TA-039

Los Alamos
NATIONAL LABORATORY

Hazardous & Solid Waste, ESH-19
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Date: December 17, 2001
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DEC 2001 RECEIVED

Ms. Lee Winn
Environmental Specialist
Hazardous Waste Bureau
New Mexico Environment Department
2905 E. Rodeo Park Drive, Building E
Santa Fe, New Mexico 87505

Dear Ms. Winn:

This letter is to transmit answers to questions regarding the Beryllium Technology Facility that you recently requested. If you should have additional questions, please feel free to contact me at any time (667-0820).

Sincerely,

Alice Barr
Hazardous and Solid Waste Group

AB/vh

Att. (1)
Cy: S Abeln, MST-6, w/att., G741
G. Turner, LAAO, w/att., A316
ESH-19 File
IM-5, A150

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To Lee Winn	From Alice Barr	
Co./Dept. NMED-HWB	Co. LANL-SWRC	
Phone #	Phone # 667-0820	
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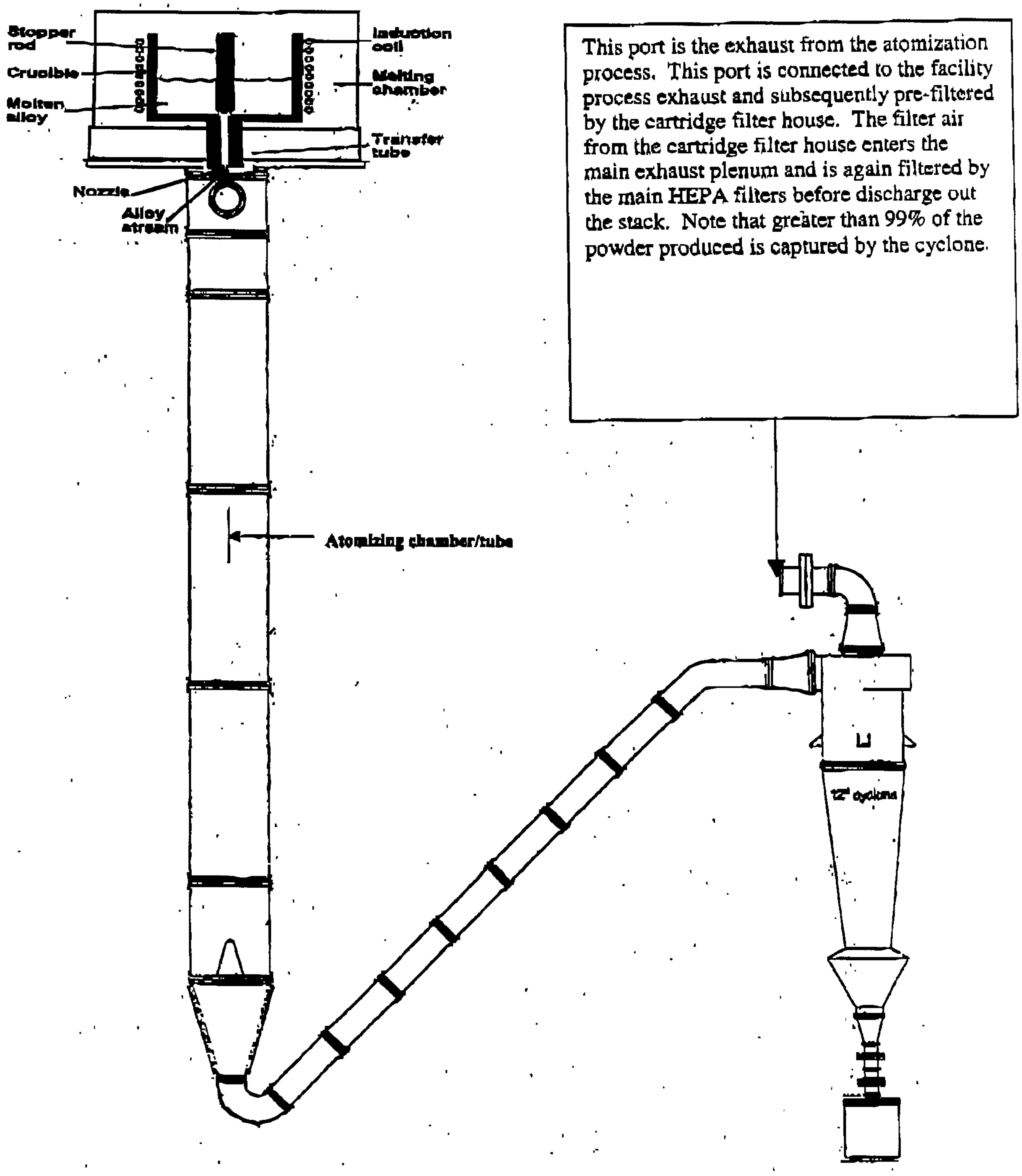
Stopper rod
Crucible
Molten alloy
Induction coil
Melting chamber
Transfer tube
Nozzle
Alloy stream
Atomizing chamber/tube
This port is the exhaust from the atomization process. This port is connected to the facility process exhaust and subsequently pre-filtered by the cartridge filter house. The filter air from the cartridge filter house enters the main exhaust plenum and is again filtered by the main HEPA filters before discharge out the stack. Note that greater than 99% of the powder produced is captured by the cyclone.
12" cyclone

