

FESHM 4190: SPECIAL TOXIC HAZARDS

Beryllium and Beryllium Alloys Chronic Beryllium Disease Prevention Program

Revision History

| Author | Description of Change | Revision Date |
|---------------|--|----------------------|
| Rich Ruthe | <ol style="list-style-type: none">1. Updated the chapter to reflect applicable portions of the OSHA 29CFR1910.1024, which became effective May 20, 2017.2. Minor editorial changes and updated FESHM Chapter links. | August 2017 |
| David Baird | <ol style="list-style-type: none">1. Formatted the chapter according to ESHS requirements.2. Defined a Beryllium Activity to an airborne exposure.3. Modified the surface contamination level to match the DOE 10 CFR 850 standard.4. Updated the Beryllium Operations table found in Attachment A. | November 2011 |

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1.0 INTRODUCTION

Inhalation of beryllium has been associated with short and long term adverse health effects to individuals with a hypersensitivity to the metal. Acute effects include pneumonia-like symptoms such as inflammation of the respiratory system, substernal pain, moderate shortness of breath, and weight loss. Chronic beryllium disease is manifest primarily by similar respiratory symptoms, however, the disease progresses to severe lung impairment. Symptoms may not develop for years following the last beryllium exposure. There is no cure for this disease.

Sophisticated medical tests have been developed that can detect individuals who are sensitized to beryllium well before overt symptoms develop. These tests have suggested that the sensitization can occur in individuals at extremely low air exposure concentrations.

Fermilab uses beryllium, beryllium alloys and ceramic beryllia for targets and beamline components. These materials are primarily used as “articles” as defined by Department of Energy (DOE) 10 Code of Federal Regulations (CFR) Part 850, and as such, most beryllium uses are exempt from the requirements of the DOE’s Chronic Beryllium Disease Prevention Program. Handling of solid components does not normally result in measurable airborne beryllium particulate. Nevertheless, every effort must be made to limit employee exposure by controlling how beryllium is used at the laboratory.

Note: This document contains the detail, scope and content commensurate with the hazard of the Beryllium activities performed at Fermilab. As required by DOE 10 Code of Federal Regulations (CFR) Part 850.12, any new tasks that involve the potential for exposure to airborne beryllium outside the scope of this document will result in the modification of this program and a re-submittal for approval by the Head of DOE Field Element.

2.0 DEFINITIONS

Action Level - Air (AL) - Employee exposure, without regard to the use of respirators, to an airborne concentration of beryllium of 0.0001 milligrams per cubic meter of air (mg/m^3) calculated as an 8-hour time-weighted average (TWA) as measured in the worker's breathing zone.

Action Level - Surface (ALS) - surface concentration levels in excess of 0.03 micrograms per square centimeter ($0.03 \mu\text{g}/\text{cm}^2$ or $3.0 \mu\text{g}/100 \text{cm}^2$).

Beryllium - elemental beryllium and insoluble beryllium compound or alloy containing 0.1% or greater beryllium by weight that may release airborne beryllium particulates.

Beryllium Activity – means an activity that has the potential to expose workers to total airborne beryllium above $0.00005 \text{ mg}/\text{m}^3$ calculated as an 8-hour time-weighted average (TWA) as measured in the worker's breathing zone. Activities include, but are not limited to, cutting, grinding, sanding, and soldering.

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

75
76 **Beryllium-associated worker** - means a current worker who is or was exposed or potentially exposed
77 to airborne concentrations of beryllium above detectable limits, including:

- 78 (1) A beryllium worker
- 79 (2) A current worker whose work history shows that the worker may have been exposed to
80 airborne concentrations of beryllium
- 81 (3) A current worker who exhibits signs or symptoms of beryllium exposure
- 82 (4) A current worker who is receiving medical removal protection benefits.

83
84 **Beryllium emergency** - any occurrence such as, but not limited to, equipment failure, container
85 rupture, or failure of control equipment or operations that results in an unexpected and significant
86 release of beryllium.

