

Effectiveness of various shields in minimizing radiation exposure for Lu-177 based radiopharmaceutical delivery

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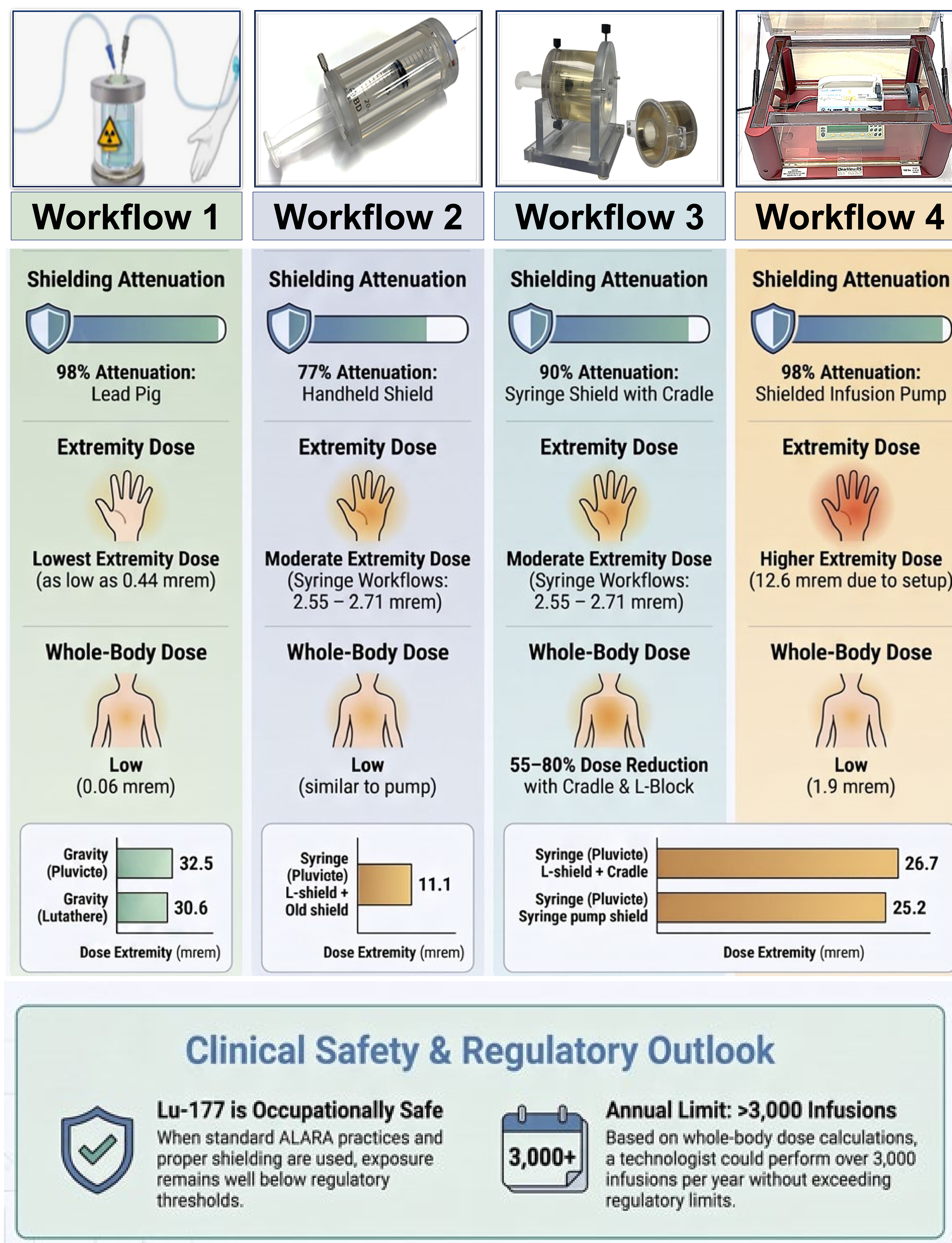
Purpose

Occupational exposure during Lu-177 radiopharmaceutical therapy depends on administration technique, shielding configuration, and staff proximity—temporal and spatial. This study quantified extremity and whole-body exposure contributions for varying Lu-177 administration workflows.

Methods & Materials

Exposure estimates were evaluated using a representative 200 mCi Lu-177 therapy dose (Pluvicto™/Lutathera™) utilizing a gamma constant of 0.028 mrem·hr⁻¹·mCi⁻¹ at 1 meter. Instantaneous radiation exposure rates were collected using two ion-chamber survey meters. Per-infusion technologist extremity and whole-body exposures were estimated assuming clinically realistic handling times across four distinct administration workflows:

- **Workflow 1:** Gravity-based vial using a lead pig.
- **Workflow 2:** Handheld ClearView® syringe shield without a cradle.
- **Workflow 3:** ClearView® administration and transport shield with a cradle.
- **Workflow 4:** Shielded infusion pump system



Results

- **Shielding attenuation:** Lead pig and shielded infusion pump achieved ~98% attenuation; Clearview syringe shield 77%; Clearview administration/transport shield 90%.
- **Extremity dose:** 0.44 mrem (gravity), 2.55–2.71 mrem (syringe), and 12.6 mrem (injector). Unshielded/modified configurations increased doses to 25.2–32.5 mrem.
- **Whole-body dose:** Low across all workflows: 0.06–0.58 mrem (gravity), 0.26–1.31 mrem (syringe), and ~1.9 mrem (injector).
- **Dose reduction:** Syringe cradle with L-block reduced whole-body and lens doses by **55–80%** compared with standard syringe shielding.
- **Annual workload:** Estimated limits exceeded **3,000 infusions/year** for all workflows, well above typical clinical volumes.

Conclusion

Lu-177 therapy administration results in minimal occupational exposure when standard shielding and ALARA practices are used. Estimated technologist doses remain well below regulatory limits supporting Lu-177 therapy as an occupationally safe procedure.