PANTEX CHRONIC BERYLLIUM DISEASE PREVENTION PROGRAM

GENERAL

This document establishes Pantex management requirements for implementation of the Chronic Beryllium Disease Prevention Program (CBDPP). The goal of the CBDPP is to prevent future cases of chronic beryllium disease (CBD) by minimizing: the number of workers exposed to beryllium, the levels of airborne beryllium exposure, and the potential for future exposure to beryllium. The CBDPP applies to all operations performed at Pantex which involve exposure, or potential exposure, to insoluble forms of beryllium, with the exception of beryllium articles (see "Definitions"). The CBDPP does not apply to laboratory operations involving beryllium which are included in the scope of the Pantex Chemical Hygiene Program (see Chapter 8).

BASELINE INVENTORY AND SAMPLING

The Industrial Hygiene Department will develop a baseline inventory of beryllium material locations and operations. The inventory will document the description, location, and approximate quantity of beryllium or beryllium-containing components, and will be used to identify exposed and potentially exposed workers. The inventory will be updated as necessary to reflect additions or deletions of beryllium material or operations. The following are examples of operations which require work with beryllium and/or beryllium components at Pantex.

1. Demilitarization/Sanitization of Weapon Components

    a. Disfigurement Operations - Components which contain beryllium will be crushed, shredded, or otherwise disfigured to ensure declassification and to render unusable for military purposes. These operations will be conducted in a beryllium regulated area. Local exhaust ventilation and enclosures will be used where feasible. Full-face respirators and protective clothing will be used, as needed, until operations are adequately characterized by airborne beryllium monitoring and surface swipe sampling.

    The feasibility of designing engineering controls for existing tooling requires further evaluation. A full characterization of these operations by airborne beryllium monitoring and surface swipe sampling will be required once operations begin.

    b. Firing Site Operations - Energetic demilitarization (firing to disable) of components containing small quantities of beryllium is conducted at FS-21, FS-22 and FS-24. Demilitarization at FS-22 is open air while FS-24 demilitarization is performed in a firing chamber which is exhausted to outside air. A beryllium regulated area is designated when firing beryllium

parts. Respiratory protection and protective clothing will be used when accessing chambers and areas of potential contamination until operations are adequately characterized by airborne beryllium monitoring and surface swipe sampling. Debris is HEPA vacuumed whenever possible to minimize the potential for dust generation. Due to the small quantity of beryllium in these components, significant release of airborne beryllium particulate is not anticipated.

Test shots containing beryllium were historically fired at FS-23 resulting in significant contamination in the test chamber. This is an inactive operation and the associated facility is locked, access restricted, and posted with appropriate warning signs & labels. Procedures are being developed to decontaminate the chamber.

2. Special Operations

a. Pit Characterization - Pit surface characterization was historically conducted which occasionally required minimal abrasion of pit exterior using a scotchbrite or brillo pad. These operations were conducted using local exhaust ventilation, protective clothing, wet-methods, and barrier paper. This is an inactive operation which was conducted during initial pit surface characterization studies. These operations did not result in the generation of airborne beryllium particulate.

3. General Handling of Beryllium Components (Articles)

a. Weapon Dismantlement, Assembly, & Maintenance - Beryllium and beryllium alloy components are handled during dismantlement, assembly, and stockpile maintenance operations. Articles sent to departments within Pantex or offsite with removable contamination levels at or above 0.025 $\mu g/cm^2$ are cleaned to below this level using wet methods or double bagged and labeled with a beryllium warning label. Although some components have removable surface contamination present, operations with these components do not generally involve machining, cutting, or other activities which result in the generation of airborne beryllium particulates.

b. Warehouse Operations - Beryllium and beryllium alloy components are handled for staging purposes. Beryllium components which have the potential for significant removable beryllium contamination are generally bagged and labeled prior to arriving at warehouse facilities. These operations do not result in the generation of airborne beryllium particulate.

Where appropriate, the Industrial Hygiene Department will conduct monitoring to characterize beryllium airborne exposures and surface contamination. Exposure monitoring will be conducted initially to determine adequacy of control measures then periodically to ensure that work controls continue to function effectively.