Response to NMED's Request for Additional Information
Beryllium Technology Facility
LAUR-01-6752

1. Describe exactly how the Beryllium powder is produced.

Operation of High-Pressure Gas Atomizer to Produce Beryllium Metal Powder

The high-pressure gas atomization (HPGA) process, while not yet in operation, involves vacuum induction melting of a beryllium metal or beryllium/alloy charge, and directing the molten metal through a nozzle containing gas jets around the periphery of the exiting molten metal stream. The liquid metal stream is atomized into finely divided spherical droplets by the impingement of the high pressure, high velocity gas flowing from the nozzle. The atomizing chamber consists of a 1 ft. diameter x 12 ft. long SS tube divided into several sections to allow for easier cleaning and maintenance. The atomizing gas solidifies the molten metal droplets into powder, carries the powder in a streamlined flow down the length of the chamber, and into the cyclone separator where the powder is collected in a removable can. This process produces low-oxide spherical beryllium powder with solidification rates on the order of 10^4-10^6 C/s.

The HPGA equipment consists of a melt chamber, and a tubular atomizing chamber designed by engineers at the National Institution of Standards and Technology (NIST) and modeled after an HPGA atomizer at Ames Laboratory. The process control system will be modeled after the NIST HPGA atomizer and designed to operate in both manual and automatic mode utilizing a software control system known as LabVIEW. The tubular atomizing chamber design has been evaluated using surrogate metals at NIST before any beryllium atomization is done at Los Alamos National Laboratory (LANL).

The following figure is a simple schematic showing the primary components of the HPGA atomizer. The general steps involved in operating this equipment to produce beryllium powder are; 1) prepare and install crucible assembly into melt chamber, 2) charge beryllium and alloy additive metal stock into crucible, 3) place cover on melt chamber, evacuate entire closed system including melt and atomizing chamber and powder collection system, purge with argon, and evacuate again to required vacuum level, 4) using induction heating coil, heat metal charge to about 50% of melt temperature, 5) back fill entire closed system with inert gas, 6) continue heating metal charge to melting point and predetermined superheat level, 7) activate video monitor and recording system, 8) withdraw stopper rod to begin molten metal transfer into nozzle, 9) electronically open exhaust vent on cyclone powder collector and open inert gas atomizing valve, 10) entire molten metal charge converts to solidified powder in less than 2 minutes, 11) stop atomizing gas flow and close exhaust valve on cyclone, 12) close valve on powder collection can, 13) allow closed system to cool overnight, 14) remove powder canister from cyclone and transfer powder into inert gas glovebox for subsequent processing, 15) perform cleanup and maintenance on atomizing and melt chamber in preparation for next powder production run.

2. Is it a metal containing Beryllium or some kind of mineral that is used to produce the Beryllium powder?

We will either atomize pure beryllium metal or beryllium with some alloy additions such as aluminum.

3. Does atomizing remove impurities and if so what are the impurities?

The atomizing isn't designed to remove impurities. Some impurities such as aluminum may be removed during the melting operation due to its low vapor pressure.

4. Describe the process of machining the Beryllium powder, is it the sole ingredient in the machining process?

The beryllium powder is consolidated by combinations of heat and pressure to form a part or billet. This part or billet is then machined to the prescribed final configuration. The consolidated powder is the sole ingredient in the machining process, unless it is an alloy and then it may contain Al, Mg, Cu, etc.

5. How are the HEPA filters managed after they are spent? Include a description of the safety precautions used when managing the HEPA filters.

The HEPA filters are expected to be non-hazardous solid waste and will be managed in accordance with LANL's beryllium management requirements, including such activities as posting, labeling, packaging and monitoring, etc. All HEPA filters will be placed in double containment prior to movement from filter housing to storage and subsequent transport. They will be sent to a commercial industrial waste landfill approved for receipt of beryllium-contaminated waste.

The HEPA filter housing is built to nuclear specifications and includes isolation dampers and bag out ports. The HEPA filters are changed out by a qualified filter change crew from Johnson Controls Northern New Mexico following all the safety precautions used in changing nuclear facility HEPA's. In addition, an aerosol filter penetration challenge test is conducted after every filter change to insure the integrity of the filters and installation.

6. Are there different venting systems (with HEPA filters) at each different process (e.g. powder production, machining)?

All air exiting the beryllium processing areas goes thru the main HEPA filters. However, there are some process specific prefilters such as cyclones, small HEPA's, and a cartridge filter house included in the facility design, but all effluent from these prefilters is routed thru the main ventilation system and the main HEPA filters prior to discharge out the stack.