WALK-THROUGH SURVEY REPORT OF THE BAGGING OPERATION

AT

Tennessee Valley Authority's
National Fertilizer Development Center
Muscle Shoals, Alabama

SURVEY CONDUCTED BY:
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NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
Division of Physical Sciences and Engineering
Engineering Control Technology Branch
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PURPOSE OF SURVEY: To perform a preliminary survey of the fertilizer bagging operation at the National Fertilizer Development Center.

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ANALYTICAL WORK: None

ABSTRACT

NIOSH studies have demonstrated a need to examine the packaging processes used for dry chemicals. A large number of workers in a variety of industries are involved in the packaging process. The use of low density polyethylene valve bags at TVA's packaging operation shows a potential for reducing leakage from the filled bags over multiply paper, hand tuck or valve-type, bags. The control techniques for filling bags were not considered to be exemplary. An in-depth study at this operation is not recommended.

I. INTRODUCTION

The Engineering Control Technology Branch of the Division of Physical Sciences and Engineering, NIOSH, is conducting a research study to assess and document the exemplary technology available for the control of airborne dust in dry chemical bagging and filling operations. The control technology studies will be described in sufficient detail to allow the information to be used to prevent or reduce the generation and transmission of the dust in similar industrial operations. The results of the assessment will be disseminated in a manner that will maximize the application of demonstrated control technologies in the workplace.

A survey of the packaging (bagging) operation was conducted to determine the suitability of this operation for an in-depth study. Engineering control technology observed included; ventilation systems, work practices, and protective equipment. The National Fertilizer Development Center (NFDC) had some controls worth noting. However, the packers were in need of repair. Product continually leaked from the fill spouts into the worker's environment whenever a bag was not on the spout. This operation is not considered for an in-depth study.

II. PLANT DESCRIPTION

The NFDC is part of the Tennessee Valley Authority's (TVA) facility of Muscle Shoals Alabama. Pilot plants and production units are located in several buildings within the plant area. The NFDC's basic purpose is to improve and develop products, processes, and processing equipment that can be used in the fertilizer industry. The NFDC is divided into three divisions: Chemical Development - which includes chemical research and engineering development in bench-scale equipment and pilot-plants; Chemical Operations - which maintains and operates basic production facilities (small ammonia, nitric acid, etc.) and TVA-designed demonstration plants (10- to 20-ton-per-hour capacity) for manufacturing limited quantities of experimental fertilizers; and Agricultural Development - which conducts agronomic research, economic and marketing research, and a national program to introduce new TVA fertilizer technology.

The NFDC works with granular, liquid, and suspension fertilizers, but at present is not set up to work with pesticides. Of the various types of fertilizers developed, NFDC will produce quantities of the more promising products. These are made available for use in educational programs aimed at improving the manufacture, distribution, and use of fertilizers. Many fertilizer grades produced at NFDC are in granular form. On December 16, 1981, 46-0-0 granular urea (46% total nitrogen, 0% available phosphoric acid, and 0% soluble potash) was being packaged into 50-pound plastic bags.

Bulk fertilizer is stored in a 840- by 100-foot building located at the south side of the plant area. The building is an enclosed metal frame, metal roofing, concrete- and metal-walled (20-ft concrete walls topped with 28 ft of metal siding) structure with a concrete floor. It can house up to 30,000 tons of fertilizer. The bagging operations building is located adjacent to the bulk storage building separated by parallel railroad tracks. A conveyor system from the bulk storage building can load rail cars or transport fertilizer to the bagging operations. The bagging building is an enclosed metal frame and corrugated metal siding structure with a concrete floor. The intermediate levels are open metal floors. Bag packers are located on the ground floor, and the ancillary equipment is located overhead.

III. PROCESSING DESCRIPTION

In the storage building, bulk fertilizer is transported from the various stockpiles to one of several hoppers by an overhead crane with clam shell. The hopper discharges onto an enclosed cleat-type Redler Conveyor, manufactured by Stevens Adamnson Company. This conveyor uses a series of metal blades (positioned at right angles to the conveying direction) to move the material through the conveyor. The fertilizer is transported from the bulk storage building (horizontally a few feet, vertically upward 3 stories, and then on an incline an additional story) to the bagging building. The conveyor discharges onto a vibrating, enclosed screen. Trash is removed as the overflow with the underflow droping into surge bins and onto weigh feeders leading to the bagging machines. Three manually operated single-spout, force-flow packers (bag filling machines), manufactured by St. Regis, are used to fill valve-type bags (Gard-Plas$_R$, a low density polyethylene bag manufactured by the Great Plains Bag Corporation). The bag is manually placed on the packer spout, filled, and manually removed. It is dropped (three feet) onto a belt conveyor, transfered to a short inclined belt conveyor, and then onto another horizontal belt conveyor leading to the loading area.

The average crew consists of 8 employees (1 crane operator, 1 packer operator for each of the three packers, 2 to 3 stackers to load the bags for shipping, foreman, and the project director). There is a separate crew for maintenance.

IV. DESCRIPTION OF PROGRAMS

Employees are required to wear safety shoes, safety glasses, and hard hats. Respirators are not required in the bagging building. Maintenance is done on a routine basis.

V. SAMPLE DATA

No samples were taken during the survey.

VI. DESCRIPTION OF CONTROL STRATEGY FOR THE BAGGING OPERATION

In the bagging building, exhaust ventilation is provided at the vibrating screens and packer spouts. (Detailed drawings of the duct work for this ventilation system were provided by TVA.) The dust collecting unit is a roto-clone assembly, size 20, type W, model B manufactured by American Filter Company.

The conveyors leading from the bulk storage building to the vibrating screens in the bagging building are completely enclosed. This conveyor has been in operation for 17 years and appears to be dust tight. The enclosed vibrating screen, located 20 feet above the packers, has hinged covers for trash cleanout. With the covers shut and under exhaust ventilation, little dust appears to escape into the environment.

When hydroscopic material is being processed, it tends to collect inside the duct work, plugging the system. Some fertilizers are corrosive when wet, creating additional problems with the system.

VII. CONCLUSIONS AND RECOMMENDATIONS

Of primary interest at the NFDC was the bag filling operation. The control techniques for bag filling were not considered to be exemplary. The fifteen year old St. Regis packers were in need of repair (the packers continued to discharge a small stream of product into the environment once the bag was removed from the fill spout).

In the area of the vibrating screens, workers tended to leave the hinged covers open, creating a dust source over the bag filling area. Improved work practices would reduce this dust source.

The seams and valve of the polyethylene bag appears to be more effective in reducing leaks than observed elsewhere for multi-ply paper bags. Also, the reported breakage rate is low, averaging 0.1% to 0.3% for the plastic bags. (The bags are field tested for breakage by dropping a full bag four feet onto a solid surface six times).