U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION DETERMINATION
REPORT HE 78-17-567

FILE COPY

KAWECKI BERYLCO INDUSTRIES, INC.
READING, PENNSYLVANIA

MARCH 1979

I. TOXICITY DETERMINATION

A National Institute for Occupational Safety and Health environmental survey team conducted a health hazard evaluation of the Hygiene Assistant workers in the Kawecki Berylco Industries, Reading plant on January 10 and 11, 1978. Employees' exposure to beryllium and asbestos were investigated. The following determinations are based on environmental measurements of beryllium, confidential interviews, OSHA records, a review of corporate environmental measurements, a review of potential contaminants, observation of work practices, conditions, and exposure controls, and a review of the current literature and toxicity criteria.

Potentially toxic airborn concentrations of beryllium were present during the period of this survey for both workers engaged in emptying dust collecting systems. From observation of work conditions, it is clear that Hygiene Assistants work activities will frequently result in levels of beryllium in their breathing zone well above both the NIOSH recommended criteria and the existing and proposed revised OSHA standard for beryllium. The continued use of respiratory protective equipment is certainly required in these activities. A thorough evaluation for proper respirator selection for each exposure should be made based on the revised NIOSH recommended criteria. Engineering controls should be provided to achieve the lowest feasible exposure levels for each work activity. Decontamination procedures and facilities should be provided. Protective suits should be selected to meet the needs of each working condition.

Asbestos work activities were not observed during this survey. However, potentially toxic exposures were reported by OSHA in their inspection of reflocking activities on February 24, 1976. While not in excess of OSHA limits, their short term samples exceeded NIOSH recommended criteria by a factor of ten and exceeded OSHA's proposed revision to the standards. The elimination of this exposure by substitution should be accomplished if feasible. Complete enclosure of this process is the only acceptable alternative.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are currently available upon request from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from NIOSH, Publication Office at the Cincinnati address.

Copies of this report have been sent to:

a. Plant Manager, Kawecki Berylco Industries
b. Employee Representative
c. United Steelworkers of America, AFL-CIO
d. NIOSH, Region III
e. OSHA, Region III

For the purpose of informing the (4) affected employees, the employer will promptly "post" the Determination Report in a prominent place(s) near where exposed employees work for a period of 30 calendar days.

III. INTRODUCTION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The National Institute for Occupational Safety and Health (NIOSH) received such a request from an employees representative for the Kawecki Berylco Hygiene Assistants regarding their exposure to asbestos and beryllium. The request involves work throughout the general area of the plant on Tuckerton Road in Mulenberg Township, Reading, Pennsylvania. This report provides additional and updated information that was previously discussed in our interim report of February 28, 1978.

IV. HEALTH HAZARD EVALUATION

A. Process Description

The Alloy Division of KBI employes 200 administrative and 400 production workers. Ninety-five percent of their products are beryllium-copper alloys, 4 percent beryllium-nickel alloy, and 1 percent beryllium-aluminum alloy. Four employees are assigned as Hygiene Assistants.

The daily activities of the Hygiene Assistants are varied. They service a large number of air cleaning systems of various types. These range from portable 55 gallon industrial vacuum cleaners to multi sectional bag houses. Their daily work assignments are made on a 40 item work order sheet (Attachment 1). The frequency and duration of these activities are indicated on Attachment 1. These estimates were made by the maintenance supervisor from a work log. The daily activities of emptying the particulates collected in central cyclone floor vacuums and local exhaust systems is interspersed with periodic servicing of bag houses and cleaning up spills.

The bag houses require a complete rebagging every 2 or 3 years. This requires about 122 man hours per compartment. There are two 5 compartment and one 3 compartment units. Intermittent servicing requirements vary with the type of system and the process activities which they support. In the arc room bag house overheating frequently results in bags being destroyed requiring partial rebagging. In the calcine bag house there is a need for frequent cleaning due to the very fine particulates penetrating the bags; this has been averaging two days work a month. Other systems require less frequent cleaning depending upon their use. The use of supplied air respirators is mandatory in bag houses. The use of disposable coveralls is authorized, however, the available suits do not have hoods and are reportedly not large enough to fit over cold weather gear in all cases. When leaving the job, there is no provision for decontamination except removal of clothing. It is common practice to do this in the washroom adjacent to the respirator cleaning room.

The Ultra Collectors cleaning and reflocking operations identified as #7 Ultra Collector and #9 Melt and Cast collector on the Hygiene Department work assignment sheet were not observed; however, the facilities and equipment were studied and the process described. These dust collectors are the final stage bag filters which are lined with asbestos and Solka-Flac, a cellulose product. These filters are cleaned periodically as required. The #9 collector requires servicing about once a year and takes about 8 man days of effort. The #7 unit requires servicing every one to two months and takes about 2 man days of effort. This activity involves bagging of waste and used filter materials and recoating with the asbestos and flock. The coatings are in bags which are opened and placed in a hopper from which their contents are blown into the bag filter.

The emptying of the numerous cyclone collectors requires opening up the collector, placing the waste in a plastic bag and then double bagging and sealing it. Typically, the cyclones are on a stand which provides sufficient clearance below to empty the accumulated waste through a chute directly into a hand held plastic trash bag. The waste will usually drop out with a little pounding on the cyclone collection chamber. The workers sometime have to reach up arms length into the chamber to dislodge the waste with their hands or a stick. Workers wear half face masks with high efficiency cartridges and are provided with laundered work clothes daily. Protective coveralls are available for contamination control. For systems located inside buildings floor vacuuming is required after the waste transfer is completed.

Cleaning up of spills and decontamination after blow outs of the calcine furnace boot are unscheduled events. The time spent in this activity is unpredictable as is the extent of exposure. Major jobs such as the furnace blow out have occurred 2 to 4 times a year and require 3 men 3 or 4 days to clean up. There have been other 3 day jobs in the foundry. This work is sometimes done by contractors.

The emptying of mobile floor vacuums is accomplished by shoveling into a fiber drum. This activity was done in front of a hood/booth, formerly a furnace exhaust system. The hood had several openings and was not well suited for the purpose.

