

Automated Decontamination of Floor Surfaces

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Introduction

Radioiodine therapy

- Twice per week at SCGH
- INDICATION: thyroid carcinoma to ablate remnant thyroid tissue
- ADMINISTRATION: oral
- UPTAKE: remaining active thyroid tissue
- EXCRETION: through the urine. Saliva and sweat also be mildly radioactive
- PATIENT CARE: held in isolation for several days following treatment.
- DISCHARGE: when activity drops below 600 MBq due to radioactive decay and excretion.
- DECONTAMINATION: Following discharge, the physicist detects and removes contamination from the surfaces, items and floors on the ward



Introduction

Decontamination

The original method

- Process = Vacuum, wet mop
- Time = 30 mins
- Hazards = vacuum bag, mop bucket, time



The new method

- Process = Automatic vacuum and mopping device
- Time = 5 mins intervention (45 min auto clean)
- Hazards = minimal (tip dirty water down drain)



Introduction

iRobot Scooba

- SCGH has recently acquired a floor washing robot
- FEATURES:
 - navigates throughout room in a 45-min cycle
 - washes beneath cabinet edges, tables, chairs, etc
 - Infra red barrier confines robot to room
 - 4-stages; prep, wash, scrub and squeegee linoleum floors
 - uses only clean solution to wash floors
 - used water contained in “dirty” tank
- COST: Approximately \$800
- DEMO: <http://store.irobot.com/home/index.jsp>



The project

Aim

- Establish floor surface contamination levels in the room to evaluate the effectiveness of the robot and assess the benefits of automated surface decontamination

Criteria

1. effectiveness of decontamination
2. time impost
3. economy
4. occupational safety and health

Methods

Detection of contamination

- DIRECT Geiger Mueller (GM) counter for direct measurement of fixed and removable
- INDIRECT Wipe testing for removable contamination (10 cm x 10 cm wipe on moistened filter paper, 30 min count for betas in internal gas flow proportional chamber)

Experimental design

- 1) CONTROLLED deliberate radioiodine spill on linoleum off-cut
- 2) IN SITU decontamination on the ward

1) Controlled experiment



Aim

- Assess the effectiveness of the iRobot in removing I-131 from linoleum

Method

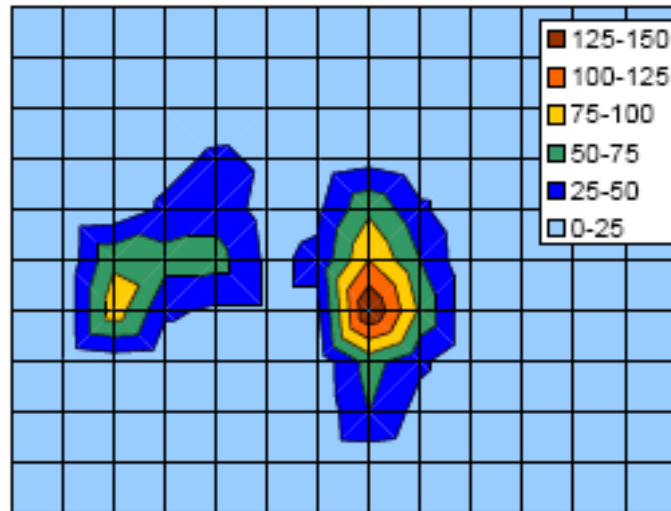
- Sourced a linoleum offcut and drew a 5 cm x 5 cm grid
- Deliberately contaminated with I-131 and left to dry
- GM count rate at each of 154 grid locations
- Wipe tests 10 cm x 10cm (35 data points)
- Sectioned lino in two and cleaned half

