WALK-THROUGH SURVEY REPORT OF THE TALC BAGGING OPERATION

AT

Cyprus Industrial Minerals Company
Three Forks, Montana

SURVEY CONDUCTED BY:
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NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
Division of Physical Sciences and Engineering
Engineering Control Technology Branch
4676 Columbia Parkway
Cincinnati, Ohio 45226

PURPOSE OF SURVEY: To perform a preliminary survey of the talc bagging operation at Cyprus Industrial Minerals Company.

EMPLOYER REPRESENTATIVES:

CONTACTED: Jack Buettner, Manufacturing Manager, Talc Division; Mike Lorang, Chief Engineer, Talc Division; Phil Hangas, Operations Manager; Tom Flink, Safety Officer and Allen Vaughan, Staff Industrial Hygienist, AMOCO (parent company).

EMPLOYEE REPRESENTATIVES

CONTACTED: Gene Townsend, Union Representative, United Cement, Lime and Gypsum Worker.

STANDARD INDUSTRIAL

CLASSIFICATION OF PLANT: SIC Code 1496
Mining: Talc, soapstone, and pyrophyllite

ANALYTICAL WORK

PERFORMED BY: None

ABSTRACT

NIOSH studies have demonstrated a need to examine the packing processes used for dry chemicals. A large number of workers in a variety of industries are involved in the packing process. Semi-bulk bagging at Cyprus's Three Forks Talc Operation shows a potential for reducing the number of workers exposed, also, reducing labor, handling, and bag disposal. The control techniques, used on the equipment for packing 50 pound bags, were not considered to be exemplary. However, with the increasing interest in semi-bulk packing, an in-depth study at the semi-bulk bagging operation would be 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, and material conveying 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.

The people contacted at the Three Forks operation were: Jack Buettner, Manufacturing Manager, Talc Division; Mike Lorang, Chief Engineer, Talc Division; Phil Hangas, Operations Manager; Tom Flink, Safety Officer; Allen Vaughan, Staff Industrial Hygienist, AMOCO (parent company); and Gene Townsend, Union Representative, United Cement, Lime, and Gypsum Workers.

Cyprus Industrial Minerals Company at Three Forks continues to pioneer new processes. They are developing a semi-bulk bagging operation that merits an in-depth study. However, the control techniques used in the 50 pound valve-type bagging operation were not considered to be exemplary and would not merit an in-depth study.

II. Plant Description

Cyprus Industrial Minerals Company is a subsidary of AMOCO. Cyprus's Talc Plant is located at the southern edge of Three Forks, Montana. Three Forks is a community of approximately 300 situated in a large open valley between the cities of Bozeman and Butte, Montana. The area is semi-arid range land with temperature variations from $-20^{o}F$ to $100^{o}F$.

The plant, constructed in 1961, is a wooden frame building with metal roofing and siding, concrete floors, and steel substructures. On a routine basis, the plant is modified to upgrade processes, dust controls, or allow for expansion. The building consists of: comminuting (30,000 square feet); warehousing areas (30,000 square feet); packing (60,000 square feet); and six storage silos, as shown in Figure A. There is a railroad line next to the plant and Interstate 90 is three miles north of the plant.

The plant annually produces 50,000 to 100,000 tons of industrial grade talc (no consumer products) operating 24 hours per day, 7 days per week. Bagging is normally scheduled 24 hours a day (3 shifts), 5 days per week. The plant employs 42 full-time workers and 7 supporting personnel. The average bagging crew consists of four employees; packer, stacker, forklift operator, and foreman. Occasionally, an extra packer, stacker, and forklift operator may be added. Excluding the foreman, the crew rotates to the various bagging work areas every 2 hours.