HAZARD ASSESSMENT

The Industrial Hygiene Department, using the results of the baseline inventory and sampling, will conduct a hazard assessment of all beryllium operations identified. The hazard assessment will include an analysis of existing conditions, exposure data, medical surveillance trends, and the exposure potential of planned activities. The hazard assessment will be documented and will be designed to determine the degree of risk associated with the identified beryllium operations.

EXPOSURE MONITORING

The Industrial Hygiene Department will identify operations and areas with potential for personnel exposure to airborne beryllium and conduct exposure monitoring necessary to characterize beryllium hazards. Normally, personal breathing zone sampling will be conducted for all workers exposed or potentially exposed to airborne beryllium. If sampling is conducted for only a subset of exposed or potentially exposed workers, the rational for this decision will be documented. Where possible, personal breathing zone sampling will be performed according to NIOSH or OSHA sampling protocols (or other generally accepted protocols). Laboratory analysis will be performed by a laboratory accredited by the American Industrial Hygiene Association (AIHA) for analysis of metals. Short term exposure sampling may be performed using sampling methods not in accordance with NIOSH or OSHA protocols. The frequency of all sampling will be established based on risk, and will be documented. Additional sampling will be performed when operations or procedures change.

The Industrial Hygiene Department will provide personal sampling results to employees' supervisors.

The Industrial Hygiene Department will conduct swipe sampling to determine the level of surface contamination and to aid in evaluating the effectiveness of housekeeping and other controls.

Permissible Exposure Limits

Permissible exposure limits for airborne beryllium are as follows:

- 8-hr Time Weighted Average - 2.0 $\mu g/m^3$
- Ceiling - 5.0 $\mu g/m^3$

Until feasible real time instrumentation becomes available, the ceiling of 5.0 $\mu g/m^3$ will be measured as a 15-minute STEL. Area sampling will be conducted as necessary to determine operational control or as otherwise needed.

Surface Contamination Levels

Surface swipe sampling will be conducted as necessary to identify and quantify beryllium surface contamination. Administrative levels for beryllium surface contamination are as follows:

- Non-regulated Area - less than 2.5 $\mu g/100cm^2$
- Regulated Area - 2.5 $\mu g/100cm^2$ to 25 $\mu g/100cm^2$
- Release to the public - less than 0.15 $\mu g/100cm^2$

EXPOSURE REDUCTION AND MINIMIZATION

The Industrial Hygiene Department will develop a documented program for exposure reduction and minimization which will include the following elements: 1) exposure reduction and minimization goals based on risk, 2) a plan for meeting the goals, 3) methods used for tracking status of attaining goals, and 4) rationale used for determining reduced and minimized exposures.

All employees will minimize the potential for development of CBD by reducing airborne levels of beryllium to as low as practical, minimizing the number of workers exposed and potentially exposed to beryllium, and minimizing the number of exposure opportunities.

Engineering Controls

Engineering controls will be used as the primary control for reducing exposures. Engineering control examples include local exhaust ventilation, glove boxes, enclosures, and wet methods.

Ventilation system requirements must meet the design and testing criteria of "ACGIH Industrial Ventilation, A Manual for Recommended Practice" and Plant Standard-3290, "Local Exhaust Ventilation." Exhaust which may contain beryllium particulates must be filtered through an approved high-efficiency particulate air (HEPA) filter. Maintenance of HEPA filters which contain beryllium must be conducted with a minimum of full-face respirators and protective clothing; bag-out techniques and wet methods must be used whenever possible.

All beryllium clean up activities must be done using wet methods and/or HEPA vacuuming. Dry sweeping and the use of compressed air is not allowed. HEPA vacuums may be obtained through the Tooling Warehouse by completing a Safe Work Permit signed by the Industrial Hygiene Department. Vacuum cleaners used for beryllium operations must have a warning label which indicates that the vacuum cleaner contains or may contain beryllium. Cleaning and maintenance of HEPA vacuum cleaners used for beryllium operations must be procedurally controlled and approved by the Industrial Hygiene Department.

