invisible. Frequent use of the ULV procedure will greatly reduce the number of insects that are on the walls, beams, floors or outside of bags.

A battery powered ULV unit. The haze in the picture is the insecticide.

The fog generated by a thermal unit. A food grade insecticide is used. This fogging method creates a conspicuous smoke. The smoke contains the insecticide. The equipment is powered by a gasoline engine.

The use of "inert" dusts or diatomaceous earth has application in some situations. Insects are killed because of the abrasive action of the dust. The sharp particles fracture the outer layer of protection on an insect's body and it dies by drying or desication. The dusts are non-toxic to warm blooded animals and will remain effective for months. It is a method of control that has been used for hundreds of years and should not be overlooked. The top picture is a demonstration of the safety and abrasiveness of inert dust. The lower picture shows a method of application of dust by means of a simple hand duster.

RODENT CONTROL
November 5

The control of rodents requires a combination of knowledge, effort and tools. As in the case with insects the primary effort should be directed to cleanliness. Rodents require food and shelter. Therefore the removal of weeds and debris in the yards surrounding a warehouse or storage facility is important. Broken bags, poorly stacked equipment and general untidiness within a building is an invitation to rodents. Doors, windows and other openings into a building should be screened or kept closed, especially at night. Wire of 1/2 inch mesh should keep rats out, 1/4 inch is required for mice. Poison baits and tracking powders may be used both within a building as well as around the exterior. An anti-coagulant type poison is relatively safe to use since it would require an extremely large quantity to injure a human. The purpose of a tracking powder is to place it in an area frequented by rodents, they get it on their feet and body, lick it off and take it into their system through the mouth. The same formulations used to fumigate grain and food would also be effective against rodents. Actually rodents are killed with a lower concentration of a fumigant than is required to kill insects.

Traps may be used in a rodent control program. However because of the problem of servicing and pilferage, traps may not be practical. Cats will catch a few rodents but like the traps, they are usually not of much value.

Rodent control is a combination of five efforts:

1. Cleanliness
2. Structure design
3. Poison baits and tracking powders
4. Trapping
5. Fumigation

An anti-coagulant tracking powder placed along the floor-wall junction in a warehouse. Rodents will usually move close to a wall.

MONITOR FOR CONCENTRATION OF FUMIGANTS
November 5

The two demonstration fumigations were checked with detectors to determine the concentration of fumigant under the tarpaulins. This was 24 hours after the fumigation was started. During an actual fumigation the monitoring should be done at 2, 4 and 6 hours after introduction of the chemical. This practice will show if the gas concentration is at the proper level. After six hours then the frequency can be extended to once every 24 hours unless a problem is suspected.

FUMIGATION

This subject was handled in its entirety under the section dated November 4. All photographs were included in that discussion. On November 6 the following action was taken:

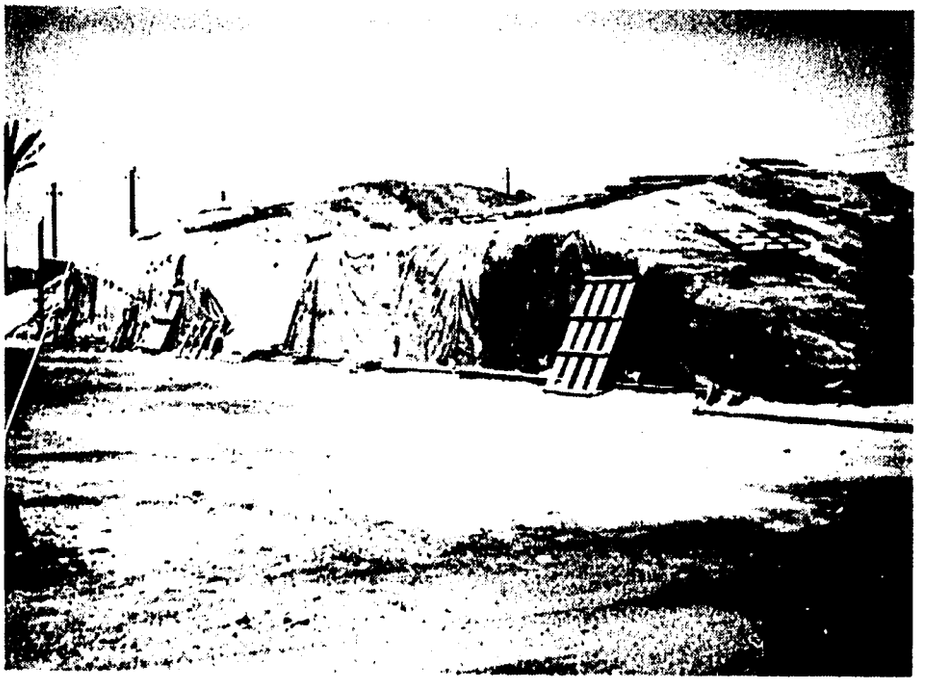
1. Monitor for gas concentration under the tarpaulins
2. Removal of the tarpaulins
3. Monitor around the bags after removal of the tarpaulin for safety reasons
4. Inspection of the bags to determine the results of the fumigation.

SAMPLING TECHNIQUES
November 6

When grain or any dry food product is stored in the open, it is subject to deterioration much more rapidly than when it can be protected under a roof. The sunshine, rain, insects and rodents all may contribute to spoilage and control or prevention is very difficult.

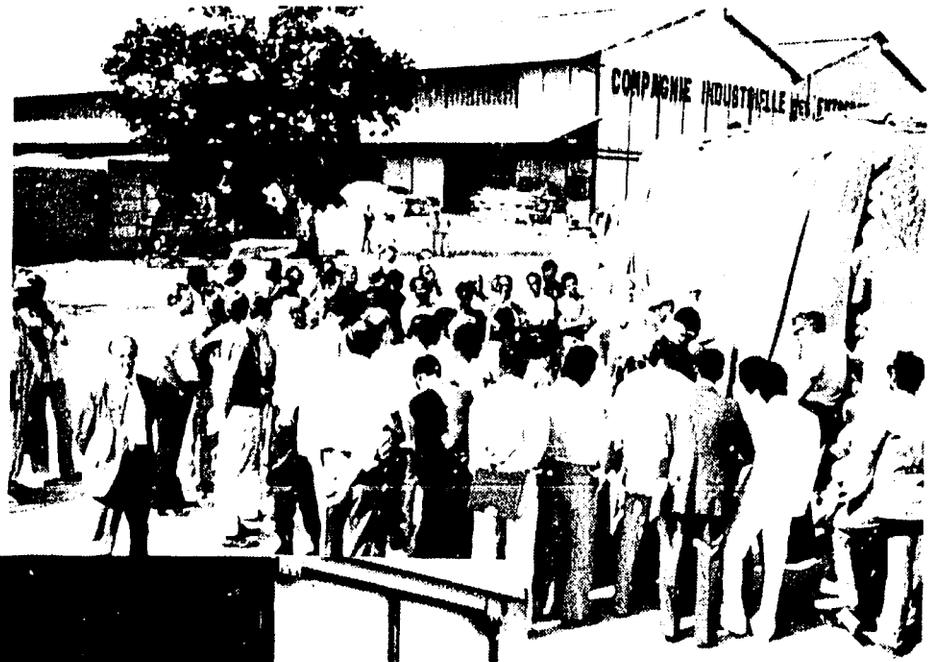
It is difficult to sample to any depth in large piles of bagged material. However it should be examined frequently to determine if a problem does exist.

Storage out-of-doors. Note that pallets have been placed under this pile of bags. A heavy tarpaulin has been spread on top of the pallets. The tarpaulin will not stop rodents but should prevent the migration of moisture from the ground into the grain and should help to prevent insects from gaining access to the grain.



The piles of grain are covered with tarpaulins. Weights are added to reduce wind damage. Inspection or sampling to any depth of such a huge pile is very difficult.

The tarapulin has been pulled back exposing some of the bags. The dark spots on some of the bags are dead insects. These may have been killed by fumigation or by the extremely high temperature that develops under the tarpaulin. The ground at the base of the pile is covered with grain which would serve as an attraction to insects, rodents and birds. Cleanliness around this type of storage is important. Insecticide sprays would probably break down very quickly due to atmospheric conditions.



Top — Demonstration in sampling grain conducted by Robert McDill, USAID/Dakar. A probe was pushed into the bags and a portion of the contents removed. The grain was passed over a divider to reduce the size of the sample. It was examined for mustiness and for insects.

Left — Loading a rail car. Where rail cars are of good construction they can be used as a fumigation chamber. Tape and plastic may be necessary to seal around the doors and any openings in the floor, walls or roof.

INSPECTION
November 6

Storage facilities and their contents should be inspected. The frequency should be established by the problems that are noted. At least once each month is a good starting point. The time lapse can be adjusted to meet the needs of the season or the specific problems.

Inspection should include both the area around the exterior as well as the interior of buildings that are used for the storage of food. Artificial light, such as a flashlight, is helpful.

An inspection form was distributed at the seminar (see below). Although this may not meet the needs of all areas, it may be considered as a pattern or a guide. It does list the types of conditions that are important and that may cause spoilage to food.

The information presented at this seminar by means of lectures, demonstrations and literature should have prepared each attendee to recognize problems or the conditions that could result in problems.

INSPECTION

YARD AREA SURROUNDING THE BUILDING(S)

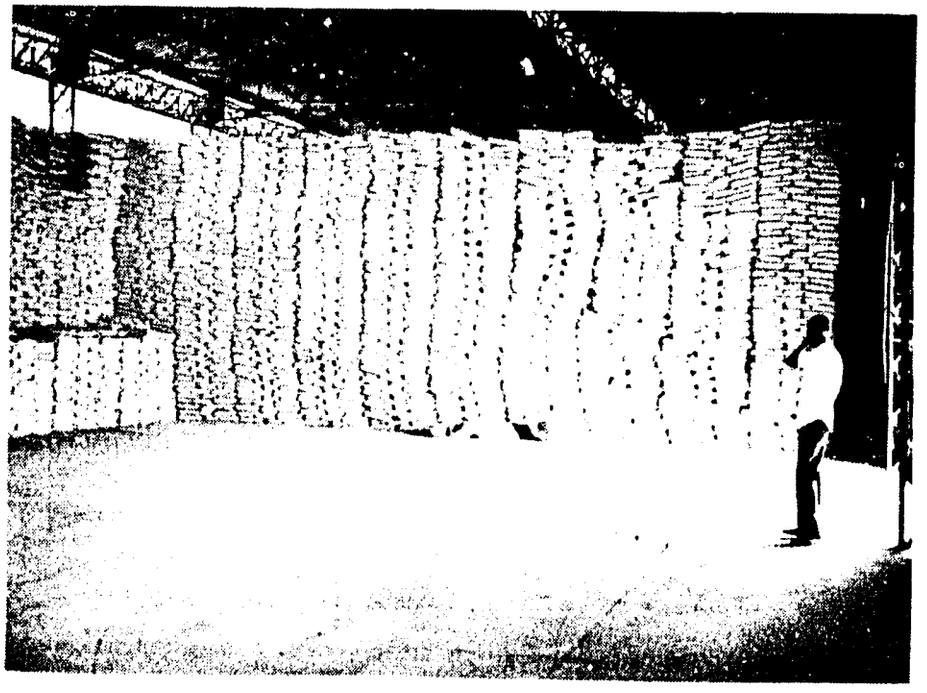
1. ARE RODENTS PRESENT?
2. ARE THERE REFUSE OR OTHER CONDITIONS SERVING AS AN ATTRACTANT OR BREEDING AREA FOR INSECTS?

BUILDING(S)

1. ARE THERE OPENINGS THAT PERMIT THE ENTRY OF BIRDS? ARE THEY SCREENED?
2. ARE THERE OPENINGS THAT PERMIT THE ENTRY OF RODENTS? ARE THEY SCREENED? ARE TRAPS OR RODENT BAIT STATIONS IN USE? ARE THE RODENT CONTROL DEVICES BEING USED PROPERLY?
3. DOES THE ROOF LEAK? IF SO, HAVE THE PRODUCTS BEEN ADEQUATELY PROTECTED SO THEY DO NOT GET WET?
4. CAN RAIN CONTACT THE PRODUCTS BECAUSE OF OPEN WINDOWS OR DOORS?
5. DOES SURFACE WATER GET INTO THE BUILDING? IF SO, HAVE THE PRODUCTS BEEN STORED ON PALLETS OR IN SUCH A MANNER SO AS TO KEEP THEM DRY?

PRODUCTS

1. ARE THE PRODUCTS STORED IN AN ORDERLY MANNER?
2. IS THERE SPACE BETWEEN PILES ALLOWING SUFFICIENT ROOM FOR INSPECTION AND CLEANING?
3. IS THERE SPACE BETWEEN PILES AND WALLS OR PARTITIONS?
4. IS THERE REFUSE STORED IN THE SAME BUILDING?
5. ARE THE FLOORS, WALLS AND BEAMS FREE OF ACCUMULATIONS OF FOOD THAT WOULD ATTRACT INSECTS AND RODENTS?
6. ARE THE PRODUCTS STORED OFF THE FLOOR, SUCH AS ON PALLETS?
7. IS THE EXTERIOR OF THE PACKAGES OF PRODUCTS CLEAN?
8. AFTER MOVING A FEW BAGS, IS IT FREE OF INSECTS OR PRODUCTS BETWEEN THE BAGS?
9. IS THERE EVIDENCE OF ACTIVITY BY INSECTS? RODENTS? BIRDS?
10. IS THERE MOLD ON THE OUTSIDE OF ANY PACKAGES OF FOOD?
11. HAVE DAMAGED BAGS BEEN SEPARATED FROM UNDAMAGED BAGS?
12. IS THERE A PROGRAM FOR RAPID DISPOSITION OF DAMAGED OR OUT-OF-CONDITION PRODUCTS?
13. ARE INSECTICIDE SPRAYS OR FOGS USED? IF SO, ARE THE RESULTS SATISFACTORY?
14. IS THERE A PROGRAM FOR THE FUMIGATION OF INSECT-INFESTED PRODUCTS? IF SO, DOES IT APPEAR TO BE SUCCESSFUL?
15. IS THERE A PROGRAM OF STOCK ROTATION SUCH AS FIRST IN-FIRST OUT?



Inspection involves much more than just looking into a warehouse door. The first impression of this storage area would be that it is well organized and clean.

However upon close examination live insects are observed. A damaged bag, as indicated by the arrow, if left in storage for three months could contain thousands of insects. The contents of the bag may not be fit for human consumption but it also serves as an incubation point for insects to spread to other bags. Damaged bags should be separated from good bags and should be watched carefully to assure the steps are taken to keep the commodity in good condition.

Top — Product spills such as shown here should be removed. The dark specks are insects. There is evidence of webbing left by both spiders and the larvae of grain moths.

Left — Salvage is important but it should be remembered that whenever grain or products are removed from their original shipping container, they may become infested with insects. Bags that are repaired or a commodity transferred to another bag should be fumigated or used quickly.

