Radiological Decontamination and Decommissioning of a Life Sciences Facility, etc.
Craig Morrissey, Aurora Health Physics Services

The presentation will focus on the decommissioning strategy adopted by several life sciences organisations and Aurora in the radiological decontamination and decommissioning of a number of UK R&D facilities. Examples dealing with the radiological contamination challenges in other sectors including higher education, former MoD sites, and brownfield sites will also be included.

Title of Study: Considerations for management of widespread Lu177 contamination: A case study of a leaking hot toilet.

Submitters details: James Hubber, Imperial College Hospitals NHS Trust

Background. Considerations are presented for the management of a “worst case scenario” Lu177 contamination, based on a case study of a significant leak from a faulty toilet waste pipe following an administration of Lu177-PSMA. A patient was administered 7.4 GBq Lu177-PSMA as an outpatient, having exclusive access to a Nuclear Medicine toilet. Approximately 1 hour post discharge, Nuclear Medicine were made aware of a significant leak on the floor below, in an outpatients department. The origin of the leak was suspected to be the Nuclear Medicine soil pipe, which following subsequent investigation had become blocked and placed unusually high pressure on a faulty seal. Non-radiation workers had been working in the room when the leak had begun.

Methods. Routine good practice techniques were utilised, with adaptations made where necessary to handle the unique and challenging scenario. Dose-rate measurements were made regularly to ensure safe working practices. Levels or radioactivity were assessed using contamination monitors and by counting waste water samples on a Gamma Counter. Risk Assessment was performed for all work aspects of decontaminating the room/ preparing it for public use, and subsequently the room was designated a Controlled Area under IRR17.

Results. The leak resulted in approximately 5L of waste water contaminated with Lu177 spreading in a single outpatient’s clinic room measuring 3m x 4m. One day post administration the estimated activity concentration in the waste water was 90MBq per litre. An initial floor decontamination took 3 people approximately 6 hours, and yielded 60L of solid waste in 2 x 30L sharps bins, with an estimated 107MBq of Lu177. The following week, heavily contaminated ceiling tiles were removed in 2 x 30L sharps bin measuring 45MBq Lu177. Dose-rates at the centre of the room following floor decontamination were measured to be 2μSv/hr. The dose-rate 1cm from the contaminated ceiling tile was measured at 200μSv/hr. The room remained designated as a Controlled Area and unusable for approximately 2 months.

Discussion. Despite the large volume of contaminated waste water, the contamination was contained within a single lockable room. The management of the spill could be broken down into 4 clear phases; containment of contamination and monitoring of personnel, decontamination of floor and surfaces to allow for inspection, preparation for drain clearance, and preparation for plumbing repairs. An initial decontamination procedure was performed on the room’s floor, to allow for staff to enter the room to assess the wider extent of the issue. This allowed risk assessment to be performed for the subsequent aspects of making the necessary repairs. Certain aspects of the job including clearing the blocked pipe, and repair of the pipe, were not possible due to the measured dose-rates. The clinical need for the space, and the risks to staff members performing the repairs were assessed, with the conclusion being it was not possible to decontaminate the area whilst keeping staff doses low and minimising the possibility of incidents. Thus, the most appropriate course was to allow the radioactivity to decay to safe levels before the work was carried out.

Conclusion. Extensive contamination of long-lived radionuclides can be exceptionally challenging to manage. Breaking down tasks and re-evaluating management plans at regular intervals was key to ensuring the situation was handled safely and effectively. The later phases of drain unblocking and repair should only be performed with full collaboration with estates and external contractors to ensure all workers are safe.

Abstract for RWA Update Meeting – June 13th 2023

Title:

Experience of and actions from, a cluster of externally reportable radioactive waste bag incidents across the Trust

- ***Aims and/or Background***: Description of the events and root causes of the externally reportable radioactive waste bag incidents reported to the EA and ONR over the past 12 to 18 months and to explain the actions taken to minimise and prevent further similar incidents from occurring in the future.
- ***Methods***: Report on actions taken including monitoring, retrieving waste, training staff, reviewing and auditing pathways, changing EHRS system, purchasing security items and updating processes and documentation.
- ***Results*****:** No externally reportable incidents occurring. Actions taken and processes implemented have prevented the incidents from re-occurring.
- ***Discussion around results*** Some obvious and practical things to share that were simple in hindsight but not previously considered necessary.
- ***Conclusion*****:** Simple and practical ways to prevent loss of control of radioactive waste across the Trust from various departments.
- ***Key Words:*** Incident, waste, radiation, reportable, causes, actions, prevention.

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How to demonstrate competence for sealed source authorisation and training

- ***Aims and/or Background***: More training and competence needs to be demonstrated in all areas. This talk discusses a presentation along with quiz assessment to demonstrate this evidence for users of sealed sources.
- ***Methods***: Demonstrating training requirements is a requirement under IRR17 (regulation 15). Additionally, 'maintaining records demonstrating compliance' regarding 'using sufficient competent persons and resources' is a general management condition of sealed source EA Permits. The training presentation was designed to be sent to anyone who uses or has access to sealed sources in a particular area. It covers basics of radiation protection, relevant legislation, what a sealed source is and practicalities of use. These have been adapted for use in nuclear medicine and radiotherapy. The quiz covers 15 questions with a pass mark of 80% and can then be used as evidence to demonstrate compliance with the above training requirements.
- ***Results*****:** All users have passed the quiz, mostly with 100% and feedback has been that users have found it a useful summary. For new staff it covers the basics for relevant legislation and responsibilities. Having a marked quiz assessment is a clear way to demonstrate competence in using sealed sources.
- ***Conclusion*****:** Marked assessments is a good way to demonstrate competence for users of sealed sources. Passing the assessment before being given access to sealed sources is useful for security purposes.
- ***Key Words:*** Sealed source, competence assessment.

