

1. Background and Goal of the present work

The Indonesian National Nuclear Agency (BATAN - Now BRIN) believe that In the product of obsolete sealed sources of the Iridium-192 type Gamma Mat, there are two important components that can be reused to assemble new products, namely the outer capsule and pigtail/source holder. From an economical perspective, reusing these two components will be beneficial due to the asking price of one-third below the overall product price. With the issuance of the Indonesian Government Regulation Number 61 of 2013 concerning Management of Radioactive Waste, it opens legal opportunities for BATAN to recycle the radioactive substances that have not been used which come from waste producers, including the sealed source products in the Gamma Mat type Iridium-192. The dismantling process of Gamma Mat type Iridium-192 sealed sources products in order to reuse the outer capsule and pigtail/source holder components is also a form of implementation for the Regulation of the Head of BATAN Number 7 of 2017 concerning Reuse and Recycle of Unused Sealed Radioactive Substances.

2. Preliminary

2.1 General Evaluation

In the Radiography industry in Indonesia the use of the product of obsolete sealed sources of the Iridium-192 type Tech Ops (TO) have been an ongoing practices since the 90's as for the Gamma Mat TSI became regularly used since 00's. These two Gamma Mat types are the most common ones found in Indonesian until today.

- Two main components could be reuse, namely the outer capsule and pigtail/source holder.
- After receiving the used product of obsolete sealed sources of the Iridium-192 as radioactive wastes, it is mandatory for BATAN to collect and group each wastes.
- During the collection and grouping, BATAN may conduct a study in accordance with the standards, guidelines, requirements and/or procedures set by the Head of BATAN.
- BATAN will determine whether the package of the received radioactive substance can be reused, recycled, or as radioactive waste.

2.2 General Procedure

- Prior to reusing it is necessary to identify the source wrapped in Ir-192 Gamma Mat so that it can be traced related to the history of the source.
- The inner capsule containing the Ir-192 disk must first be removed from the outer capsule by removing the connection lock pin between the outer capsule and the pigtail/source holder.
- The outer capsule and pigtail/source holder that have been separated are first checked for surface contamination. If it is free from contamination, it is continued by checking its physical condition, whether there is rust or damaged parts.
- To further ensure its contamination-free and to remove other impurities inside the gaps between the pigtail/source holder and the inside of the outer capsule. The outer capsule and pigtail/source holder were placed in a vibrating vessel filled with radiacwash liquid for 24 hours.
- The outer capsule and the soaked pigtail/source holder are removed and cleaned with decontamination material which has been moistened with alcohol and dried with a tissue.
- The radiacwash liquid resulting from the immersion of the outer capsule and pigtail/source holder was chopped using a chopper. The outer capsule and pigtail/source holder were declared free of contamination if the activity of the contaminant was less than 5 nCi.
- This contamination-free outer capsule and pigtail/source holder can be reused to assemble the source product wrapped in Gamma Mat type Ir-192.

3. Methodology

The methodology used in carrying out the dismantling of packaged sources of Ir-192 Gamma Mat type which is no longer used in the context of reusing the outer capsule and pigtail/source holder components is by studying literature, reviewing government regulations, regulations from the Head of BAPETEN and regulations from the Head of BATAN, as well as a study of the author's experience related to the recycling of packaged sources of Ir-192 Gamma Mat type which was no longer used while on duty at BATAN.

4. Results and Discussion

• Economical Considerations of Reusing Outer Capsule Components and Pigtail/Source Holder

In the last ten years, the demand for packaged source products of Ir-192 type Gamma Mat has increased, based on information from the main distributor (PT. Pratita Prama Nugraha) the price of these two components is about a third of the selling price of the new product.

• Identification of Unused Ir-192 Type Gamma Mat Encased Sources

is carried out as follows: Name and address of the company sending the unused source wrapped in Ir-192 Gamma Mat type, Product certificates (Decay Charts), The serial number of the unused source product wrapped in Ir-192 Gamma Mat type, Photocopy of permit for the use of radioactive substances and/or radiation sources from BAPETEN, Letter of approval for the transportation of radioactive substances from BAPETEN, Photocopy of the official report on the handover of the unused source product wrapped in Ir-192 Gamma Mat type.

• Release of Ir-192 Type Gamma Mat Packaged Sources From Inside Transport Containers

Before reusing the source holder/pigtail and outer capsule components, the source product wrapped in Ir-192 Gamma Mat type is first removed from the transport container using a source cable and put into a special container and stored in a glove box for further handling and is declared safe if the value of the radiation exposure rate on the surface of the special container is less than 2 mSv/hour.

• Activity Measurement using a dose callibrator to measure its activity.

The measured activity is recorded as an unused source product activity wrapped in Ir-192 Type Gamma Mat which will be stored and treated as radioactive waste. From past experience, the activity of the source product wrapped in Ir-192 Type Gamma Mat that is not used is generally less than 10 Ci. This measured activity is matched with the activity values listed on the decay charts (decay charts).

• Removal of the Inner Capsule from the Outer Capsule

Inside the glove box, the connection parts of the outer capsule and pigtail/source holder with pins are clamped with a vise and the bottom is supported with stainless steel pipes. Using a hammer and an L wrench appropriate to the size of the hole, the pin is punched out and then stored in separated containers and treated as radioactive wastes along with the outer capsule and the inner capsule containing the Ir-192 disc

• Surface Contamination Inspection On Outer Capsule And Pigtail/Source Holder

Outer capsule and pigtail/source holder are declared free of contamination if the value of the level of surface contamination is less than 3.7 or these two components are put into a vibrating vessel with radiacwash liquid and left for 24 hours. Both components were declared free of contamination if the activity of the measured contaminant was less than 5 nCi.

• Physical Condition Check Outer Capsule And Pigtail/Source Holder

1. Outer capsule components: absence of defects or cracks on the surface.
2. Pigtail/Source Holder Components: defects or cracks on all parts of the surface of the pigtail/source holder (unfit), Smooth hinge movement between pigtail/source holder segments. (Dragging means unfit)

• Reuse of Outer Capsule Components and Pigtail/Source Holder

For importers/distributors, using the two components of the outer capsule and pigtail/source holder will greatly reduce the purchase price of the source product wrapped in Ir-192 Gamma Mat type from overseas manufacturers. Meanwhile, for domestic producers, using these two components will greatly reduce production costs.

5. Conclusion

The outer capsule and the Pigtail/source holder are two important components of the non-used Ir-192 Gamma Mat packaged source product. These two components are declared eligible for reuse if they are free of contamination and there is no physical damage. The reuse of these two components is economically very profitable considering the price is almost a third of the selling price of the source product wrapped in Ir-192 type Gamma Mat as a whole.