FIELD TRIP
November 7

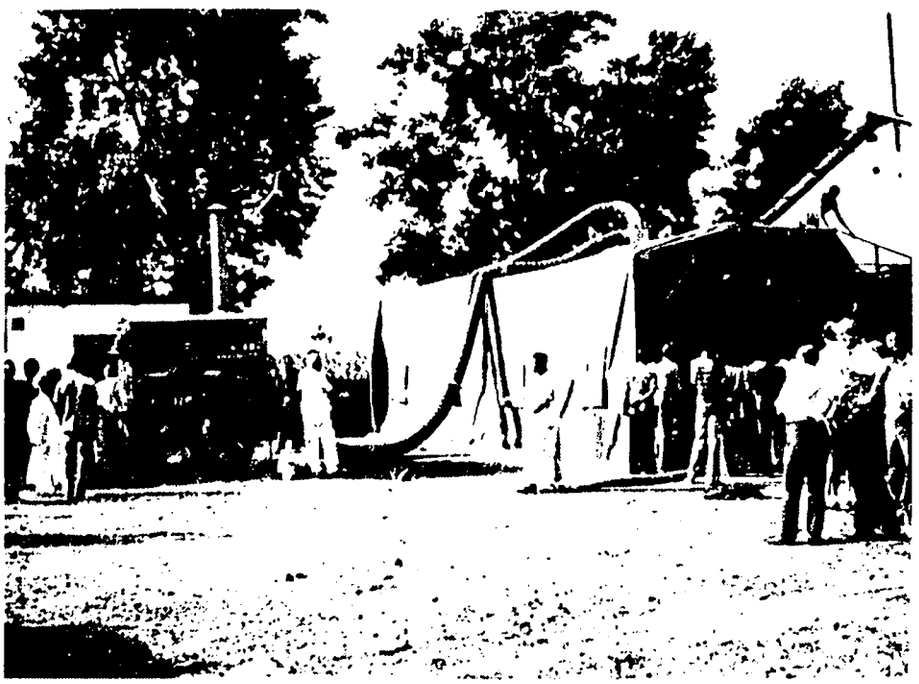
Buses Transported Attendees, Staff and Guests from Dakar to Thies, 70 kilometers

Fumigation (by ONCAD)

1. Portable Warehouse
2. Portable Fumigation Equipment
   a. Fans
   b. Fumigant Measurement Device
   c. Air Ducts
3. Explanation of Procedures

FUMIGATION BY RECIRCULATION

The demonstration was of a portable unit to fumigate with methyl bromide. It was very well described and because of its versatility could be used to fumigate a variety of commodities. The fumigant is recirculated which assures rapid distribution. The portable fumigation chamber can be enlarged to meet the needs of the quantity of material that requires fumigation.



The fumigation chamber is partially assembled to show how it is designed. To the left is the gasoline engine which operates the fan. The methyl bromide calibration device is located by the fan. The fumigant is metered into the air current at this point. This should be a rapid and effective method of fumigation.

APPENDIX A: Administrative Arrangements Checklist

I. Meeting Room

1. Adequate size
2. Location
3. Availability on required dates
4. Coffee breaks
5. Lunches
6. Dinners

II. Warehouse(s)

Request only *routine* sanitation practices be employed prior to seminar.

1. Adequate size to accomodate attendees
2. Location (name and address)
3. Availability on required dates
4. Commodities on hand
   Grain and cereal products
   (1) in multi-wall paper bags
   (2) in cotton or jute bags
   (3) in woven polypropylene bags

III. Transportation

1. Staff and guests
   (1) Hotel to meeting room
   (2) Meeting room to warehouse (See attached schedule)
2. Attendees
   (1) Hotel to meeting room
   (2) Meeting room to warehouse (See attached schedule)

IV. Personnel

Other than staff and guests

1. Translator(s)
2. Local pest control operator
3. Secretarial services with duplication equipment

V. Equipment

1. Mailing of equipment and supplies from U.S.
2. Meeting room
   (1) PA system (with individual headphones for translation if necessary)
   (2) Audio-visual equipment
      (a) 16 mm movie projector — sound
      (b) Super 8 mm movie projector — sound preferred
      35 mm slide projector (Kodak carousel with remote control preferred)
      Screen — 6 foot preferred
      (e. Pointer
   (3) Blackboard
   (4) Easel with paper and 10 felt tipped pens (black ink)
3. Warehouse
   (1) Portable PA system
   (2) 2 tarpaulins for fumigation, 40 ftte by 80
   (2) 2 tarpaulins for fumigation, 40 feet by 80 80 feet preferred 5 mil polyethylene minimum or gas tight vinyl-covered canvas
   (3) Phosphine — pellets or tablets
   (4) Methyl bromide — cans
   (5) Jiffy applicator with 10 feet plastic tube for methyl bromide cans
   (6) Sand snakes (4 or 6 inch plastic tubing) to hold down edges of tarpaulin
   (7) Hand sprayer, 2 or 3 gallon capacity
   (8) Fog device, any model that is available, ultra-low-volume preferred
   (9) Insecticide (spray), residual or contact, formulation permissible for use in Senegal
   (10) 2 full face gas masks with 2 canisters for methyl bromide and 2 for phosphine
   (11) Halide detector for detection of methyl bromide — with 20 feet of plastic tube
   (12) Auer (or similar) detector with tubes for phosphine — with 20 feet plastic tube
   (13) 10 fumigation warning signs as may be required in Senegal

APPENDIX B: Participant Questionnaire

A questionnaire was prepared by the seminar staff. It is suggested that the questionnaire be mailed sixty to ninety days prior to the seminar. It is also suggested that the replies be returned at least thirty days prior to the seminar.

The purpose of the questionnaire is to obtain pertinent information so the seminar staff can be assured that the lectures met the needs of the audience.

The questionnaire met the needs of the staff, however if this practice is to be repeated in the future, it is suggested that a cover letter should also be included in the early mailing. The letter should thoroughly explain the objectives of the seminar and detail the subject matter to be covered.

Please complete this questionnaire and return it to the AID Mission/American Embassy office _____

Name: _____ Title: _____ Organization: _____

Office Address: Home address:

_____ _____

What language do you speak? ___ English ___ French ___ Spanish ___ Other (please specify _____)

1. Description of typical *central* or *institutional* warehouses.

   a. Size:

   _____

   b. Construction:
      (1) Walls, (wood, adobe, metal, etc.): _____

      (2) Roof (wood, metal, etc.): _____

      (3) Floor (dirt, wood, concrete, etc.): _____

      (4) Windows (number, size, glassed?): _____

      (5) Are pallets used? _____

   c. Capacity: _____

   d. Commodities stored: _____

2. Outdoor Storage
   a. Is food stored outdoors? _____

   b. For what reasons? _____

   c. How? _____

   d. For what length of time? _____

3. Insecticides
   a. What insecticides are allowed to be used according to national laws?

   _____

   b. For each insecticide*, please give the following information:
      (1) Name
         (a) Chemical name _____
         (b) Trade name _____
         (c) Source or supplier: _____

(2) How is it used?

(a) Surface spray on floors, walls, stacks of bags, etc. _____

(b) Fumigation under sealed tarps _____

(c) Fogging machine _____

(d) Other uses _____

4. What are the legal tolerances for insecticide residues in food that result from treating for insect control?

5. What sored foods have insect problems?

6. What person or agency is responsible for insect control in warehouses storing PL 480 foods?

7. What kinds of tarpaulins are available?

8. What kind of spray equipment is generally used?

9. What person or agency determines if infested food is fit for human consumption?

10. What person or agency disposes of food declared unfit for human consumption?

How?

11. Are trained pest control operators available for consultation and/or services?

12. Are trained entomologists available from universities for consultation?

In the space below, please add any questions, comments, or suggestions which you think will help the staff develop a more effective seminar.

APPENDIX C: Course Outline

1. HOW TO EXTEND THE WORLDS FOOD SUPPLY THROUGH IMPROVED PACKAGING, STORAGE, AND HANDLING

BACKGROUND: THE FILM IS A COMPILATION OF SCENES TAKEN IN A NUMBER OF WIDELY SCATTERED LOCATIONS SUCH AS SOUTH AND CENTRAL AMERICA, THE DOMINICAN REPUBLIC, THE PHILIPPINE ISLANDS AND INDIA. A TEAM OF INDUSTRY AND U.S. GOVERNMENT SCIENTISTS HAVE WORKED TOGETHER TO IMPROVE THE TYPES OF PACKAGES USED TO PROTECT FOODS SHIPPED IN THE AGENCY FOR INTERNATIONAL DEVELOPMENT PROGRAMS. AS EARLY AS 1965, WHEN THE FIRST TEST SHIPMENT WAS MADE, IT WAS APPARENT TO THE TEAM THAT REGARDLESS OF THE MERITS OF THE PACKAGE CERTAIN PROBLEMS COULD STILL RESULT IN THE LOSS OF SUBSTANTIAL AMOUNTS OF FOOD. THE OBJECTIVE OF THE FILM, THEREFORE, IS TO ACQUAINT THE VIEWER WITH THE QUALITY ASSURANCE PROGRAMS THAT ARE MANDITORY AT THE FOOD PROCESSING, PACKAGING AND RAIL SHIPMENT LEVELS. THE FILM WILL ALSO ILLUSTRATE BOTH GOOD AND POOR STORAGE AND HANDLING PRACTICES.

THE FILMING WAS ACCOMPLISHED UNDER RATHER DIFFICULT CONDITIONS AND BY AMATEURS. THEREFORE, THE QUALITY IS NOT TRULY PROFESSIONAL. FOR THIS THE TEAM OFFERS ITS APOLOGIES. HOWEVER, IT IS FELT THAT A VALUABLE STORY IS TOLD AND THE SCENES THAT FOLLOW WILL ALERT THE VIEWER TO ACTUAL CONDITIONS OF HANDLING, EXPOSURE AND LOSSES THAT DO OCCUR IN THE FOOD THAT *IS* AVAILABLE.

A TITLE WILL APPEAR ON THE FILM AT THE BEGINNING OF EACH SUBJECT. THE FILM IS SUBDIVIDED INTO THE FOLLOWING SUBJECTS:

- A MODERN CEREAL PROCESSING PLANT
- PACKAGING
- RAIL SHIPMENT
- OCEAN SHIPMENT
- BARGE SHIPMENT TO CENTRAL WAREHOUSE
- IMPROPER STORAGE PRACTICES
- STORAGE PRACTICES
- TRANSFER TO LOCAL WAREHOUSE
- IMPROPER STORAGE PRACTICES (AT 6 MOS.)
- PROPER STORAGE PRACTICES 6 MOS. LATER
- PROBLEMS CAUSED BY EXCESSIVE MOISTURE
- VERMIN CONTROL
- THIS IS WHAT IT'S ALL ABOUT

*(11) **HOW TO EXTEND THE WORLD'S AVAILABLE FOOD SUPPLY THROUGH IMPROVED PACKAGING, STORAGE AND HANDLING**

*(5) A Modern Cereal Processing Plant *32 sec.*

The Quality Control Laboratory *5 min. 34 sec.*
1. door *14 sec.*
2. incubator *20 sec.*
3. microscopic count *11 sec.*
4. extraneous procedure *44 sec.*
5. extraneous microscopic analysis *31 sec.*
6. over-all control lab view *25 sec.*
7. fiber rack *12 sec.*
8. protein analysis *34 sec.*
9. fat extraction analysis *2 min. 08 sec.*
10. product display case *15 sec.*

*(5) Packaging *1 min. 13 sec.*

*(5) Rail Shipment *50 sec.*
1. car coopering *16 sec.*
2. car loading *34 sec.*

*(5) Ocean Shipment *2 min. 45 sec.*
1. unloading *1 min. 03 sec.*
2. unloading *1 min. 42 sec.*

*(5) Barge Shipment to Central Warehouse *1 min.*

*(5) Improper Storage Practices (1 year bags) *1 min. 08 sec.*

*(5) Storage Problems (after 3 days) *2 min. 07 sec.*

*(5) Transfer to Local Warehouse *1 min. 03 sec.*
*(5) Improper Storage Practices — 6 Month Later *2 min. 45 sec.*

*(5) Proper Storage Practices — 6 Months Later *25 sec.*

*(5) Problems Caused by Excessive Moisture *1 min. 46 sec.*
1. truck *15 sec.*
2. wet bags *13 sec.*
3. wet bag closure *20 sec.*
4. damaged product (moisture) *28 sec.*
5. undamaged product (comparison) *30 sec.*

*(5) Vermin Control *3 min. 27 sec.*
1. view of warehouse *10 sec.*
2. pallets of product *40 sec.*
3. fumigation *2 min. 37 sec.*

*(7) This Is What It's All About *2 min. 12 sec.*

* = Number of seconds per film topic title

2. QUALITY ASSURANCE PROGRAMS IN THE UNITED STATES

WHEN THE QUALITY OF A FOOD INDICATES THAT DETERIORATION HAS TAKEN PLACE, THE FINGER OF RESPONSIBILITY IS USUALLY POINTED TOWARD THE MANUFACTURER OF THAT FOOD. THIS TENDENCY IS NOT UNIQUE TO THE UNITED STATES BUT SEEMS TO BE THE SAME IN ALL OF THE COUNTRIES THAT WE HAVE VISITED.

SPEAKING AS FOOD PROCESSORS, WITH MANY YEARS OF EXPERIENCE IN THE FIELD OF FOOD QUALITY PRESERVATION, WE WILL DEFEND THE QUALITY OF FOOD AT THE TIME IT LEAVES THE PRODUCTION PLANT. UNFORTUNATELY, THE EXPOSURE TO POTENTIAL CONTAMINATION BEGINS AS THE FOOD MOVES INTO THE CHANNELS OF DISTRIBUTION AND CONTINUES UNTIL THE FOOD IS CONSUMED. EACH TIME THE FOOD IS MOVED IT IS SUBJECT TO DAMAGE TO THE PROTECTIVE PACKAGE, WHICH IN TURN WOULD PERMIT THE ENTRY OF SOME FORM OF CONTAMINATION OR DETERIORATION. ONCE THE PROTECTIVE BARRIER HAS BEEN PENETRATED OR DESTROYED, THEN THE PROBLEM IS USUALLY COMPOUNDED BY TIME.

THEREFORE, A PURE FOOD MOVING THROUGH NORMAL DISTRIBUTION CHANNELS MAY BE SUBJECTED TO ADVERSE CONDITIONS THAT PERMIT THE ENTRY OF SOME FORM OF DETERIORATION AND DURING THE MONTHS THAT ELAPSE BETWEEN THE PRODUCTION AND CONSUMPTION, THE DETERIORATION INCREASES TO THE POINT OF TOTAL DESTRUCTION OF THE FOOD OR TO THE EXTENT THAT IT IS RENDERED UNPALATABLE.

THE FOOD INDUSTRIES IN THE UNITED STATES ARE CLOSELY REGULATED. SOME OF THE AGENCIES THAT ARE CHARGED WITH THE RESPONSIBILITY OF SURVEILLANCE ARE:

FDA . . . . . FOOD AND DRUG ADMINISTRATION
USDA. . . . . DEPARTMENT OF AGRICULTURE
(1) GRAIN DIVISION
(2) DAIRY DIVISION
(3) MEAT AND POULTRY DIVISION
EPA . . . . . ENVIRONMENTAL PROTECTION AGENCY
(PESTICIDE USAGE)
OSHA. . . . . OCCUPATIONAL SAFETY AND HEALTH ACT

THERE IS SOME OVERLAPPING OF THE REGULATIONS ENFORCED BY THE FOUR AGENCIES. IF A FOOD PROCESSOR DOES NOT COMPLY WITH THE FOOD REGULATIONS HE IS NOT ALLOWED TO REMAIN IN BUSINESS. THIS MAY SOUND HARSH BUT THE LAWS CLEARLY DEFINE THE RESPONSIBILITIES OF A FOOD PROCESSOR AND THE PURPOSE OF THE LAWS IS TO ASSURE THAT THE CONSUMER WILL RECEIVE CLEAN AND WHOLESOME FOODS.