87
88 **Beryllium Worker** - a current worker who is regularly employed in a beryllium activity.

89
90 **Breathing Zone** - defined as a hemisphere forward of the shoulders, centered on the mouth and nose,
91 with a radius of 6 to 9 inches.

92
93 **Chronic Beryllium Disease Prevention Program (CBDPP)** – the program that supplements and is
94 integrated into existing worker protection programs that are established for DOE contractor
95 employees. This chapter describes the Fermilab CBDPP.

96
97 **Competent Person** - One who can identify beryllium hazards in the surroundings or working
98 conditions and who has authorization to take prompt corrective measures to eliminate them.

99
100 **Permissible Exposure Limit Time-Weighted Average (PEL TWA)** - the time-weighted average
101 concentration for a conventional 8-hour workday and a 40-hour workweek. The Occupational Safety
102 and Health Administration (OSHA) has established a PEL-TWA of $0.2 \mu\text{g}/\text{m}^3$ for beryllium, without
103 regard to the use of respirator averaged over an 8-hour period.

104
105 **Regulated Areas** - area demarcated in which airborne concentration of beryllium exceeds, or can
106 reasonably be expected to exceed the AL.

107
108 **Removable beryllium contamination** - means beryllium contamination that can be removed from
109 surfaces by nondestructive means, such as casual contact, wiping, brushing or washing.

110
111 **Short Term Exposure Limit (STEL)** – OSHA has established a STEL of $2.0 \mu\text{g}/\text{m}^3$ for beryllium as
112 determined over a 15-minute sampling period.

113
114 **Site Occupational Medical Director (SOMD)** - the Fermilab physician responsible for the overall
115 direction and operation of the site occupational medicine program.

116 **3.0 RESPONSIBILITIES**

117
118 A responsibilities section is included only if there are any responsibilities which are unusual, i.e.,
119 different than those indicated in [FESHM 1010](#).

121 **3.1 Divisions/Section/Project Heads**

122
123 Division/Section/Project (D/S/P) heads shall be aware of the materials, operations, and related hazards
124 with which their personnel may be involved. They shall assure the policies, procedures, and
125 requirements as set forth in this FESHM chapter are followed.

127 **3.2 Supervisors, Construction Coordinators, and Task Managers**

128
129 Supervisors, construction coordinators, and task managers shall conduct their operations in a safe
130 manner. They shall assure competent personnel use adequate protective measures and that appropriate
131 personal protective equipment is available and used properly. They shall be familiar with potential
132 hazards and assure that their personnel are trained and understand procedures, hazards, protective
133 measures & equipment, and emergency procedures to prevent adverse effects from their work.

135 **3.3 Individuals working with or handling beryllium**

136
137 Individuals working with or handling beryllium shall have sufficient knowledge and training to
138 perform their work safely. Before performing work, which involves beryllium materials, they shall be
139 familiar with the potential hazards, protective measures, proper use of all materials and equipment,
140 and emergency procedures. They shall follow the precautions listed in this chapter and on the hazard
141 analysis or [Toxic Material Handling Permit](#), if a permit is required. Employees may consult with their
142 Division Safety Officer (DSO) or the ESH&Q Industrial Hygiene Group for additional information.

144 **3.4 Occupational Medical Office**

145
146 The Occupational Medical Office shall provide a medical surveillance program for beryllium workers
147 as defined by this chapter (see Medical Surveillance).

149 **4.0 PROGRAM DESCRIPTION**

151 **4.1 Scope**

152
153 This chapter applies to all present and past exposure, or the potential for exposure to beryllium at
154 Fermilab.

156 **4.2 Inventory**

157
158 D/S/P heads will utilize their records, process knowledge, employee interviews, and hazard assessment
159 of beryllium locations to determine if they have beryllium or beryllium contamination areas. Locations

160 where beryllium was previously used and residual contamination exist, must be included in the
161 inventory. Conduct air, surface, and bulk sampling if necessary. An inventory of current beryllium
162 locations and operations shall be maintained by the ESH&Q Section. The inventory shall also identify
163 the workers exposed or potentially exposed to beryllium at these locations. The inventory shall be
164 reviewed and updated annually. A list of those operations that involve beryllium that are currently
165 being performed, or are planned can be found in Attachment A.

