

1.0 Purpose

The Chronic Beryllium Disease Prevention Program (CBDPP) supplements the overall worker protection program at the Rocky Flats Environmental Technology Site (Site) in order to support the Kaiser-Hill mission of closure of the Site. The goals of the CBDPP are to:

- minimize the number of workers who are potentially exposed to airborne beryllium,
- minimize the level of any potential exposure to beryllium.

This will be implemented through the Work Control Packages (WCP) as identified in the Integrated Safety Management Manual and will replace the Health and Safety Practices Manual section 1-15310-HSP-13.04.

2.0 Scope

The CBDPP applies to all contractors working on Site. All contracts awarded for work activities in buildings, rooms or areas identified as containing beryllium will include the requirements to comply with this program.

The majority of beryllium operations currently at RFETS focus on packaging beryllium items, dismantling beryllium contaminated machinery, and decontaminating and decommissioning past beryllium areas.

3.0 Responsibilities And Authorities

3.1 Kaiser-Hill Management

Kaiser-Hill management is responsible for ensuring that the CBDPP is implemented at all levels throughout the Site. The following are the primary responsibilities of Kaiser-Hill management:

- Ensure all work activity planning includes an assessment of the potential for beryllium exposure,
- Integrate the planning and implementation of the CBDPP throughout all contractors and employees,
- Require contractors implement this CBDPP in all subcontracts where the potential for beryllium exposure is determined to be applicable,
- Ensure adequate funding in project baselines and planning to implement the CBDPP for all identified work activities that are covered by this document,

- Develop methodology to release equipment contaminated, and possibly contaminated, with beryllium to other DOE sites, industry, the general public and waste disposal sites,
- Minimize the number of beryllium workers as much as possible or allowed for by the current governmental contractual requirements,
- Addition of new beryllium workers will require written approval of the cognizant Operation's Kaiser-Hill Vice President and concurrence from the Kaiser-Hill Vice President of Safety Systems and Engineering. The number of new beryllium workers will be tracked and reported monthly to DOE, RFFO.
- Perform assessments of subcontractors to evaluate the implementation of the CBDPP, and
- Ensure that a formal training program is developed and implemented and is updated as needed.

3.2 Kaiser-Hill Safety and Industrial Hygiene

The following are the primary responsibilities of the Kaiser-Hill Safety and Industrial Hygiene staff.

- Review and update the CBDPP on a regular basis (at least annually),
- Develop CBDPP goals for the Site and annually review and update the goals,
- Develop methods and strategies to minimize the overall number of beryllium workers,
- Assist subcontractors in implementing the CBDPP,
- Develop criteria for equipment release,
- Maintain all records as defined in section 5.7,
- Maintain technical oversight of the CBDPP, and
- Create and guide the Site Beryllium Steering Committee.

3.3 Subcontractors

All subcontractors shall implement this CBDPP for work activities in areas identified as containing beryllium metal or parts, beryllium processing equipment or machining tools, or contaminated with beryllium particulate.

The following are the primary responsibilities of subcontractors' management:

- Ensure all requirements of the CBDPP are implemented for work activities with the potential for beryllium exposure,

- Utilize the work control procedures on all work packages to identify potential beryllium hazards,
- Maintain records to verify that their beryllium workers have met medical surveillance and training requirements,
- Provide Kaiser-Hill management and industrial hygiene monthly reports, as stated in section 5.7, highlighting the status of the CBDPP, and
- Develop subcontractor specific goals in accordance with the Kaiser-Hill goals.

3.4 Subcontractor Industrial Hygiene and Safety Staff

The following are the primary responsibilities of subcontractor industrial hygiene and safety staff:

- Complete the IWCP process for all beryllium operations,
- Complete the Hazard and Risk Assessment for all Beryllium Operations, and
- Complete all requirements placed on them by this program such as work evaluations, industrial hygiene monitoring, training, and recordkeeping.

3.5 Rocky Flats Occupational Medicine Department

The following are the primary responsibilities of the Occupational Medicine group:

- Develop and implement a beryllium medical surveillance program, and
- Maintain medical surveillance records.

3.6 Building Managers and Work Planners

The following are the primary responsibilities of building managers and work planners:

- Maintain an inventory of beryllium areas within their building or work planning area,
- Initiate work control procedures and note possible beryllium exposures for all operations in beryllium areas, and
- Attend necessary beryllium training as instructed.

3.7 Employees

The following are the primary responsibilities of employees:

- Follow all safety and health requirements of the CBDPP,
- Attend necessary beryllium training as instructed, and

- Report any new or unknown beryllium, beryllium article, and/or beryllium area or support area to their contractors industrial hygiene and safety staff.

3.8 Beryllium Steering Committee

The Beryllium Steering Committee will be guided by a representative of the Kaiser-Hill Safety and Industrial Hygiene staff and made up of representatives from the subcontractors, the steelworkers union, employees, and occupational medicine. The primary responsibilities for the Committee will be to:

- Develop performance feedback measures and utilize measures to evaluate the CBDPP,
- Address technical issues,
- Modify and update goals and develop performance measures,
- Evaluate program status and establish program goals and objectives,
- Develop methods for cost savings, and
- Develop methods to minimize numbers of beryllium workers.