WITH SO MANY AGENCIES CHARGED WITH SIMILAR RESPONSIBILITIES, THE RESULT IS ALMOST CONSTANT SURVEILLANCE. THE SURVEILLANCE EXTENDS BEYOND THAT OF AN OFFICIAL NATURE AS THE FOOD COMPANIES HAVE ESTABLISHED THEIR OWN LABORATORIES, INSPECTORS AND MONITORING PROCEDURES. IN A CLOSELY-REGULATED BUSINESS IT IS FAR BETTER TO FOLLOW A PREVENTIVE PROGRAM THAN TO TAKE THE CALCULATED RISK OF A "SHUT-DOWN" OR AN EXPENSIVE CORRECTIVE PROGRAM.

INDUSTRY-SPONSORED PROGRAMS ARE EXTENSIVE AND INCLUDE THE FOLLOWING:

1. ACCEPTANCE STANDARDS FOR ALL RAW MATERIALS RECEIVED AT THE PLANT
2. INSPECTION OF INCOMING MATERIALS TO ASSURE THEY MEET THE REQUIREMENTS
3. PROPER STORAGE OF INCOMING MATERIALS TO ASSURE THEIR CONTINUED PURITY
4. CLEANLINESS OF PRODUCTION FACILITIES TO ASSURE THAT CONTAMINATION DOES NOT OCCUR
5. CLEANLINESS OF PACKAGING AREAS AND WAREHOUSES TO AVOID CONTAMINATION OF THE FINISHED FOODS
6. PREPARATION OF TRANSPORTATION FACILITIES TO REDUCE THE POTENTIAL EXPOSURE TO CONTAMINATION. THIS REFERS TO RAIL CARS AND TRUCKS.

AT THIS POINT, MOST FOOD PROCESSORS LOSE CONTROL OF THEIR PRODUCTS; HOWEVER, IN PRODUCTS DESTINED FOR EXPORT, THE REGULATORY AGENCIES CONTINUE WITH THEIR SURVEILLANCE AND ENFORCEMENT OF THE FOOD LAWS. THIS CONTINUED INSPECTION TENDS TO KEEP THE FOOD UNDER CONTROLLED CONDITIONS AS IT MOVES THROUGH DOMESTIC AND EXPORT CHANNELS.

WHAT HAS BEEN DONE TO EXTEND THE PERIOD OF PROTECTION BEYOND THE PROCESSING PLANT AND EVEN INTO THE CHANNELS OF DISTRIBUTION? THE AMERICAN GOVERNMENT AND AMERICAN INDUSTRIES REALIZED MANY YEARS AGO THAT EVEN WITH THE CLOSE REGULATION OF THE ACTUAL FOOD PROCESSORS THAT THE EXTENDED TIME, THE NUMBER OF HANDLINGS, AND THE EXPOSURE TO ADVERSE CONDITIONS COULD STILL RESULT IN SUBSTANTIAL LOSSES. AND THOSE LOSSES HAVE OCCURRED. IT SEEMED THAT THE OBVIOUS ROUTE TO FOLLOW WAS TO PROVIDE A CONTAINER THAT WOULD REMAIN RELATIVELY INEXPENSIVE AND WOULD CONTINUE TO PROTECT THE FOOD FOR MANY MONTHS.

EXTENSIVE RESEARCH WAS CONDUCTED BY GOVERNMENT ENTOMOLOGISTS, FOOD TECHNOLOGISTS, BIOLOGISTS AND PACKAGING EXPERTS. MANY DIFFERENT BAG CONSTRUCTIONS HAVE BEEN TESTED — SUCH AS COTTON, COMBINATIONS OF COTTON AND PAPER, PAPER AND PLASTICS. INSECTICIDES AND MOLDICIDES HAVE BEEN ADDED FOR ADDITIONAL PROTECTION. LARGE-SCALE FIELD TESTS HAVE BEEN CONDUCTED IN MANY COUNTRIES AND THE PACKAGING MATERIALS NOW BEING USED FOR PRODUCTS THAT ARE ESPECIALLY VULNERABLE TO DETERIORATION DO OFFER EXTENDED PROTECTION. RESEARCH IS CONTINUING AND NO DOUBT THERE WILL BE IMPROVEMENTS IN BOTH PACKAGING MATERIALS AND HANDLING PROCEDURES.

UNFORTUNATELY, THE PRESENT PACKAGING MATERIALS HAVE NOT SOLVED ALL OF THE PROBLEMS. ACTUALLY THERE IS NO WAY OF ACCURATELY ASSESSING THE AMOUNT OF PRODUCT THAT HAS BEEN SAVED. IT IS APPARENT THAT A PROBLEM DOES STILL EXIST AND IT IS HOPED THAT THROUGH SEMINARS OF THIS TYPE IT WILL BE POSSIBLE TO BETTER UNDERSTAND THE REASONS FOR LOSSES AND WHAT MAY BE DONE TO FURTHER REDUCE THE LOSSES.

YOU MAY REST ASSURED THAT THERE WILL CONTINUE TO BE IMPROVEMENTS IN THOSE AREAS CONTROLLED BY THE FOOD PROCESSORS IN THE UNITED STATES AND IN COOPERATIVE RESEARCH AND TESTS TO DEVELOP EVEN BETTER PACKAGES AND PROCEDURES.

SLIDE PRESENTATION

QAP-1 (a) REGULATORY AGENCIES (CHART)
QAP-2 (a) SURVEILLANCE AND CONTROL (CHART)
QAP-3 (a) LABORATORY TESTING — EXTRANEOUS (HEAVY)
QAP-4 (a) LABORATORY TESTING — EXTRANEOUS (LIGHT)
QAP-5 (a) LABORATORY TESTING — EXTRANEOUS (SEPARATORY FUNNEL)
QAP-6 (a) LABORATORY TESTING — EXTRANEOUS (MICROSCOPE)
QAP-7 (a) LABORATORY TESTING — SALMONELLA (CHART)
QAP-8 (a) LABORATORY TESTING — SALMONELLA (3 AGAR DISHES)
QAP-9 (a) LABORATORY TESTING — SALMONELLA (T.S.I. SLANTS)
QAP-10 (a) LABORATORY TESTING — SALMONELLA (BIO-CHEMICALS)
QAP-11 (a) LABORATORY TESTING — MYCOTOXINS (SAMPLE PREPARATION)
QAP-12 (a) LABORATORY TESTING — MYCOTOXINS (EXTRACTION)
QAP-13 (a) LABORATORY TESTING — MYCOTOXINS (TITRATION)
QAP-14 (a) LABORATORY TESTING — MYCOTOXINS (PLATING)
QAP-15 (a) LABORATORY TESTING — MYCOTOXINS (U.V. EXAMINATION)
QAP-16 (a) PACKAGING — COTTON BAGS
QAP-17 (a) PACKAGING — MULTIWALL — CURRENT CONSTRUCTION
QAP-18 (a) PACKAGING — MULTIWALL — RESEARCH BAG (POM)
QAP-19 (a) PACKAGING — MULTIWALL — RESEARCH BAG (TOS)
QAP-20 (a) PACKAGING — MULTIWALL — CLOSURE (TOS)
QAP-21 (a) TRANSPORTATION — EMPTY CAR (SPRAYING) — *"REMOVED"*
QAP-22 (a) TRANSPORTATION — EMPTY CAR (COOPERED)
QAP-23 (a) TRANSPORTATION — LOADED CAR (UNDER FUMIGATION)
QAP-24 (a) SHRINK WRAP — MULTIWALL
QAP-25 (a) SHRINK WRAP — COTTON
QAP-26 (a) SHRINK WRAP — IN WAREHOUSE (U.S.A.)
QAP-27 (a) SHRINK WRAP — IN WAREHOUSE (PANAMA)
QAP-28 (a) SLING HANDLING — IN WAREHOUSE (FORK LIFT PICK-UP)
QAP-29 (a) SLING HANDLING — IN WAREHOUSE (FORK LIFT PICK-UP — HIGH)
QAP-30 (a) SLING HANDLING — BOTTOM VIEW (DISTRIBUTION OF STRESS)

3. FUMIGATION PROCEDURES

I. GENERAL DISCUSSION

A. WHAT ARE FUMIGANTS?
   a. INSECTICIDE WHICH IS A GAS WHEN IT IS IN ITS INTENDED STATE
   b. AN INSECTICIDE IS INTENDED TO PENETRATE MASSES OF MATERIAL TO KILL ALL STAGES OF AN INSECT

B. HOW DO THEY DIFFER FROM OTHER INSECTICIDES?
   a. GAS — (NOT LIQUID OR SOLID)
   b. PENETRATION
   c. MUST BE USED ONLY IN A CONFINED AREA
   d. DESIGNED TO KILL ALL INSECTS WITHIN THE CONFINED AREA
   e. THE USE OF FUMIGANTS REQUIRES EXPERTISE IN
      1. SEALING OF STRUCTURES, EQUIPMENT OR ROOMS
      2. ABSOLUTE KNOWLEDGE OF THE PHYSICAL AND CHEMICAL QUALITIES OF THE FUMIGANT
      3. ABSOLUTE UNDERSTANDING OF THE SAFETY MEASURES NEEDED TO INSURE HUMAN SAFETY
   f. THEY ARE DESIGNED TO DO A COMPLETELY DIFFERENT JOB THAN OTHER INSECTICIDES
      1. A TOOL TO HELP BRING THE HIDDEN AND EXPOSED INFESTATION TO A ZERO POINT SO THAT OTHER INSECTICIDES CAN BE USED MORE EFFECTIVELY

C. WHEN SHOULD A FUMIGANT BE SELECTED?
   a. WHEN THERE IS AN UNCONTROLLABLE INFESTATION IN
      1. FLOORS
      2. WALLS
      3. VOIDS
      4. RAIL CARS
      5. CRACKS
      6. OTHER TRANSPORTATION VEHICLES THAT CAN'T BE READILY CONTROLLED BY OTHER INSECTICIDES
   b. WHEN THERE IS AN INFESTATION WITHIN THE FOOD IN FOOD CONTAINERS, SUCH AS
      1. INFESTED BAGS
      2. RAIL CARS
      3. TRUCKS
      4. SHIPS, ETC.

D. ARE FUMIGANTS THE ONLY TOOL NEEDED FOR INSECT CONTROL?
   ABSOLUTELY NOT — THEY ARE OF VALUE ONLY WHEN THEY CAN BE USED AS A PART OF A TOTAL SANITATION PROGRAM, INVOLVING KNOWLEDGEABLE
   a. CLEAN-UP PROGRAMS
   b. INSECTICIDE PROGRAMS
      1. INSIDE
      2. OUTSIDE
   c. STORAGE AND HANDLING PROCEDURES
   d. WAREHOUSING PROCEDURES

II. FUMIGANTS — PHYSICAL CHARACTERISTICS

A. METHYL BROMIDE
   a. GAS ABOVE 40°F
   b. PACKAGED
      1. SMALL CANS (1 OR 1-1/2 LB. CANS)
      2. LARGE CYLINDERS UP TO 500 LBS.
   c. RELEASED AS A GAS
   d. HEAVIER THAN AIR — 3.5 TIMES WEIGHT OF AIR
      1. MOVES DOWNWARD
      2. WHEN USED IN LARGE STRUCTURES, ONE SHOULD USE FAND
   e. ODOR — NONE, UNLESS USED WITH OTHER GASES (CHLOROPICRIN, ETHYLENE DIBROMIDE)
   f. COLOR — COLORLESS
   g. CAN THERE BE AN ADDITIVE TO ENABLE ODOR DETECTION? (USE CAUTION AS THERE MAY BE SEPARATION OF CHEMICALS)
      1. ETHYLENE DIBROMIDE
      2. CHLOROPICRIN

B. PHOSPHINE
   a. PACKAGED AS A SOLID
      1. PHOSTOXIN
      2. DETIA
   b. RELEASED AS A SOLID
   c. SLOW BREAK-DOWN
   d. SAME WEIGHT AS AIR
   e. VERY GOOD PENETRATION
   f. STRONG ODOR — (CARBIDE-LIKE), DETECTED AT .025 PPM
   g. COLOR — COLORLESS

III. DOSAGE AND EXPOSURE

A. METHYL BROMIDE
   a. 1-1/2 LBS./1000 CU. FT. DOSAGE
   b. 24-48 HRS. EXPOSURE

B. PHOSPHINE
   a. 165 PELLETS/1000 CU. FT. DOSAGE
   b. 36-48 HRS. EXPOSURE

IV. DETECTION DEVICES

A. METHYL BROMIDE — HALIDE DETECTOR

B. PH_3 — AUER OR DRAEGER DETECTOR WITH TUBES

V. SAFETY PROCEDURES

A. METHYL BROMIDE
   a. ALWAYS HAVE FULL-FACE GAS MASK ON WHILE WORKING WITH METHYL BROMIDE
   b. FUMIGATE IN WELL-VENTED AREAS
   c. DON'T WORK IN HIGH CONCENTRATIONS OF METHYL BROMIDE
   d. ALWAYS WORK IN PAIRS — NEVER ALONE
   e. WHEN IN DOUBT, USE HALIDE DETECTOR
      1. AFTER FUMIGATION TO SEE IF IT IS SAFE TO ENTER AFTER OPENING A FUMIGATION
      2. IF YOU SUSPECT A TARP LEAKAGE

f. SAFETY PROBLEMS ASSOCIATED WITH METHYL BROMIDE
   1. CHRONIC OR CUMULATIVE TYPE OF POISON
   2. METHYL BROMIDE IS ABSORBED THROUGH THE SKIN
   3. METHYL BROMIDE IS HEAVIER THAN AIR, CONSEQUENTLY IT CAN POCKET
   4. ALCOHOL AND METHYL BROMIDE DO NOT MIX

B. PHOSPHINE
   a. WORK IN PAIRS — NEVER FUMIGATE ALONE
   b. ALWAYS HAVE A FULL-FACE MASK WITH PROPER CANISTER AVAILABLE WHEN WORKING WITH PH_3
   c. WEAR COTTON GLOVES WHEN HANDLING PELLETS OR TABLETS OR BE CERTAIN TO WASH HANDS CAREFULLY WITH SOAP AND WATER AFTER HANDLING
   d. HAVE A GAS DETECTOR AVAILABLE TO CHECK SAFETY OR RE-ENTRY
   e. NEVER STACK A LARGE GROUP OF PELLETS OR TABLETS TOGETHER BECAUSE PHOSPHINE IS COMBUSTIBLE AT 1.79% OR ABOUT 18,000 PPM
   f. DISPOSE OF THE HYDRATED ALUMINA BY BURNING, BURYING OR POURING INTO A SOLUTION OF DETERGENT AND WATER
   g. SAFETY ADVANTAGES OF PH_3
      1. SLOW DECOMPOSITION WITH SLOW EVOLUTION OF THE GAS
      2. STRONG ODOR
      3. NO RESIDUE
      4. NOT CHRONIC-TYPE OF POISON
      5. EASY TO HANDLE WITHOUT WEARING A MASK