166

167 **4.3 Storage and Labeling**

168

169 Label beryllium to identify it from other, less toxic, metals. Individual pieces need not be labeled when
170 stored in a labeled container or cabinet. Where possible, components used in experiments should be
171 labeled, however, in some cases this may be impossible due to the complex nature of the component.

172

173 Beryllium must be stored in designated storage areas and must be stored in sealed containers, labeled,
174 and secured in a dry location. Surplus beryllium must be stored in a locked storage facility maintained
175 by the ESH&Q Section. Activated beryllium may be stored at the Railhead Facility.

176

177 **4.4 Medical Surveillance**

178

179 The Fermilab Occupational Medical Office shall implement a beryllium medical surveillance program
180 for beryllium-associated workers who voluntarily participate in the program. See Attachment B for
181 further details of Fermilab's Beryllium Medical Surveillance Program.

182

183 To aid the Occupational Medical Office in this endeavor, the ESH&Q Section shall provide, and when
184 necessary assist, the SOMD with the information needed to operate and administer the medical
185 surveillance program. This includes:

186

- 187 1. List of beryllium-associated workers
- 188 2. Beryllium inventories
- 189 3. Job Hazard Analysis
- 190 4. Exposure monitoring data
- 191 5. Copies of any Toxic Material Handling permits
- 192 6. A copy of the current 10 CFR Part 850 and its preamble.

193

194 The medical requirements in this CBDPP shall be performed by or under the supervision of a licensed
195 physician familiar with the health effects of beryllium.

196

197 **4.5 Training**

198

199 Several levels of training are offered for distinct worker classifications:

200

201 Hazard Communication Training is required for all new Fermilab employees and is given as part of
202 New Employee Orientation.

203

204 Beryllium Handling Training is an awareness-level course required for all workers who may handle
205 non-oxidized beryllium articles, and therefore are not exposed above 0.00005 mg/m³. This training
206 shall include information on the health effects of beryllium, safe work practices, proper handling, and
207 control of beryllium.

208
209 Beryllium Worker Training is required for current Beryllium workers only. This shall include
210 Beryllium Handling Training, and additional information on use of personal protective equipment,
211 required medical monitoring, waste management, and decontamination procedures. Beryllium Worker
212 training shall take place before or at the time of initial assignment and every two years thereafter.

213
214 Beryllium Associated Worker Training is required for any employee who self identifies by opting into
215 the Beryllium Associated Worker Program or any employee who was previously considered to be a
216 Beryllium Worker. The training includes, but is not limited to, information on the chemical and
217 physical properties of beryllium, the health effects of beryllium exposure, exposure standards, and
218 who/what is the Oak Ridge Institute for Science and Education (ORISE).

219
220 Retraining shall be provided if there is reason to believe a trained individual lacks the proficiency,
221 knowledge, or understanding needed to work safely with beryllium. Such situations include, but may
222 not be limited to, a change in the operations, procedures, or beryllium controls about which the
223 individual was not previously trained.

224 **4.6 Records**

225
226
227 Documentation concerning this program shall be maintained per electronic format for 75 years.
228 Records shall be maintained as follows:

229
230 **Industrial Hygiene Sampling Results** - the electronic database is maintained by the ESH&Q Section.
231 Employee exposure results are available for viewing by the Occupational Medicine Office and
232 inclusion into the employee's medical file.

233
234 **Inventories** - database maintained by the ESH&Q Section.

235
236 **Training** - database maintained by the ESH&Q Section.

237
238 **Permits and Hazard Analyses** - shall be maintained by the D/S/P and the ESH&Q Section. Not all
239 records are maintained electronically.