III. Process Description

Three mines (one chlorite and two talc) provide the ore for the plant operation. (According to the company, the talc is an asbestos-free variety.) The ore is screened to minus 6-inch size and hand sorted at the mine sites. It is shipped 60 miles by truck to the Three Forks Operation (Cyprus Talc Plant) and stored on one of three stock piles. The stockpile areas are 20 square foot concrete pads with the chlorite ore being stored separate from the talc ore. A front end loader transfers the ore (less than 100 feet) to a five cubic yard hopper. The ore feeds onto a short conveyor belt and into an impact crusher reducing it to minus 3/4 inch. The crusher discharge is coarse ground either in a 60 inch or 54 inch Raymond Roller Mill to minus 200 to 325 mesh. (These two roller mills can be operated either separately, in series, or in parallel.) A portion of the coarse ground product is stored in silos until shipped either in bulk or packaged in 50 pound bags.

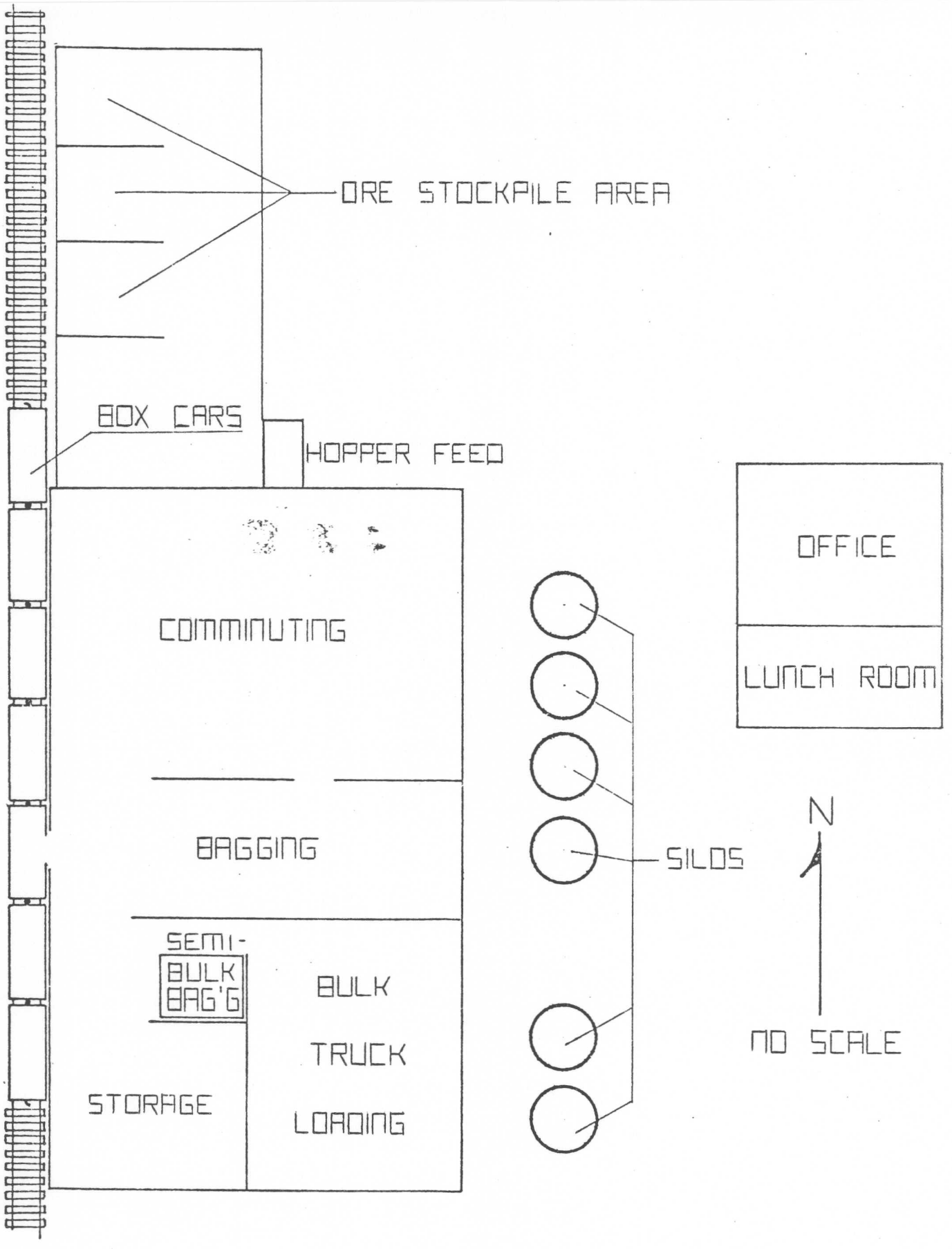


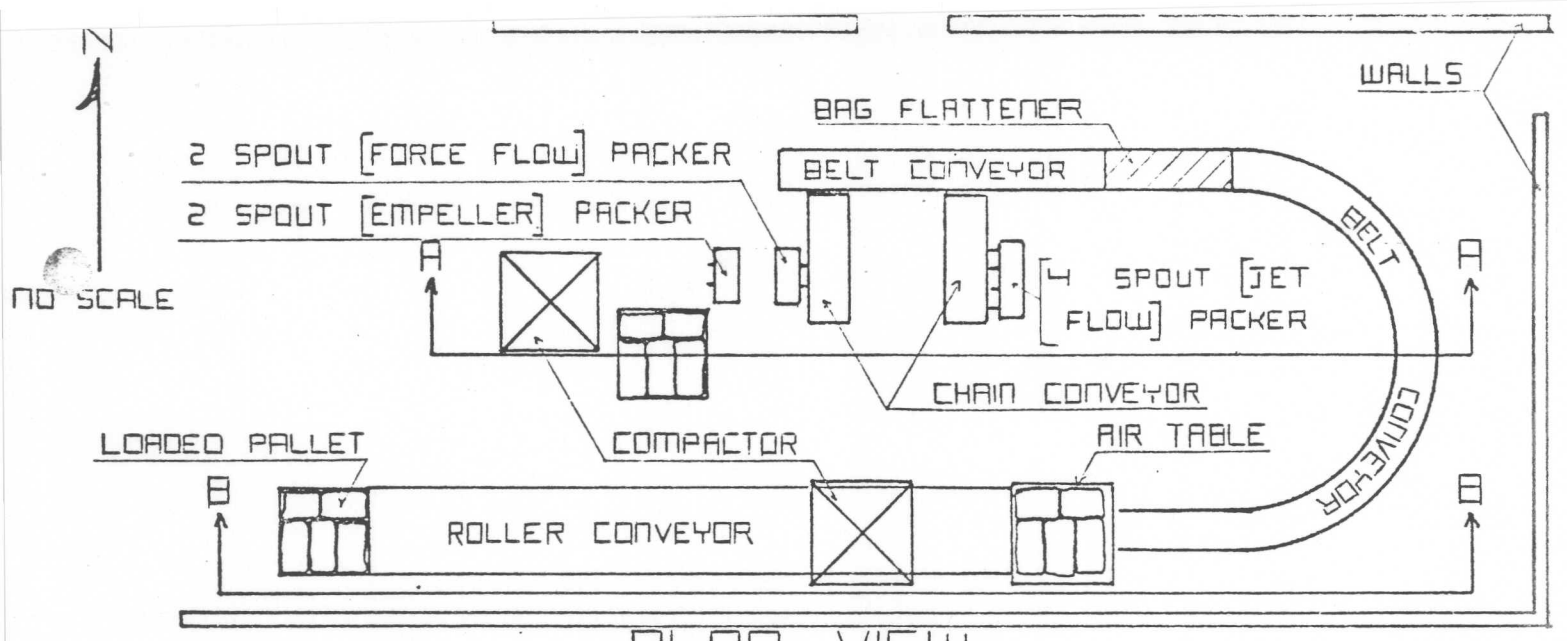
Figure A: General Plant Area

CYPRUS INDUSTRAIL MINERALS COMPANY

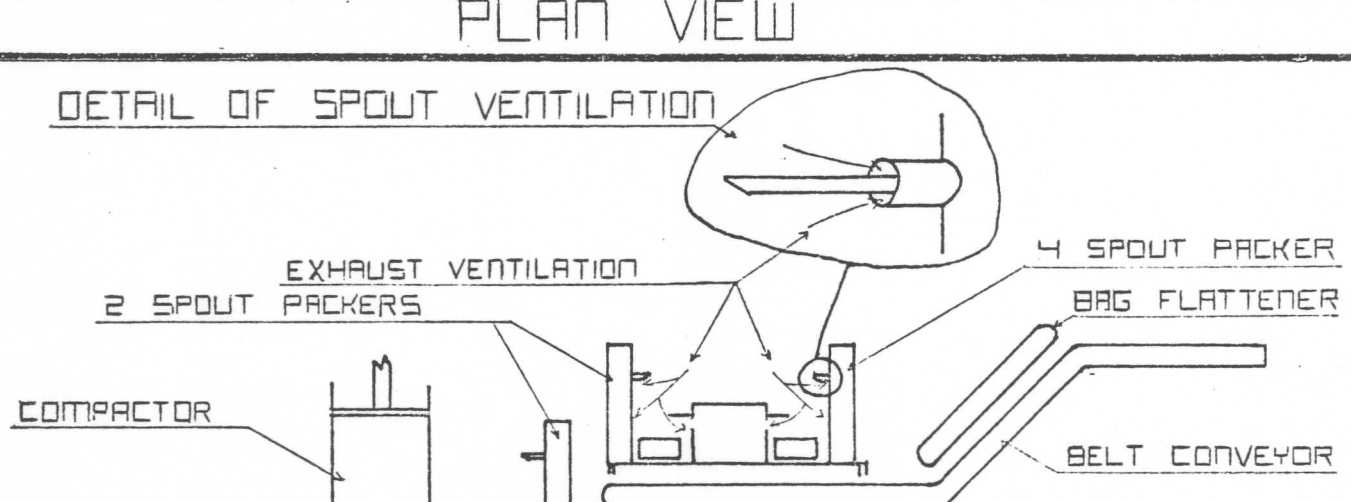
The remaining coarse ground product is further reduced in size in a fluid energy mill to minus 0.5 micron. (Cyprus was one of the first in the industry to use this type of mill for talc grinding). This mill uses steam to accomplish autogenous grinding (ore grinding on itself). A portion of the minus 0.5 micron product, Mistron Vapor(T), is stored in silos until shipped in bulk or packaged in 50 pound bags. The remaining Mistron Vapor(T) is compacted in a pellet mill. Compacting increases the density of the talc from 7 pounds per cubic foot to 55 pounds per cubic foot. The resulting product, Compacted Mistron Vapor(T) (a pellet-like solid), is stored in silos until shipped in bulk, or packaged in 2200 pound semi-bulk containers or 50 pound bags.

Three St. Regis packer machines (Figure B) are used to fill paper bags: 2-spout impeller (auger-type) for coarse grind and Compacted Mistron Vapor(T); 2-spout force flow (fluidizing-type) for Compacted Mistron Vapor(T); and 4-spout jet (fluidizing-type) for Mistron Vapor (T). The force flow and jet packers operate semi-automatically using conveyor belts to move the filled bags to the palletizing station. The impeller packer is presently a manual system (filled bags carried by hand and palletized). Cyprus plans to covert it to a semi-automatic system in the near future.