Radionuclide contamination in Iodine-123 radiopharmaceuticals

Helen Davison, County Durham and Darlington NHS Foundation Trust

Background. Iodine-125 and Tellurium-121 are known contaminants of cyclotron produced Iodine-123 products. A general level of radionuclidic purity is provided with each kit, however, the exact levels of contaminants are not well documented. Different sources (for example Summaries of Product Characteristics and radionuclide calibration certificates provided by the National Physical Laboratory) suggest different levels of contaminant as a fraction of the Iodine-123 activity. At this site, radioactive waste generated by Iodine-123 procedures is managed through decay storage of used vials to “Very Low Level Waste” (VLLW) activity concentration, assuming a small amount of long-lived contaminant. However, the assumptions used for Iodine-125 contaminant meant that some waste would not decay to VLLW activities within the accumulation period of the site environmental permit and so the waste would have to be consigned and disposed as Low Level Waste.

Methods. A small selection (n=12) of Iodine-123 radiopharmaceutical kits were analysed using a Packard Cobra 5003 sample counter, to measure the activity of Iodine-125 present in the samples. The activities were then decay corrected to provide an estimate of the activities of each radionuclide the time of reference of the product.

Results. All samples demonstrated some contamination of Iodine-125 in the Iodine-123 product. However, the estimated activity (expressed as a fraction of the reference Iodine-123 activity) was consistently lower than the assumptions used in the local waste calculations.

Conclusion. This study has allowed a lower Iodine-125 contaminant value to be applied when calculating waste for decay storage locally. This means that the waste going into each sharps bin no longer needs to be actively and conservatively managed, and there is a reduction in the number of consignments as low level waste for small sharps bins.

Disposal of a cell irradiator

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Background.

A cell irradiator containing two high activity sealed sources needed to be disposed from a hospital site as it was no longer being used. The disposal was needed quickly in order to avoid non-compliance with the site permit. This paper describes the actions taken to enable the process and successfully transfer the source off site.

Methods.

Radiation Safety liaised with the hospital site, the source transfer company and the Environment Agency to ensure compliance with The Environmental Permitting Regulations[1] and The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations[2] for the transfer of the source. The Shipments of Radioactive Substances (EU Exit) Regulations[3] were also considered. A Type B package was used for the transport of the cell irradiator.

This liaison involved giving advice, overseeing the documentation and procedures and being present on site on the day of transfer. Security of the source and site were also considered.

Results.

The source was transferred off site smoothly with appropriate input from all stakeholders. The required documentation was completed before and after the transfer and the relevant regulations were complied with.

Discussion and Conclusion.

Even though the transfer of the source went smoothly and regulatory compliance ensured, the process highlighted some issues with communication and availability of equipment which provided learning opportunities for the future.

Key references.

1. The Environmental Permitting Regulations 2016 (as amended) SI 2016 No. 1154
2. The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 (as amended) SI 2009 No. 1348
3. The Shipments of Radioactive Substances (EU Exit) Regulations SI 2019 No. 571

Revised IRAT Methodology – Implications for Medical & University Users

Tony Hughes, Christie Medical Physics & Engineering

Background.

A methodology for performing initial radiological assessments using dose per unit release (DPUR) factors was published in 2006 [1] and has been widely adopted to estimate doses to members of the public from environmental discharges via different routes. This technique was revised in 2022 [2] to incorporate up-to-date models and data, include additional radionuclides and exposure groups and formally incorporate an assessment of dose rates to wildlife. This presentation will review some of the changes made to DPURs for radionuclides frequently used in hospitals and universities and explore how these changes may affect the estimated doses to the public for existing practices.

Methods.

DPURs for discharges to the atmosphere and to the sewer were compared for the 2006 and 2022 methodologies for 27 radionuclides used in medicine or research. Radiological assessments were also performed using the two IRAT methods for releases to the atmosphere & sewer involving typical combinations of radionuclides.

Results & Discussion

DPURs were introduced for several novel radionuclides with medical applications in the 2022 methodology: Ga68, Cu64, Zr89, I124, At211 and Ac225. Additionally, the DPURs for discharges to sewer were modified for several of the 27 radionuclides surveyed, in some instances by a factor of 10 or more. Applying these new DPURs to dose estimation for releases to sewer resulted in significant increases for ‘children playing in a brook’ and the ‘angler family’. Some discrepancies in the ‘partitioning and decay factor’ (Qeff), were also discovered for 2 radionuclides which affected the dose estimate for the ‘angler family’, the ‘irrigated food family’ and the ‘fishing family’.

Changes to DPURs for atmospheric discharges were mostly within ±30%. The only exceptions were for I123, which increased by a factor of 28 and P32 which was reduced by a factor of 2.8. Doses due to atmospheric releases were largely unchanged except were significant amounts of I123 or P32 were involved. The DPURs for alpha-emitting radionuclides were typically 25-50 times higher than those for beta-gamma emitting radionuclides in the 2022 methodology.

Key references.

1. “Initial radiological assessment methodology – part 2 methods and input data”, Science Report: SC030162/SR2, 2006
2. “Initial radiological assessment tool 2: part 2 methods and input data”, Chief Scientist’s Group report, 2022