240
241 **Medical** - maintained by the Occupational Medical Office. These are not maintained electronically.

242
243 Information from these documents can be combined if a need arises to link hazard assessment,
244 exposure monitoring, and medical surveillance activities. This information is being captured in the
245 DOE Office of Epidemiologic Studies, Beryllium-Associated Worker Registry. Registry information
246 is submitted biannually by the ESH&Q Section in cooperation with the Fermilab Occupational
247 Medicine Office.

248

249 **4.7 Experimenters and Outside Contractors**

250
251 Experimenters and subcontractors that may be exposed to beryllium while at Fermilab shall be subject
252 to the requirements of this chapter.

253
254 When beryllium is sent off-site for machining or other activity that may release airborne dust or fume,
255 Fermilab shall inform the recipient of the hazard with warning labels or other appropriate warning
256 methods. The Purchase Requisition and contract exhibits shall be reviewed and approved by the DSO.
257 The ESH&Q Section shall be consulted regarding contract exhibits and contractor selection.

258
259 Experimenters and subcontractors shall notify the ESH&Q Section prior to bringing any beryllium on-
260 site.

261 **4.8 Emergency Preparedness**

262
263
264 The Fire Department shall be **immediately** informed of any beryllium emergency.

265 **4.9 Performance Feedback**

266
267
268 The ESH&Q Section must conduct periodic analyses and assessments of this program, including
269 monitoring activities, hazards, medical surveillance, exposure reduction and minimization, and
270 occurrence reporting. The Tripartite Assessment Program described in [QAM 12080](#), *Self-Assessments*,
271 is the vehicle best utilized to fulfill this requirement.

272 **5.0 PROCEDURES**

273 **HAZARD ASSESSMENT AND CONTROL OF BERYLLIUM ACTIVITIES**

274
275
276
277 Every effort shall be made to minimize employee exposure to beryllium. All beryllium activities that
278 are performed at Fermilab must be reviewed by the ESH&Q Section.

279 **5.1 Exposure Assessment**

280
281
282 Exposure assessment is conducted by an ESH&Q professional using the following guidelines:

283 Initial Monitoring

284
285
286 Eight-hour TWA personal breathing zone exposure sampling shall be conducted in all areas that may
287 have airborne beryllium above 0.00005 mg/m^3 , as indicated by the baseline inventory and hazard
288 assessment.

289 Note: In some instances, the activity being performed may be of short duration, and therefore the
290 eight-hour sampling period may not be possible.

- 291
292 a. Beryllium activities are assumed to be above the AL unless there is data for similar
293 previous work, which documents exposures below the AL.

- 294
295 b. Exposure above the AL is assumed when handling a significant number of beryllium
296 pieces with surface oxidation in excess of $0.03 \mu\text{g}/\text{cm}^2$ unless there is data for similar
297 prior work, documenting exposures below the AL.
298

299 Periodic Monitoring

- 300
301 a. Eight-hour TWA personal breathing zone exposure sampling shall be performed at
302 least every 3 months (quarterly) in areas where airborne concentrations of beryllium
303 are at or above the Action Level.
304
305 b. If operations, maintenance or procedures change additional exposure monitoring must
306 be performed.
307

308 Reduce or Terminate Monitoring

309
310 Professional judgement shall be used to reduce or terminate monitoring. Whenever practical, a
311 statistically-based monitoring strategy will be applied to ensure that a sufficient number of sample
312 results were performed that adequately characterize exposures.
313

314 General Monitoring Requirements

- 315
316 a. The method of monitoring and analysis must have an accuracy of not less than plus or
317 minus 25 percent, with a confidence level of 95 percent, for airborne concentrations
318 of beryllium at the Action Level.
319
320 b. The laboratory must be accredited for metals by the American Industrial Hygiene
321 Association (AIHA).
322