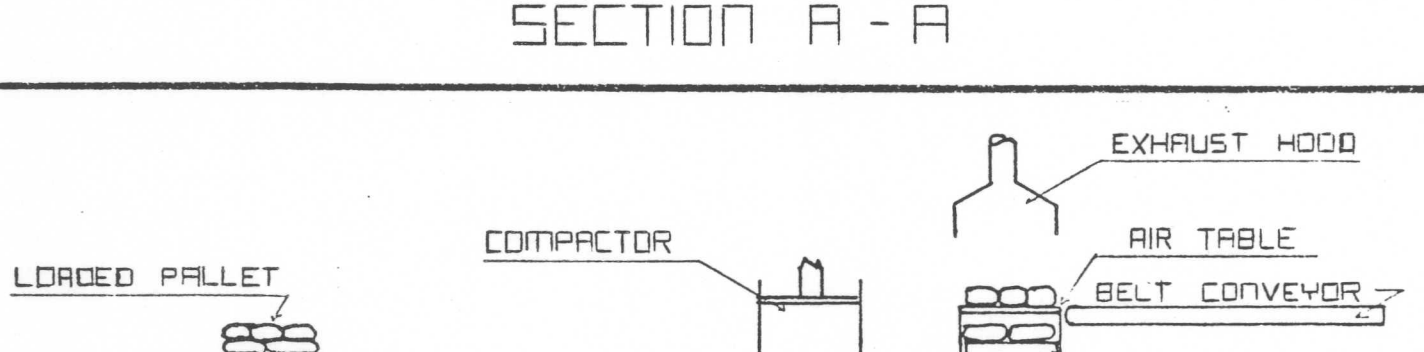
Packing on the semi-automatic system; bags are hand placed on the packer spout, filled, and tipped by hand onto a horizontal chain conveyor. The chain conveyor moves the bags horizontally a few feet, flips them 180^{o}, and drops them approximately 1 1/2 feet onto a belt conveyor. (The purpose of flipping the bags is for alignment to enter the bag flattener without tearing on or jamming inside the unit.) The bags travel a few horizontal feet, enters the inclined bag flattener, and are discharged onto the belt conveyor on the upper level. The bags, make a 180^{o} arcing turn to the pallet loading station. Here, they are discharged onto an air table (a horizontal table with a grid of air-jets blowing upward). The operator slides the bags (no lifting required) into position to form a layer of bags to be loaded onto the pallet. The



PLAN VIEW



SECTION A - A



SECTION B - B

Figure 8: Bagging Area

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air table rapidly retracts, dropping the bags vertically onto the pallet. As this process is repeated, the pallet automatically lowers as each layer of bags is added. When the pallet is fully loaded, it moves onto a roller conveyor and into a compactor to compress the loaded pallet. The pallet then moves along a roller conveyor to the station where shrink wrap (a plastic bag) is placed over the loaded pallet. (The company plans to replace shrink wrap with stretch wrap in the future). A forklift moves the pallet either to storage or directly in a truck or boxcar for shipment.

Packing on the manually operated packer; bags are manually placed on the packer spout, filled, lifted off the spout, and placed on a pallet. When the pallet is loaded, a forklift positions it in a compactor (a second unit near the packer machine). Next, the forklift transports the pallet to the shrink wrap station and then either transports the pallet to storage or directly loads it for shipment.

At the semi-bulk packing station (not in operation during the site visit), the bags are manually placed on the packer and filled with Compacted Mistron Vapor$^{(T)}$ by gravity flow from an overhead hopper. When the bag is placed on the packer, it rests on a raised platform. As the bag fills, this platform automatically lowers while the bag opening remains attached to the fill spout. When the bag is filled (in 1 to 2 minutes), it is manually released from the packer spout. The inner plastic bag is twisted and tied shut and the outer bag has a draw string to tie it shut. The semi-bulk bags are moved by forklift to either storage or directly loaded for shipment.

Fifty pound bags (3-and 4-ply pasted valve bags with 50 and 60 pound plies, manufactured by Union Camp Corp. and other manufacturers) are used. The bag valve (paper flap) is placed on the packer spout. As the bag fills, the flap is pressed against the spout. When removed from the spout the flap then presses against the top of the bag. This "positive lock" of the bag valve is designed to stop product leakage through the

valve. The company reports a bag breakage rate below 0.1%. If bags of a particular shipment start breaking while filling or on the conveyors, that consignment of bags is withdrawn and another consignment used.

