TECHNICAL SUPPORT DOCUMENT
BRUSH CERAMIC PRODUCTS
PERMIT NUMBER 1571

Issued, November 8, 2006, Revised October 10, 2007 & July 22, 2010

SUMMARY

The Brush Ceramic Products (BCP) beryllia fabrication plant processes beryllium oxide powder in producing ceramic components used in the integrated circuit electronics industry. The facility's operations are subject to the National Emission Standard for Hazardous Air Pollutants (NESHAPS) for Beryllium (40 CFR 61, Subparts A and C) which prohibits the emission of more than 10 grams of beryllium over a 24-hour period. It is important to note that the 10-gram limit includes both fugitive and non-fugitive emissions.

Air pollution control equipment at the facility includes a 15K cfm dust collecting system which includes a Cartridge 60 filter unit and a triple filtered dust collector, a 40K cfm dust collecting system which includes two Farr 80 filter units and a double filtered dust collector, and a Torit 7K cfm triple filtered dust collecting system. Production operations that would involve the potential emissions of beryllium either utilize wet methods and are completely enclosed (hooded) or use a high vacuum pick-up sweep at the point of operation for capture of beryllium containing particulate material. Captured particulate emissions are routed to the air pollution control equipment prior to exhausting it to the ambient air. There are several cleaning air showers at the facility. The exhausted air from these units is either HEPA filtered outside the building or have self-contained HEPA filters within the unit. In either case, exhaust air ultimately is vented through the control systems before being released to the ambient air.

BCP has identified several "building penetrations" (i.e., exhaust or intake vents that are not routed to any control system) that exist at the facility. These exhaust/intake vents fall into seven main categories:

Powered Exhaust Fans in Production Areas
Powered Exhaust Fans in Non-Production Areas
Relief Vents in Production Areas
Relief Vents in Non-Production Areas
Gas Vents from Area Heaters in Production Areas
Gas Vents from Area Heaters in Non-Production Areas
Make-Up Air Intakes

Of these seven main categories of "building penetrations", the category of most concern is the powered exhaust fans in production areas. The powered exhaust fans in the production areas, which are all mounted in or near the building roof, have the greatest potential to contribute to fugitive emissions. Twelve of these vents were identified in the BCP letter dated February 28, 2001. Historical records show that when the plant was originally built in 1979 and 1980, some vents were tested. The Control Officer required BCP to test for beryllium emissions from other vents since they were located in the production area. Of the twelve vents, five were selected to be tested based upon stack configuration, production area vented, and potential for emissions. Such tests, using EPA Test Methods 1 through 4 and 104, were conducted on May 23, 2001 and on May 29, 2001. Test results indicated that if any amount of beryllium was being emitted it was below the detection levels of the analytical method. The maximum beryllium emissions that could be expected would be less than 0.145 grams of beryllium per 24-hour period for all the tested vents. That value is derived by assuming beryllium is being emitted at just below the detection level at each of the vents. Extrapolating that emission rate over the remaining untested vents would provide an overall estimate of no more than approximately 0.4 grams of beryllium being vented from all powered exhaust vents combined each 24 hour period. Concurrent with the testing of the exterior vents, indoor sampling was conducted in the production areas using

NIOSH Methods 7102 and 7300 in an attempt to determine a relationship between concentrations of beryllium in the production areas and the amount of beryllium exhausted through the uncontrolled vents, even though no powered exhaust vents are located in rooms where beryllium compound powder is used. Indoor sampling results (nine samples taken at normal production levels, or 4 to 6 feet above floor level) yielded beryllium concentration values that ranged from 0.0502 μg per m^3 of sampled air at the low end to 0.0573 μg per m^3 of sampled air at the high end. Although no exact quantitative relationship between indoor beryllium concentrations and outdoor beryllium vent exhaust amounts could be derived because of differences in the test methods, a qualitative appraisal suggests that the indoor and outdoor results are reasonably consistent. This qualitative relationship is important because indoor sampling is conducted and recorded much more frequently than the exterior testing. The information produced from indoor sampling may be used to provide a rough estimate of the potential for uncontrolled emissions from powered exhaust fans in production areas.