Another activity performed by the Hygiene Assistant is the respirator cleaning room operation. One man works most of the day at this. He collects used respirators from numerous pickup stations throughout the plant, cleans the respirators and redistributes them. He processes 75 to 95 masks per day. The cleaning room is very small which makes it hard to segregate clean work areas from contaminated areas. Masks are disassembled, put through an automatic wash cycle, and air dried on tables. The wash room adjacent to the mask cleaning area was used as a contaminated coverall or clothing change area by the Hygiene Assistants.

B. Evaluation Design

Personal breathing zone air samples for beryllium dust were collected for morning and afternoon activities of the two workers assigned waste collection tasks. A full shift sample was taken on the mask cleaning worker. An area sample was collected to check the dust level in the mask cleaning room. Confidential medical interviews were held with the Hygiene Assistants and the Occupational Health nurse. Conferences were held with management and records were reviewed. Due to the many tasks performed by the Hygiene Assistants it was impractical to measure each type of activities exposure during a single survey. Throughout the course of the survey, workers were asked to point out the other types of tasks in areas which were not scheduled for that days activity. Special effort was made to observe the portable vacuum cleaning area, the bag houses, and the ultra cleaner reflocking systems. The employees controlled locker room was visited. Consultation with OSHA and a recently retained MIT Engineering Consultant were used to assess the nature of ongoing abatement activities and the basis of current OSHA citations.

C. Evaluation Method

Personal breathing zone samples were collected on 37 mm (.45 um) cellulose ester filters in a 3 piece cassette. MSA Model G pumps provided a 1.5 lpm air sample rate. Cassettes were positioned closed face on the collar of the worker in his breathing zone. The area samples taken in the respirator cleaning room were collected at 9 lpm. Unfortunately these two filters were inadvertently left at the plant.

Beryllium analysis was performed by atomic absorption spectrophotometry first by NIOSH method P&CAM #121 using the aspirated technique. The limit of detection was 1.0 ug/sample. In order to improve the sensitivity the samples were further analyzed using the graphite furnace technique. The limit of detection was estimated to be 0.1 ug/sample.

D. Evaluation Criteria

The criteria available to assess the potential toxicity of both asbestos and beryllium exposures have been under revision in recent years due to the growing evidence of serious delayed long term health effects from low level exposures.

The asbestos criteria recommended by NIOSH in their "Revised Recommended Asbestos Standard", December 1976, NIOSH Publication #77-169 is 0.1 fibers/cc for an 8-hour time weighted average (TWA) (100,000 fibers/M^3) for fibers >5 um in length. This is based on the lowest level detectable by phase contrast microscopy which is the only generally available and practical analytical technique at the present time. They also recommend the peak concentration not exceed 0.5 fibers/cc (500,000 fibers/M^3) based on a 15 minute sample period.

The recommended standard of 100,000 fibers >5 um in length/M^3 is intended to: (1) protect against the noncarcinogenic effects of asbestos (asbestosis), (2) materially reduce the risk of asbestos-induced cancer (only a ban can assure protection against carcinogenic effects of asbestos).

The existing OSHA standard of 2,000,000 fibers >5 um in length/M^3 TWA and a 10,000,000 fibers >5 um in length/M^3 ceiling are in agreement with the original NIOSH recommended criteria published in 1972 (HMS 72-10267). The ACGIH TLV's have been published with an intended change in 1978 to limit TWA asbestos exposures as follows: amosite 0.5 fibers/cc; chrysotile 2.0 fibers/cc; crocidolite 0.2 fibers/cc; tremolite 0.5 fibers/cc; other forms 2.0 fibers/cc.

The beryllium criteria recommended by NIOSH in August 19, 1975 testimony given by Edward Baier at OSHA hearing on the October 17, 1975 proposed revision to the standard is .5 ug/M^3 for a 130 minute sampling period. This criteria is based on the lowest detectable limit by NIOSH analytical method S 339 modified to require a minimum of 230 liter sample volume.

This standard would protect against the noncarcinogenic effects of acute beryllium disease and materially reduce the risk of chronic beryllium disease and beryllium induced cancer.

The existing OSHA standard of a 2 ug/M^3 TWA with a 5.0 ug/M^3 ceiling and a 25 ug/M^3 peak for not more than 30 minutes was adopted from the American National Standards Institute (ANSI) Z37.29 - 1970 standard. The present ACGIH TLV first published in 1959 is in agreement with these limits, however, they provide no ceiling value and allow only a 15 minute period for the 25 ug/M^3 short term exposure limits (STELs). OSHA, on October 17, 1975, proposed a reduction in the standard to 1.0 ug/M^3 TWA and 5.0 ug/M^3 15 minute ceiling with no peaks specified.

The carcinogenic potential of beryllium has been a controversial issue in the past few months. NIOSH's conclusion and the position taken by OSHA in its proposed revision is that there is sufficient evidence to require beryllium to be considered a suspect human carcinogen. As such, exposures should be controlled as low as possible so as to reduce the risk of cancer. Following the NIOSH testimony OSHA requested an independent panel of experts review the evidence and make a determination. In a letter of November 7, 1978 the Secretary of Health, Education and Welfare informed the Secretary of Labor of the findings of a panel of 7 independent consultants and advised that he proceed to set standards that limit exposure to beryllium in the workplace. The panel of consultants' findings were that animal studies showing carcinogenicity in at least two species were credible, however, there was need for additional studies to improve the understanding of the effects of beryllium exposure on man. They stated there was insufficient data to determine whether the copper-beryllium alloy specifically was a human carcinogen. They recommended further studies in this area since a large number of workers are exposed to this alloy. They concluded that epidemiological evidence is suggestive that beryllium is a carcinogen in man and "in our opinion beryllium should be considered as a suspect carcinogen for exposed workers".