All engineering controls must be approved by the Industrial Hygiene Department to ensure their adequacy.

Administrative Controls

Administrative control examples include establishment of restricted-access areas, arranging schedules or equipment such that fewer persons are potentially exposed or exposed for shorter periods, developing exposure minimization procedures, housekeeping, and the posting of warning signs.

Beryllium Regulated Areas

Contamination control will be established to prevent, as far as practical, exposure to beryllium. Beryllium regulated areas will be established when there is a significant potential for personnel exposures to exceed an eight-hour TWA of 0.5 $\mu g/m^3$ or a ceiling of 5 $\mu g/m^3$, or where surface contamination exceeds 2.5 $\mu g/100cm^2$. Warning signs, barriers, and/or surface demarcation will be used to warn personnel of regulated areas.

All beryllium regulated areas must be procedurally controlled with a Beryllium Work Permit signed by the Industrial Hygiene Department which contains requirements for work practices, controls, training, and personal protective equipment. The Industrial Hygiene Department will establish beryllium regulated area requirements for the specific operation which will be based on the risk of exposure.

Employees sensitive to beryllium or those having chronic beryllium disease or other chronic lung disease will be restricted from entering beryllium regulated areas.

Employees entering a beryllium regulated area must have a minimum of beryllium awareness training and may be required to have additional training as specified by the Beryllium Work Permit. In general, visitors are not permitted in beryllium regulated areas. If entrance is absolutely required, visitors must at a minimum complete beryllium awareness training, be escorted, and comply with all personal protective equipment and procedures required by the Beryllium Work Permit.

Operation supervisors will maintain a log containing the following information identifying individuals who enter beryllium regulated areas (such a log is provided on the Beryllium Work Permit).

- location of the regulated area
- name & badge of person entering regulated area
- date & time the regulated area was entered and exited
- personal protective equipment worn
- type of activity performed

The Operation Supervisor forwards a copy of the log to the Industrial Hygiene Department on a routine basis.

Eating, drinking, gum chewing, the use of tobacco, or the application of cosmetics is not allowed in beryllium regulated areas.

Articles, tooling, or other components with surface contamination levels equal to or above 2.55 $\mu g/100cm^2$ must be cleaned below this level or double bagged and labeled with a beryllium warning label before being removed from a regulated area.

Beryllium regulated areas may be discontinued after cleaning to surface contamination levels below 0.025 $\mu g/cm^2$. The Industrial Hygiene Department must conduct surface swiping and provide written approval after beryllium operations are complete for the regulated area to be discontinued.

An administrative action level for the use of respiratory protection and protective clothing of 0.5 $\mu g/m^3$ (8-hr TWA) or a ceiling of 5.0 $\mu g/m^3$ (measured as a 15-minute STEL) is established to reduce or minimize worker exposure to airborne beryllium.

All beryllium waste and waste containers must be labeled as beryllium containing and have a beryllium warning label.

All beryllium operations must be approved by the Industrial Hygiene Department procedurally, through engineering instructions, or through a Beryllium Work Permit.

Personal Protective Equipment

Personal protective equipment will be used only when engineering and/or administrative controls are not feasible or sufficient to control exposures.

Respiratory protection and protective clothing (lab coat, gloves, & booties) are required where airborne beryllium may exceed 0.5 $\mu g/m^3$ (8-hr TWA) or a ceiling of 5.0 $\mu g/m^3$ (measured as a 15-minute STEL). All respiratory protection used for protection from beryllium must be quantitatively fit tested. Air purifying respirators for beryllium will use NIOSH approved N, R, or P100 filters.

Gloves are required to prevent skin contact where the potential for beryllium surface contamination exists.

MEDICAL SURVEILLANCE

The Occupational Medicine Department will administer a medical surveillance program for all workers at risk of developing CBD. Once employees are identified and placed in the Beryllium Medical Surveillance Program, medical surveillance will continue for duration of employment.

Current employees will be classified into the following medical surveillance exposure categories based on answers to a Beryllium Exposure Questionnaire, work history, exposure records, and medical records.