VI. HOW TO APPLY FUMIGANTS

A. METHYL BROMIDE
   a. HAVE THE STACK PROPERLY PREPARED — RUN POLY TUBE ABOVE THE CENTER OF THE STACK — PLACE POLY TARP AND SEAL THE POLY TO THE FLOOR
   b. APPLICATION OF METHYL BROMIDE IN SMALL CANS
      1. METHYL BROMIDE SHOULD BE APPLIED FROM OUTSIDE THE AREA TO BE FUMIGATED USING
         a. JIFFY APPLICATOR — TO OPEN CAN
         b. POLY TUBING — TO TRANSPORT METHYL BROMIDE FROM CAN TO FUMIGATION AREA (UNDER POLY TARP)
         c. DRIP PAN TO PROTECT THE MATERIAL UNDER METHYL BROMIDE OUTLET
      2. FULL-FACE MASK WITH PROPER CANISTER SHOULD BE WORN AT TIME OF APPLICATION IN CASE PROBLEMS ARISE, EXAMPLE:
         a. TUBE BREAKS
         b. CAN BURSTS
         c. TARP IS NOT PROPERLY SEALED
   c. APPLICATION OF METHYL BROMIDE IN CYLINDERS
      1. METHYL BROMIDE SHOULD BE APPLIED FROM AREA OUTSIDE OF THE AREA TO BE FUMIGATED AND TRANSPORTED TO THE FUMIGATION AREA (TARPED BAGS) VIA POLY TUBING
      2. FULL-FACE MASK WITH PROPER CANISTER SHOULD BE WORN AT TIME OF APPLICATION

B. PHOSPHINE
   a. PELLETS (PHOSTOXIN)
      1. PLACE PELLETS ON PAPERS SO THE ASH CAN BE EASILY RECOVERED AFTER FUMIGATION IS COMPLETED
      2. PROTECT HANDS WITH COTTON GLOVES — IF GLOVES ARE NOT WORN, WASH HANDS CAREFULLY WITH SOAP AND WATER IMMEDIATELY AFTER HANDLING FUMIGANT
      3. PLACE PAPERS ON FLOOR OF AREA TO BE FUMIGATED (UNDER POLY TARP)
      4. HAVE FULL-FACE MASK WITH PROPER CANISTER FOR PROTECTION AGAINST PHOSPHINE ON HAND IN CASE OF EMERGENCY. IT IS GENERALLY NOT NECESSARY TO BE WEARING MASK WHILE APPLYING MOST TYPES OF PHOSPHINE-PRODUCING FUMIGANTS SINCE THEY BREAK DOWN SO SLOWLY
      5. SEAL POLY TARP TO FLOOR
   b. TABLETS (PHOSTOXIN) & DETIA BAGS
      1. PROTECT HANDS
      2. PLACE PAPERS ON FLOOR IN FUMIGATION AREA
      3. HAVE FULL-FACE MASK WITH PROPER CANISTER AVAILABLE
      4. PLACE TABLETS ON PAPERS
         (NOTE: IF A CAN OF TABLETS OR DETIA BAGS IS OPENED, IT SHOULD BE COMPLETELY USED UP. THIS IS NOT TRUE OF PELLETS.)
      5. SEAL POLY TO THE FLOOR

VII. POTENTIAL HAZARDS

A. METHYL BROMIDE
   a. PRODUCT
      1. EXCESSIVE RESIDUE
      2. OFF-ODOR WHEN BAKED
         a. HIGH FAT
         b. IODIZED SALT, ETC.
   b. PERSONNEL
      1. CHRONIC POISON
      2. SKIN ABSORPTION
      3. POSSIBLE BURNS IF
         a. SPILLED ON SKIN
         b. WORKING IN HIGH CONCENTRATION FOR EXTENDED PERIODS OF TIME

B. PHOSPHINE
   a. PRODUCT
      1. KEEP ASH OUT OF FOOD PRODUCT IN CASE IT IS EATEN PRIOR TO COMPLETE DECOMPOSITION
   b. PERSONNEL
      1. EXPOSURE TO HIGH CONCENTRATION WITHOUT MASK COULD CAUSE DEATH

VIII. OPENING PRECAUTIONS

A. METHYL BROMIDE
   a. WEAR MASK TO OPEN
   b. CHECK WITH HALIDE DETECTOR TO MAKE CERTAIN THERE HAVE BEEN NO LEAKS CAUSING A DANGEROUS BUILD-UP OF METHYL BROMIDE IN THE AREA OUTSIDE THE FUMIGATION AREA

c. TO OPEN AND AIR FUMIGATED STACK, PULL TARP ONLY PART WAY BACK — WAIT 30 MIN. BEFORE COMPLETELY REMOVING TARP. FANS MAY BE NEEDED TO ASSIST IN PROPER AERATION
d. ALLOW STACK PLENTY OF TIME FOR COMPLETE AERATION BEFORE WORKING IN THE AREA
e. DOUBLE CHECK WITH HALIDE DETECTOR BEFORE WORKING THE AREA

B. PHOSPHINE
a. HAVE FULL-FACE GAS MASK AT THE *READY-TO-WEAR* POSITION
b. PARTIALLY OPEN FUMIGATED AREA AND ALLOW 30 MIN. TO AIR
c. AFTER 30 MIN. AERATION PERIOD, TAKE GAS READING WITH AUER OR DRAEGER GAS DETECTOR
d. REMOVE THE PAPERS ONE AT A TIME FROM FUMIGATION AREA AND POUR THE ASH INTO A BUCKET CONTAINING DETERGENT AND WATER. STIR UNTIL THE DUST GOES INTO SOLUTION. (IT IS OFTEN ADVISABLE TO WEAR A FULL-FACE GAS MASK DURING THE STIRRING OPERATION.) POUR THE SOLUTION INTO A TRASH CONTAINER, ON THE GROUND, OR INTO A SEWER (IT IS RENDERED HARMLESS BY THE DETERGENT AND WATER.)

FUMIGATION IS A VERY VALUABLE TOOL THAT, IF USED PROPERLY, CAN HELP YOU MAINTAIN ADEQUATE CONTROL SAFELY AND ECONOMICALLY.

IX. FILM: "THE ENEMY WITH-IN"

4. RODENT CONTROL

A COMPLETE RODENT CONTROL PROGRAM INVOLVES A GREAT DEAL MORE THAN KILLING RODENTS.

A. ELIMINATION OF HARBORAGE
   1. INSIDE
   2. OUTSIDE
      a. TRASH
      b. HOLES
      c. WEEDS
      d. TALL GRASS

B. RODENT-PROOFING STRUCTURES VIA CONSTRUCTION
   1. FIX HOLES IN WALLS
   2. CHECK DOOR CLOSURES
   3. SEE THAT DOORS ARE NOT LEFT OPEN

C. PROPER WAREHOUSING ROCEDURES
   1. ELIMINATE INSIDE HARBORAGES, TRASH, HOLES IN WALLS, ETC.
   2. STORE PRODUCT AWAY FROM THE WALL

D. SET UP A COMPLETE BAITING PROCEDURE
   1. PRIMARY DEFENSE OUTSIDE
   2. INSIDE BAITING
   3. INSIDE TRAPPING

E. RODENTICIDES. WITH THE EXCEPTION OF EXTERIOR GASSING OF RODENT BURROWS, THE PRIMARY TYPE OF RODENTICIDE TO BE USED AROUND FOOD AND FOOD STORAGE SHOULD BE OF THE ANTI-COAGULANT TYPE.
   1. TYPES OF ANTI-COAGULANTS
      a. DRY
      b. WET
   2. FREQUENCY OF BAITING
      a. ALL BAIT MUST BE FRESH SO THAT IT WILL BE ACCEPTABLE TO THE RODENT
      b. DRY BAIT MUST NOT BE ALLOWED TO BECOME MOLDY OR INFESTED
   3. TYPES OF BAIT CONTAINERS
      ALL SHOULD BE COVERED
      a. FOUNTAINS
      b. BAIT TRAYS
      c. BAIT BOXES
         1. METAL
         2. CARDBOARD
         3. PLASTIC

NOTE: A NEW PROBLEM ARISES VIA THE USE OF ANTI-COAGULANT OR ANY KILLING BAIT AND THAT IS THAT THE RODENT USUALLY DIES IN A HARD-TO-GET-TO AREA, THUS CREATING A NEW PROBLEM.

   4. TRAPPING
      TRAPPING CAN BE AN EXCELLENT FORM OF RODENT CONTROL, BUT IT IS ONE OF MANY TOOLS NECESSARY FOR COMPLETE CONTROL
      a. TYPES OF TRAPS
         1. WIND-UP
         2. SPRING
   5. POTENTIAL PROBLEMS OF A BAITING PROGRAM
      a. NON-ACCEPTANCE OF THE BAIT
      b. INFESTATIONS OF THE BAIT
      c. RESISTANCE TO THE ANTI-COAGULANT BAITS

RODENT CONTROL IS A NECESSARY PART OF ANY FOOD WAREHOUSING SANITATION PROGRAM, FOR RODENTS DESTROY FOOD, EAT FOOD, AND CONTAMINATE FOOD PRODUCTS AND FOOD CONTAINERS. THEY CAN BE CONTROLLED.

5. INSECT PESTS OF PROCESSED CEREALS AND BAGGED GRAIN

I. WHAT IS AN INSECT?

INSECTS ARE DISTINGUISHED BY —

A. AN EXOSKELETON, WHICH PROVIDES PROTECTION FROM PHYSICAL DAMAGE AND DEHYDRATION

B. THREE BODY DIVISIONS
HEAD — HAS EYES, ANTENNAE, MOUTHPARTS
THORAX — HAS WINGS AND LEGS
ABDOMEN — HAS THE GUT AND SPIRACLES

C. TWO PAIRS OF WINGS
BOTH PAIRS OF WINGS ON MOST INSECTS ARE ABOUT THE SAME SIZE; ON OTHER INSECTS SUCH AS THE HOUSEFLY ONE PAIR OF WINGS ARE VERY SMALL.

D. SIX LEGS THAT ARE BASICALLY FIVE-JOINTED.

THESE ARE THE MOST CONSPICUOUS FEATURES THAT SET INSECTS APART FROM THER ANIMALS. ANOTHER STRIKING CHARACTERISTIC IS THE WAY IN WHICH INSECTS GROW AND DEVELOP. ALL INSECTS GO THROUGH CHANGES IN FORM OF BODY TO REACH THE ADULT STAGE. IN SOME SPECIES, GRASSHOPPERS FOR INSTANCE, THE IMMATURES LOOK MUCH LIKE THE ADULT. THIS IS INCOMPLETE METAMORPHOSIS. IN OTHER SPECIES THE INSECTS GOES THROUGH COMPLETE CHANGE OF BODY FORM IN THESE FOUR STAGES — EGG, LARVA, PUPA, ADULT. THIS IS COMPLETE METAMORPHOSIS.

ALL COMMON STORED-PRODUCT INSECTS GO THROUGH COMPLETE METAMORPHOSIS.

II. MOST STORED-PRODUCT INSECTS ARE EITHER MOTHS OR BEETLES.

A. MOTHS

THERE ARE ABOUT 100,000 SPECIES OF MOTHS. THE ADULTS HAVE TWO PAIRS OF WINGS COVERED WITH SCALES THAT FORM DISTINCTIVE COLOR PATTERNS. THEY HAVE NONFEEDING MOUTHPARTS CALLED A PROBOSCIS. THE LARVA HAS A HEAD, THREE THORACIC AND 10 ABDOMINAL SEGMENTS. THE THORAX HAS THREE PAIRS OF TRUE LEGS. ABDOMINAL SEGMENTS 3 THROUGH 6 AND SEGMENT 10 HAVE PROLEGS. THE LARVA HAVE BITING MOUTHPARTS AND ARE RESPONSIBLE FOR ALL FEEDING DAMAGE CAUSED BY MOTHS.

B. BEETLES

THERE ARE ABOUT 250,000 DESCRIBED SPECIES OF BEETLES, AND ABOUT 600 HAVE BEEN FOUND ASSOCIATED WITH STORED PRODUCTS. MANY OF THESE SPECIES, HOWEVER, FEED NOT ON THE PRODUCT ITSELF BUT ON REFUSE OR FUNGI ASSOCIATED WITH SPOILED PRODUCTS.

THE ADULTS HAVE HARD LEATHERY FRONT WINGS WHICH ARE ACTUALLY COVERS FOR THE REAR MEMBRANOUS WINGS WHICH ARE FOLDED UNDER THE FRONT WINGS. THESE INSECTS GO THROUGH A COMPLETE METAMORPHOSIS FROM EGG TO LARVA TO PUPA TO ADULT. THE LARVA HAS WELL DEVELOPED BITING MOUTHPARTS, A THORAX WITH THREE PAIRS OF LEGS; AND THE ABDOMEN DOES NOT HAVE PROLEGS.

SLIDES WERE USED TO DESCRIBE THE ADULTS, LARVAE, LIFE CYCLES, TYPICAL DAMAGE, AND UNUSUAL CHARACTERISTICS OF THE FOLLOWING INSECTS:

1. SCHEMATIC ILLUSTRATION OF A GRASSHOPPER, SHOWING THE MAIN PARTS OF A TYPICAL INSECT
2. *TRIBOLIUM CASTANEUM* ADULT
3. *T. CASTANEUM* LARVA
4. *T. CASTANEUM* PUPA
5. *CRYPTOLESTES FERRUGINEUS* ADULT
6. *C. FERRUGINEUS* LARVA
7. *RHYZOPERTHA DOMINICA* ADULT
8. *R. COMINICA* LARVA
9. WHEAT DAMAGED BY *R. DOMINICA*
10. *DINODEROUS MINUTUS* ADULT
11. *LASIODERMA SERRICORNE* ADULT
12. *L. SERRICORNE* LARVA
13. *L. SERRICORNE* PUPA
14. *STEGOBIUM PANICEUM* ADULT
15. *ORYZAEPHILUS SURINAMENSIS* ADULT
16. *SITOPHILUS GRANARIUS* ADULT
17. *SITOPHILUS ORYZAE* ADULT
18. *S. GRANARIUS* LARVA IN WHEAT
19. *S. GRANARIUS* PUPA IN WHEAT
20. *S. GRANARIUS* ADULT IN WHEAT
21. *TENEBROIDES MAURITANICUS* ADULT
22. *T. MAURITANICUS* LARVA
23. *T. MAURITANICUS* PUPA
24. *CARPOPHILUS OBSOLETUS* ADULT
25. *C. OBSOLETUS* LARVA
26. *C. OBSOLETUS* PUPA
27. *PLODIA INTERPUNCTELLA* ADULT
28. *P. INTERPUNCTELLA* LARVA
29. *P. INTERPUNCTELLA* PUPA
30. *P. INTERPUNCTELLA* WEBBING AND FRASS
31. *TROGODERMA GLABRUM* ADULT
32. *T. GLABRUM* LARVA
33. *T. GLABRUM* PUPA
34. *T. GLABRUM* ADULT EMERGING FROM PUPAL CASE
35. *ALPHITOBIUS DIAPERINUS* ADULT

6. APPLICATION OF INSECTICIDE SPRAYS AND FOGS

1. INSECTICIDES — WHAT ARE THEY? — ANYTHING USED TO CONTROL INSECTS
   A. BASICALLY 3 MAJOR CATEGORIES
      a. FUMIGANTS b. RESIDUAL c. CONTACT
2. WHAT FORMS DO INSECTICIDES COME IN?
      a. SOLID b. LIQUID c. GAS
3. HOW ARE INSECTICIDES APPLIED?
   A. FOG
      a. WET
      b. DRY
   B. SPRAY
   C. DUST
4. WHAT TYPES OF COMMON CARRIERS ARE USED TO MIX WITH INSECTICIDE CONCENTRATES?
   A. OIL
   B. H_2O
   C. AIR
5. MOST COMMON TYPES OF INSECTICIDES
   A. CONTACT INSECTICIDES
      a. PYRETHRINS
      b. FUMIGANTS
   B. RESIDUAL INSECTICIDES
      a. MALATHION
      b. DURSBAN
      c. BAYGON
      d. DIAZINON
      e. METHOXYCHLOR
      f. DDVP (VAPONA)
      g. DIATOMACEOUS EARTH OR SILICA
6. WHY USE INSECTICIDES?
   A. PRIMARILY TO HELP MAINTAIN MINIMUM SANITATION STANDARDS
   B. TO PREVENT ACTUAL ECONOMIC LOSS OF FOOD TO INSECTS
7. INSECTICIDE SELECTION
   A. RESIDUAL — PREVENTIVE
   B. CONTACT — CORRECTIVE
8. APPLICATION METHODS AND WHEN TO SELECT SPECIFIC TYPES OF APPLICATION
   A. *FOGGING* — IS SELECTED AS AN EXCELLENT TOOL FOR CONTROL OF FLYING AND/OR EXPOSED INSECTS. FOGGING IS ONE OF THE MORE COMMON AND POPULAR MEANS OF APPLYING *CONTACT* INSECTICIDES SUCH AS PYRETHRIN MIXTURES. IT CAN, HOWEVER, BE USED TO APPLY RESIDUAL INSECTICIDES AS WELL.