E. Findings and Discussion

Personal breathing zone air samples for beryllium dust were collected for morning and afternoon activities of the air cleaning systems maintenance workers and a full shift sample was taken of the mask cleaning worker. Results of these analyses were as follows: for morning maintenance activities 58 ug/M^3 and 64 ug/M^3 for a 3½ hour period; afternoon maintenance activities 15 ug/M^3 and 4.0 ug/M^3 for a 3 hour period. The mask cleaning worker's exposure was 0.5 ug/M^3 for the five hour period. The higher exposure levels observed in morning vs. afternoon activities shown on Attachment #1 is accountable to a much greater activity in potential exposure areas before noon. The measured exposure levels for air cleaning systems activities are well above both the NIOSH recommended 0.5 ug/M^3 criteria and the OSHA 2.0 ug/M^3 standard. At these measured levels of potential exposure, the half face mask respirators worn by the air cleaning systems maintenance workers are not considered adequate protection.

The continued use of respirators is certainly required in the air cleaning system maintenance activities such as were observed during our study. These limited measurements are insufficient to base any assessment of the overall potential health hazards related to the Hygenic Assistants' work. Since the work is highly varied, it is not possible to represent the average work exposure by a single day's monitoring results.

Many types of activities were not observed during this visit including the rebagging, bag house cleaning, and reflocking which are potentially hazardous procedures.

Some additional exposure data was obtained from OSHA. On April 2, 1976, they issued citations in several areas including the reflocking operation. They sampled for both beryllium and asbestos on February 24, 1976. A Hygiene Assistant's lapel sample was 18.7 ug/M^3 beryllium for an 80-minute period. This exceeds the 2 ug/M^3 TWA standard for an 8-hour day as well as the 5 ug/M^3 30-minute ceiling.

Results of OSHA asbestos lapel samples were for 51 minutes (0.9 fibers/cc), 13 minutes (3.5 fibers/cc), and 6 minutes (2.3 fibers/cc). An 80-minute sample was 1 fiber/cc. None of these exceeded the existing OSHA standard of 2 fibers/cc for an 8-hour TWA or the 10 fiber/cc ceiling. They are far above the NIOSH recommended criteria of 0.1 fiber/cc TWA and 0.5 fiber/cc for a short term ceiling exposure.

The KBI Safety and Health Manager advocated the use of the AEC high volume area and breathing zone monitoring methods for beryllium. He stated, however, that they had used lapel monitors in the past and were required to use them for quarterly abatement progress reports to OSHA. These quarterly reports on reflocking activities are included in Table I. The additional lapel samples taken during other Hygiene Assistants work activities which the Safety and Health Manager agreed to provide from KBI files have not yet been received. Repeated verbal and written requests for this lapel data have been made. It would appear that KBI does not have the earlier lapel sampling data or that they are not willing to provide it for this evaluation. The exposure profiles of numerous work activities in the KBI plant were shown to the investigator to illustrate the KBI surveillance program which is patterned after the AEC Guidelines. KBI did not have such a profile for the Hygiene Assistants activities due to the highly varied and complexed work activity sequence. Failure to provide this data is a hinderance to the assessment of the potential health hazard to the Hygiene Assistants.

In addition to the environmental sampling data the company was requested to provide a list of emissions and relate them to their respective sources and dust collection systems. They were also asked to provide the type and specifications of the collection systems and their locations in the plant. They provided the blueprint and data chart for the dust collector location plan (Figure I & II). Additional information was provided for several source compositions upon request (see Attachment #2). From this data it can be seen that beryllium, beryllium oxide, and beryllium copper alloy are prevalent throughout the systems. The refractory brick manufacturers referred to in Attachment #2, paragraph B, were contacted. They advised that the #26 and #28 insulating brick ranged from 30 to 60 percent free crystalline silica (SiO_2). This dust is present in Emission Source #27 and should be considered highly toxic. The NIOSH recommended criteria for SiO_2 exposure is 50 ug/M^3 of the respirable dust fraction. Reference HEW Publication (NIOSH) 75-120; dated 1974, Criteria for a Recommended Standard for Occupational Exposure to Crystalline Silica.

It is impractical for this office to conduct a survey of all 40 work assignments, however, it is possible to make a number of observations relating to these work activities.

The following are observations and recommendations discussed briefly in the January 11 closing conference.

a. During the day's observation of the Hygiene Assistant's activities, the dumping of a Hoffman cyclone servicing the oxide room revealed an undesirable repetitive handling of wastes first from removing a drum and then dumping it into plastic bags. In other locations throughout the day the bagging of wastes was generally performed by opening a valve which allowed passage of waste through a chute into hand held plastic bags. While this procedure lends itself to less exposure if no complications arise and if bags are held very securely, it does not provide optimum exposure control. In the event that waste clogs the chute, and beating on the outside fails to dislodge it, a worker must release the plastic bag and reach up into the chute to clear the material. This was observed in the cleaning of the R&D Spencer floor vacuum. This procedure is reportedly not an uncommon one. The placing of foreign objects such as plastic lunch bags in the vacuum system has been one cause of this problem. The freezing rain experienced the day before our survey caused a number of these collectors to "freeze up" resulting in difficulty cleaning out.

It is noted that the November 23, 1977 health and hygiene technical committee meeting report on its first meeting of November 16, 1977, made reference to "new items discussed" ... 1) vacuum system and dust collector dumping operations, ...". There is a need for further study of these operations. The exposure should be minimized by proper design and engineering controls.

In a January 25, 1979 telephone discussion with the MIT Engineering Consultant, it was learned that this is still an area of concern which is being studied to develop a long term engineering control solution.

b. The arc room floor vacuum system was checked but dumping was not required. It was, however, observed that there is an excessive accumulation of dust on the second level around the dust collection equipment. Housekeeping improvements are indicated. It is understood that this vacuum system has been replaced by a new "Super Sucker Vacuum Cleaning System", completed since our survey. Therefore, no further discussion of waste handling procedures is warranted. The new system deposits wastes directly into a "Sputnic" charging vessel for return to the arc furnace. This procedure should be an improvement over previous drum handling, however, the handling in the charging operation should be carefully controlled to avoid dust exposures.

c. The emptying of portable floor vacuums was not observed, however, the procedure and the ventilation being used were given careful consideration. The present use of a former furnace hood/booth as a local exhaust control should be evaluated from the point of view of either changing the method of transferring from shoveling or dumping to a vacuum system or if this is not possible, then providing the necessary modifications of the hood to obtain a uniform 75 FPM lateral face velocity. If the latter course is taken, then work procedures would be stipulated to insure effective use of the exhaust system. That is to draw the dust away from the workers breathing zone and not through it.