A. Potential for Direct Exposure: Personnel directly involved or performing operations which may routinely result in exposure to airborne beryllium exceeding an eight-hour TWA of 0.5 $\mu g/m^3$. Examples *may* include personnel who work or have worked with the demilitarization/sanitation of beryllium parts, milling of beryllium parts, or FS-23 Silver Bullet operations.

B. Potential for Indirect or Incidental Exposure: Personnel indirectly involved or who may have been incidentally exposed during operations which may have the potential to occasionally exceeded an eight-hour TWA of 0.5 $\mu g/m^3$. Examples *may* include personnel who handle beryllium parts known to have significant levels of removable contamination or maintenance workers who maintain beryllium ventilation systems

C. Remote Potential for Exposure: Personnel not directly involved or indirectly involved with operations which resulted in beryllium exposure. Examples *may* include security personnel, janitorial personnel, and other personnel who may have worked around beryllium operations.

D. No Known Potential for Exposure; all others.

The Industrial Hygiene Department will identify workers for inclusion into medical surveillance categories, based on their exposure or potential exposure to airborne beryllium. New employees or employees being transferred into jobs with the potential for beryllium exposure will be placed into one of the above medical surveillance categories. Each employee in medical surveillance category A-C will be included in the Beryllium Medical Surveillance Program based on the above priority.

The Occupational Medicine Department will perform pre-placement, termination, and periodic (at least every three years) medical surveillance for personnel in the Beryllium Medical Surveillance Program which includes the following:

- standard, self-administered medical history of signs and symptoms of pulmonary disease
- pulmonary function test which includes forced vital capacity (FVC) and forced expiratory volume at one second (FEV1)
- chest x-ray taken according to the following schedule

1. upon initial entry into the program
2. every five years

3. whenever there is a significant change in pulmonary function tests or symptoms

4. whenever there is a new “positive” lymphocyte proliferation test

- lymphocyte proliferation test (LPT) offered on a voluntary basis with counseling on the risks/benefits and signed informed consent according to the following schedule:

  1. upon initial entry into the program

  2. every three years

  3. whenever there is a significant change in pulmonary function tests, symptoms, or x-ray findings

- workers found to have a positive LPT will be offered a second confirmative test. If the second test is positive, then the worker will be offered a referral to a pulmonologist for bronchoscopic examination, collection of bronchial secretions, and a biopsy.

The Occupational Medicine Department is responsible for notifying employees and their supervisors, in writing of any medical restrictions. Employees with medical restrictions prohibiting potential exposure to beryllium will not be permitted to enter a beryllium regulated area.

Employees are responsible for attending scheduled physical and medical surveillance examinations.

TRAINING

Beryllium training will be provided to workers exposed and potentially exposed to beryllium as well as supervisors, managers, and others involved in activities with exposure or potential exposure to beryllium.

The Training and Development Technologies Department (T&DT), with input and assistance from the Industrial Hygiene Department, will provide an initial beryllium awareness training to all workers who may work around or with beryllium and those individuals who are considered beryllium workers. Such workers include employees adjacent to beryllium regulated areas, production technicians, line supervisors, facility managers, planners, maintenance workers,

emergency response personnel, waste workers, industrial hygienists, medical personnel, and visitors. Training will include information on the following:

- beryllium background, history, & uses
- site specific occupational beryllium exposures
- health hazards and symptoms of beryllium exposure
- controls & work practices used to minimize exposures
- methods to minimize the number of workers potentially exposed to beryllium and methods to minimize the number of beryllium exposure opportunities

The Training and Development Technologies Department, with input and assistance form the Industrial Hygiene Department, will provide job specific beryllium training to beryllium workers (which may include technicians, line supervision, maintenance workers who maintain equipment with potential beryllium contamination, and waste workers who work with beryllium waste) with an annual refresher which will include information on the following:

- work specific engineering controls, work practices, and administrative controls used to minimize exposures
- work specific use of personal protective equipment
- work specific decontamination procedures
- medical surveillance
- waste management
- applicable beryllium regulations

RECORDKEEPING

Records of beryllium inventory, hazard assessments, sampling data (personal, area, and surface), engineering and administrative controls, personal protective equipment, and medical surveillance will be maintained in an electronic data base. The data base will allow linking of workplace records with medical surveillance records to permit correlation between workplace exposures and controls, and health effects.