3.9 Beryllium Visitor Host

- Ensure that the building manager and industrial hygienist are aware of the intended visit, and
- Ensure that the Visitor Procedures are completed and complied with.

4.0 **Definitions**

Action Level - an airborne or surface level of beryllium at which controls are implemented to reduce potential exposures and or maintain cleanliness.

- The airborne action level is 0.5 ug/m^3 (8 hour TWA). Operations in which airborne beryllium levels could potentially exceed the action level will be controlled through the use of engineering controls. If engineering controls are not feasible, exposures will be controlled through the use of personal protective equipment (PPE) including respiratory protection according to 29 CFR 1910.134.
- The surface action level matrix for an index of cleanliness is as follows:
 1. Non-beryllium operations areas shall be maintained below $0.2 \text{ ug}/100\text{cm}^2$ beryllium. Areas found to exceed this will be classified as beryllium operations areas and/or decontaminated. Upon successful decontamination to levels below $0.2 \text{ ug}/100\text{cm}^2$, these areas can be reclassified as non-beryllium operations areas.

2. Beryllium operations areas shall be maintained below $2.5 \text{ ug}/100\text{cm}^2$. Areas that exceed this level shall be decontaminated using systematic methods and proper PPE or downgraded to a Non-Beryllium Operations Area when operational specific breathing zone air sampling can show that potential exposures do not exceed $0.5 \text{ ug}/\text{m}^3$, regardless of surface contamination levels. Following decontamination, the area can be reclassified. Note: these levels are intended for accessible surfaces. They will not be used for inaccessible surfaces such as exhaust ventilation, glove boxes or interior machine surfaces as long as access is not gained. Inaccessible surfaces in beryllium operations areas that are suspected to be highly contaminated will be considered limited access beryllium operation areas when entry becomes necessary.
3. Limited access beryllium operations area are those areas that have beryllium contamination equal to or above $2.5 \text{ ug}/100\text{cm}^2$ on surfaces which are accessible to employees. These areas shall be posted with proper warning signs and proper PPE as determined by the industrial hygienist and stated on the sign shall be required for entry.

Action Level for Equipment Release - equipment potentially contaminated with beryllium that is to be released to the general public will be sampled to ensure that all surfaces which have the potential to be accessed have less than $0.2 \text{ ug}/100\text{cm}^2$ of beryllium. Equipment to be released to facilities that routinely handle beryllium will be sampled to ensure that all surfaces that have the potential to be accessed have beryllium surface levels less than the level allowed by the facility.

Beryllium Area Visitor - anyone other than a Beryllium (or Incidental) Worker who enters a beryllium area when beryllium operations are not being conducted. No visitors are allowed in beryllium operations areas while operations are being conducted. All visitors to beryllium areas, through the visitor's host, must follow the visitor procedures (Appendix 4 to be completed) including exposure monitoring and proper justification from upper management verified by K-H management documenting the need for entry and limiting the number of visitors. A beryllium area visitor will be offered medical surveillance if exposure monitoring sample results exceed $0.5 \text{ ug}/\text{m}^3$ (8Hour TWA).

Baseline Inventory - a survey of buildings and facilities on the site to determine locations of beryllium, beryllium operations, and beryllium contamination. Information from the survey includes a record review, employee interviews, documentation of beryllium operations, and beryllium surface and air sampling results. The number of samples taken in each building will vary depending on the history and use of the building and will be determined by the CBDPP Manager ensuring with statistical confidence that the area is accurately characterized.

Beryllium - for the purpose of this Program, beryllium means 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 beryllium article is 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 Contamination - detectable levels of beryllium particulate in areas that are expected to be free of beryllium.

Beryllium Inventory - an inventory of all beryllium, beryllium operations, and beryllium contamination areas. This inventory is a constantly updated version of the baseline inventory.

Beryllium Operation - an operation that meets one of the following categories: 1) any operation involving the use of compounds greater than 0.15% beryllium where there is a potential for airborne beryllium particulate, 2) any operation taking place in a Beryllium Operations Area where there is potential for airborne beryllium particulate, or 3) any operation taking place in a Limited Access Beryllium Operations Area.

Beryllium Operations Area - an area where beryllium compounds are used or beryllium contamination exists and operations are conducted that have the potential to generate beryllium particulate. For the purpose of D&D work, a beryllium operations area is an area where general room surface contamination levels are equal to or above 0.2 ug/100 cm² but below 2.5 ug/100cm². A Beryllium Operations Area can be downgraded to a Non-Beryllium Operations Area when operational specific breathing zone air sampling can show that potential exposures do not exceed 0.5 ug/m³, regardless of surface contamination levels.

Beryllium Operations Support Area - an area that has the potential of becoming contaminated with beryllium due to the proximity to a beryllium operations area, but the risk is low. These areas require routine monitoring by industrial hygiene.

