BROOKHAVEN NATIONAL LABORATORY
PROCESS ASSESSMENT FORM

I. General Information

Process ID:	AM-527-SSP	PEP ID# 527		
Process Name:	Small Scale Tinning/Bus-Bar Tinning			
Process Flow Diagrams:	AM-527-SSP-01			
Process Description:	The process includes the Small Scale Tinning/Bus-Bar Tinning associated with the fabrication and operation of superconducting magnets and support systems at BNL. This process involves tinning copper wires with solder to ensure reliable electrical connections. The tinning operations are performed within a laboratory hood to control air emissions. Section II and the above-referenced Process Flow Diagram provide more detail on the Small Scale Tinning/Bus-Bar Tinning procedures.			
Dept./Div.:	Superconducting Magnet			
Dept. Code:	AM			
Building(s):	902			
Room(s):	N/A			
Point of Contact:	J. Durnan	x8236		
Prepared by:	M. VanEssendelft	Reviewed by:	J. Durnan	

II. Detailed Process Descriptions and Waste Determination

Superconducting magnets are designed to bend and focus ion beams used in accelerator/collider projects at BNL and other laboratories. Superconducting Magnet Division designs, fabricates, tests and repairs superconducting magnets. The magnets are cooled to 4.6°K (and lower) using either liquid helium or supercritical helium gas. At cryogenic temperature, the magnets acquire superconducting properties, thereby greatly reducing the amount of electricity that must be supplied to generate the magnetic field.

Process Flow Diagram AM-527-SSP-01, provided in Attachment 1, graphically depict the process inputs and outputs for Small Scale Tinning and Bus-Bar Tinning Operations. These diagrams were developed to support fabrication and assembly operations associated with the Relativistic Heavy Ion Collider (RHIC). The processes and controls are still in use and continue to be applicable..

RHIC magnets and magnets for other off-site laboratories are fabricated in Buildings 902 and 924. Also located in Building 902 are shops where printed circuit boards utilized in the RHIC

magnets and other components are assembled by wiring and interconnecting the various electronic components to the printed circuit boards. In addition to small-scale plating/bus-bar plating operations, Building 902 contains a small staff shop, electronics assembly operations, cryogenic helium production, magnet testing systems and the final magnet mechanical assembly operations.

To ensure that proper connections are made between electronic equipment utilized in the superconducting magnets, copper wires and parts (e.g., superconducting cable, bus-bar ends) are dipped into a bath of solder. The bath of solder is contained in a solder pot. Dipping is performed as a pre-soldering step and to keep the individual strands of wire together. If electrical current needs to pass through a magnet to power other magnets, bus bars are used. Bus bars are long copper bars that are used for mechanical and electrical properties that have superconducting cables soldered on them.

Primarily, tinning operations are performed under exhaust hood systems in Building 902, either in Room 09 or in the High Bay. Bus Bar soldering operations are performed using a RF Induction heating system that uses an argon gas purge, which is exhausted out of the building. The exhaust from these hoods and the bus bar soldering operations has been categorized as trivial sources under the laboratory's NYSDEC Title V permit. Logbooks are maintained at the hoods to record the estimated emissions from this and other processes. Posting at these points list evaluated activities.

Prior to tinning in Rm 09, methanol and acetone are sprayed onto the wires and parts and wiped with rags to remove any dirt, oil, grease, etc. Cleaning is performed within a hood. The hood contains a fan to exhaust vapors to outside air. Operating personnel estimate that they utilize approximately 5 gallons of methanol and 1 liter of acetone each year. The chemicals are purchased in bulk containers and are dispensed for use into spray bottles.

Following the cleaning step, tinning is performed. The solder utilized in tinning is composed of 96% tin and 4% silver. The electric pot is switched on to melt the solder. Once the solder is melted, the wires and parts are dipped into the bath and then set aside to allow the solder coating to cool and solidify (Note: unused solder from other operations are reused by melting them down in the solder pot.). Once the tinning operations are complete, the pot is switched off and the solder remaining in the pot solidifies. When the solder bath is in its molten state, contaminants float to the top. Therefore, when the pot is switched off these contaminants solidify at the surface of the bath. Periodically, the top of the solder bath is scraped off to remove any contaminants. Contaminated solder is referred to as "tailings" and is transferred to the Hazardous Waste Management Facility (HWMF) for disposal as hazardous waste. Approximately 1 pound of tailings are generated each year. Solid solder is periodically placed within the pot to replace tinned solder and tailings.