PERFORMANCE FEEDBACK

Analysis and assessment of sampling results, identified beryllium hazards, medical surveillance results, status of exposure reduction and minimization goals, and occurrence reporting will be conducted periodically. Results of this analysis will be communicated to workers, line managers, work planners, medical staff, and other involved groups. Results will be communicated in a manner which is understandable to all groups so that weak points can be identified and improvements made.

DEFINITIONS

Beryllium (Be) - A light, stiff, grey metal used with a variety of aerospace, semiconductor, and nuclear applications. For the purpose of this program beryllium is defined as elemental beryllium and any insoluble beryllium compound or alloy containing 0.15 percent beryllium or greater that may be released as an airborne particulate.

Beryllium Article - A manufactured item formed to a specific shape or design during manufacture that has end-use functions dependent in whole or in part on its shape or design during end-use, and that does not release or otherwise result in exposure to airborne concentrations of beryllium under normal conditions of use.

Beryllium Operations - Operations where beryllium is handled, abraded, machined, or otherwise processed.

Beryllium Regulated Area - Demarcated area established when a significant potential for personnel exposures exceeds an eight-hour TWA of 0.5 $\mu g/m^3$ or a ceiling of 5 $\mu g/m^3$ (measured as a 15-minute STEL), or where surface contamination exceeds 0.025 $\mu g/cm^2$ exists.

Beryllium Worker - Individuals who perform operations with beryllium who have the potential to be exposed to airborne beryllium at or above an eight-hour TWA of 0.5 $\mu g/m^3$ or a ceiling of 5 $\mu g/m^3$ (measured as a 15-minute STEL).

Chronic Beryllium Disease (CBD) - a chronic, delayed-type chemical pneumonitis characterized by pulmonary symptoms that include dyspnea, non-productive cough, and detriments in lung function, although symptoms can also include progressive weakness and fatigue, pain, and anorexia.

High Efficiency Particulate Air (HEPA) Filters - Filters which test at least 99.97 percent efficient against a challenge aerosol of 0.3 microns.

Permissible Exposure Limit (PEL) - Airborne concentrations to which nearly all workers may be repeatedly exposed without adverse health effects. An airborne concentration of 5 $\mu g/m^3$ (measured as a 15-minute STEL) or an eight-hour time weighted average concentration of 2 $\mu g/m^3$.

APPENDIX (References)

1. DOE Order 5480.10, “Contractor Industrial Hygiene Program”
2. DOE Order 5480.8A, “Contractor Occupational Medicine Program”
3. Plant Standard 3250, “Pantex Industrial Hygiene Program”
4. Plant Standard 3570, “Medical Surveillance Program”
5. Plant Standard 3505, “Comprehensive Medical Examinations”
6. Plant Standard 3260, “Pantex Written Hazard Communication Program”
7. Plant Standard 3265, “Chemical Control Program”
8. Plant Standard 3261, “Carcinogens”
9. Plant Standard 3290, “Industrial Ventilation”
10. Plant Standard 3112, “Respiratory Protection Program”
11. IOP D6201, “Sampling for Metal Dusts and Fumes”
12. IOP D6206, “Procedure for the Sampling of Metal Dust Surface Contamination”
13. IOP D6200, “Maintenance and Calibration of Air Sampling Pumps”
14. IOP D6141, “Beryllium Analysis of Air, Swipe, and Urine Samples”
15. IOP D6239, “Area Breathing Zone, & Personal Noise Monitoring Data Management”
16. IOP D6250, “Exposure Assessment Reports”
17. IOP D6241, “Local Exhaust Ventilation Survey”
18. IOP D6500, “Procedure for Quantitative Fit Testing of Respirator Users”
19. IOP 487, “Occupational Medical Program Plan”
20. IOP 504, “Patient Confidentiality”

21. ACGIH Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices (latest edition)

22. ACGIH Industrial Ventilation, A Manual of Recommended Practice (latest edition)

PROPOSED IMPLEMENTATION OUTLINE

Funding for a full scope Chronic Beryllium Disease Prevention Program has not been provided for FY 98 or 99. With the limited funding currently available, the Pantex Plant will be able to perform the work identified in this document as a part of approved FY 98 and 99 work plans.

