

Maximum Activity of Radium-223 for Cremation of Corpses Without Special Precaution

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Introduction

Radium-223 (Ra223) dichloride is an alpha-emitting radiopharmaceutical used for treatment of bone metastases from prostate cancer. There is no UK guidance on the safe cremation of patients who die shortly after such treatment.

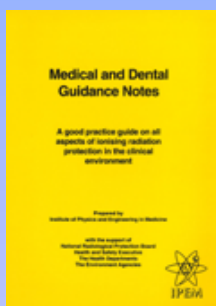


Aim

Determine the maximum retained activity when a corpse may be safely cremated.

Methods

- Three methods were used
- Assumed dose constraint of 0.3mSv and 50 cremated corpses per year



Method 1

- Method used in Medical & Dental Guidance Notes (MDGN) for P-32 and Y-90
- Set at 1/3 of the total activity limit requiring an area to be designated as controlled under the superseded Ionising Radiations Regulations 1985 (IRR85) [Schedule 2, Column 5]

Method 2

- Adaptation of the method used for Sr-89, described in IPSM Report 30 and adopted by the MDGN
- Ratio of ICRP119 dose coefficients for Sr-89 and Ra-223 used to convert Sr-89 inhalation and ingestion doses to dose/kBq of retained Ra-223



Method 3

- Adaptation of the method described in IPEM report 106 for cremation of corpses containing I-125 brachytherapy seeds
- Assumes:
 - 2.5kg ashes produced
 - 10mg of ash inhaled and 10mg ingested (considered a pessimistic assumption)
- ICRP dose coefficients for Ra-223

Results for Method 1

- IRR1985 controlled area limit for Ra-223 = 0.3MBq.
- Suggests cremation limit of 100kBq

Results for Method 2 & 3

| | Method 2 | Method 3 |
|---|-----------------------|-----------------------|
| Inhalation ($\mu\text{Sv}/\text{kBq}$ retained) | 3.15×10^{-3} | 2.76×10^{-2} |
| Ingestion ($\mu\text{Sv}/\text{kBq}$ retained) | 3.08×10^{-5} | 4.00×10^{-4} |
| Retained Activity (MBq) to give 0.3mSv | 94 | 11 |
| Average Retained Activity (kBq)/patient (for 50 cremated corpses) | 1880 | 220 |

Other Relevant Work

Pryor et al¹ detected no contamination at a crematorium following cremations of 2 patients with estimated retained activities of 80 and 200kBq of Ra-223

Discussion

IPEM Report 106 gave the most detail about the method used and was based on current legislation, allowing more confidence in the adaptation to Ra-223
The calculated limit using this method is in keeping with the measurements made by Pryor et al¹

Conclusion

A maximum retained activity of 200kBq is suggested for the cremation of corpses without special precautions