There is an additional concern in the use of portable vacuums. It must be assured that they are equipped with high efficiency filters approved for use with toxic dusts. Ordinary vacuums would generate a serious toxic dust exposure.

d. Bag house entries were not observed. The #4 Section of Unit #3 was visited and work practices were discussed both for rebagging operations and for cleaning. The bag replacement occurs as maintenance is needed. A complete rebagging is usually accomplished every two or three years requiring about 122 man hours per compartment. Cleaning is required more frequently (about 2 days/month) in the calcine process bag house due to the fine dust penetrating the bags. This results in a frequent exposure to heavy contamination. The use of supplied air respirators is mandatory in bag houses. The use of disposable coveralls is authorized, however, the available suits do not have hoods and are reportedly not large enough to fit over cold weather gear in all cases. When leaving the job, there is no provision for decontamination except removal of clothing. It is common practice to do this in the washroom adjacent to the respirator cleaning room. There is a need for a decontamination procedure and the facilities to implement it. The use of contamination control clothing is essential. Coveralls with an integral hood would seem necessary in the bag house environment. Vacuuming is a recognized method of personal decontamination. This should be followed by removal of the soiled suit and then the removal of respirators. It is noted that personal decontamination systems were being evaluated for use in the calcine furnace and arc room operations, reference January 9, 1978, quarterly OSHA abatement progress report. It was learned in a January 25, 1979 telephone conversation with the MIT industrial hygiene engineering consultant that several decontamination booths have been purchased since the survey. At least two of these are portable. Hopefully, they can be placed adjacent to bag houses during work activities.

e. The Ultra Collectors cleaning and reflocking operations identified as #7 Ultra Collector and #9 Melt and Cast collector in the Hygiene Department work assignment sheet were not observed; however, the facilities and equipment were studied and the process described. These dust collectors are the final stage bag filters which are lined with asbestos and Solka-Flac a cellulose product. These filters are cleaned periodically as required. The #9 collector requires servicing about once a year and takes about 8 man days of effort. The #7 unit requires servicing every one to two months and takes about 2 man days of effort.

The modifications being developed for unit #7 to meet OSHA abatement requirements include an automatic valve cut off activated by a drum level sensor. This is to avoid the waste overflowing drums which was identified as a major cause of exposure. The modification has been altered on one of the two drumming stations at the time of this survey to allow an early shut off with sufficient freeboard in the drum to accomodate the portion of waste already passed below the rotary valve in the chute. This has reportedly been successful in reducing exposure and should be considered for use in both facilities. There has also been a problem with the plastic drum liner being drawn into the drum level sensor causing a premature shut off. This could seemingly be avoided by using a retaining ring to hold up the bags. Another alternative suggested was to use disposable fiber drums. There is reportedly a plan to provide enclosure of these operations to reduce the wind effects. There is likely a need for this control; however, at the same time it will be necessary to consider the possible increase in dust/fiber concentrations in the confined space. Therefore, a well designed local exhaust system will be required for both the waste drumming operation and the asbestos bag dumping and blowing operations.

A preferred alternative that might reduce requirements for engineering controls is the substitution of a less toxic substance for the asbestos. Management stated that since there were no "over exposures" to asbestos this costly substitution could not be justified. It was pointed out that although federal regulations may not have been violated during the OSHA inspection, it was not likely that exposures to open bags of asbestos in confined areas would be easily controlled below the NIOSH recommended limits of detection for this carcinogen which is .1 fibers/cc. It was also pointed out that NIOSH considered beryllium to be a human carcinogen and that exposures to it should be controlled to the greatest extent possible. The limit of detection NIOSH has recommended is .5 ug/M^3. Therefore, it was suggested that this process be completely enclosed if possible.

f. The respirator cleaning room was noted to be dirtier than necessary. The air circulated in this room should be filtered to remove contamination. The masks are laid in the open to dry. The cramped quarters are not well suited for decontamination and clean mask handling. Procedural and facility improvements are needed. The storage of a bag of asbestos near the door to this room was noted as a poor practice. The question was asked in what process this asbestos was used, it was stated in Attachment #2 that it was not used in a process. Contaminated clothing removal in the adjoining washroom is also inappropriate. (Reference paragraph e above.)

g. Locker room facilities are in several locations throughout the plant. The Hygiene Assistants are assigned to the controlled shower/locker rooms. The clean locker room is separated from the contaminated one by a partial wall about 8 feet high. They are connected through the showers. Clean work clothing is provided in baskets each day. There was an excessive accumulation of dirt on the tops of lockers, the partition, and other elevated locations. The practice of storing work boots on top of the partition contributed to this problem. The air handling system was designed to supply air from a central duct above both rooms. Air was removed through exhausts on the contaminated end of the facility. This would provide a general air movement from clean to contaminated areas; however, the large open area above the partition would allow air currents to carry soil to the clean locker area. It is noted that the November 16 Health and Hygiene Technical Meeting Report has identified as new Item (2) Control locker room improvements. It is the opinion of this investigator that this area is in need of improvement. In discussing this subject with the Health and Safety Manager it was learned that corporate plans include a complete review of all locker room requirements to meet future needs. There appears to be a problem of workers working in the same area but one having controlled locker room assignments and the other not. This should be resolved.