Cyprus has an on-going program to reduce airborne dust in the bagging area. The compaby reports that since this survey, progress has been made by going to the latest in valve designs from paper bag manufacturers.

IV. Description of Programs

The company has a comprehensive industrial hygiene program. From the corporate staff, there are experts on noise, toxicology, epidemology, safety, ventilation, and other areas. They also develop the sampling protocol and quality control in monitoring and analysis. The local staff is active in safety, conducting monthly walk-around safety tours accompanied by a representative of the local union. The foreman presents monthly slide and tape safety training. MSHA periodically monitors various parts of the operation and inspects the entire mill on a regular basis - two or three times a year.

The company requires safety shoes, safety glasses and hard hats. In some operations such as maintenance, disposable dust masks are required. In the bagging as well as other plant areas, no respiratory protection is required.

All new employees are required to have a pre-employment physical. Annually, each emplopyee receives a chest X-ray and an audiogram. The corporate medical program complements the local program.

Housekeeping is done on a regular basis on each shift. A central vacuum system is used to remove dust from around the packers or spilled product.

V. Sample Data from Preliminary Plant Survey

No samples were taken during the survey.

VI. Description of Control Strategy for the Bagging Operation

All dust producing equipment is connected to exhaust ventilation. There are 36 dust collector bag houses varying in size from 9-to 800-eight foot long bags, each with a micropulse cleaning system. There is one dust collection system for the bagging operation. The total exhausting capacity of the entire system is 30,000 cfm. A Magnehelic continuously monitors the ventilation system by measuring the pressure drop across the filters.

At the packers, there is exhaust ventilation around each spout. Along the chain conveyor, there is a capture face to remove additional dust. There is also a capture hood above the air table used to palletize the bagged product. There are several exhaust connections in the bagging area to which a flexible hose can be attached to permit vacuum sweeping.

On three sides of the semi-bulk bagging area, there is a transparent plastic curtain (12-inch wide strips). At the fill spout and extending into the bag, there is exhaust ventilation around the spout to remove the dust generated inside the bag.

Administrative controls include rotating the bagging crew among the various work stations every two hours. Also, new employees hiring on or transferring to the bagging operation are trained in the loading and removing of bags from the packer spouts and how to clean the floor without generating large amounts of airborne dust. None of the employees are normally required to wear respiratory equipment while bagging.

The main air contaminant appears to be nuisance dust consisting mostly of talc product. No other air contaminants were reported to be present.

VIII. Conclusions and Recommendations

Of interest at the Cyprus operation were the two areas of packing; bagging and semi-bulk bagging. At the operation where 50 pound valve-type bags were loaded, the control techniques were not considered to be exemplary. The most obvious source of dust was leakage from the bag valves during filling and each subsequent operation unit the loaded pallet was wrapped in plastic. A modified bag valve would more effectively control this dust source. Also, accumulation of dust and product around the packers was apparent. A revised capture and exhaust ventilation system would reduce this dust source.

The semi-bulk packing equipment was not operated during the preliminary site visit. Presently, semi-bulk packing accounts for one third of the total bagging business, with potential growth to 75%. The advantages of semi-bulk packing are reduced labor, reduced dust, and easier handling and bag disposal. The loading of the 2200 pound bags would be more appropriate for a detailed study, especially as a comparison with the company's 50 pound bagging operation.

The company reports that disposal of empty paper bags is a problem in the industry. With the use of semi-bulk one-way bags, there is only one bag, instead of 44 bags, for disposal. Cyprus also uses water soluble bags to ship to their paper mill customers. These bags are dumped, contents and bag, into the process, thereby eliminating the problems of bag disposal and dust exposure during emptying.