323 Notification of Monitoring Results

- 324
325 a. The ESH&Q Section shall personally notify, in writing, the affected worker within 10
326 working days after receipt of any monitoring results.
327
328 b. If the monitoring results indicate that the worker's exposure is at or above the action
329 level, the notice shall include a statement that the Action Level has been met or
330 exceeded, a description of the corrective action(s) being taken to reduce the worker's
331 exposure to below the Action Level, and be sent to both DOE and the SOMD within
332 10 working days after receipt of any monitoring results.
333

334 Release Criteria

335
336 Beryllium contaminated equipment being released to the general public or a DOE facility for non-
337 beryllium use, or to another facility for work involving beryllium must be labeled in accordance with

338 section 3 on "Signage and Labeling" and cleaned to the lowest level practicable, but not to exceed
339 the following levels:

- 340
- 341 a. Removable beryllium contamination on equipment or other items released to the
342 general public or for use in non-beryllium area of a DOE facility must not exceed the
343 higher of $0.002 \mu\text{g}/\text{cm}^2$ ($0.2 \mu\text{g}/100 \text{cm}^2$) or the concentration level of beryllium in
344 soil at the point of release, whichever is greater. The release is conditioned on the
345 recipient's written commitment to implement controls that will prevent foreseeable
346 beryllium exposure, considering the nature of the equipment or item and its future
347 use, and the nature of the beryllium contamination.
- 348
- 349 b. Removable beryllium contamination on equipment or other items released to another
350 facility performing work with beryllium must not exceed $0.03 \mu\text{g}/\text{cm}^2$ or ($3.0 \mu\text{g}/100$
351 cm^2). The equipment or item must be enclosed or placed in sealed, impermeable bags
352 or containers to prevent the release of beryllium dust during handling and
353 transportation.
- 354

355 5.2 Exposure Reduction and Minimization

- 356
- 357 a. Where exposure levels are at or above the Action Level (AL), an exposure and
358 minimization plan will be established which includes the following:
- 359
- 360 [Toxic Material Handling Permit](#) - The permit includes the start and expiration dates
361 of the permit, the location of the work, the description of the work, the name(s) of the
362 employees and an indication as to whether the employee has received both beryllium
363 training and medical approval. Other information required by the permit includes;
364 pre-job conditions, required controls, required personal protective equipment and
365 required sampling, what hygiene facilities are needed, waste disposal instructions and
366 special instructions. The permit also contains signature approval space for the Task
367 Manager and the DSO or other Fermilab ESH professional.
- 368
- 369 1. Beryllium Worker training and respiratory protection training, as a
370 minimum, is required of all employees assigned to the job.
 - 371
 - 372 2. The Occupational Medicine Office must be notified prior to any job for
373 which a permit is needed. Medical approval including respiratory
374 protection approval is needed for each worker assigned to the job.
 - 375
 - 376 3. As part of the permit process, preparation for the job may include wipe
377 samples to determine beryllium contamination of work area or beryllium
378 components, safety or ergonomic concerns, etc. Surfaces contaminated
379 because of work operations must be cleaned to below $0.03 \mu\text{g}/\text{cm}^2$.
 - 380
 - 381 4. The required controls and subsequent required personal protective
382 equipment are based upon the conventional hierarchy of industrial hygiene