Limited Access Beryllium Operations Areas - an area where personnel access is limited physically or through administrative controls due to potential beryllium exposures above that of a beryllium operations area. Examples of these areas include contaminated gloveboxes, fume hoods, ductwork, areas where potential airborne beryllium has the potential to exceed 0.5 ug/m³, or areas with surface contamination levels equal to or greater than 2.5 ug/100 cm².

Beryllium Worker Classifications:

- Beryllium Worker - a worker whose breathing zone air sample result on any single day exceeds an 8 hour time weighted average exposure of 0.5 ug/m³ for beryllium particulate or has the potential for exposure to beryllium in excess of 0.5 ug/m³ (8 hour TWA); or a worker with the potential for short term beryllium exposures in excess of 2.0 ug/m³ for 15 minutes. These levels are without regard to the use of respiratory protection.
- Incidental Beryllium Worker - a worker who has the potential for exposure to airborne beryllium lower than that of a beryllium worker, but requiring industrial hygiene review. Examples of incidental workers are workers who must enter a beryllium area, but do not conduct beryllium operations include health and safety personnel, computer and other support staff, and some supervisors. An incidental beryllium worker will be reclassified to a beryllium worker if exposure monitoring sample results on any single day exceed 0.5 ug/m³(8Hour TWA).

Hazard Assessment - the process of determining the level of beryllium hazard in an area due to the airborne resuspension of beryllium surface contamination. The hazard assessment is based on the anticipated level of contamination in buildings. The anticipated level of contamination is evaluated based on the process knowledge review of each building, facility, or area. This evaluation is

confirmed by surface sampling using statistical evaluation of the results to determine accuracy. The four contamination categories are as follows.

- **Assumed Clean:** Areas where beryllium processing was never conducted, air spaces and ventilation systems are not shared with rooms used for beryllium processing, beryllium workers did not visit unless fully decontaminated, and no other routes of contamination are known,
- **Probably Clean:** Areas where beryllium processing was never conducted but the possibility for cross-contamination from beryllium areas exists through shared air spaces, shared ventilation systems, and cross-contamination by beryllium workers,
- **Possibly Contaminated:** Areas that appear to have a direct connection to a beryllium processing area or where only small quantities of beryllium were handled (e.g., laboratory), and
- **Probably Contaminated:** Areas where beryllium processing was conducted and the probability for contamination is considered high.

Hierarchy of Controls - the order in which industrial hygiene controls are implemented to protect workers. Controls should be implemented in the following order: 1) substitution of beryllium from the operation or substitution of the operation for one that does not allow exposure, 2) engineering controls, 3) administrative controls, 4) personal protective equipment.

Industrial Hygienist - for the purpose of carrying out the requirements of the CBDPP, an individual who is certified in the comprehensive practice industrial hygiene through the American Board of Industrial Hygiene or has the ability to become certified and has training, experience or knowledge of IH in beryllium operations.

Industrial Hygiene Technician - an individual who has training in industrial hygiene, occupational safety, or environmental science to at least the level of a bachelors degree and/or has experience in the field of industrial hygiene. This individual will work under the supervision of the industrial hygienist but will be expected to be completely familiar with sampling methodology, hierarchy of controls, toxicological effects of chemical exposures, and common occupational stressors.

Occupational Exposure Limit (OEL) - the Occupational Safety and Health Administration (OSHA) airborne exposure limit standard, 29CFR 1910.1000, for air contaminants. The OEL for beryllium is an 8 hour time weighted average of 2.0 ug/m³.

Risk Assessment - a process to characterize the likelihood for exposure to beryllium taking into account the hazard assessment and the probability of generation of airborne beryllium, the quantity of airborne beryllium potentially generated and the adequacy of engineering controls to remove airborne beryllium.

Work Control Procedure (WCP) - for the purpose of this program, WCP refers to the formalized procedures, defined in the Integrated Safety Management Manual, to control the work process from defining the job to finishing the work.

5.0 Chronic Beryllium Disease Prevention Program

The objective of the CBDPP is to prevent exposure to airborne beryllium, reducing the incidence of future cases of CBD. The main program focus will be to:

- Minimize, to the extent possible, the number of workers who are potentially exposed to airborne beryllium,
- Minimize the exposure opportunities to airborne beryllium, and
- Minimize the magnitude of potential beryllium exposure.

5.1 Exposure Reduction And Minimization

The goal of the Site is to minimize the number of workers per work activity who have the potential for beryllium exposure and minimize their potential exposure to beryllium. The number of workers potentially exposed to beryllium is a fundamental part of the hazard assessment process. The greater the number of workers potentially exposed to beryllium, the greater the risk ranking associated with the work activity.

Work planning mechanisms at the Site will be used to identify beryllium operations. These will trigger the CBDPP Risk Assessment Matrix to determine hazard potential and initiate hazard reduction.