      THE PRIME HAZARDS OF THIS TYPE OF APPLICATION ARE: (1) A POTENTIAL HAZARD TO THE INDIVIDUAL EXPOSED TO AN ATMOSPHERE OF INSECTICIDE, AND (2) A POTENTIAL HAZARD OF CONTAMINATING THE FOOD OR FOOD CONTAINERS WITH THE INSECTICIDE OR ITS CARRIER (OIL).

      THERE ARE SEVERAL TYPES OF FOGGING DEVICES AVAILABLE, SOME OF WHICH APPEAR TO BE MORE EFFECTIVE THAN OTHERS; BUT AGAIN, IT MUST BE REALIZED THAT A FOGGING OPERATION MUST NOT BE CONFUSED WITH A FUMIGATION, FOR THERE IS NO PENETRATION OF PRODUCT, BAGS, OR WALLS WITH A FOG.

B. *SPRAYING* — IS MOST COMMONLY USED IN CONJUNCTION WITH PROPERLY SELECTED RESIDUAL MATERIALS SUCH AS MALATHION, BAYGON, DIAZINON, ETC., WHERE THE PRIME VALUE OF MATERIAL WILL COME FOR MANY DAYS AFTER THE MATERIAL HAS BEEN APPLIED. CAREFUL SELECTION OF A GOOD RESIDUAL INSECTICIDE, ALONG WITH A CAREFUL SPRAYING APPLICATION, CAN GIVE PROTECTION OF SPECIFIC AREAS FOR CONSIDERABLE PERIODS OF TIME, PROVIDED THE PROPER CLEAN-UP PROGRAM IS ALSO INSTITUTED.

9. WHEN SHOULD A RESIDUAL INSECTICIDE BE SELECTED?
   A. THE PRIMARY FUNCTION OF A RESIDUAL INSECTICIDE IS TO PROVIDE PROTECTION AGAINST FUTURE INVASION OF A SPECIFIC AREA, CONSEQUENTLY A RESIDUAL SHOULD BE USED AFTER:
      a. THE SURFACE IS THOROUGHLY CLEANED
         1. USUALLY A PERIMETER AROUND PRESENTLY-STORED PRODUCT
         2. OR AN AREA UPON WHICH PRODUCT WILL BE PLACED
      b. THE PRODUCT IS ADEQUATELY PROTECTED FROM ACCIDENTAL CONTAMINATION
   B. A RESIDUAL INSECTICIDE WILL ONLY PROVIDE SURFACE PROTECTION — NOT PENETRATION.

10. WHEN SHOULD A CONTACT INSECTICIDE BE SELECTED?
    AGAIN IT MUST BE POINTED OUT OR RE-EMPHASIZED THAT A CONTACT FOG OR SPRAY KILLS ONLY THE EXPOSED INSECTS AND THIS PROCESS SHOULD NOT BE CONFUSED WITH FUMIGATION.
    A. AS A SPRAY
       a. THE AREA SHOULD BE CAREFULLY CLEANED BEFORE A SPRAY IS USED.
       b. NEVER MIX MORE CONTACT OR RESIDUAL INSECTICIDE THAN YOU PLAN TO USE IN A SHORT PERIOD OF TIME — THE INSECTICIDE COULD:
          1. LOSE STRENGTH
          2. SETTLE OUT

          REMEMBER THAT YOU MUST CONTACT THE INSECT WITH THE SPRAY AT THE TIME THE SPRAY IS RELEASED, FOR THERE IS NO RESIDUE
    B. TYPES OF PROBLEMS A CONTACT SPRAY IS DESIGNED FOR
       a. HEAVY INSECT PROBLEM
       b. PROBLEM OF ROACHES OR OTHER EXPOSED INSECTS
    C. TYPES OF PROBLEMS A CONTACT FOG IS DESIGNED FOR
       a. EXTENSIVE FLYING-INSECT PROBLEM
       b. ROACHES OR OTHER PARTIALLY-EXPOSED INSECTS

11. INSECTICIDE APPLICATION
    A. SPRAYER TIPS
       a. DON'T OVER-FILL SPRAYER
       b. LABEL SPRAYER AS TO WHAT INSECTICIDE IS IN IT
       c. TRY TO USE THE SPRAYER FOR ONE PURPOSE:
          A SPRAYER FOR CONTACT
          A SPRAYER FOR RESIDUAL
          A SPRAYER FOR WEED CONTROL, ETC.
       d. DO NOT PUMP UP A HIGH PRESSURE IN SPRAYER
          1. SPLASH-BACK
          2. AIR-BORNE CONTAMINATION
          3. BURST SPRAYER
          4. BURST HOSE
          5. HARD ON SPRAYER LIFE

e. DO NOT PUT MORE INSECTICIDE IN SPRAYER THAN YOU WILL USE OVER A SHORT PERIOD OF TIME
   1. SETTLE OUT
   2. LOSE STRENGTH
   3. DAMAGE SPRAYER

f. CLEAN SPRAYER VERY CAREFULLY AFTER EACH USE

B. FOGGING TIPS

a. DON'T PUT IN MORE INSECTICIDE THAN WILL BE USED IN A SHORT PERIOD OF TIME

b. MAKE CERTAIN THAT THOSE RUNNING THE FOGGER HAVE PROPER RESPIRATION AND EYE PROTECTION FROM THE INSECTICIDES BEING USED

c. MAKE CERTAIN THAT THE INSECTICIDE SELECTED WON'T LEAVE ANY HARMFUL RESIDUES

d. MAKE CERTAIN THAT THE FOGGER IS PROPERLY CLEANED AFTER USAGE

C. APPLICATION OF CONTACT OR RESIDUAL INSECTICIDES

a. APPLY AT THE RECOMMENDED RATE — TOO MUCH COULD BE AS BAD AS TOO LITTLE

b. DON'T MIX MORE THAN YOU PLAN TO USE OVER A SHORT PERIOD OF TIME

c. MAKE CERTAIN THAT THE MATERIAL SELECTED WAS DESIGNED FOR THE PARTICULAR PROBLEM YOU HAVE IN MIND.

7. TYPES OF DAMAGE TO PACKAGED FOOD COMMODITIES

A SEEMINGLY-INTACT PACKAGE OF FOOD IS OPENED ONLY TO FIND THE CONTENTS HEAVILY INFESTED WITH INSECTS OR BADLY MOLDED. HOW DID IT OCCUR? THERE MAY BE OBVIOUS DAMAGE TO THE PACKAGE OR IT MAY REQUIRE CLOSE EXAMINATION TO DETERMINE THE ROUTE OF ENTRY OF THE CONTAMINATION. THE OBJECTIVE IN THIS DISCUSSION IS TO POINT OUT SOME OF THE CONDITIONS THAT COULD SERVE AS THE ROUTE OR ROUTES OF ENTRY OR SOURCES FOR DETERIORATION.

IF AN INSECT PROBLEM HAS DEVELOPED WITHIN A BAG THERE ARE USUALLY INSECTS CRAWLING ON THE OUTSIDE TOO. WHEN INSECTS ARE OBSERVED AROUND A BAG OR STACK OF BAGS, IT SHOULD SERVE AS A WARNING AND WOULD SUGGEST THAT A THOROUGH INSPECTION SHOULD BE MADE. ANY OBVIOUSLY-DAMAGED BAGS SHOULD BE SEPARATED FROM GOOD BAGS AND ANY SPILLED PRODUCT REMOVED. INSECTS REQUIRE FOOD AND IF FOOD IS NOT PRESENT, THEY WILL LEAVE THE AREA.

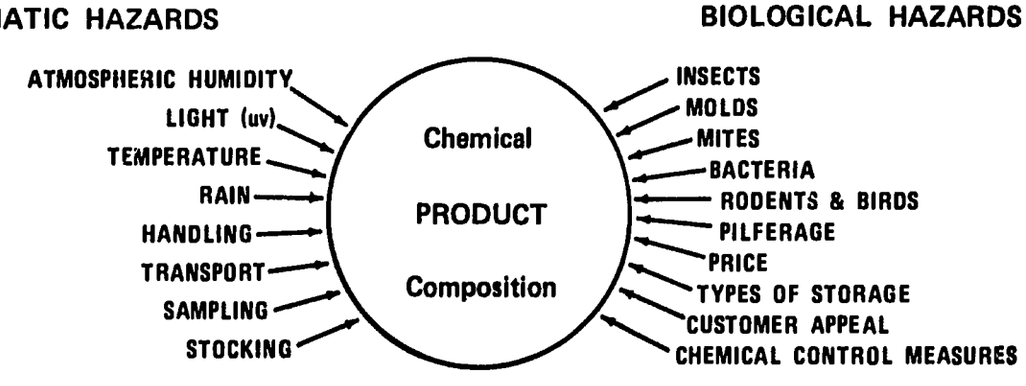
IT REALLY ISN'T AS SIMPLE AS THE FOREGOING COMMENTS MAY INDICATE. SEVERAL TALENTS ARE IMPORTANT IN FINDING AND HOLDING DOWN AN INSECT POPULATION. SOME OF THESE HAVE ALREADY BEEN DISCUSSED IN EARLIER LECTURES AND OTHERS ARE STILL TO COME.

TO BE CONSIDERED ARE:

1. CLEANING, WHICH MEANS THE REMOVAL OF ALL RESIDUE THAT COULD SERVE AS FOOD FOR INSECTS. THIS MEANS NOT ONLY FROM THE OPEN AREAS BUT FROM CORNERS, BETWEEN BAGS, AROUND AND UNDER PALLETS.
2. PRODUCT THAT IS, OR MAY BE, OUT-OF-CONDITION SHOULD BE MOVED TO AN ISOLATED AREA. IF INSECTS ARE NOTED, THEN FUMIGATION WOULD BE ADVISABLE.
3. CONTAMINATED MATERIAL SHOULD BE DESTROYED OR DISPOSED OF QUICKLY.
4. INVENTORIES SHOULD BE MOVED AS SOON AS POSSIBLE AND KEPT ON A "FIRST in-FIRST OUT" BASIS.
5. PRODUCT SHOULD BE SO STACKED THAT IT IS EASY TO INSPECT; EXAMPLES WOULD BE OPEN SPACES BETWEEN THE STACKS OF FOOD AND WALLS AND BETWEEN STACKS.

DAMAGE TO THE PACKAGE AND ITS CONTENTS COULD BE DIVIDED INTO FOUR CATEGORIES. THEY ARE:

1. CLIMATIC HAZARDS
2. MECHANICAL HAZARDS
3. BIOLOGICAL HAZARDS
4. OTHER FACTORS, SUCH AS PILFERAGE, CHEMICALS, ETC.



ONE OF THE PROBLEMS THAT HAS MADE IT DIFFICULT TO GIVE ANSWERS TO INQUIRIES FROM OVERSEAS IS THE LACK OF ACCURATE DATA OR ASSESSMENT OF THE CONDITIONS THAT HAVE ACTUALLY CAUSED THE LOSS OF FOOD. AS ALREADY MENTIONED, SOME OF THE CAUSES ARE OBVIOUS, HOWEVER, SOME OF THEM ARE DIFFICULT TO DETERMINE. MANY FORMS HAVE BEEN DEVISED FOR REPORTING LOSSES; HOWEVER, FEW, IF ANY, OF THOSE HAVE BEEN SUCCESSFUL BECAUSE OF THE AFORE-MENTIONED DIFFICULTY. WE DEBATED WHETHER A FORM SHOULD BE PRESENTED AS A PART OF THIS COURSE AND THE DECISION WAS NOT TO GO THAT ROUTE BUT INSTEAD, TO CONCENTRATE ON METHODS OF INSPECTION, PREVENTING AND CORRECTING. REPORTING COULD BE GREATLY SIMPLIFIED IF THE OTHER CONDITIONS ARE UNDERSTOOD AND FOLLOWED.

IN THE SIX COUNTRIES WHERE EXTENSIVE OBSERVATIONS AND FIELD TESTS HAVE BEEN CONDUCTED IT IS ESTIMATED THAT 90% OF THE PROBLEMS WOULD HAVE BEEN SOLVED IF THE FIVE RECOMMENDATIONS HAD BEEN FOLLOWED. AGAIN IT IS UNDERSTANDABLE THAT THE SOLUTION IS NOT SIMPLE AND WILL REQUIRE TRAINING AND FOLLOW-UP. WE HOPE THAT SEMINARS OF THIS TYPE CAN BE CONDUCTED AT MANY LOCATIONS AND THAT THE INFORMATION WILL BE PRESENTED IN A MEANINGFUL AND BENEFICIAL MANNER.