- 383 controls (i.e., engineering controls, administrative controls, and personal
384 protective equipment). Examples of engineering and administrative
385 controls include exhaust ventilation, hygiene practices, enclosing and
386 restricting access to the work area, etc.
387
- 388 5. The permit should indicate the type of respirator selected by the ESH&Q
389 professional for the job. Employees that use respirators must also receive
390 medical surveillance, fit testing and training. Disposable coveralls or
391 similar full-body work clothing, gloves, hoods, and disposable shoe
392 coverlets shall be worn when exposure may exceed the AL. Contaminated
393 protective clothing and equipment shall be collected in a sealable
394 container or bag and labeled as beryllium contaminated (Section 5.3.b).
395
- 396 6. The number and frequency of personal and area air samples should be
397 indicated on the permit. It should also indicate the number and location of
398 wipe samples if surface contamination is of concern.
399
- 400 7. All working surfaces shall be maintained as free as practicable of
401 accumulations of beryllium. Floors and other surfaces shall be routinely
402 sampled and cleaned, as necessary, by vacuuming or other methods (i.e.,
403 sticky tack cloths) that minimize the likelihood of beryllium becoming
404 airborne. Where vacuuming methods are used, the vacuums shall be
405 equipped with High Efficiency Particulate Air (HEPA) filters and used
406 and emptied in a manner, which minimizes the re-entry of beryllium into
407 the workplace. HEPA filters shall be changed as often as needed to
408 maintain their capture efficiency. All cleaning equipment used to clean
409 beryllium-contaminated surfaces shall be labeled, controlled, and not used
410 for non-hazardous materials. Compressed air or dry methods must not be
411 used for such cleaning.
412
- 413 Food and/or beverage shall not be stored or consumed and tobacco
414 products shall not be present or used in areas where employees may be
415 exposed to beryllium above the Action Level. Employees who may be
416 exposed above the AL shall be required to wash their hands and face prior
417 to eating, drinking, smoking, or applying cosmetics.
418
- 419 Whenever employee exposure to beryllium may exceed the Action Level,
420 employees shall not leave the workplace wearing any protective clothing
421 or equipment that is required to be worn during the work shift. Employees
422 shall be provided with a clean change area having separate facilities for
423 protective work clothing and street clothes to prevent cross contamination.
424
- 425 Showers shall be taken at the end of the work shift or job. Employees shall
426 be provided with shower and hand washing facilities close to the work
427 area, when feasible, when beryllium exposure may be above the AL.

- 428 Lunchroom facilities must be readily accessible to beryllium workers and
429 contain tables that are free of beryllium and at no time shall the worker be
430 exposed to beryllium at or above the Action Level in a lunchroom facility.
431
- 432 The change rooms/areas, shower and hand washing facilities and
433 lunchroom facilities must comply with 29 CFR 1910.141, Sanitation.
434
- 435 Employees exposed to beryllium above the AL shall not leave the area
436 with PPE or equipment unless surface dust has been removed by HEPA
437 vacuuming or other cleaning methods that limit beryllium dust dispersion.
438
- 439 8. Every reasonable effort shall be made to limit the release of beryllium
440 residues into air, ground, or water. To the extent practical, all beryllium-
441 contaminated residues must be contained, collected and containerized for
442 disposal. All generated waste shall be disposed of per Fermilab's regulated
443 chemical waste disposal program. See Section 3, Signage and Postings, of
444 this chapter for waste labeling requirements.
445
- 446 9. The permit shall be signed by the ESH&Q professional supervising the
447 project and by the task manager, project supervisor or lead technician.
448
- 449 10. Every reasonable effort shall be made to minimize the number of workers
450 exposed and potentially exposed to beryllium. A log (reverse side of the
451 permit) must be maintained by the task manager, project supervisor, or
452 lead technician for the job to track all individuals who enter regulated
453 areas. These records must include the name, date, time in and time out,
454 and work activity.
455
- 456 11. Upon the completion of the job, a copy of the permit must be sent to the
457 ESH&Q Section.
458
- 459 b. Where exposure levels are above 0.00005 mg/m^3 but below the Action Level of
460 0.0002 mg/m^3 , and when practicable, implement the following actions to reduce
461 employee exposures; written hazard analysis (FESHM [2060](#)), engineering controls
462 (i.e., ventilation), administrative controls (i.e., personal hygiene, warning signs and
463 labels, work practices) and personal protective equipment (i.e., gloves, respirators).
464
465

466 5.3 Signage and Postings

467
468
469

- a. Regulated areas shall be posted with a warning sign, which states:

DANGER
BERYLLIUM WORK AREA
BERYLLIUM CAN CAUSE LUNG DAMAGE
CANCER HAZARD
AUTHORIZED PERSONNEL ONLY
CONTACT _____ PRIOR TO ENTRY