It is the responsibility of the project manager, the industrial hygienist, and the work planning team to develop an approach to perform work in beryllium areas to minimize the number of potentially exposed workers and minimize potential exposures to beryllium. This process will be initiated on all jobs through the Work Control Procedure unless a negative determination of beryllium is determined and documented. The approach to reducing the risk will be documented in the work planning documents. Risk reduction can be accomplished numerous ways, will follow the hierarchy of controls and shall be evaluated on a project basis. The following methods, as determined by the project manager, industrial hygienist and work planning team, will be employed for exposure and risk reduction for each work activity:

- Reduce the number of workers who are potentially exposed to airborne beryllium. Utilize only a limited subset of workers in each trade discipline to conduct work in beryllium areas,
- Limit the number of workers who have access to beryllium areas to only essential workers and support personnel. Employees who are not directly involved in the actual work or are not necessary for building surveillance or building maintenance and support will not enter beryllium areas. Visitors will only be allowed in beryllium areas with upper management justification and will not be allowed in beryllium areas during beryllium operations,
- Evaluate contamination and exposure control options to reduce potential exposures to as low as reasonably practicable. Methods include engineering design (ventilation),

administrative controls (restricted access areas, scheduling activities on off-shifts) and PPE (clothing and respirators.) The hierarchy of controls will be observed. Engineering controls shall always be considered as the primary control option, followed by administrative controls and PPE is the last option,

- Design and follow work practices to reduce potential beryllium exposure. Operations shall be planned and conducted as efficiently as possible in order to minimize unnecessary steps and reduce the length of time spent on beryllium operations,
- Develop and implement Hazard Control Plans (HCP) to ensure systematic analysis of hazards are addressed. HCP's shall be reviewed and updated annually and when processes change. The line manager, with technical input from safety and industrial hygiene professionals and occupational medicine professionals, is responsible for approving work on the HCP,
- Develop and follow entry and exit procedures for beryllium operations areas which include methods of donning and doffing PPE and entry/exit logs,
- Develop a Beryllium Work Form to be used in all beryllium operations,
- Design and follow work practices to minimize the potential for airborne releases of beryllium particulate. Dry sweeping of beryllium and use of compressed air contaminated areas is prohibited. Use of HEPA vacuums and wet methods are acceptable methods for cleaning,
- Adhere to the airborne beryllium action level of $0.5 \mu\text{g}/\text{m}^3$ (8 hour TWA), and reduce airborne exposures as low as practicable based on feasibility of engineering, administrative controls and available resources.
- The following steps will be taken if an exposure occurs or is expected above the action level without regard to respiratory protection:
 - The work planning team including the IH will evaluate the operation,
 - The work planning team including the IH will determine if engineering controls are feasible and implement such controls,
 - Respiratory protection will be used in accordance with HSP 7.03, Respiratory Protection,
 - Actual exposures above the action level will be reported to K-H S&IH on the monthly report.
- Maintain surfaces in beryllium operations areas and non-beryllium operations areas to a cleanliness level below the surface action level and/or conduct operational specific breathing zone air sampling to show that potential exposures do not exceed $0.5 \mu\text{g}/\text{m}^3$,
- Review and utilize exposure monitoring results to target operations and individuals for exposure reduction,
- Establish restricted areas with controlled access, with appropriate warning signs and access control logs according to the definitions of such areas as stated in Section 4.0,

- Use of decontamination facilities, change rooms, and shower facilities shall be evaluated for each project in an effort to minimize cross contamination or the spread of contamination. These facilities shall also be designed to limit potential exposures to the employee from personal hygiene issues and prevent spread of contamination outside of beryllium areas and off Site,
- Regulated areas will be established and demarcated with the following distinctive warning signs and labels:
 - Beryllium Operations Areas will have all entrances conspicuously posted with the following sign - “CAUTION BERYLLIUM DUST OR FUME Inhalation of Dust or Fume May Cause Serious Chronic Lung Disease Potential Cancer Hazard AUTHORIZED PERSONNEL ONLY”
 - Limited Access Beryllium Operations Areas will have all entrances conspicuously posted with the following sign: “DANGER DO NOT ENTER WITHOUT BEYLLIUM WORK PERMIT Inhalation of Dust or Fume May Cause Serious Chronic Lung Disease Potential Cancer Hazard AUTHORIZED PERSONNEL ONLY Minimum PPE Requirements _____ Contact _____ Prior To Entry”
- Beryllium articles and waste will be demarcated with the following distinctive warning signs and labels:
- Beryllium Operations Areas will have all entrances conspicuously posted with the following sign - “CAUTION BERYLLIUM DUST OR FUME Inhalation of Dust or Fume May Cause Serious Chronic Lung Disease Potential Cancer Hazard AUTHORIZED PERSONNEL ONLY”. “CAUTION” will be printed in YELLOW lettering on a BLACK background. The text will be printed in BLACK lettering on YELLOW background.
- Limited Access Beryllium Operations Areas will have all entrances conspicuously posted with the following sign: “DANGER DO NOT ENTER WITHOUT BEYLLIUM WORK PERMIT Inhalation of Dust or Fume May Cause Serious Chronic Lung Disease Potential Cancer Hazard AUTHORIZED PERSONNEL ONLY Minimum PPE Requirements _____ Contact _____ Prior To Entry”. “DANGER” will be printed in WHITE lettering on a RED oval. The text will be printed in BLACK lettering on WHITE background.
- Beryllium articles and waste will be demarcated with the following distinctive warning signs and labels:
 - Waste containers, other items with the potential for containing or being contaminated with beryllium will have the following sign: “BERYLLIUM Compound _____ Contact _____ DANGER Inhalation of dust or fume may cause serious chronic lung disease May cause ulcers in open wounds use (or work with this equipment) only with

