STUDY CASE N° 21: RADIOLOGICAL INCIDENT INVOLVING A Tc-99m GENERATOR IN IRELAND

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❑ Introduction

During 2004 the Dosimetry Service of the Radiological Protection Institute of Ireland measured a penetrating dose of 11.3 mSv on a TLD assigned to a van driver employed by a licensed distributor of radioactive sources in Ireland. The TLD was issued on 1st September 2004 and received back on the 18th October 2004. The exposure period for the TLD is taken to be between 4-6 weeks.

On Saturday morning of each week the driver collected six Technetium generators (from a licensed depot at Dublin Airport) for delivery to hospitals in Cork city to the south and Galway city to the west. Cork city is about a 3 hour drive from Dublin and Galway city is about a further 3 hour drive from Cork.

In accordance with their licence conditions the Distributor carried out an incident investigation into this recorded dose of 11.3 mSv, and in their Incident Report they stated that, during the exposure period of this TLD, the van driver had carried the Technetium generators into the hospitals as on-going construction work at the hospitals had prevented trolley access. The van driver was wearing his TLD on his trousers pocket/belt during each days work.

During the exposure period in question it was estimated that the van driver would have physically carried the generators for a total of about 120 to 180 minutes, and the Distributor concluded in their Incident Report that physically carrying the Technetium generators into the hospitals was responsible for the high recorded dose on the van driver's TLD. It is worth noting that carrying the Technetium generators into the hospitals was a clear breach of the Distributor's own stated work procedures.

As part of the Regulatory Services Division investigation into this recorded high dose it was decided to conduct a series of exposure/dose measurements on live Technetium generators following their arrival into Dublin Airport on one Saturday morning. These measurements would be used as part of a dose reconstruction.

All radiation measurements were therefore conducted on Saturday 15th January 2005 in the car park of one of the Cargo Depots at Dublin Airport.

❑ Measurements

One of the Technetium generators with a designated TI of 2.5, based on a facility production date of 14th January 2005, was isolated for analysis from the rest of the consignment.

A series of radiation measurements were made at the top surface (lid) and at the side walls of the outer container using Mini-Rad 1000 Series instruments. Additional measurements were made at a distance 1 m from the container in order to validate the TI value.

TLDs were placed on the lid of the container, and attached to the side walls of the container for a period of 11 minutes.

Radiation measurements were made in the driver's seat at the front of the vehicle in order to estimate the dose received by the driver during transport with the full consignment of 6 generators securely stowed in the back of the Ford Transit transport vehicle.

Radiation measurements were also made at a point c.5 cm distance from the load in order to replicate the exposure situation of the generators being securely stowed in the front of the transport vehicle i.e. directly behind the driver's seat.

❑ Results

The Technetium generator in question indicated a dose rate of c.500 μSv/hr along the vertical sides of the container and a dose rate of c.600 μSv/hr across the lid. The TI recorded, with a Min-Rad 1000, was between 2 and 3 consistent with a designated TI value of 2.5 as of the 14th January 2005.

When all the generators were securely stowed at the back end of the transport vehicle the dose rate at the driver's seat in the front end of the vehicle was 5-10 μSv/hr. The dose rate at a point c.5 cm distance from the load was c.500 μSv/hr, and this was taken as representing the maximum dose rate that could possibly be received by the driver if the generators were stowed directly behind the driver's seat and not to the rear of the vehicle.

❑ Discussion of results

The van driver explained that during the period in question he wore his TLD on his trousers pocket/belt and he carried the generators at arms length down by his side. At the end of each Saturday the TLD was left in the transport vehicle until the following Saturday. The transport vehicle was not involved in transporting radioactive sources from Sunday to Friday.

A typical Saturday trip for the driver was to deliver 3 generators to Hospitals in Cork and 3 generators to hospitals in Galway. This would entail about 6 hours of travelling with a diminishing number of generators on board. The return journey from Cork or Galway would entail an empty van.

On the basis of the information supplied by the van driver and the results of the radiation measurements made on the Technetium generator in Dublin Airport a maximum dose of the order of 1 to 1.5 mSv could possibly have been received by the van driver from carrying the generators. An additional dose of c.400 μSv could have accrued from transporting the generators giving rise to a maximum dose of the order of 2 mSv over the exposure period. An estimated dose of this magnitude is not consistent with a recorded TLD dose of 11.5 mSv over the exposure period.

In the course of further discussions with the van driver it transpired that the Technetium generators were, more than likely, stowed directly behind the driver's seat in the front of the vehicle, as this allowed easier access to the generators by the driver.

Stowing the generators directly behind the driver's seat could have given rise to dose rates of the order of 500 μSv/hr over several hours each Saturday. If we assume 3 hours at 500 μSv/hr and a further 3 hours at 200 μSv/hr then the van driver could have received a dose of the order of 2 mSv per week from transporting the generators giving rise to a total dose from transporting and carrying the generators of the order of 12 mSv.

❑ Conclusions and lessons learned

It is the opinion of the Regulatory Services Division that the high dose received by the van driver was as a consequence of a lack of understanding of the radiation hazard associated with the products he is transporting, and of a deficiency of appropriate training and supervision by the Distributor. Stowing the generators in the front end of the vehicle is not consistent with the "Notes for Drivers" issued by the Regulatory Service, and is also a clear breach of the Distributor's own stated work procedures.

The Distributor was asked to update/amend their Radiation Safety Procedures or Local Rules and to revise their staff training to emphasise that:

a) Technetium generators should always be stowed in the rear of transport vehicles in order to ensure that the radiation dose rate at the driver's seat is less than 20 μSv/hr when the transport vehicle is fully loaded.

b) Once outside the transport vehicle the Technetium generators should only be moved around on a designated trolley provided by his employer. Drivers should not, under any circumstances, physically carry generators into client's premises.

This incident highlighted:

1) The merits of drivers wearing TLDs as it was through this practice that the circumstances giving rise to unacceptable radiation doses to this particular van driver was discovered.

2) The benefits of conducting dose reconstructions following incidents of high recorded doses.

3) Inspections carried out by Regulatory Authorities on licensed Distributors should always include field inspections of the transport side of things.