470
471
472
473
474
475
476
477

- b. Containers of beryllium, beryllium compounds, beryllium-contaminated clothing, equipment, waste, scrap, or debris shall be labeled with a warning, which at a minimum contains the following information:

DANGER
CONTAMINATED WITH BERYLLIUM
DO NOT REMOVE DUST BY BLOWING OR SHAKING
CANCER AND LUNG DISEASE HAZARD

478
479
480
481

482 6.0 STANDARDS

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484
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Department of Energy 10 CFR Part 850, "Chronic Beryllium Disease Prevention Program; Final Rule. Implementation Guide for use with DOE 10 CFR Part 850, "Chronic Beryllium Disease Prevention Program".

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492
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Occupational Safety and Health Administration 29 Code of Federal Regulations 1910.1024, Beryllium effective date May 20, 2017.

495
496
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498

Department of Energy Position, February 2, 2009 regarding "American Conference of Governmental Industrial Hygienists® Adopts TLV for beryllium of 0.05 $\mu\text{g}/\text{m}^3$."

499
500

Fermilab Environmental, Safety and Health Manual (FESHM) Chapter [4130](#) – Personal Protective Equipment (PPE)

501
502
503

FESHM Chapter [4150](#) – Respiratory Protection

504
505

FESHM Chapter [8021](#) –Chemical and Radioactive Waste Management

506
507

FESHM Chapter [8022](#) – Recycling, Waste Minimization and Pollution Prevention Program

508
509

FESHM Chapter [8023](#) – General Refuse

510 **7.0 ATTACHMENTS**

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 ATTACHMENT A
 Beryllium Operations
 &
 Storage Locations

| Facility | Location | Job Description |
|---------------------------|---|--|
| Accelerator Division | MI-8 Service Building, MuCool Test Area | Handling Beryllium Components (vacuum windows, targets, electrodes) |
| Accelerator Division | Linac Gallery (NTF), Cross Gallery, MI-8 Service Building, AP0 Service Building, Neutrino Target Service Building, C0 Assembly Building, MuCool Test Area | Stored Beryllium Components (vacuum windows, targets, electrodes) |
| Accelerator Division | Linac (NTF), NuMI Target Hall, MiniBooNE MI-12B Enclosure, MI 400 Area Lambertson Magnet, MuCool Test Area | Beryllium Components in Operating Beamline or Experiment Apparatus (vacuum windows, targets, electrodes) |
| Accelerator Division | RF Barn Site 50 | Beryllium Beam Tube Beryllium Beam Tube Sections |
| Particle Physics Division | ME-7 Worm | Parts Storage |
| Technical Division | IB-3 locked cabinet (Winding Room) | Cu-Be wire storage |

518

519 ATTACHMENT B
520 Beryllium Medical Surveillance

521
522 Baseline examination-done post offer—pre-placement

- 523
- 524 1. History including questionnaires.
 - 525 2. Physical examination.
 - 526 3. Spirometry
 - 527 4. B-reader chest x-ray.
 - 528 5. Beryllium Proliferation test (Be-LPT)

529
530 Current Beryllium Worker examination---done annually

- 531
- 532 1. History including questionnaires.
 - 533 2. Physical examination.
 - 534 3. Spirometry annually.
 - 535 4. B-reader chest x-ray every 5 years.
 - 536 5. Be-LPT

537
538 Beryllium Associated Worker examination---done biannually

- 539
- 540 1. History including questionnaires.
 - 541 2. Physical examination.
 - 542 3. Spirometry biannually.
 - 543 4. B-Reader chest x-ray every 5 years.
 - 544 5. Be-LPT

545
546 The following is the detailed description:

- 547
- 548 1. History and documentation of previous Beryllium exposure - medical will question employees
549 on this topic in the medical office.
550
 - 551 2. Baseline medical office evaluation for current Beryllium worker, or Beryllium associated
552 workers: SOMD will obtain history, emphasizing pulmonary and beryllium issues and
553 utilizing the Fermilab Beryllium Medical Questionnaire and the OSHA Respirator Medical
554 Evaluation Questionnaire. The SOMD will perform comprehensive physical exam, with
555 attention to lungs, skin, and eyes. Investigations offered will include chest radiograph
556 (posterior-anterior, 14x17 inches) interpreted by a National Institute for Occupational Safety
557 and Health (NIOSH) B- reader of pneumoconiosis or a board-certified radiologist (unless a
558 baseline chest radiograph is already on file). Spirometry consisting of forced vital capacity
559 (FVC) and forced expiratory volume at 1 second (FEV1), and Be-LPT.
560
 - 561 3. Beryllium worker follow up medical surveillance: SOMD history, Fermilab Beryllium
562 Medical Questionnaire and the OSHA Respirator Medical Evaluation Questionnaire, SOMD

- 563 physical exam, and Spirometry will be offered annually. B-reader chest X-ray will be offered
564 every 5 years. Be-LPT will be offered annually.
565
- 566 4. Beryllium associated worker follow up medical surveillance: SOMD history, Fermilab
567 Beryllium Medical Questionnaire and the OSHA Respirator Medical Evaluation
568 Questionnaire, and Spirometry will be offered every two years. B-reader chest X-ray will be
569 offered every 5 years. Be-LPT will be offered at a minimum of every 3 years.
570
- 571 5. Emergency treatment - Any occurrence such as, but not limited to, equipment failure, container
572 rupture, or failure of control equipment or operations that results in an unexpected and
573 significant release of beryllium. The medical evaluation will include the requirements of
574 paragraph (b)(2) of 10 CFR PART 850.
575
- 576 a. Detailed medical and work history with emphasis on past, present, and anticipated
577 future exposure to beryllium;
578 b. Respiratory symptoms questionnaire;
579 c. Physical examination with emphasis on the respiratory system;
580 d. Be-LPT;
581 e. Any other medical evaluations deemed appropriate by the examining physician for
582 evaluating beryllium-related health effects.
583
- 584 6. If a beryllium associated worker is diagnosed by the Site Occupational Medical Director
585 (SOMD) to be sensitized to beryllium or to have Chronic Beryllium Disease, a counseling
586 program will be initiated which includes communications on:
587
- 588 a. Medical surveillance program provisions and procedures (i.e., Written Medical
589 Reporting (opinion and recommendation), Data Analysis, Medical Removal
590 Protection, etc.;
591 b. Medical treatment options;
592 c. Medical, psychological, and career counseling;
593 d. Medical benefits;
594 e. Administrative procedures and workers' rights under applicable Worker
595 Compensation laws and regulations;
596 f. Work practice procedures limiting beryllium associated worker exposure to beryllium;
597 g. The risk of continued beryllium exposure after sensitization.
598
- 599 7. Multiple Physician Review. Fermilab shall have a multiple physician review process in place
600 that meets the requirements of 10CFR850.34(c) and (d). A copy of this rule and preamble shall
601 be provided to any physician performing an evaluation.
602
- 603 8. Questionnaires utilized in all above exams will consist of the attached Fermilab Beryllium
604 Medical Questionnaire and the OSHA Respirator Medical Evaluation Questionnaire.
605
- 606 9. At least one week prior to the first medical evaluation, the employee is to be given a summary
607 of the medical surveillance program which includes:

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- 616
- a. Type of data to be collected
 - b. How data will be collected and maintained
 - c. Purpose for data use
 - d. Description of how confidential data will be protected
 - e. A statement as to the benefits and risks of the tests
 - f. A notice to the employee that they are free to ask questions about this process at the time of their visit

617 A copy of the consent form, Appendix A to Part 850 - *Chronic Beryllium Disease Prevention*
618 *Program*, will be included with the summary of the medical surveillance program. The SOMD will
619 meet with the employee and obtain the employee's signature on the informed consent form prior to
620 performing medical evaluations and tests.