approved beryllium work permit”. “DANGER” will be printed in WHITE lettering on a RED oval. The text will be printed in BLACK lettering on WHITE background.

- Equipment used for beryllium operations will have the following sign: “DANGER BERYLLIUM CONTAMINATION Inhalation of Dust or Fume May Cause Serious Chronic Lung Disease This equipment was known to have been used for beryllium operations, and may be internally contaminated If the internal compartments of this equipment are breached, workers must be protected in accordance with the RFETS CBDPP.” “DANGER” will be printed in WHITE lettering on a RED oval. The text will be printed in BLACK lettering on WHITE background.
 - Equipment used in a room where beryllium operations were conducted but not used for beryllium operations will have the following sign: “CAUTION POSSIBLE BERYLLIUM CONTAMINATION Inhalation of Dust or Fume May Cause Serious Chronic Lung Disease This equipment was in a room where beryllium operations were conducted This equipment was not used in beryllium operations, but may be internally contaminated If the internal compartments of this equipment are breached, workers must be protected in accordance with the RFETS CBDPP.” “CAUTION” will be printed in YELLOW lettering on a BLACK background. The text will be printed in BLACK lettering on YELLOW background.
- Implement an effective waste management program to identify and control beryllium contaminated waste to limit exposure to beryllium. This will focus on Site waste workers and individuals down line who may come in contact with potentially contaminated material,
- Develop and use methods for decontamination and cleaning respirators and laundry potentially contaminated with beryllium to ensure no exposures to decontamination workers and workers using this PPE down line.
- Utilize the Hazard Assessment and Risk Ranking (Appendix 1) to determine the exposure reduction and minimization strategy. This shall be documented and completed on each project and work activity.

5.2 Exposure Assessment

Exposure monitoring will be conducted for workers engaged in beryllium operations. The exposure monitoring data will validate the estimates of the magnitude, frequency, and duration of potential beryllium exposure to workers performing a variety of work activities. The initial exposure monitoring strategy will be designed based on the risk ranking (Appendix 1). The exposure assessment strategy shall be documented as part of the Beryllium Exposure Assessment Plan (Appendix 2).

5.2.1 Beryllium Exposure Assessment Plan

The Beryllium Exposure Assessment Plan shall be developed for all projects with potential beryllium exposure. The Beryllium Exposure Assessment Plan shall include the following information:

- baseline characterization and inventory for the affected work areas,
- hazard assessment and risk ranking documentation,
- employees or job classifications potentially exposed to beryllium during work activities,
- exposure assessment strategy to characterize the potential beryllium exposures, including type of monitoring; the number of workers to be monitored and the rationale supporting the decision; and frequency and duration of monitoring,
- additional monitoring considerations to be implemented for changes in processes, controls, work practices, personnel, and upset or emergency conditions,
- communication of exposure monitoring results to workers and management,
- documentation and recordkeeping requirements, and
- sampling and analytical methods (personal exposure monitoring shall be in accordance with OSHA or NIOSH methods).

5.2.2 Exposure Monitoring

The initial beryllium exposure assessment strategy for all beryllium operations shall be to monitor every beryllium worker on every shift. This approach enables a statistical evaluation of worker exposure to be assessed and quantified. The Beryllium Exposure Assessment Plan shall include provisions to conduct short term and excursion monitoring. Once the beryllium exposure to workers has been statistically defined, a revised exposure monitoring approach can be developed that limits the exposure monitoring to a subset of workers and activities. The subset being monitored should be characteristic of the group for which the exposure data represent.

Other types of sampling (area and surface) will be conducted as appropriate. This sampling will not be used to characterize worker exposures, but will be used to determine cleanliness and efficiency of controls.

The knowledge base and understanding of potential beryllium exposures including the statistical analysis of the exposure monitoring results by activity and job category will be used in future hazard assessments and work planning efforts. The data analysis will support and justify negative exposure determinations, revise hazard control determinations, and improved employee exposure reduction and minimization determinations. Exposure monitoring results will be communicated to workers, management, K-H Safety and Industrial Hygiene, and DOE in an electronic format.