In a January 25, 1979 telephone conversation with the MIT engineering consultant it was learned that the proposals for a major facility improvement including new locker rooms and respirator cleaning and storage areas have been submitted. This is certainly an urgent need and it is strongly recommended that these facility improvements be expedited.

h. Respiratory Protection Program - In addition to these specific comments made with respect to the observations of work activities, there are several recommendations regarding the surveillance of the Hygiene Assistants work exposures and the selection of proper respiratory protection. It is recognized that the activities of these workers cannot be totally free from exposure to toxic levels of beryllium and the accidental exposure to beryllium and asbestos will be an ever-present threat. Therefore, it is most important to provide adequate personal protective equipment for each work activity and proper decontamination facilities. The most critical element in protective equipment is proper selection of respiratory protection. The guidelines set forth in NIOSH technical publication #76-189, A Guide to Industrial Respiratory Protection, present the proper decision logic for the selection of respiratory protection. The guide for use of half face mask respirators with high efficiency filters specifies use in contamination levels no greater than 10 times the accepted exposure limit. Full face mask respirators provide a protection factor of 50 times the limit. Based on the measured exposures during this survey it is apparent that half face masks would not meet this criteria when applied to the NIOSH recommended .5 ug/M^3 exposure limit. Neither would they be adequate for the 2 ug/M^3 OSHA standard. The same could be said regarding the quarterly exposures reported for the reflocking activities up through the fourth quarter of 1977.

A key step in proper selection of respiratory protection is the assessment of the contamination levels to be protected against. A thorough study of these workers' exposures should be accomplished. A complete respiratory protection program as outlined in 29 CFR 2910.134a should be implemented for the Hygiene Assistants work activities.

The use of personal respiratory protective equipment is the least desirable method of protecting the worker. This is due to the difficulties inherent in their use. Respirators provide protection only if properly selected, fitted to the employee, and serviced. It is theoretically possible for all of these requirements to be met; however, more often they are not, then the respirators do not provide effective protection.

It is recognized that some difficulties arise in developing specific work practices and innovative engineering controls or process changes. However, due to the limitations of routine use of respiratory protective devices and to the serious consequences of even low level exposures to human carcinogens these difficulties should not be cited as cause for permitting continued exposures to beryllium dust or asbestos fiber above the NIOSH recommended criteria.

Where in certain cases it can be shown that feasible engineering controls and supplemental work practice controls are insufficient to reduce exposures below these permissible exposure limits, they should nonetheless be used to reduce the exposure to the lowest practical level. Respirators should be used as a supplement to these controls. They are frequently necessary in maintenance and repair activities and during the time period necessary to develop and install engineering controls.

It was learned in a January 25, 1979 telephone conversation with the MIT engineering consultant that the use of supplied air respirators has been greatly expanded. The Hygiene Assistants activities are such that this is undoubtedly the correct selection for most of their work environments. It will provide the most reliable protection even in emergency conditions of high exposure levels. With a full face mask and continuous flow or pressure demand the permissible exposure is 2000 times the exposure limit.

F. Summary of Recommendations

1. The use of asbestos in the reflock activity should be eliminated by substituting other materials if possible. Alternatively, the process should be enclosed to eliminate workers exposure.

2. Respirator protection must be provided based on a complete program as outlined in the OSHA regulation 1910.134.

3. Decontamination facilities must be provided to eliminate exposures in clothes changing areas and to reduce exposures to contaminated personnel.

4. Locker rooms and showers should be provided to isolate the clean area from the dirty area.

5. Engineering process modifications and controls should be implemented wherever feasible to minimize the exposure of workers to beryllium.

V. AUTHORSHIP AND ACKNOWLEDGEMENTS

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ATTACHMENT 1

Hygiene Department Work Assignment Sheet
(Annotated with Frequency and Duration of Work, Task, and Observation Period)

Kaweki Berylco Industries
Reading, Pennsylvania Plant

HYGIENE DEPARTMENT

Task — Date ________ Day ________

Estimated Man Hours/Frequency	DEPT.	ASSET NUMBER	WORK ORDER	LABOR CODE	WORK DESCRIPTION — Tasks Observed on Jan. 10, a.m. or p.m.
	6518		5036	9190	Distribute/wash respirators (am & pm)
	6518		5037	9090	Clean/Bag House inspection
As Required*+	6545	99853	5037	bagging	#1 Detroit collector
Avg. 5 hrs/wk^Δ*+	6530	01363	5037	bagging	#2 Arc Room collector
Avg. 5 hrs/wk^Δ*+	6530	01362	5037	bagging	#3 Arc Room collector
Avg. 16 hrs/mo++	6530	00813	5037	clean	#4 Calcine collector
19 hrs/year	6596	01178	5037	empty	#6 Machine Shop collector
16 hrs/2 wk +	6530	01366	5037	empty & reflock	#7 Ultra collector
?/6 wk	7031	01224	5037	shakedown	#8 - 8.A R&D Wheelabrator
As required*+	7031	01231	5037	bagging	R&D Dustube collector
As required*+	7031	01223	5037	bagging	#8B Dustube collector
64 hrs/year*+	6540	00024	5037	empty & reflock	#9 M&C collector
As required*+	7031	01364	5037	bagging	Metals Atomizing collector
As required*+	7031	01222	5037	bagging	R&D Pangborn collector (bag)
As required*+	7031	01221	5037	bagging	R&D Pangborn collector
As required*+	7031	01220	5037	bagging	Metallographic Lab. collector
Discontinued	6521	00839	5039		Hi Purity floor vacuum
3 hrs/day	6530	99723	5039	empty	Arc Room floor vacuum (2) (am)
2 hrs/day	6540	00072	5039	empty	M&C floor vacuum (am)
3 hrs/2 wk	6545	00483	5039	empty	Detroit floor vacuum (pm)
4 hrs/wk	7031	01080	5039	empty	R&D floor vacuum (am)
3 hrs/3 mo	6596	00177	5039	empty	Specialty Machine Shop vacuum
4 hrs/6 mo	7031	01226	5039	empty	R&D Torit Mod. 75
Not serviced	6561	01370	5039		Cold Mill chip collector
2 hrs/2 wk	6561	01369	5039	empty	Roll Grind collector

ΔRebagging more often due to heat.
*Rebagging is done every 2 or 3 years. About 122 man hours per compartment
+The frequency of maintenance during the interim depends on operating conditions.
++Frequent cleaning required due to fine dust penetrating bags.