The frequency of tinning operations has decrease significantly from being performed every day during full magnet production. Currently, tinning and the associated cleaning is performed within the exhaust hood less than 2 to 3 times per month and is expected to continue in limited use to support the LHC program and construction of replacements of RHIC operational magnets that fail over the life of the machine.

In addition to soldering, the hood in Room 09 was being utilized to etch wedges for the magnet coils. Etching was performed by dipping parts into a bath containing nitric acid. The exhaust fan on the hood was operated during etching to remove any vapors generated. This operation is not currently performed since RHIC magnet production in the building is complete.

Complete lists of chemicals utilized by the Superconducting Magnet Division are tracked using the BNL Chemical Management System (CMS). Current lists of chemical assigned to the Division can be found using the BNL CMS web site. Not all of the chemicals listed in the CMS list or located in SMD Buildings are used on a regular basis. When projects are completed, the chemicals used for that particular project typically remain in storage cabinets at the building for possible use in the future.

In general, waste generated in SMD Buildings during tinning operations is reused when possible, recycled if containers are available or disposed as hazardous waste. Soldering /flux fumes are vented to the outside air using permitted air hoods.

Regulatory Determination of Process Outputs

Small scale tinning is performed within a laboratory hood located in Room 09 of Building 902 (and potentially in the High Bay hood in 902). Prior to tinning, the wires and parts are cleaned within the hood using methanol and acetone. These chemicals are applied using plastic spray bottles. The wires and parts are wiped with rags to remove dirt and excess chemicals. Spent rags are discarded in the regular trash along with empty bulk chemical containers. Vapors from the chemicals are exhausted to outside air by a fan located above the hood.

After cleaning the solder pot is switched on. Once the solder is melted, the wire or part is dipped into the bath and then set aside to cool and solidify. The exhaust from the hood is discharged to outside air. When tinning is complete, the pot and the hood are switched off. The solder solidifies within the pot for reuse at a later time. Periodically, tailings are scraped from the surface of the solder pot and transferred to the HWMF for disposal as hazardous waste.

Waste ID	Waste Description	Determination/Basis	Waste Handling	Corrective Action Required
1.1	Solder pot tailings	Hazardous solid waste as determined by process knowledge	Waste is reused (if possible), or Transferred to HWMF as hazardous waste for disposal	None
1.2	Spent rags and empty chemical/cleaner	Non-hazardous solid waste as determined by process	Waste is discarded in the regular trash. Rags must	None

	containers	knowledge.	not be saturated or dripping.	
	Vapors and fumes from cleaning and soldering	Non-hazardous vapors as determined by process knowledge	Vapors are discharged to outside ambient air through exhaust hood	None

III. Waste Minimization, Opportunity for Pollution Prevention

During the initial effort of evaluating SMD's processes for Pollution Prevention and Waste Minimization Opportunities, each waste, effluent, and emission was examined to determine if there were opportunities to reduce either the volume or toxicity of the waste stream. Consideration was given to substitute raw materials with less toxic or less hazardous materials, process changes, reuse or recycling of materials and/or wastes, and other initiatives. These actions were documented in this section of the original process evaluation. Action taken on each of the Pollution Prevention and Waste Minimization items identified can be found in the Environmental Services Division's PEP Database. Further identification of Pollution Prevention and Waste Minimization Opportunities will be made during annual assessments of the SMD processes. If any Pollution Prevention and Waste Minimization Opportunities are identified, they will be forwarded to the Environmental Services Division for tracking through the PEP Database.

IV. Assessment Prevention and Control

During the initial effort of evaluating SMD's Assessment, Prevention, and Control (APC) Measures, operations, experiments and waste that have the potential for equipment malfunction, deterioration or operator error, and discharges or emissions that may cause or lead to releases of hazardous waste or pollutants to the environment or that potentially pose a threat to human health or the environment were described. A thorough assessment of these operations was made to determine: if engineering controls were needed to control hazards; where documented standard operating procedures needed to be developed; where routine, objective, self-inspections by department supervision and trained staff needed to be conducted and documented; and where any other vulnerability needed to be further evaluated. These actions are documented in this section of the original process evaluation. Action taken on each of the Assessment, Prevention and Control Measures is documented in the Environmental Services Division's PEP Database. Further identification of Assessment, Prevention and Control Measures will be made during annual assessments of SMD processes. If any Assessment, Prevention and Control Measures are identified, they will be forwarded to the Environmental Services Division for tracking through the PEP Database.

ATTACHMENT 1

PROCESS FLOW DIAGRAM

AM-527-SSP-01