5.2.3 Determining Beryllium Operations

All operations will be screened through the IWCP and ISMS process to determine potential for exposure to beryllium. Potential beryllium operations will be determined by the using surface contamination levels (according to the beryllium inventory) of the area or equipment to be worked on according to the Beryllium/Non-Beryllium Area definitions or by the operation if there is a potential for release of airborne beryllium. Breathing zone air sampling will be conducted according to Section 5.2.2. If the air sampling and exposure assessment shows that there is no potential for beryllium exposures over the Action Level, the area may be reclassified. If work activities have the potential for release of airborne beryllium levels to reach the Action Level, the operation will continue as it was initially classified and the hierarchy of controls will be used to reduce levels.

5.3 Baseline Inventory And Sampling

5.3.1 Baseline Inventory

The objective of the baseline inventory and sampling is to determine all beryllium areas on Site and what locations on Site are beryllium contaminated. Each building or facility will undergo a baseline assessment to determine the presence or absence of airborne and surface beryllium contamination. The presence or absence of beryllium will be determined by applying process knowledge, professional judgment, and collecting air and surface samples.

The number of samples taken in each building will vary depending on the history and use of the building and will be determined by the CBDPP Manager ensuring, with 95% statistical confidence, that Site facilities are accurately characterized. Using a risk based approach, buildings and areas with higher probability of contamination will have a higher number of samples taken within them. Buildings with less likelihood of contamination will have less samples taken within them. For buildings where there is little likelihood that beryllium was ever introduced, such as the 130 trailers or building 060, historical and process knowledge will be used to determine sampling requirements, if any.

This information will also be used in preliminary hazard assessment categorization for each building, facility or area within a building. The information is the basis for the baseline beryllium inventory. As additional sampling information is gathered and buildings are decontaminated and decommissioned, the baseline inventory will be updated on a regular basis to track the ongoing beryllium inventory.

5.3.2 Beryllium Inventory

The beryllium inventory provides information to managers and industrial hygiene professionals on the activities and locations with potential beryllium exposure hazards. This information is used by management and industrial hygiene during enhanced work planning to identify activities with the potential for exposure to airborne beryllium particulate. The information is used in pre-planning for hazard control and mitigation in the design phase of each activity.

The beryllium inventory will be maintained in a database by Kaiser-Hill Safety and Industrial Hygiene (S&IH). Exposure assessment results shall be transmitted to Kaiser-Hill S&IH at the end of each month. The complete beryllium inventory will be used in the work planning process by

managers, work planners, Safety and IH staff, and DOE to assist future hazard assessments and determine adequate controls and need for additional sampling for operations including decontamination and demolition projects.

The beryllium inventory includes the following items:

- Historical data for the locations on Site where beryllium was processed, machined, stored or otherwise present,
- *Site Beryllium Characterization Report, Radian Corporation September 1997,*
- On-going and future sampling data including personal breathing zone samples, swipe samples, and area samples, and
- An updated list of areas on Site where beryllium is used or stored, where beryllium contamination is present, and where beryllium is not present.

5.4 Hazard and Risk Assessment

Hazard and risk assessments will be performed to determine the degree of risk associated with the potential exposures to beryllium particulate during work activities. The hazard assessment will be based on the beryllium inventory and exposure assessment information. The risk assessment will be based on the likelihood for exposure to beryllium taking into account the hazard assessment and the probability of generation of airborne beryllium, the number of workers potentially exposed, the quantity of airborne beryllium potentially generated and the adequacy of engineering controls to remove airborne beryllium.

Because the work at the Site is based upon projects that are focused on decontamination and decommissioning, and not process or product oriented, the hazard assessment will be a dynamic, iterative process. The data gathered for the beryllium inventory will be used for the initial planning and hazard assessment criteria. The hazard assessment rating may change as the work progresses and more information is gathered to support the exposure assessment during defined work activities.

5.4.1 Hazard Assessment

The current hazard assessment characterization is based on the anticipated level of contamination in buildings. The anticipated level of contamination was evaluated based on the process knowledge review of each building, facility, or area. The four contamination categories are as follows.

- Assumed Clean: Areas where beryllium processing was never conducted, air spaces and ventilation systems are not shared with rooms used for beryllium processing, beryllium workers did not visit unless fully decontaminated, and no other routes of contamination are known.

- **Probably Clean:** Areas where beryllium processing was never conducted but the possibility for cross-contamination from beryllium areas exists through shared air spaces, shared ventilation systems, and cross-contamination by beryllium workers.
- **Possibly Contaminated:** Areas that appear to have a direct connection to a beryllium processing area or where only small quantities of beryllium were handled (e.g., laboratory).
- **Probably Contaminated:** Areas where beryllium processing was conducted and the probability for contamination is considered high.

The detailed methodology for this hazard assessment is included in *Site Beryllium Characterization Report*.

From the hazard assessment, a qualitative risk assessment will be developed to incorporate all of hazard assessment information and establish a risk ranking. This will incorporate a matrix utilizing the contamination category, the likelihood of beryllium particulate to become airborne; the frequency, duration, and magnitude of the potential exposure; the variability of the exposure; and the number of workers potentially exposed to airborne beryllium.

