Pit production at AWE

A90

The main pit production facility at AWE is A90. The 2 main buildings are the production facility A90.1 and the support facility A90.2. There are also a number of smaller support buildings in the A90 complex. A90.2 processes the graphite moulds that are used for casting the plutonium pits. It also provides storage, changing rooms and support facilities for A90.1.

A90.1 is a two-storey building. It is a replica of PF-4, the plutonium fabrication building in the TA55 complex at Los Alamos National Laboratory. There are three pressure zones to control the flow of air in PF-4 and the same system is used in A90.1. On the ground floor of A90.1 are a number of plant buildings and storage facilities. On the first floor there are 4 bays.

Bay 1

Plutonium pits are cast and machined in Bay 1. There are six high frequency vacuum induction furnaces. Within these furnaces plutonium is heated and poured into a graphite mould. The items cast are probably hollow hemispheres.

The plutonium components, probably hemispheres, are then machined by a series of computer-controlled machine tools. During this process the dimensions are checked by radiography and gauges.

After machining the density of the plutonium components are checked by immersing them in a bath. They are then despatched to Bay 2.

Bay 1 also carries out two recovery processes. (a) Some radioactive material remains on the casting moulds. This is oxidised in furnaces. (b) Swarfs, small fragments of plutonium removed during machining operations, are compacted in a press.

Bay 2

A shell made from Beryllium surrounds the plutonium core of the pit. Bay 2 machines Beryllium. Work on Beryllium is also carried out in A5.

Bay 2 then assembles pits by joining the plutonium components, the Beryllium shell and other parts.

Bay 2 has facilities for joining metals using a variety of methods: Metal-Inert Gas (MIG) Brazing, High Frequency (HF) Brazing, Tungsten-Inert-Gas (TIG) welding, Electron Beam (EB) welding and isostatic pressing.

MIG brazing is a standard way of joining 2 Beryllium components and may be used to join the 2 hemispheres of Beryllium.

TIG welding is carried out on stainless steel. This could be work on the pit tube. The pit tube is a small stainless steel tube through which tritium can pass into the centre of the pit.

Bay 3

Bay 3 has been described as a research and development facility. It carries out minor machining operations. It has a furnace for casting plutonium and an arc

melt furnace for producing alloys. There is an Electron Beam (EB) Welder. There are facilities to explore the effect of adding gases to radioactive material using three techniques. There is a bath for density tests. Polishing of metals is also carried out.

Bay 4

Bay 4 dismantles pits that have been withdrawn from service. Machining operations are carried out on Beryllium and on the braze which is used to join Beryllium.

The plutonium is refined so that it can be used in new weapons. The following refining operations are carried out in separate furnaces: electro- refining, vacuum stripping of impurities and removal of decay products.

There is also a furnace that recovers plutonium from residues of the casting process carried out in Bay 1.

A5 Beryllium Processing Facility

A5 was built in 1962 on the old runway. There were fires in the building in 1971 and 1977. It was refurbished and extended between 1989 and 1993. A5 is close to A90 and is North of it.

A number of machine tools are used to machine Beryllium. There are also two vacuum furnaces. These are used for joining components, using a braze, and they are also used to heat treat components. There is a diffusion bonder, which bonds components by compressing them together under heat. There are facilities for spot welding, torch brazing and for joining metal components with glue. The dimensions and surface properties of components are examined and measured. Components are regularly cleaned by hand and in a chemical bath. The list of materials used in A5 indicates that there is also a Metal-Inert-Gas (MIG) brazing facility.

There are a number of facilities for analysing Beryllium components. Samples are removed in a slitter. Specimens of the metal can be mounted in acrylic or Perspex. Samples can be ground and polished.

New machinery and capabilities are due to be installed in A5 including an Alpha Barrier Coater which will deposit a metallic coating on components; a Penetration Crack Detection unit to inspect welds and brazed joints; a new spot welder, production lathe, measuring machine, scanning electron microscope and electrochemistry fume cupboard. Test equipment will be moved into A5 from an adjacent building.

Beryllium waste and legacy stocks of beryllium powder are stored in containers outside A5.

A45

A45 was used for the production of plutonium pits until A90 became operational. It was then used for the production of HEU components of the Secondary of the Trident warhead.

A45 has a vacuum furnace for brazing two metal components.
There are two Alpha Coating plants, one of which is no longer operational. There is a Metal-Inert-Gas (MIG) brazing facility. In July 2007 the use of this MIG

facility in A45 was under review and it may no longer be used. Spot welding, Penetration Crack Testing and leak testing and cleaning of components can be carried out in A45.

Annual consumption of materials and warhead estimates

Gallium

Warhead pits are made from an alloy of plutonium and gallium. A small proportion of gallium is added to stabilise the plutonium. A90 uses 500g of Gallium per year. The percentage gallium is not known and the exact weight of plutonium in the pit is not known. If the pit is 1 % gallium and each pit contains 4 kg of plutonium then the annual consumption of gallium is appropriate for the production of around 12 pits per year.

Beryllium

There are two substantially different indications of the amount of Beryllium processed each year in A5. The material inventory indicates that the facility uses less than 1 tonne of Beryllium per year. But the list of solid waste arising from the facility says that the annual total is 75 kg. The material inventory says that 75 % of the material ends up as solid waste. This suggests that the total amount processed is 100 kg per year, of which 25 kg ends up in the product.

The material inventory for A90 says that 25 kg of Beryllium is used in component manufacture and disassembly and that 99 % of this is in the product.

The amount of Beryllium in each reflector is not known. Annual production could be off around 12 reflectors each containing around 2 kg of Beryllium.