Despite the unlikelihood of beryllium emissions from powered vents (as demonstrated by the testing), the control officer believes it is appropriate for BCP to maintain internal operating procedures that would require shutting down the powered exhaust fans in affected production areas as one of the first actions BCP staff would take in the event of a beryllium compound powder spill. The permit, therefore, requires that action of the Permittee.

Solvents, acids, and bleaches are used in the facility as cleaning agents and binders but none in sufficient quantities to trip permitting thresholds.

Several pieces of fossil fueled fired equipment are used at the facility for purposes of firing ceramics, binding materials, and providing heat for the facility.

There are no NSPS or MACT standards applicable to any operations at the facility. There are applicable SIP rules (primarily for fugitive dust control) and applicable county rules (fugitive dust and fossil fuel fired commercial and industrial equipment). The control officer has determined that the SIP rule governing the 40% opacity limit will be incorporated within the permit even though operations at the BCP facility are not of the nature for which an opacity limit is meaningful. The opacity limit in rule is so high that any violation of the opacity limit would have been preceded by a violation of the NESHAP standard.

BCP has received approval from the Administrator (see EPA Letter to PDEQ dated September 3, 1992) to modify EPA Test Method 103 or 104 to include the use of an in-stack filter as described in EPA Test Method 17. This approved testing change allows the filter to be sealed immediately after the test and shipped to the laboratory for analysis. It eliminates the testing site cleaning of the probe which may be more conducive to errors.

Source information for many of the calculations that follow are taken from the BCP application dated February 21, 1995, and the BCP letter to PDEQ dated January 4, 1996.

1. **Beryllium oxide operations -** Character of Emissions: Controlled Non-Fugitive.

   BCP operations include pressing, firing, drilling, grinding, milling, abrading, and otherwise shaping of BeO material. There are no emission factors in AP-42, the EPA's FIRE database, or in any other document researched by PDEQ. The PTE for beryllium operations will default to the federal standard for beryllium (40 CFR Part 61, Subpart C). That standard is set at no more than 10 grams of beryllium over a 24-hour period (0.004 Tons per Year) and does not distinguish between fugitive and non-fugitive emissions.

2. **Natural Gas Fuel Fired Equipment -** Character of Emissions: Uncontrolled Non-Fugitive.

BCP has several pieces of natural gas burning equipment on site. The two largest are the Ajax boiler (rated at 3,000,000 BTU per hour) and the Bryan boiler (rated at 1,500,000 Btu per hour). Other equipment is individually rated at well below 1,000,000 Btu per hour each and is not required to be permitted pursuant to PCC 17.12.140.B.3.c. Emission estimates are based on the emission factors in AP-42 Tables 1.4-1 through 1.4-4 (7/98version). Estimates are based on uncontrolled, continuous firing for 8760 hours per year for the current equipment list in the permit for the facility.

Natural Gas Fuel Fired Equipment	
Pollutant	**Tons per Year**
Nitrogen Oxides	1.9
Carbon Monoxide	1.6
Sulfur Dioxide	0.012
Particulate Matter*	0.15
Volatile Organic Compounds	0.11
Lead	0.00001
Hazardous Air Pollutants	0.04

*Assumes all particulate emissions are PM_{10}

3. **Solvent Operations -** Character of Emissions: Controlled and uncontrolled generally non-fugitive.

BCP uses different types of solvents in its operations as both cleaning and binding agents. The VOC emissions worksheet in the application lists total VOC emissions rate of 2.5 lb per hour for solvent-using operations. Not all of the operations have identical annual operating hours. For potential to emit (PTE) estimates, all operations are assumed to operate the maximum 8760 hours per year.

PTE_{VOC} = 2.5 lb/hr x 8760 hr/yr x 1 ton/2000 lb = 10.95 tpy.

4. **Hazardous Air Pollutants** - Character of Emissions: Generally controlled non-fugitive.

There are five areas where hazardous air pollutants are emitted during BCP operations. Beryllium is emitted during numerous operations involving the production of the ceramic components and the tape, the natural gas fuel fired equipment contains negligible HAPs in its combustion flue gases. The T2 binding solvent contains toluene and MEK. MEK has been delisted and is no longer considered a HAP, (See Federal Register dated 12/19/2005). Some Nickel is emitted in the nickel plating operation, and a small amount of HCL is emitted in the plating and cleaning processes. The beryllium emissions and the combustion flue gas emissions have already been addressed in paragraphs 1 and 2.