5.4.2 Risk Assessment

The risk ranking will be the basis for ranking the engineering and administrative controls, required personal protective equipment, the initial exposure monitoring requirements, and the exposure reduction and minimization considerations for the work activity. The risk ranking can be modified during the work activities if the exposure monitoring demonstrates a risk of exposure to workers that is different than anticipated by the initial hazard assessment.

All hazard assessments and risk assessment information will be documented and forwarded to Kaiser-Hill S&IH department in a timely fashion.

5.5 Medical Surveillance

The medical surveillance program is broken into 4 categories of workers: Current Beryllium Worker, Incidental Beryllium Worker, Self Identified Beryllium Exposed Current Employee, and Former Worker Participating in Health Effects Program. The following table addresses priority and frequency of testing.

	Current Beryllium Worker	Incidental Beryllium Worker	Current Workers who either were Former Beryllium Workers or Elect Participation	Former Worker Participating in Health Effects Program
Priority	1	2	3	*
Frequency	Initial/Yearly	Initial/once every 3 years	once every 3 years	once every 3 years

* Former beryllium workers will be included in the Beryllium Health Effects Program under Public Law 102-484. For routine screening, this program is conducted on a three year basis and contains the elements listed below. Any worker or former worker diagnosed as sensitized or as having CBD will undergo medical surveillance annually. In addition, this program is available to all former RFETS employees who believe they have been exposed to beryllium.

The program includes the following:

- Initial blood Lymphocyte Proliferation Testing (LPT),
- Annual re-testing for beryllium workers,
- Health questionnaire,
- Physical examination, and
- Chest x-ray (as needed based on the results of LPT and physician recommendations).

Individuals who are sensitized or have clinical symptoms of disease receive additional medical surveillance and testing as prescribed by the Rocky Flats Occupational Medicine Department or an equivalent medical facility.

Medical recordkeeping systems are maintained in the Rocky Flats Occupational Medicine Department.

5.6 Training

The Site beryllium worker training program is required every two years for all identified beryllium workers, supervisors and managers of beryllium workers, incidental beryllium workers and personnel who might access beryllium areas, but not work with beryllium. The amount of training will vary between these groups depending on the level of contact with beryllium. Training will include:

- beryllium hazards,
- routes of entry,
- hierarchy of controls,
- principles of As Low As Reasonably Practicable,
- use and purpose of personal protective equipment,
- proper handling and control,

- medical monitoring, emergency procedures, and
- waste management and decontamination procedures.

Beryllium workers will require additional on-the-job training stressing work practices including; entry and exit of beryllium areas, contamination control, and specific procedures to minimize airborne beryllium during job activities.

Visitors who are authorized to enter beryllium operations areas will be required to complete a beryllium briefing prior to every entry into a beryllium operations area. This will incorporate at least:

- beryllium hazards,
- routes of entry,
- hierarchy of controls,
- principles of As Low As Reasonably Practicable, and
- use and purpose of personal protective equipment.

Training objectives will be tested to ensure understanding of information. Documentation of training will be maintained by Kaiser-Hill Training Department.

The current Site training program will be updated to identify current work activities that may result in exposure to beryllium and concepts addressed by this program.

5.7 Recordkeeping

Recordkeeping will be centralized within the Kaiser-Hill S&IH Department, except for medical records and training records. The following records will be maintained:

- Roster of current Beryllium Workers and Number of new beryllium workers since January 1, 1998,
- Additional beryllium workers approved by cognizant Operation's Kaiser-Hill Vice President with concurrence from the Kaiser-Hill Vice President of Safety Systems and Engineering,
- Inventory of beryllium contamination within buildings on Site and entry logs,
- Hazard Assessment of beryllium operations,
- Risk Assessment for all planned beryllium operations,

- Exposure Monitoring results including personal sampling results and area sampling results,
- Exposure Reduction and Minimization Strategy for the work package, and
- Results of Performance Feedback Measures.

It is anticipated that exposure monitoring results will be maintained in an MS Access 7.0 database on an IBM platform. All other records will be maintained electronically or as hard copies in a data management system. All records will be transferred to K-H S&IH monthly in the form of a report. K-H S&IH will maintain updated records and revise the records which are maintained through the Beryllium Steering Committee.

Rocky Flats Occupational Medicine will maintain records from the beryllium medical surveillance program. Training records will be maintained by the Kaiser-Hill Training department. All records associated with this program will be maintained for the life of the facility and turned over to DOE upon closure of the facility if not before.

5.8 Performance Feedback

Performance measurement will be an essential element of all work activities involving the potential for exposure to beryllium. Performance metrics will be used to track the effectiveness of the exposure monitoring plans and exposure reduction and minimization goals (Appendix 3). The Beryllium Steering Committee will modify and update the goals and develop performance measures. These measurement systems will be developed more in depth as the implementation of this program is phased into work processes at the Site.