HYGIENE DEPARTMENT

Estimated Man Hours/Frequency	DEPT.	ASSET NUMBER	WORK ORDER	LABOR CODE	Task WORK DESCRIPTION Tasks Observed on Jan. 10, a.m. or p.m.
Not serviced	6560	00325	5039		Rolling Mill chip collector
3 hrs/mo	6563	10367	5039	empty	Rod & Wire collector
3 hrs/mo	6570	00235	5039	empty	Tool Assembly collector
3 hrs/mo	6562	01368	5039	empty	Slitter Band Saw collector
2 hrs/mo	6560	01371	5039	empty	Hot Mill tool grind. collector
2 hrs/2 wks	6563	00325	5039	empty	Die Room Torit collector
As required	6563	00017	5039	empty	Spencer vacuum cleaner (portable)
1½ hrs/day	6519	00749	5039	empty & clean	Boot & shoe cleaner
3 hrs/year	6518	00581	5039	bagging	Drum compactor vacuum
As required	6560	00570	5039	empty	Hot Mill portable vacuum
Discontinued	7031	01317	5039		Bldg. 13 (AEC) floor vacuum
Not serviced	7042	01231	5039		Mikro Pulsaire Powder Lab.
From 2-10 hrs 3-4 times/mo			5040	9210	Decontaminate (steam cleaning)
3 hrs/2 wks	6510	01488	5037	empty	Box Shop sawdust collector
3 hrs/mo	6517	01489	5037	empty	Polishing table collector
See below			5038	9210	Vacuum clean areas

Vacuum cleaning areas - Decontamination of spills or blow outs are done upon request. Size of job varies. The boot is blown off the calcine furnace 2 to 4 times per year. This takes 3 man 3 or 4 days to clean up. This is one of the larger jobs, however, other 3 day jobs have been done in the foundry.

ATTACHMENT 2

KAWECKI BERYLCO INDUSTRIES, INC.

P. O. Box 1462, Reading, Pa. 19603
Telephone: 215 / 929-0781

July 12, 1978

Mr. Bruce A. Hollett
Industrial Hygienist
Hazard Evaluations & Technical
Assistance Branch - NIOSH
4676 Columbia Parkway
Cincinnati, Ohio 45226

Dear Mr. Hollett:

Contained herein is the additional information that you have requested.

(A) Emission source #27 - This brick cutting unit is used approximately once every 6 months. The material is insulating brick GR #26 and #28 manufactured by A. P. Green Co. or General Refractory Co.

(B) Emission source #19 - The composition of this waste had been classified. However, the operation has not operated since March 1973 and most probably will not operate again.
Sources 1,6,11 and 12.
Analysis sheets attached.

(C) The bag of asbestos observed next to the respirator cleaning room was removed immediately upon its' discovery. The asbestos had been used to patch some refractory in a Heat Treat Furnace. It would not be related to any emission control system.

Hygiene Assistant Lapel Samples -
(Values in micrograms of Be/m^3)

1st Quarter 1978 - 2.76, 3.48, 4.62
4th Quarter 1977 - 12.4, 9.76, 6.15, 11.3, 10.8, 2.35
3rd Quarter 1977 - 24.7, 19.0, 38.4, 15.3, 41.4, 3.61,
13.0, 40.5, 5.55, 6.93, 8.27
2nd Quarter 1977 - 27.6
1st Quarter 1977 - 53.0

Respectfully,

7-13-78

	Emission Source #1 Flue Dust	Emission Source #6 #7 Collector		Emission Source #11 Melt & Cast Collector - Primary	Emission Source #12 Melt & Cast Collector - Secondary
Lab No.	47821	47846	47847	47848	47849
% Be	10.3	14.0	16.0	0.61	1.05
Fe	0.2	2.0	1.0	2.5	3.0
Si	0.2	7.0	5.0	7.5	10.0
Al	0.1	0.5	0.3	7.5	5.0
Co	0.01	<0.01	<0.01	0.25	0.1
Sn	<0.01	<0.01	<0.01	<0.01	<0.01
Pb	<0.01	0.05	0.02	0.07	0.1
Zn	<0.05	<0.05	<0.05	<0.05	<0.05
Ni	0.03	0.1	0.07	0.2	0.1
Cr	0.01	0.07	0.05	<0.01	<0.01
Mn	0.2	0.1	0.07	0.04	0.05
Mg	4.0	7.0	5.0	15.0	10.0
Ag	0.05	0.01	0.01	<0.005	<0.005
Cu	38.74	5.57	3.68	17.10	1.56
Zr	0.05	<0.01	<0.01	0.04	0.1
Ti	0.01	<0.01	<0.01	0.4	0.5
Na	2.0	0.3	0.2	<0.05	0.5
Ca	5.0	1.0	0.7	0.75	10.0
B	<0.005	<0.005	<0.005	0.05	0.1
Cd	<0.05	<0.05	<0.05	0.04	0.1
Mo	<0.01	<0.01	<0.01	<0.01	<0.01

Beryllium - by Quantitative Analysis (Beryllium Analyzer)
Copper - by Quantitative Analysis (Electrolytic)

All other elements by Semi-Quantitative Spectrographic Analysis

LAB NO. 47846 - 6518-01366 - #7 COLLECTOR FLOC SAMPLE - 6-29-78

47847 - 6518-01366 - #7 COLLECTOR FLOC SAMPLE - 7-6-78

47848 - 6540-00072 - MELT + CAST COLLECTOR - PRIMARY SIDE

47849 - 6540-00072 - MELT + CAST COLLECTOR - SECONDARY SIDE

47821 - FLUE DUST - 7-10-78

Table I

Reading KBI Quarterly Abatement Report to OSHA on Beryllium Exposures
(Taken on Gross High Volume and Lapel Sampling Bases - ug/M³)