SLIDE PRESENTATION
TYPES OF DAMAGE TO PACKAGED FOOD COMMODITIES

TDP-1 (d) FOUR CATEGORIES OF DAMAGE (CHART)
TDP-2 (d) GOOD WAREHOUSING PRACTICES — PALLETS AND ADEQUATE SPACE (PANAMA)
TDP-3 (d) CLIMATIC HAZARD — PROBLEM CAUSED BY RAIN AND HUMIDITY
TDP-4 (d) CLIMATIC HAZARD — EXCESSIVE MOLD ON EXTERIOR OF BAGS
TDP-5 (d) CLIMATIC HAZARD — SOME BAGS REMOVED FROM STACK
TDP-6 (d) CLIMATIC HAZARD — CLOSE-UP OF BADLY MOLDED BAG
TDP-7 (d) CLIMATIC HAZARD — COTTON OVER-WRAP OPENED TO EXPOSE MULTI-WALL BAG INTERIOR. . .
TDP-8 (d) CLIMATIC HAZARD — MULTIWALL OPENED TO SHOW INTERIOR PLIES NO MORE DAMAGE. . .
TDP-9 (d) CLIMATIC HAZARD — PRODUCT EXPOSED AND IN GOOD CONDITION
TDP-10 (d) MECHANICAL HAZARD — GREASE FROM FORK LIFT TRUCK
TDP-11 (d) MECHANICAL HAZARD — DAMAGED PALLETS
TDP-12 (d) MECHANICAL HAZARD — WEAR-DESTROYED PAPER, PLASTIC EXPOSED
TDP-13 (d) MECHANICAL HAZARD — TOS BAG, TAPE FATIGUE (COMMENT ON TAPE TEAR)
TDP-14 (d) MECHANICAL HAZARD — TOS BAG, TAPE WEAR DAMAGE
TDP-15 (d) MECHANICAL HAZARD — TOS BAG, CORNER EAR TEAR
TDP-16 (d) MECHANICAL HAZARD — POM BAG, ADHESIVE FAILURE
TDP-17 (d) MECHANICAL HAZARD — POM BAG, ADHESIVE FAILURE
TDP-18 (d) MECHANICAL HAZARD — PUNCTURE OR SNAG
TDP-19 (d) BIOLOGICAL HAZARD — FLOUR BEETLES ON EXTERIOR OF CSM BAGS
TDP-20 (d) BIOLOGICAL HAZARD — PALLETS OF WHEAT FLOUR (AT 6 MO. STORAGE)
TDP-21 (d) BIOLOGICAL HAZARD — CLOSE-UP OF COTTON BAG(S)
TDP-22 (d) BIOLOGICAL HAZARD — CLOSE-UP OF COTTON BAG (MOLD AND INSECTS)
TDP-23 (d) BIOLOGICAL HAZARD — CLOSE-UP OF COTTON BAG (INSECT ENTRY AT STITCH)
TDP-24 (d) BIOLOGICAL HAZARD — CLOSE-UP OF INTERIOR OF COTTON BAG
TDP-25 (d) BIOLOGICAL HAZARD — CLOSE-UP OF PAPER BAG (INSECT ENTRY AT STITCH)
TDP-26 (d) BIOLOGICAL HAZARD — RODENT DAMAGE
TDP-27 (d) TEMPORARY SALVAGE OF DAMAGED BAGS

8. PROTECTION OF PACKAGED COMMODITIES FROM INSECTS

WE HAVE SEEN THAT THE FOOD PROCESSOR MAY FOLLOW ALL NECESSARY PROCEDURES TO AVOID INSECT CONTAMINATION OF HIS PRODUCT. HOWEVER, HE MAY HAVE LITTLE CONTROL OVER CONDITIONS ENCOUNTERED AFTER THE PRODUCT LEAVES HIS PLANT.

AFTER THE PACKAGED FOOD LEAVES THE MANUFACTURER, WHERE IS IT EXPOSED TO INSECTS? PACKAGED FOODS MAY BE EXPOSED TO INSECT INFESTATION IN RAILCARS, TRUCKS, CENTRAL WAREHOUSES, SHIPS, PORT WAREHOUSES, OUTLYING WAREHOUSES, AT THE FINAL DISTRIBUTION POINTS, AND WHILE THE FOOD IS BEING STORED BY THE CONSUMER. INTACT INSECT-RESISTANT PACKAGES CAN PROTECT FOODS FROM INFESTATION IN ALL OF THESE SHIPPING AND STORAGE SITUATIONS. SLIDE 1

THERE ARE TWO IMPORTANT PREREQUISITES FOR THE MANUFACTURE OF INSECT-RESISTANT PACKAGES. FIRST, THE PACKAGE MUST BE CONSTRUCTED SO AS TO PREVENT THE ENTRANCE OF INSECTS THROUGH SEAMS, CLOSURES, THE WEAVE OF FABRIC, OR ANY OTHER OPENING THROUGH WHICH THE INSECT CAN CRAWL OR OVIPOSIT. THESE INSECTS ARE CALLED INVADERS, AND THEY MUST FIND AN EXISTING OPENING TO GET INTO THE PACKAGE. SECOND, SOME INSECTS CAN BORE THROUGH ALMOST ANY FLEXIBLE PACKAGING MATERIAL IN USE TODAY, INCLUDING POLYETHYLENE FILM AND ALUMINUM FOIL. THESE ARE CALLED PENETRATORS. THE PACKAGE MUST THEREFORE BE CHEMICALLY TREATED TO PREVENT THESE INSECTS FROM BORING INTO THE PACKAGE. SLIDE 2 SLIDE 3 SLIDE 4

WHAT PROCEDURES ARE TAKEN TO PREVENT INVASION AND PENETRATION? IN THE UNITED STATES ONLY A COMBINATION OF PYRETHRINS AND PIPERONYL BUTOXIDE IS REGISTERED FOR USE AS AN INSECT-RESISTANT PACKAGE TREATMENT. PYRETHRINS IS OBTAINED FROM PLANTS AND HAS A VERY LOW MAMMALIAN TOXICITY VALUE; PIPERONYL BUTOXIDE IS A CHEMICAL THAT EXTENDS EFFECTIVE LIFE OF PYRETHRINS AND ALSO HAS A VERY LOW MAMMALIAN TOXICITY VALUE. THE INSECTICIDE COMBINATION MUST NOT EXCEED APPROXIMATELY 64 MG OF PYRETHRINS AND 640 MG OF PIPERONYL BUTOXIDE PER SQUARE METER (6 AND 60 MG PER SQUARE FOOT, RESPECTIVELY) ON THE OUTER SURFACE OF MULTIWALL PAPER BAGS OR 59 MG OF PYRETHRINS AND 590 MG OF PIPERONYL BUTOXIDE PER SQUARE METER (5 AND 50 MG PER SQUARE FOOT, RESPECTIVELY) ON THE OUTER SURFACE OF COTTON BAGS. ALL BAGS MUST CONTAIN AT LEAST 22.7 KILOGRAMS (50 POUNDS) OF DRY CEREAL PRODUCTS. THE COTTON BAGS MUST HAVE AN INNER LINER WAXED PAPER LINER, AND THE PRODUCT MUST CONTAIN NO MORE THAN 4 PERCENT FAT. EXTENSIVE 2-YEAR TESTS CONDUCTED AT THE STORED-PRODUCT INSECTS RESEARCH AND DEVELOPMENT LABORATORY IN SAVANNAH CLEARLY PROVED THAT VERY LOW RESIDUES OCCURRED IN COMMODITIES STORED IN THESE BAGS. AS A RESULT OF THESE STUDIES THE OFFICIAL RESIDUE TOLERANCE IS NOW 1 AND 10 PARTS PER MILLION, RESPECTIVELY, OF PYRETHRINS AND PIPERONYL BUTOXIDE.

INSECT-RESISTANT SHIPPING BAGS ARE NOW BEING USED TO SHIP MOST TYPES OF PROCESSED CEREALS FROM THE UNITED STATES IN

OUR AID PROGRAMS. THESE BAGS CONSIST OF 5 OUTER PLIES OF PAPER AND 1 INNER PLY OF 3-MIL POLYETHYLENE FILM. THE OUTER SEAMS ARE SEALED SO THAT THERE IS NO MORE THAN 5 MM OF UNGLUED EDGE, TO ELIMINATE INSECT HARBORAGE. THE OUTER SURFACE OF THE OUTER PLY IS TREATED WITH SYNERGIZED PYRETHRINS AND IS ACCORDINGLY LABELED WITH A U.S. GOVERNMENT REGISTRATION NUMBER. THE MANUFACTURERS OF IRT PAPER CONDUCT RIGID TESTS BY CHEMICAL ANALYSES TO BE CERTAIN THAT IR COATINGS ARE APPLIED CORRECTLY.

SLIDE 5

TWO TYPES OF INSECT-TIGHT CLOSURES ARE AUTHORIZED FOR THESE BAGS. THE ONE USED MOST OFTEN IS COMMONLY CALLED THE PINCH-BOTTOM CLOSURE. ON THIS BAG, WHICH IS GUSSETED, THE EXTENDED FLAP AT EACH END OF THE BAG IS COMPOSED OF THE STEPPED PLIES OF PAPER. SEALING IS ACCOMPLISHED WITH A WIDE BAND OF HEAT-ACTIVATED ADHESIVE. THE FLAP IS FOLDED OVER AND SEALED TO THE OPPOSITE FACE OF THE BAG. BOTH ENDS OF THE BAG ARE SEALED IN A LIKE MANNER. DEFECTIVE SEALS CONSIST OF INCOMPLETE ADHESION OF THE FOLDED-OVER FLAP (USUALLY CORNER PRRL), SHORT FOLDED-OVER FLAP, TAPERED FOLDED-OVER FLAP, WRINKLED FOLDED OVER FLAP, OR MISALIGNED FOLDED-OVER FLAP. ANOTHER DEFECT IS A PARTIALLY SEALED LONGITUDINAL SEAM.

SLIDE 6
SLIDE 7
SLIDE 8
SLIDE 9
SLIDE 10

THE OTHER TYPE OF INSECT-TIGHT CLOSURE IS THE TAPE-OVER STITCHING IN WHICH THE THREAD CHAIN EXTENDING FROM EACH SIDE OF THE BAG IS COMPLETELY ENCLOSED BY THE PAPER TAPE. THIS PREVENTS SMALL INSECTS FROM CRAWLING UP THE CHANNEL FORMED BY THE TAPE OVER THE STITCHING. THE TAPE AND LONGITUDINAL SEAMS ARE SEALED SO THAT THERE ARE NO UNBONDED EDGES. THIS BAG ALSO CONSISTS OF 1 INNER POLYETHYLENE AND 5 OUTER PAPER PLIES, AND THE EXTERIOR PLY IS TREATED WITH SYNERGIZED PYRETHRINS.

SLIDE 11
SLIDE 12
SLIDE 13
SLIDE 14

CERTAIN COMMODITIES ARE SHIPPED IN FABRIC BAGS MADE OF JUTE, COTTON, OR WOVEN POLYPROPYLENE. THESE BAGS PROVIDE NO PROTECTION FROM INSECT INFESTATION. INSECTS CAN ENTER EVEN INTACT BAGS BY CRAWLING THROUGH THE GAPS AND HOLES FORMED BY THE STITCHING, THROUGH THE WEAVE OF THE FABRIC, OR BY THE FEMALE OVIPOSITING THROUGH THE WEAVE.

SLIDE 15

COMMODITIES SHIPPED IN IRT PAPER SACKS INCLUDE:

- FLOUR, SOY FORTIFIED
- ROLLED OATS, SOY FORTIFIED
- CORNMEAL, SOY FORTIFIED
- SORGHUM GRITS, SOY FORTIFIED
- SOY FLOUR (FULL FAT)
- SOY FLOUR (DEFATTED)
- WHEAT FLOUR (BLEND A)
- WHEAT SOY BLEND
- WHEAT SOY BLEND, SWEETENED AND FLAVORED
- CSB
- CSB, INSTANT
- CSB, SWEETENED AND FLAVORED
- CORNMEAL
- ROLLED OATS

THESE ARE SHIPPED IN IRT BAGS BECAUSE OUR RESEARCH AT THE SAVANNAH LABORATORY HAS SHOWED THAT PROTEIN FORTIFICATION OF PROCESSED CEREALS MAKES THEM MORE SUSCEPTIBLE TO ATTACK BY A NUMBER OF STORED-PRODUCT INSECTS.

COMMODITIES SHIPPED IN NON-INSECT-RESISTANT FABRIC BAGS INCLUDE:

- BULGUR
- BULGUR, LYSINE FORTIFIED
- BULGUR, SOY FORTIFIED
- ROLLED WHEAT
- WHEAT FLOUR, BAKER'S SOFT
- WHEAT FLOUR, BAKER'S HARD
- WHEAT FLOUR, DURUM
- WHEAT FLOUR, ENRICHED, LYSINE FORTIFIED
- RICE, MILLED

HOW CAN WE EXAMINE BAGS FOR INFESTATION? THE PRESENCE OF INSECTS CRAWLING ABOUT ON THE BAG SURFACES CAN INDICATE THE EXISTENCE OF A MAJOR INFESTATION. IF STORED-PRODUCT INSECTS ARE SEEN ANYWHERE ON OR AROUND FABRIC BAGS OF PROCESSED CEREALS OR GRAINS, INCLUDING FLOORS, PALLETS, OR ON OTHER STORED GRAINS OR PACKAGES, IT IS ALMOST CERTAIN THAT THE FABRIC BAGS WILL BE INFESTED. UNDER THESE SAME CONDITIONS, HOWEVER, IRT BAGS WOULD PROBABLY BE FREE OF INSECTS, PROVIDING THE BAGS ARE INTACT AND PROVIDING RECOMMENDED STORAGE PERIODS HAVE NOT BEEN EXCEEDED. IT SHOULD BE NOTED THAT THE IRT WILL NOT DESTROY INFESTATIONS THAT EXIST INSIDE OF THESE BAGS. IF INSECTS SUCCEED IN GAINING ENTRANCE INTO IRT BAGS VIA SEAMS, CLOSURES, OR TEARS, HIGH POPULATIONS CAN BUILD UP AND PENETRATORS WILL BORE OUT OF THE BAGS TO DISPERSE.

SLIDE 16

TO EXAMINE IRT PAPER BAGS FOR THE POSSIBILITY OF INFESTATION, LOOK FOR PENETRATIONS IN THE BAG WALLS AND FOR INSECTS UNDER LOOSE TAPES AND IN THE CORNER FOLD OF PINCH-BOTTOM CLOSURES. INSECTS CAN OFTEN BE FOUND HARBORING BETWEEN STACKED BAGS, ESPECIALLY WHEN THE BAGS HAVE BEEN STORED FOR LONG PERIODS. IF INSECTS ARE ONLY FOUND HARBORING BETWEEN BAGS, IT DOES NOT NECESSARILY MEAN THAT THEY HAVE SUCCEEDED IN GAINING ENTRANCE TO THE BAGS. IT IS, HOWEVER, A GOOD INDICATION THAT THE BAGS SHOULD BE CAREFULLY EXAMINED FOR TEARS AND DEFECTIVE CONSTRUCTION. IF TORN BAGS ARE FOUND, CONSIDERATION MUST BE GIVEN TO FUMIGATING THE ENTIRE LOT OF BAGS.

IF THE BAGS ARE FUMIGATED, THE TARPAULINS CAN BE LEFT IN PLACE UNTIL THE BAGS ARE TO BE MOVED. THIS WILL HELP EXCLUDE INSECTS, IF THE FLOOR IS TREATED WITH A RESIDUAL INSECTICIDE. OF COURSE, THE COVER MUST BE REMOVED AND THE STACK WELL AERATED BEFORE THE BAG CAN BE SAFELY HANDLED. A WORD OF CAUTION IS REQUIRED HERE: ALL IRT PAPER BAGS FROM THE UNITED STATES CONTAIN A POLYETHYLENE FILM LINER THAT DELAYS THE ESCAPE OF THE FUMIGANT FROM INSIDE THE BAG. THEREFORE, ONE MUST ALLOW AT LEAST 1 FULL DAY BETWEEN REMOVAL OF THE FUMIGATING TARAPULIN AND HANDLING OF THE BAGS.

WHAT ARE SOME OF THE OTHER PROCEDURES FOR PROTECTING PACKAGED COMMODITIES? WHEN THE PACKAGES ARE DELIVERED TO THE WAREHOUSE FOR STORAGE, THEY SHOULD BE CAREFULLY EXAMINED FOR DAMAGE AND FAULTY CONSTRUCTION. IRT BAGS WITH ANY TEARS OR FAULTY CONSTRUCTION SHOULD BE SEGREGATED AND USED AS SOON AS POSSIBLE. THIS CANNOT BE OVER-EMPHASIZED. TORN FABRIC BAGS SHOULD BE MENDED IN THE INTEREST OF GOOD HOUSEKEEPING, TO PREVENT SPILLAGE OF THE COMMODITY FROM THE BAG.