The remaining work identified in the Implementation Plan is beyond the scope of current Pantex capabilities. Work at this additional level is not possible until additional funding is provided.

1998

Baseline Inventory and Sampling

- Compile list of known beryllium operations and locations

Hazard Assessment

- Begin beryllium exposure summaries for known beryllium operations which is limited to a summary of operations and sample results with conclusions regarding potential hazards

Exposure Reduction & Minimization

- Implement beryllium controlled areas for operations with the potential to exceed an eight-hour TWA of 0.5 $\mu g/m^3$ or a ceiling of 5 $\mu g/m^3$

Medical Surveillance

- Perform medical surveillance on employees with known potential for significant beryllium exposure (potential to exceed an eight-hour TWA of 0.5 $\mu g/m^3$ or a ceiling of 5 $\mu g/m^3$) which includes: interval history; pulmonary function test; chest x-ray (every 3 years); CBC and chemical profile; routine urinalysis; and physical examination

- Implementation of the beryllium medical surveillance Notice requirements will begin when funding is received.

Exposure Monitoring

- Conduct air monitoring for operations with the potential to exceed an eight-hour TWA of 0.5 $\mu g/m^3$ or a ceiling of 5 $\mu g/m^3$

- Conduct surface swiping for operations and areas with the potential for significant surface contamination above 2.5 $\mu g/100cm^2$

Training

- Update existing awareness training course to ensure accuracy

- Provide job specific beryllium briefings on beryllium hazards, controls, & work practices to workers with potential for significant beryllium exposure (potential to exceed an eight-hour TWA of 0.5 $\mu g/m^3$ or a ceiling of 5 $\mu g/m^3$)

Recordkeeping

- Maintain medical records in personal Occupational Medicine Department files

- Maintain beryllium exposure summaries and exposure records in Industrial Hygiene Department files

Performance Feedback

- Communicate medical surveillance and exposure monitoring results to supervisors and employees

1999

Baseline Inventory and Sampling

- Compile list of known beryllium operations and locations

Hazard Assessment

- Complete beryllium exposure summaries for known beryllium operations

Exposure Reduction & Minimization

- Implement beryllium regulated areas for operations with potential to exceed an eight-hour TWA of 0.5 $\mu g/m^3$ or a ceiling of 5 $\mu g/m^3$

- Begin implementation of "Beryllium Work Permit" process for beryllium regulated areas

Medical Surveillance

- Perform medical surveillance on employees with known potential for significant beryllium exposure (potential to exceed an eight-hour TWA of 0.5 $\mu g/m^3$ or a ceiling of 5 $\mu g/m^3$) which includes: interval history; pulmonary function test; chest x-ray (every 3 years); CBC and chemical profile; routine urinalysis; and physical examination

- Implementation of the beryllium medical surveillance Notice requirements will begin when funding is received

Exposure Monitoring

- Conduct air monitoring and surface swiping for operations with potential to exceed an eight-hour TWA of 0.5 $\mu g/m^3$ or a ceiling of 5 $\mu g/m^3$

Training

- Provide job specific beryllium briefings on beryllium hazards, controls, & work practices to workers with potential for significant beryllium exposure (potential to exceed an eight-hour TWA of 0.5 $\mu g/m^3$ or a ceiling of 5 $\mu g/m^3$)

Recordkeeping

- Maintain medical records in personal Occupational Medicine Department files

- Maintain beryllium exposure summaries and exposure records in Industrial Hygiene Department files

Performance Feedback

- Communicate medical surveillance and exposure monitoring results to supervisors and employees