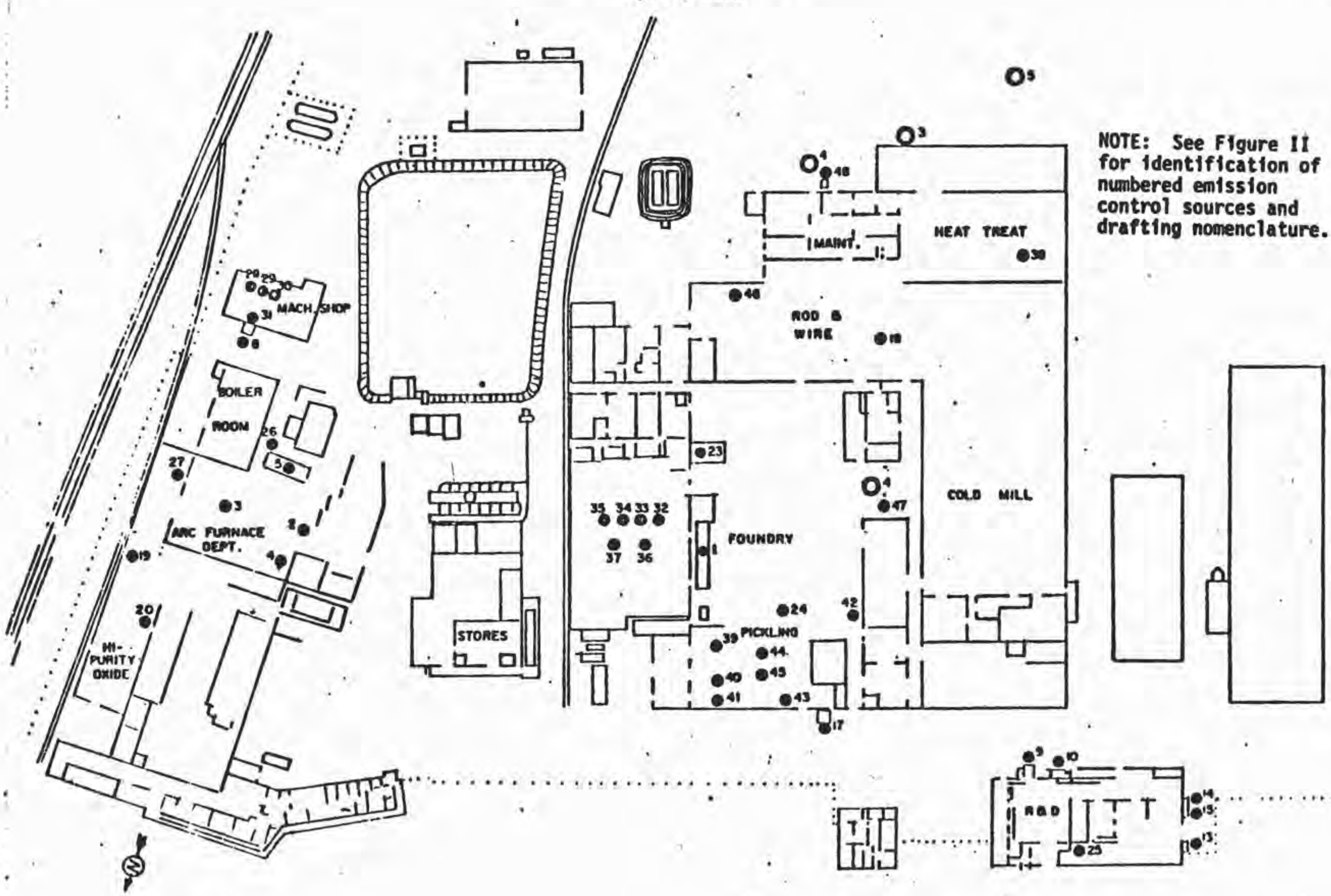
Activity	1st Quarter '77 High Volume	1st Quarter '77 Lapel**	2nd Quarter '77 High Volume	2nd Quarter '77 Lapel	3rd Quarter '77 High Volume	3rd Quarter '77 Lapel	4th Quarter '77 High Volume	4th Quarter '77 Lapel	1st Quarter '78 High Volume	1st Quarter '78 Lapel
Arc Room:										
(Operator Furnace #4)	4.27	18.1 18.1 51.2	9.51	15.5	4.16	29.3				
(Assistant Operator #4)	2.99	14.5 0.69 17.7	2.16	12.9	4.33	18.9				
(Helper Furnace #4)	2.70	5.57 7.53 11.4	2.79	69.3	2.34	4.19				
Calcine Room:										
(Furnace Operator)	2.10 4.55 6.16	3.62	6.74	5.02	3.96	3.35				
Melt & Cast:										
(Helper Pan Man)	0.66	0.84 0.28 1.11	0.35	0.28	0.34	0.57				
Tool Assembly Area:										
(Tool Assembler)	1.11	1.41	1.05	1.66	0.45	2.51				
Specialty Machine Shop:										
(Machinist Centerline Grinder)	0.24	0.83								
R & D										
(AVS Furnace Operator)					0.59	2.78				
Ultra Collector:										
(Reflocker)*		53.0		27.6		24.7 19.0 38.4 15.3 41.4 3.61 13.0 40.5 5.55 6.93 8.27		12.2 9.76 6.15 11.3 10.8 2.35		2.76 3.48 4.62

*This work is done by Hygiene Assistants.
**Lapel data reported is a full term exposure measurement taken by standard lapel sampling methods. Reference telephone conversation with Health and Safety Manager February 14, 1979.

Figure I

Dust Collector Location Plan

Kawecki Berylco Industries
Reading, Pennsylvania
April, 1978



NOTE: See Figure II for identification of numbered emission control sources and drafting nomenclature.