SLIDE 17

COMMODITIES IN IRT BAGS SHOULD BE STORED SEPARATELY FROM COMMODITIES IN FABRIC BAGS, IF POSSIBLE. THIS HELPS MINIMIZE EXPOSURE OF THE IRT BAGS TO THE HEAVY INFESTATIONS THAT CAN BUILD UP IN NON-INSECT-RESISTANT FABRIC BAGS.

STOCKS MUST BE ARRANGED SO THAT THE OLDEST STOCK CAN BE SHIPPED FIRST. THE EFFECTIVE LIFE OF THE IRT IS LIMITED; THEREFORE, OLD BAGS WILL BECOME INFESTED. ALSO, THIS MAY HELP MINIMIZE THE BUILDUP OF LARGE POPULATIONS IN FABRIC BAGS, DEPENDING ON HOW LONG THE BAGS HAVE BEEN STORED.

SLIDE 18

STOCKS THAT ARE HEAVILY INFESTED OR OTHERWISE DAMAGED SHOULD BE REMOVED IMMEDIATELY. EXPERIENCE AND WORLDWIDE OBSERVATIONS HAVE SHOWN THAT THE PRINCIPAL SOURCES OF REINFESTATION ARE EITHER DAMAGED BAGS OR STOCKS THAT ARE CONCEALED OR NEGLECTED IN HIDDEN AREAS OF THE WAREHOUSE. LEGAL ADMINISTRATIVE PROCEDURES MUST BE FORMULATED AND ADMINISTERED PROMPTLY TO DISPOSE OF THESE MATERIALS AND TO PREVENT THE STORAGE OF THESE MATERIALS IN WAREHOUSES MAINTAINING ACTIVE STOCKS OF PACKAGED COMMODITIES. IF THE INFESTED DAMAGED STOCKS CANNOT BE DISPOSED OF, MOVE THEM AWAY FROM THE UNINFESTED STOCKS.

SLIDE 19

INSPECT CAREFULLY AND FREQUENTLY FOR INSECT INFESTATIONS. REMEMBER THAT SOME INSECTS CAN COMPLETE A GENERATION IN AS LITTLE AS 30 DAYS. UNDER FAVORABLE CONDITIONS USUALLY FOUND IN THE TROPICS AND SUBTROPICS, ONE PAIR OF FLOUR BEETLES COULD PRODUCT 1,000,000 PROGENY IN 90 DAYS.

FINALLY, IT IS OF UTMOST IMPORTANCE THAT THE SANITATION PROCEDURES DISCUSSED AT THIS MEETING BE FOLLOWED WITH ALL POSSIBLE CARE. GOOD HOUSEKEEPING AND SANITATION PROCEDURES COME FIRST. DESTRUCTION OF EXISTING INFESTATIONS SHOULD BE CONSIDERED A NECESSARY STEP TO BE TAKEN BECAUSE OF FAILURE TO APPLY GOOD HOUSEKEEPING AND SANITATION PROCEDURES SOMEWHERE ALONG THE LINE OF DISTRIBUTION.

THE FOLLOWING SLIDES WERE USED TO ILLUSTRATE AND EMPHASIZE VARIOUS FACTORS AND CONCEPTS:

1. SKETCH DEPICTING THE FUTILE EFFORT OF INSECTS ATTEMPTING TO ENTER AN INSECT-RESISTANT BAG
2. CLOSEUP OF INSECT EGGS IN THE SEWN SEAM OF A COTTON BAG
3. CLOSEUP OF A SMALL LARVA NEXT TO A NEEDLE HOLE IN A PAPER BAG

4. CLOSEUP OF AN INSECT EGG, THE PERIOD TYPED FROM A TYPEWRITER, AND A LARVA CRAWLING INTO A HOLE .01 INCH IN DIAMETER

5. REGISTRATION LABEL FROM A SYNERGIZED PYRETHRINS-TREATED PAPER BAG

6. END VIEW OF PASTE-OPEN-MOUTH AND TAPE-OVER-STITCH PAPER BAGS

7. CLOSEUP OF CORNER PEEL ON A PASTED-OPEN-MOUTH BAG

8. SAME AS 7

9. CLOSEUP OF UNSEALED CORNER ON A PASTED-OPEN-MOUTH BAG

10. UNBONDED OUTER SEAM ON A FLAT TUBE PAPER BAG

11. FLAT TUBE BAG SHOWING STITCHING, PEELED BACK TAPE, AND EXPOSED THREAD UNDER SEALED TAPE

12. END VIEW OF TAPE-OVER-STITCH SHOWING UNSEALED TAPE

13. EXPOSED THREAD IN TAPE EAR

14. INSECT HARBORING IN TAPE EAR OF TAPE-OVER-STITCH CLOSURE

15. INSECT DAMAGE TO COTTON BAG (CLOSEUP)

16. INSECT DAMAGE TO COTTON BAGS (General view)

17. STACK OF CSM BAGS WITH ONE DAMAGED BAG IN THE MIDDLE OF THE STACK

18. DAMAGED CSM BAGS SHOWING RESERVOIR OF INSECTS IN A WAREHOUSE

19. DAMAGED DRY MILK BAGS

9. TYPICAL MOVEMENT OF COMMODITIES IN OVERSEAS PROGRAMS

IT IS DIFFICULT FOR PERSONS THAT HAVE NOT TRAVELED OVERSEAS AND ACTUALLY OBSERVED THE COMPLEXITY OF DISTRIBUTION TO FULLY UNDERSTAND THE NUMBER OF TIMES EACH FOOD CONTAINER IS HANDLED. TO DESIGN AN INEXPENSIVE PACKAGE TO WITHSTAND THE ABUSES THAT ARE A NORMAL OCCURRENCE HAS, IN ITSELF, BEEN A REAL CHALLENGE.

A RECENT RESEARCH SHIPMENT OF CSM AND WHEAT FLOUR TO COLOMBIA COULD BE USED AS A TYPICAL EXAMPLE. LET US FOLLOW THAT SHIPMENT FROM THE PROCESSING PLANTS IN THE UNITED STATES TO FINAL DESTINATION.

THE EMPTY BAGS WERE PLACED BY THE PACKING EQUIPMENT. EACH BAG WAS INSERTED ON THE SPOUT AND FILLED. THE BAGS WERE THEN MOVED THROUGH THE CLOSING EQUIPMENT, FALLING ONTO A RUBBER CONVEYOR BELT AND MOVING TO A RAIL CAR. IN THE RAIL CAR THEY WERE MOVED BY HAND AND STACKED. THE RAIL CAR THEN MOVED TO A SEAPORT LOCATION. AT THAT POINT THEY WERE UNLOADED BY HAND. THE BAGS WERE PLACED ON WOODEN PALLETS AND MOVED BY MEANS OF A FORK-LIFT TRUCK INTO A WAREHOUSE. PALLET LOADS WERE STACKED AND HELD UNTIL TIME TO LOAD INTO A SHIP. AGAIN THE PALLETS WERE MOVED BY A FORK-LIFT TRUCK TO SHIP-SIDE AND HOISTED INTO A HOLD. THE BAGS WERE REMOVED BY HAND AND STACKED IN THE HOLD. AT DESTINATION PORT, THE SHIP WAS UNLOADED IN MUCH THE SAME PROCEDURE AS THE LOADING. SOME PORTS DO NOT USE PALLETS FOR HOLDING THE BAGS WHILE HOISTING FROM THE SHIP; ROPE SLINGS AND EVEN AN OCCASIONAL CABLE SLING HAVE BEEN OBSERVED. WHERE PALLETS ARE USED, AS WAS THE CASE IN THE COLOMBIA TEST, THE PALLETS WERE MOVED BY FORK-LIFT TRUCK INTO A WAREHOUSE. THEY WERE MOVED A SECOND TIME BY A FORK LIFT AND THEN LOADED BY HAND ONTO A TRUCK. THE TRUCK TRAVELED A DISTANCE OF APPROXIMATELY 75 MILES FROM THE PORT CITY OF CARTAGENA TO BARRANQUILLA. THE TRUCK WAS UNLOADED BY HAND, THE BAGS PLACED ON WOODEN PALLETS AND MOVED BY FORK-LIFT TRUCK INTO THE WAREHOUSE AND AGAIN STACKED. AFTER CLEARANCE BY CUSTOM OFFICIALS, THE PALLETS WERE MOVED TO A TRUCK, THE BAGS HAND-PLACED ON THE TRUCK AND TAKEN TO A DISTRIBUTION WAREHOUSE. THERE ARE USUALLY SEVERAL MORE MOVES REQUIRED TO GET THE BAGS TO THE POINT OF CONSUMPTION.

THE NUMBER AND TYPES OF HANDLINGS WOULD TOTAL AS FOLLOWS:

NUMBER AND TYPES OF HANDLINGS

		MECHANICAL			CONVEYANCES		
	MANUAL	CONVEYOR BELT	FORK LIFT	CABLE HOIST	BOX CAR	SHIP	TRUCK
PACKING & LOADING	1	1					
RAIL SHIPMENT	2				1		
PORT STORAGE (USA)			2				
WATER SHIPMENT	2			2		1	
PORT STORAGE CARTEGENA, COLOMBIA	1		3				1
PORT STORAGE BARRANQUILLA, COLOMBIA	1		1				1
TOTALS	7	1	6	2	1	1	2

NO DOUBT YOU ARE NOW WONDERING IF IT IS POSSIBLE TO GET A PACKAGE THROUGH SO MANY HANDLINGS IN A SAFE OR UNDAMAGED CONDITION. WELL, SOME DO MAKE IT; HOWEVER, LET US LIST THE CONDITIONS OF POSSIBLE DAMAGE OR CONTAMINATION.

1. ROUGH WALLS IN RAIL CARS.
2. RAIL CARS MAY LEAK WATER.
3. RAIL CARS MAY CONTAIN CHEMICALS THAT CONTAMINATE THE PRODUCT.
4. NAILS, SPLINTERS AND SHARP EDGES ON WOODEN PALLETS EACH TIME PALLETS ARE USED AND EACH TIME PALLET LOADS ARE STACKED ONE ON TOP OF ANOTHER.
5. PUNCTURE OF BAGS BY THE METAL PRONGS ON A FORK-LIFT UNIT.
6. BAGS SCRAPING SHARP OBJECTS WHILE BEING MOVED BY THE FORK-LIFE VEHICLES.
7. ROUGH OR SHARP OBJECTS ON THE SHIP.
8. WATER DAMAGE ON THE SHIP; RAIN, SEA WATER OR THE SHIP'S PLUMBING.
9. CONTAMINATION BY CHEMICALS STORED IN THE SAME HOLD ON THE SHIP.
10. RAIN DURING THE LOADING AND UNLOADING.
11. ROUGH BED ON TRUCKS USED TO HAUL THE PRODUCT.
12. WATER DAMAGE DURING THE MOVEMENT BY TRUCK (THIS DID OCCUR IN THE RESEARCH SHIPMENT TO COLOMBIA).
13. DAMAGE IN WAREHOUSES CAUSED BY SHARP OBJECTS, WATER OR CHEMICALS.
14. AT ALL POINTS DURING STORAGE AND CONVEYING THERE IS ALWAYS THE THREAT OF DAMAGE BY BIRDS, RODENTS OR OTHER ANIMALS AND OF PENETRATION OF THE PACKAGES BY INSECTS.

WHEN WE LOOK AT ALL OF THOSE POTENTIAL PROBLEMS IT IS NO WONDER THAT SOME FOOD DOES DETERIORATE OR DOES RECEIVE SEVERE DAMAGE. HOWEVER, THOSE CONDITIONS HAVE NOT BEEN POINTED OUT TO INDICATE IT IS A HOPLESS PROBLEM; BUT, INSTEAD, TO INDICATE WHERE IT IS FELT THAT ADDITIONAL UNDERSTANDING AND ATTENTION MAY BE REQUIRED.

SLIDE PRESENTATION

TYPICAL MOVEMENT OF COMMODITIES IN OVERSEAS PROGRAMS

TMC-1 (c) MAP OF ROUTE OF TRAVEL — COLOMBIA TEST SHIPMENT
TMC-2 (c) NUMBER AND TYPES OF HANDLINGS (CHART)
TMC-3 (c) PLACING EMPTY BAG ON PACKER
TMC-4 (c) FILLED AND CLOSED BAGS
TMC-5 (c) BELT CONVEYOR FROM PACKER TO RAIL CAR
TMC-6 (c) LOADING INTO RAIL CAR
TMC-7 (c) ARRIVAL AT U.S. PORT WAREHOUSE
TMC-8 (c) UNLOADING FROM RAIL CAR AT U.S. PORT
TMC-9 (c) STORAGE IN PORT WAREHOUSE (U.S.)
TMC-10 (c) STORAGE IN PORT WAREHOUSE (U.S.)
TMC-11 (c) SHIP — GULF BANKER
TMC-12 (c) LOADING INTO SHIP AT U.S. PORT
TMC-13 (c) STARTING TO PLACE BAGS ON PALLET IN SHIP'S HOLD
TMC-14 (c) PALLET LOAD READY FOR HOISTING
TMC-15 (c) PALLET LOAD BEING LOWERED FROM THE BOAT
TMC-16 (c) LOADING INTO BARGE
TMC-17 (c) TRUCK MOVEMENT
TMC-18 (c) LOADING TRUCK — PORT WAREHOUSE
TMC-19 (c) STORAGE IN PORT WAREHOUSE (INDIA)
TMC-20 (c) STORAGE IN PORT WAREHOUSE (MANILA)
TMC-21 (c) TRANSPORT OF BAGS ON CART
TMC-22 (c) CART ARRIVING AT USE-POINT

10. WAREHOUSE CONSTRUCTION AS IT RELATES TO SANITATION

SANITATION CAN BE A RELATIVELY SIMPLE MATTER IN NEW WAREHOUSES THAT HAVE BEEN DESIGNED AND CONSTRUCTED WITH THIS IN MIND. UNFORTUNATELY, MOST OF THE STORAGE OF FOOD IS IN STRUCTURES THAT DO NOT LEND THEMSELVES TO SIMPLIFIED CONTROL OF VERMIN.

WHAT ARE THE IDEAL CONDITIONS TO BE CONSIDERED IN THE DESIGN OF A WAREHOUSE?

1. ADEQUATE SPACE FOR THE INTENDED USE
2. PROTECTION FROM RAIN AND SURFACE WATER
3. GOOD VENTILATION
4. GOOD LIGHTING, EITHER BY ARTIFICIAL MEANS OR BY WINDOWS
5. WINDOWS THAT PREVENT THE ENTRY OF VERMIN
6. DOORS THAT FIT CLOSELY ENOUGH TO PREVENT THE ENTRY OF RODENTS, BIRDS AND OTHER VERMIN
7. NO HOLES IN THE OUTER WALLS THAT WOULD PERMIT THE ENTRY OF VERMIN
8. CEMENT FLOORS
9. WINDOWS, DOORS AND VENTILATORS THAT CAN BE CLOSED TIGHTLY FOR FUMIGATION

SOUNDS LIKE A WAREHOUSE MANAGER'S DREAM, DOESN'T IT? THERE ARE STRUCTURES THAT MEET THOSE CONDITIONS IN A NUMBER OF COUNTRIES. I RECALL VISITING TWO SUCH WAREHOUSES IN A COUNTRY NOT TOO FAR FROM HERE. NO INSECTS OR RODENTS WERE NOTED IN THOSE TWO WAREHOUSES AND NO DAMAGED PRODUCT WAS AROUND. THEY FOLLOWED THE FIVE RECOMMENDATIONS OF GOOD WAREHOUSING PRACTICES.