The steering committee will generate a monthly report highlighting program status including the following:

- Number of personal breathing zone samples;
 - below the limit of detection (LOD),
 - between the LOD and the action limit,
 - between the action limit and 2.0 ug/m³ (the OEL),
 - above the OEL,
- Number and levels of area samples taken,
- Number of surface samples;
 - Below 0.2 ug/ 100 cm²,
 - Between 0.2 ug/ 100 cm² and 2.5 ug/ 100 cm²,
 - equal to or above 2.5 ug/ 100 cm²,
- Number of new beryllium workers since January 1, 1998,
- Number of current beryllium workers,

- Number of visitors in beryllium areas and justifications,

The CBDPP Manager will annually review all aspects of the program.

5.9 Equipment Release

This section is pending DOE RFFO guidance

6.0 References

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Appendix 1

CBDPP Risk Assessment Matrix

Risk Ranking

		Magnitude of Dust Generation*		
		Low	Moderate	High
Area Cleanliness	Assumed Clean	0	0	1
	Probably Clean	0	1	2
	Possibly Contaminated	1	2	3
	Probably Contaminated	2	3	3

* The quantification of dust generation is a subjective measure of the amount of dust generated. Whenever available, quantitative sampling data should be used to estimate dust and/or beryllium particulate generation. A Low ranking would be given when very little dust is expected to be generated such as in office work or walking through an area (< 0.1 ug/m³ beryllium). A Moderate ranking would be given when it is expected that some dust will be generated such as in manual work or moving furniture (0.1 ug/m³ < x < 0.4 ug/m³ beryllium). A High ranking would be given for operations that create large amounts of dust such as D&D work, aggressive cleaning, or dismantling equipment (> 0.4 ug/m³ beryllium). The magnitude, frequency, and duration of potential beryllium exposure to workers will be factored determining the expected quantity of dust generation.

Controls Chart for Areas Excluding Beryllium Operations Areas (refer to Section 5.1 for control options)

- 0 No action needed

- 1 Evaluate need for engineering controls and sampling. Sampling is required for operations in possibly contaminated areas.

- 2 Use engineering controls, PPE (Including respiratory protection unless sampling proves exposure less than the action level), conduct personal breathing zone air sampling.

- 3 Use engineering controls and PPE including appropriate respiratory protection and conduct personal breathing zone air sampling.

Hazard Potential

		Number of workers involved in process			
		1-5	6-10	11-20	21+
Risk Ranking	0	L	L	L	L
	1	L	L	L	M
	2	M	M	M	H
	3	H	H	H	H

Low - No action is necessary. If factors change the hazard will be re-evaluated.

Medium - Evaluate use of engineering controls for possible reduction in hazard and evaluate administrative controls to for reduction in overall number of people who will work on the operation.

High - Use engineering controls to reduce the hazard and administrative controls to limit the overall number of people who will work on the operation.

Operations will be prioritized focusing resources on High risk operations first, then medium, and finally low. The hierarchy of controls will be used to reduce the risk to employees.

Appendix 2

Beryllium Exposure Assessment Plan

Utilizing the K-H Form (to be developed) the following will be completed and documented:

- 1) Determine the Hazard Assessment level of the area according to the Site Beryllium Inventory.
- 2) Complete the Risk Ranking for each operation or job task.
- 3) Using the Risk Rating number (0-3) determine if sampling is necessary. The initial beryllium exposure monitoring strategy for all beryllium operations including decontamination and demolition activities shall be to monitor every beryllium worker on every shift. To estimate personnel exposures, breathing zone samples shall be collected.
- 4) Determine if personal breathing zone monitoring has been conducted which is representative of the operations or job tasks to be completed.
 - If no sampling data is available to document exposures, 100% sampling must be conducted. Full shift, breathing zone samples should be taken to record individual exposures.
 - If sampling has been completed which is representative of operations or job tasks to be completed, and workers may be grouped into similar exposure groups, a subset of workers may be sampled whose exposures represent the entire group. Subset sampling should be conducted on at least 20% of the workers to obtain accurate results. Documentation justifying the subset selection method must accompany the sampling.
- 5) Determine if any tasks during the operation have a higher potential of release of airborne beryllium. If such tasks are identified, short term and excursion sampling should be conducted targeting portions of the job tasks where exposures are most likely.
- 6) Determine if area air sampling is to be conducted to evaluate the effectiveness of engineering controls.
- 7) Determine if surface sampling is to be conducted. Surface sampling should be conducted to verify cleanliness and release of items from beryllium operations areas.
- 8) Document the exposure monitoring incorporating the following:
 - Sample Date
 - Sample Number
 - Job name
 - Location
 - Employee name/job classification

- Employee number, social security number
- Initial monitoring or continued monitoring
- Name of all workers who are represented by the monitoring results
 - Employee number, social security number
- Justification for grouping workers
- Existing conditions
 - Beryllium form (dust, solid, oxide, etc.)
 - Engineering controls used
 - Frequency and duration of operation
 - PPE used
- Statistical evaluation of sampling results including
 - Uncertainty
 - Variability
 - Level of confidence
- Baseline hazard assessment and risk ranking
- Communication of results to workers
- Sampling and analytical methods