Figure II

Kawecki Berylco Industries

EMISSION SOURCES & CONTROL EQUIPMENT DATA

SOURCE NO. & OPERATION	NET CLOTH AREA	A/C RATIO	AIR VOLUME	CONTAMINANT	STACK HT.	STACK DIA.	EXIT VEL.	EXIT TEMP.	REMARKS	COLLECTOR MFGR.
1	14,112 □'	2.46 : 1	35,000 CFM	PARTICULATE + BeO	ITEMS 1,2,3,4	3'-9"	3792 F.P.M.	89°F		WHEELABRATOR
2 ARC RM.	14,112 □'	2.46 : 1	35,000 CFM	" "	5 MANIFOLDS	4'-5"	3007 "	81°		"
3 ARC RM.	16,560 □'	2.30 : 1	38,000 CFM	" "	TO ITEM 6	4'-0"	2412 "	113°		FULLER
4 CALCINE RM.	1,536 □'	3.91 : 1	6,000 CFM	BeO		2'-1"	1388 "	77°		WHEELABRATOR
5 AEC	8,200 □'	3.48 : 1	28,800 CFM	BeCu FINES + BeO		4'-0"	2634 "	77°		"
6 ULTRA	27,000 □'	6.95	162,000 CFM	PARTICULATE + BeO	150	INLET [illegible] / STACK 72" DIA.	3392 "	83		"
7 RECLAMATION					MANIFOLD TO ITEM No.16				REMOVED TO P.C.P. (1973)	
8 MACHINE SHOP	2,550 □'	1.45 : 1	3,700 CFM	Be + BeCu FINES	28'	1'-6"	659 "	72°	INTERMITTENT	"
9 R. & D.	4,200 □'	3.57 : 1	15,000 CFM	MISC."Be" PROD'S	25'	2'-10"	2259 "	76°	"	"
10 R. & D.	2,520 □'	2.98 : 1	7,500 CFM	" " "	28'	19" x 22"	2927 "	69°	"	"
11 M. & C. PRIM	19,740 □'	2.54 : 1	50,000 CFM	PARTICULATE	75'	INLET 60"x48" / STACK 48 DIA.	2770 "	86°		"
12 M. & C. SEC.	9,800 □'	5.1 : 1	50,000 CFM	& BeO						
13 R. & D.	547 □'	3.00 : 1	1,640 CFM	MISC. "Be" PROD'S	25'	0'-11"		UNIT COLL'S.	INTERMITTENT	"
14 R. & D.	730 □'	3.00 : 1	2,190 CFM	" " "	25'	0'-11"		" "	"	"
15 R. & D.	730 □'	3.00 : 1	2,190 CFM	" " "	25'	0'-11"		" "	"	"
16 RECLAMATION					25'	32¾" x 23½"	3334 "	75°	REMOVED TO P.C.P. (1973)	"
17 RUEMELIN R & W	758 □'	3.31 : 1	2,500 CFM	BeCu FINES	23'	0'-11"	4305 "	68°		RUEMELIN
18 ROD & WIRE	20" x 24" x 10" (CARTRIDGE FILTER)		1,000 CFM	OIL MIST & BeCu. FINES	24'	4½" x 8¾"	2975 "	70°	WET MIST COLLECTOR AAF	AMER. AIR FILTER
19 PULSAIRE DEPT. 522	452 □'	6.64 : 1	3,000 CFM	CLASSIFIED PROD.	MANIFOLDS TO ITEM No.8				PROCESS NOT OPERATING	MICRO-PUL.
20 PULSAIRE DEPT. 521	63 □'	4.76 : 1	3,000 CFM	BeO	MANIFOLDS TO ITEM No.8				"	" "
21 CYCLONE CHIP COLL. HOT MILL			4,200 CFM	BeCu FINES	30'	1'-3"	4325 "	70°		FLOWTRONICS
22 MIST COLL. HOT MILL					30'	1'-3"	4329 "	70°	REMOVED 1972	
23 P.A. SCRUBBER					MANIFOLDS TO ITEM No.8				" 1973	
24 CYCLONE FOUNDRY			3,500 CFM	BeCu FINES	30'	1'-2"	3033 "	78°		DUCON
25 R. & D.	60□'	8.33 : 1	500 CFM	MISC. "Be" PRODS.	25'	4'-6"	2200 "	86°	INTERMITTENT	TORIT
26 BOILERS					175'	13'-0"	275 "			
27 BRICK CUTTING COLLECTOR	N. A.	N. A.	2,000 CFM	REFACTORY PART.	20'	1'-2"	2800 "	70°		UNKNOWN
29 AEROTEC IND.No.20			600 CFM	Be & BeCu FINES	MANIFOLDS TO ITEM No.8	0'-6"	5200 "	70°	INTERMITTENT	AEROTEC
29 " " "			600 CFM	" " "		0'-6"	5200 "	70°	"	"
30 " " "			600 CFM	" " "	MANIFOLDS TO ITEM No.8	0'-6"	5200 "	70°	"	"
31 " " "			600 CFM	" " "	" "	0'-6"	5200 "	70°	"	"
32 42" DIA. POWERED ROOF VENT					35'	3'-6"	2100 "	81°	TO ATMOSPHERE	
33 " "					"	"	" "	"	"	"
34 " "					"	"	" "	"	"	"
35					"	"	" "	"	"	"
36 POWER ROOF										
37 VENTILATORS					30'	8'-5"	1000 "	"	"	
38 BRIGHT ANNEAL. FCE. GAS FIRING					30'	12"-12"	500 "	800°F		
39 HVY. GAUGE CLEANING LINE					37'	1'-8"	6300 "	67°		
40 8 STRAND CLEANING LINE					37'	1'-9"	1950 "	65°		
41 CAD. PLATING LINE					28'	1'-3"	1000 "	65°		
42 8 STRAND CLEANING LINE					35'	2'-0"	3300 "	87°		
43 BENI CLEANING LINE					32'	1'-4"	1500 "	68°		
44 BULK PICKLING LINE FAN "A"					38'	3'-0"	3500 "	57°		
45 BULK PICKLING LINE FAN "B"					38'	3'-0"	2700 "	89°		
46 EXTRUSION PRESS					31'	1'-9"	2700 "	75°		
47 BOX SHOP					18'	0'-11"	2000 "	"		
48 CARPENTER SHOP					19'-6"	1'-4"	4100 "	"		

6807 DUST COLLECTOR LOCATION PLAN

NO. REFERENCE DRAWING

KAWECKI BERYLCO INDUSTRIES INC.
READING, PENNSYLVANIA

Checked	Drawn L.C.S.	DWG. NO.
Date 4-18-78	Eng'r.	
Scale	Approved	REV.NO.