PTE_{xylene} = 0.011 lb/hr x 8760 hr/yr x 1 ton/2000 lb = 0.05 tpy

*$PTE_{toluene}$ = 0.26 lb/hr x 8760 hr/yr x 1 ton/2000 lb = 1.14 tpy

PTE_{Ni} = 2.07×10^{-7} lb/hr x 8760 hr/yr x 1 ton/2000 lb = 9.1 E-7 tpy

PTE_{HCl} = 0.0093 lb/hr x 8760 hr/yr x 1 ton/2000 lb = 0.04 tpy

5. **Potential-to-Emit Summary**

The following table represents the BCP source's potential-to-emit for the pollutants listed:

POTENTIAL TO EMIT SUMMARY (TONS PER YEAR)	
Beryllium	0.004
Nitrogen Oxides	1.9
Carbon Monoxide	1.6
Sulfur Dioxide	0.012
Particulate Matter (as PM_{10} and not including HAPs)	0.15
Volatile Organic Compounds (including HAPs)	11.1
Lead	0.00001
Xylene	0.05
Toluene*	1.14
Nickel	9.1E-7
Hydrogen Chloride	0.04
Total HAPs	1.27

*The Tape Room has been closed during the application process, and the use and potential emissions of MEK and Toluene are no longer pertinent to the permit. If the Permittee decides to resume manufacture of Tape products, a permit revision will be required.

6. Based on the potential-to-emit estimates in the above table and the control equipment required to maintain the 10-gram beryllium standard, BCP is a synthetic minor source of both PM_{10} and HAP emissions and a true or natural minor source of all other pollutants.

   Note: Draft Permit sent to EPA for Courtesy review on December 30, 2003. Response received in February. At several meetings with BCP staff, the EPA comments were addressed. A follow up letter dated January 30, 2003 summarized the changes in the permit that were agreed to. The final issue was monitoring the powered exhaust vents. EEMC was scheduled to visit the plant in mid February to assess the monitoring requirements and report their findings for an inspection program protocol.

7. Brush Ceramic Products requested that the word "daily" in the first sentence of Part B III.B (Monitoring and Recordkeeping) should be changed to "weekly". It was suggested that the inspections required would be done much more efficiently and thoroughly if one section of the Ducting System was checked for flaws or leaks each inspection day, on a rotating basis such that each section was inspected at least once per week.

   Brush Ceramics proposed that the Ducting System could be defined as four separate sections that could be inspected, each one, once per week. The entire System would be subject to inspection on a weekly basis. This inspection, done on four different days, should be more thorough and efficient than if the entire System were inspected on one day.

8. Brush Ceramics changed the intake to the 40,000 cfm Farr Final Filters in order to facilitate more efficient fan operation. The PDEQ was notified in a letter dated December 17, 2003 that this might change the pressure

differentials across the filter, but in fact, no change in standards was required after the installation was completed and tested.

9. In a letter of July 28, 2003, Brush Ceramics Products informed PDEQ of an improved version of the final HEPA filters will be used in all air pollution control systems as listed in II.B of Part B. These filters, apparently, will lower the static pressure and the pressure drop across the filters. This lower pressure drop will require the minimum values of the final filters prescribed in III.D Table 1 of Part B of the draft permit to be changed from "0.5" to "0.4".

   This change was made to the Draft Permit.

10. In discussions with EPA, it was recommended that the source perform an additional modified stack test on the powered vents during the life of the permit. In view of the non-detect results from the previous testing, it is difficult to justify the expenditure in manpower and resources to be repeating the testing on a frequent schedule, especially when the vents exhaust from areas in the plant where there is no reasonable likelihood of BeO powder to be present.

    The applicant agreed to terminology that would require the powered exhaust vents to be tested during the penultimate year of the term of this permit.

11. The permit summary on page 3 of the permit and language in I of Part B was revised to refer to BCP operations according the definition in 40 CFR 61 Subpart C. This clarifies any discrepancies that may arise from processes defined by equipment used onsite.