NOW WHAT CAN YOU DO WITH STRUCTURES THAT DO NOT MEET ALL OF THE REQUIREMENTS? THE OBJECTIVE SHOULD BE TO AVOID ANY CONDITIONS THAT PERMIT THE ENTRY OF VERMIN, RAIN OR SURFACE WATER AND TO HAVE SURFACES THAT CAN BE CLEANED. ACCUMULATIONS OF EQUIPMENT AND SUPPLIES THAT ARE NO LONGER NEEDED SHOULD BE REMOVED FROM A FOOD STORAGE BUILDING. THE YARD AREA IMMEDIATELY SURROUNDING THE BUILDING SHOULD BE FREE OF CONDITIONS THAT WOULD BE ATTRACTIVE TO VERMIN OR WOULD OFFER FOOD OR SHELTER TO VERMIN.

NO DOUBT THOSE COMMENTS SEEM IDEALISTIC BUT THEY DO MAKE SENSE. IF YOU CAN PREVENT A PROBLEM, THEN YOU DO NOT HAVE THE EXPENSE OF CORRECTIVE MEASURES OR THE LOSSES THAT GO WITH CONTAMINATION AND PRODUCT DETERIORATION.

TO STOP RODENTS FROM ENTERING A BUILDING, THE OPENINGS MUST NOT BE LARGER THAN 1/4-INCH FOR MICE OR 1/2-INCH FOR RATS. IT ISN'S EASY TO GET A DOOR TO CLOSE THAT TIGHTLY OR TO PROVIDE A SCREEN OF THAT SMALL OF AN OPENING. THE 1/4-INCH OPENING WILL NOT BE OF VALUE IN PREVENTING THE ENTRY OF INSECTS. SMALL MESH WIRE IS REQUIRED TO KEEP OUT INSECTS AND EVEN THEN IT MAY NOT BE COMPLETELY SUCCESSFUL. CLEANLINESS AND STOCK ROTATION, ALONG WITH THE USE OF PESTICIDES, HAVE PROVEN TO BE MOST SUCCESSFUL PROGRAM.

BIRDS DO NOT USUALLY PRESENT A PROBLEM IN WAREHOUSES, HOWEVER, WE HAVE ENCOUNTERED UNUSUAL CONDITIONS AND THERE HAS BEEN SEVERE DAMAGE. THIS IS ESPECIALLY TRUE WHERE THERE IS WHOLE GRAIN. WIRE THAT

WOULD KEEP RODENTS OUT WOULD ALSO KEEP OUT BIRDS. THERE IS AN IMPORTANT HEALTH HAZARD IN THAT BIRDS DO CARRY SALMONELLA AND IF THEY NEST OR ROOST IN THE AREA OF FOOD HANDLING OR STORAGE, THEY MAY CAUSE CONTAMINATION. WITH THAT IN MIND, IT IS DESIRABLE TO KEEP THEM OUT OF A WAREHOUSE EVEN IF THEY DO NOT DAMAGE THE FOOD.

WATER CAN CAUSE A RAPID LOSS OF FOOD QUALITY. THIS COULD RESULT FROM EXPOSURE OF THE PRODUCT TO EXCESSIVE HUMIDITY, FROM RAIN OR FROM SURFACE RUN-OFF. MANY OF THE FOODS STORED IN WAREHOUSES ARE EITHER GRAIN OR CONTAIN SOME CEREAL PRODUCTS AND WHEN THESE ARE EXPOSED TO MOISTURE, THEY WILL BECOME MOLDY. THE MOLD IN ITSELF MAY CAUSE PRODUCT LOSS BUT ONE MUST NOT OVERLOOK THE POTENTIAL HEALTH HAZARD CAUSED BY MYCOTOXINS. MYCOTOXINS MAY DEVELOP WHEN ASPERGILLUS MOLDS ARE, OR HAVE BEEN, PRESENT.

IT IS MOST UNFORTUNATE THAT THERE ARE USUALLY BUDGETARY PROBLEMS ASSOCIATED WITH CONSTRUCTION. THE MOST USABLE SPACE IS REQUIRED FOR THE LEAST EXPENDITURE OF MONEY. THIS IS A PROBLEM IN MOST CONSTRUCTION. THE HOLDING-DOWN OF COSTS USUALLY RESULTS IN THE CUTTING OF CORNERS AND THE PREVENTIVE MEASURES THAT COULD BE A PART OF THE ORIGINAL STRUCTURE ARE OMITTED. THE RESULT IS USUALLY AN EXPENSIVE AND CONTINUAL PROGRAM OF CLEANING AND PESTICIDE APPLICATION OR OF LOSSES OF COMMODITIES. SUCH CALCULATIONS SHOULD BE CONSIDERED CAREFULLY WHENEVER NEW CONSTRUCTION OR RENOVATION IS CONSIDERED.

SLIDE PRESENTATION

WAREHOUSE CONSTRUCTION AS IT RELATES TO SANITATION

WCS-1 (e) TITLE SLIDE — "BUILT-IN SANITATION" (DANVILLE, ILL.)
WCS-2 (e) PANAMA, INTERNAL — WELL DESIGNED
WCS-3 (e) BARRANQUILLA, INTERNAL — FAULTY ROOF DESIGN
WCS-4 (e) BARRANQUILLA, EXTERNAL — WELL DESIGNED
WCS-5 (e) BARRANQUILLA, INTERNAL — WELL DESIGNED
WCS-6 (e) BARRANQUILLA, EXTERNAL — CLOSE-UP OF WALL DAMAGE
WCS-7 (e) BUCARAMANGA, EXTERNAL — NOTE PROBLEM AREAS
WCS-8 (e) BUCARAMANGA, INTERNAL — NOTE PROBLEM AREAS
WCS-9 (e) SANTA DOMINGO, EXTERNAL — WELL DESIGNED
WCS-10 (e) SANTA DOMINGO, EXTERNAL — CLOSE-UP OF PROBLEM AREAS
WCS-11 (e) SANTA DOMINGO, EXTERNAL — ATTEMPTED CORRECTION
WCS-12 (e) INDIA, EXTERNAL — NOTE PROBLEM AREAS
WCS-13 (e) MALABON, INTERNAL — GOOD STORAGE DESIGN

11. INSPECTION OF A WAREHOUSE

THE ABILITY TO INSPECT AND TO ACCURATELY INTERPRET THE OBSERVATIONS IS A VERY IMPORTANT PART OF QUALITY ASSURANCE. INSPECTION IS OF LITTLE VALUE WITHOUT FOLLOW-UP CORRECTIVE AND PREVENTIVE MEASURES. WE HAVE ALREADY DISCUSSED THE IMPORTANCE OF INSECTS, THE USE OF PESTICIDES AND THE DESIGN OF BUILDINGS. THAT INFORMATION IS NECESSARY IN ORDER TO INSPECT AND TO RECOMMEND THE CORRECT FOLLOW-UP. THE FREQUENCY AND THOROUGHNESS OF AN INSPECTION SHOULD BE DETERMINED BY THE CONDITIONS THAT ARE PRESENT. IT IS AN UNUSUAL SITUATION THAT DOES NOT REQUIRE AT LEAST ONE INSPECTION EVERY 30 DAYS.

HOW DOES ONE ESTABLISH AN INSPECTION PROCEDURE AND WHAT ARE THE REQUIREMENTS?

A. A PREREQUISITE IS A KNOWLEDGE OF THE PROBLEMS THAT MAY BE ENCOUNTERED. THAT IS THE REASON THIS IMPORTANT SUBJECT HAS BEEN PLACED LAST ON THE AGENDA.

B. THE PROPERTY TO BE INSPECTED SHOULD BE DIVIDED INTO SEVERAL AREAS, SUCH AS:
   a. YARD AREA SURROUNDING THE BUILDING(S)
   b. THE BUILDING OR BUILDINGS
   c. PRODUCTS STORED WITHIN THE BUILDING(S)

C. EACH INSPECTION AREA SHOULD BE EXAMINED WITH THE FOLLOWING CONSIDERATIONS:
   a. IN THE YARD AREA SURROUNDING THE BUILDING, THE FOLLOWING CONDITIONS SHOULD BE NOTED:
      1. ARE RODENTS PRESENT?
      2. ARE THRE REFUSE OR OTHER CONDITIONS SERVING AS AN ATTRACTANT OR BREEDING AREA FOR INSECTS?
   b. THE ACTUAL BUILDING SHOULD BE EXAMINED FOR:
      1. OPENINGS THAT PERMIT THE ENTRY OF BIRDS — ARE THEY SCREENED?
      2. OPENINGS THAT PERMIT THE ENTRY OF RODENTS — ARE THEY SCREENED? ARE TRAPS OR RODENT BAIT STATIONS IN USE? ARE THE RODENT CONTROL DEVICES BEING USED PROPERLY?
      3. DOES THE ROOF LEAK? IF SO, HAVE THE PRODUCTS BEEN ADEQUATELY PROTECTED SO THEY DO NOT GET WET?
      4. CAN RAIN CONTACT THE PRODUCTS BECAUSE OF OPEN WINDOWS OR DOORS?
      5. DOES SURFACE WATER GET INTO THE BUILDING? IF SO, HAVE THE PRODUCTS BEEN STORED ON PALLETS OR IN SUCH A MANNER SO AS TO KEEP THEM DRY?
   c. PRODUCTS WITHIN THE BUILDING:
      1. ARE THE PRODUCTS STORED IN AN ORDERLY MANNER?
      2. IS THERE SPACE BETWEEN PILES ALLOWING SUFFICIENT ROOM FOR INSPECTION AND CLEANING?
      3. IS THERE SPACE BETWEEN PILES AND WALLS OR PARTITIONS?
      4. IS THERE REFUSE STORED IN THE SAME BUILDING?
      5. ARE THE FLOORS, WALLS AND BEAMS FREE OF ACCUMULATIONS OF FOOD THAT WOULD ATTRACT INSECTS AND RODENTS?

6. ARE THE PRODUCTS STORED OFF THE FLOOR, SUCH AS ON PALLETS?
7. IS THE EXTERIOR OF THE PACKAGES OF PRODUCTS CLEAN?
8. AFTER MOVING A FEW BAGS, IS IT FREE OF INSECTS OR PRODUCTS BETWEEN THE BAGS?
9. IS THERE EVIDENCE OF INSECT ACTIVITY?
10. IS THERE EVIDENCE OF RODENT ACTIVITY?
11. IS THERE EVIDENCE OF BIRD ACTIVITY?
12. IS THERE MOLD ON THE OUTSIDE OF ANY PACKAGES OF FOOD?
13. HAVE DAMAGED BAGS BEEN SEPARATED FROM UNDAMAGED BAGS?
14. IS THERE A PROGRAM FOR RAPID DISPOSITION OF DAMAGED OR OUT-OF-CONDITION PRODUCTS?
15. ARE INSECTICIDE SPRAYS OR FOGS USED? IF SO, ARE THE RESULTS SATISFACTORY?
16. IS THERE A PROGRAM FOR THE FUMIGATION OF INSECT-INFESTED PRODUCTS? IF SO, DOES IT APPEAR TO BE SUCCESSFUL?
17. IS THERE A PROGRAM OF STOCK ROTATION SUCH AS FIRST IN-FIRST OUT?

THE FOREGOING QUESTIONS WILL NOT COVER EVERY SITUATION AND SOME MAY BE DELETED AND OTHERS ADDED TO FIT CERTAIN CONDITIONS.

REQUIREMENTS OTHER THAN A KNOWLEDGE OF THE PROBLEMS THAT COULD BE PRESENT, AND THE CORRECTIVE MEASURES TO USE, WOULD INCLUDE A FLASHLIGHT AND SHARP OBJECT, SUCH AS A KNIFE. THE LIGHT PERMITS THE INSPECTION OF DARK AREAS AND THE KNIFE IS USED TO PROBE INTO CRACKS, ETC.

RODENTS AND INSECTS PREFER TO LIVE AND FEED IN AREAS OF SUBDUED LIGHTING. IN CASES OF HEAVY RODENT OR INSECT POPULATIONS, THEY MAY BE OBSERVED DURING DAYLIGHT HOURS OUT IN THE OPEN. WHEN THIS DOES OCCUR, IT USUALLY INDICATES A VERY HEAVY POPULATION AND PRODUCT LOSS MAY HAVE ALREADY OCCURRED.

FREQUENT INSPECTIONS ARE IMPORTANT AND THEY SHOULD BE CONSIDERED AS A REQUIREMENT IN ANY FACILITY THAT STORES FOOD. WHO SHOULD PERFORM THE INSPECTION IS NOT IMPORTANT, AS LONG AS HE IS QUALIFIED. The INSPECTIONS SHOULD BE ON A PRE-DETERMINED FREQUENCY, AND THERE SHOULD BE FOLLOW-UP.

IF THE RECOMMENDATIONS THAT HAVE BEEN SUBMITTED AS A PART OF THIS SEMINAR ARE FOLLOWED, THERE SHOULD BE LITTLE LOSS OF PRODUCTS BECAUSE OF CONTAMINATION OR DETERIORATION.

SLIDE PRESENTATION

INSPECTION OF A WAREHOUSE

1. TITLE
2. INSPECTION TOOLS, FLASHLIGHT, ETC.
3. INSPECTION TOOLS, BLACK LIGHT
4. INSPECTION TOOLS, SIEVE
5. EXTERNAL VIEW, CARE WAREHOUSE
6. RODENT BURROW UNDER CEMENT
7. RODENT BURROW PARTIALLY CORRECTED
8. RAIL TIE ON GROUND
9. RAIL TIE MOVED, SHOWING RODENT BURROW
10. RODENT BAIT BOX — LID OFF
11. PILE OF DEBRIS, FOOD FOR RODENTS AND INSECTS
12. VIEW OF INSIDE OF A WAREHOUSE
13. JUTE BAGS ON PALLETS
14. PAPER BAGS DIRECTLY ON FLOOR
15. JOHNSON AND SCHOENHERR INSPECTING BAGS
16. COTTON BAGS — OBVIOUS INSECT DAMAGE
17. PAPER BAGS — OBVIOUS INSECT DAMAGE
18. PAPER BAGS — OBVIOUS INSECT DAMAGE
19. PAPER BAGS — CORNER PEEL — PRODUCT EXPOSED — INSECTS
20. PAPER BAGS — MOVED TO EXPOSE INSECTS
21. COTTON BAGS — MOVED TO EXPOSE INSECTS
22. PAPER BAGS — TOS — INSECT HOLES AT STITCHING
23. RAT ON JUTE BAG
24. RAT HOLE IN COTTON BAG
25. RAT PELLETS ON COTTON BAGS
26. DEAD MOUSE ON BEAM
27. RODENT PELLETS ON BEAM
28. RAT TRACKS IN FLOOR DUST
29. MOUSE TRACKS IN FLOOR DUST
30. WIND-UP TRAP CONTAINING 12 DEAD MICE
31. INSECT TRACKS ON FLOOR
32. TRIBOLIUM, ADULT TRACKS IN DUST, NORMAL
33. TRIBOLIUM ADULT TRACKS IN DUST, PARALYZED
34. DERMESTID ADULTS ON WALL
35. WATER DAMAGE, FAULTY ROOF, COTTON BAGS
36. IMPROPER STORAGE
37. IMPROPER STORAGE AND BIRD DROPPINGS
38. BIRD TRACKS IN DUST

APPENDIX D: Note to the Reader

This booklet is intended not only as a report on the Dakar Conference, but also as a course manual for future food storage seminars. Films, slides, and other visual aids may be obtained on a loan basis by contacting:

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Program Operations Division
Agency for International Development
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