12. Emissions were further defined in II.A of Part B. to include total emissions from any kind of activity at the facility.

13. Requirement to install listed pollution control equipment in Part D of the permit was added to the permit in II.B of Part B. The pollution control equipment will have the components shown in II.B of Part B.

14. In previous drafts there was no requirement to direct all beryllium containing emissions from any operation to the air pollution control equipment. This requirement has been added in II.C of Part B and BCP shall direct any kind of beryllium emissions to the air pollution control equipment.

15. A requirement was added to not allow any kind of beryllium emissions from any vents, doorways or other openings except through air pollution control equipment listed/ identified in II.B of Part B and the stack. BCP is also required to implement an emissions prevention plan which shall be submitted as required in III.C of Part B. The emissions and detection plan shall be submitted for approval to the Control Officer within 90 days of issuance of the final permit.

16. BCP shall follow the four change out procedures dated 10/12/06 in II.B.D when changing filters or collector drums on any pollution control equipment. These O & M plans assure that BCP minimizes the possibility of Beryllium emissions.

17. Local standards for fuel burning equipment were added for the natural gas boilers.

18. Requirements in III.A and B of Part B for monitoring and recordkeeping of the pollution controls and powered exhaust vents were added to ensure that Beryllium emissions are minimized.

19. Recordkeeping as required in III.F, of each instance when the filters in any of the four air pollution control devices are replaced.

20. Equipment list was updated to reflect the natural gas boilers and air pollution control equipment.

21. Part A was updated to reflect the changes dated May 2006 in Title 17 of the Pima County Code.

22. References to the particulate detection devices have been removed from the permit. Data from these systems are primarily used by Brush maintenance personnel as a qualitative measure for overall trends in the systems operations. The particle detectors are not useful as a leading measure of system functionality. They are highly variable and are dependent on many conditions, e.g. temperature, humidity, weather, particulate build up and age. Differential pressure which is monitored and outlined in Part B of the permit, operations and maintenance procedures provide much more concrete measures of collector functionality and emissions prevention strategies which again are all better measures of system condition.

23. BCP is required to install photohelic gauges that continuously monitor and show the operating ranges and failure ranges of the air pollution control device collection system. This system shall be operated at all times and maintained according to an O & M plan either developed by the manufacturer or BCP. The ranges for the photohelic gauges are shown in Table 2 of Part B.

24. Initial testing was completed by BCP before October 28, 1980. BCP is required to perform annual emission testing to assure compliance with the 10 grams per 24 hour period federal standard. BCP shall follow testing procedures and notification requirements outlined in the permit and Title 17 of Pima County Code.

25. On February 12, 2009, BCP submitted a facility change notification in which BCP informed PDEQ of an R&D project in which a mixture of cadmium and tin were going to be utilized in the project to produce targets for a solar panel manufacturing company. The metal powder is isostatically pressed into a specific shape and then dry machined on a lathe. After machining, the targets are sent to the customer.

26. On June 26, 2009, BCP submitted a notification of an increase in volume of cadmium-tin powder to be processed.

27. On July 8, 2009, BCP submitted a minor revision application to add this process as part of its main operations. This additional operation triggered the applicability of 40 CFR 63 Subpart XXXXXX, National Emission Standards for Hazardous Air Pollutants – Area Source Standards for Nine Metal Fabrication and Finishing Source Categories. The subpart addresses sources that use materials that contain the potential to emit metal fabrication or finishing metal HAP (MFHAP) as outlined in the subpart. The permit was revised in June 2010.

28. On December 07, 2009, BCP submitted another minor revision to add an aqua regia cleaning system and scrubber to replace an existing like equipment. The new system was necessary to allow the scrubber to remain on during shutdown periods when facility equipment and dust collector systems are shut off. Previously, the acid had to be neutralized and discharged to BCP's industrial wastewater collection system for treatment. The purchase of the new cleaning system was a cost saving measure for BCP to enable the source to keep the acid longer, decrease waste and potential accidents in handling. This process triggered a local requirement in PCC 17.16.430.F & G that addresses processing and handling of acids. The permit was revised in June 2010.