24 November 2009 Slide 7

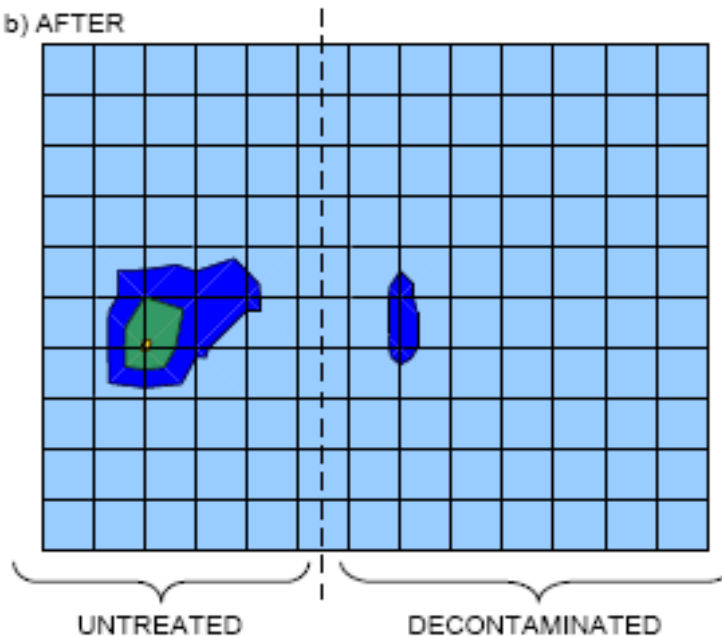


1) Controlled experiment

a) BEFORE



b) AFTER



Results - GM counts (cps)

- Radioiodine contamination pattern on linoleum
 - a) Before treatment
 - b) After treatment of right hand portion only by automated decontamination
- Significant reduction in count rate from 150 cps to 30 cps
- pattern of contamination confirms the iodine was removed by the robot, rather than spread around the linoleum

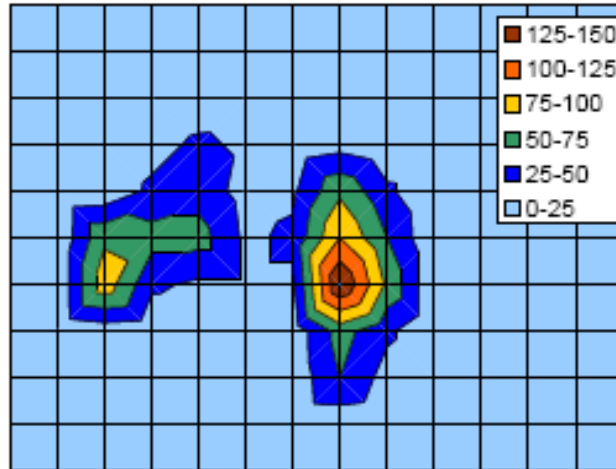
1) Controlled experiment



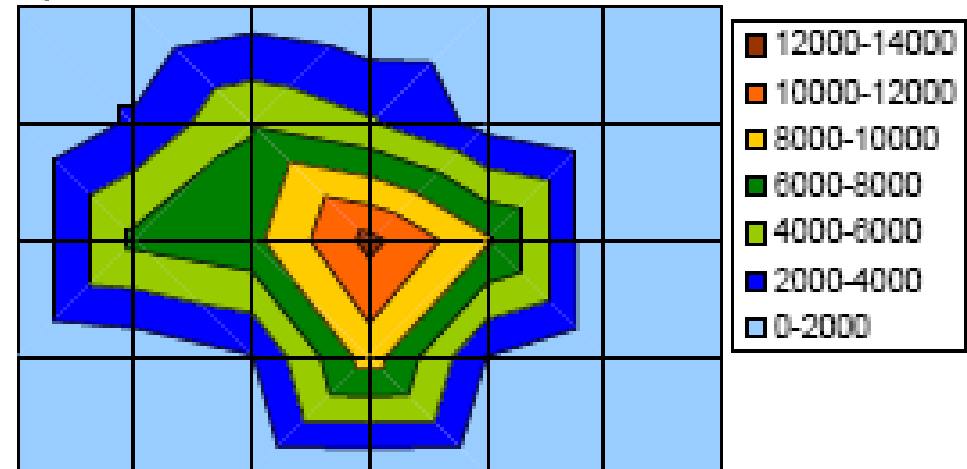
Results - GM counts (cps)

Results - Wipe test (cpm)

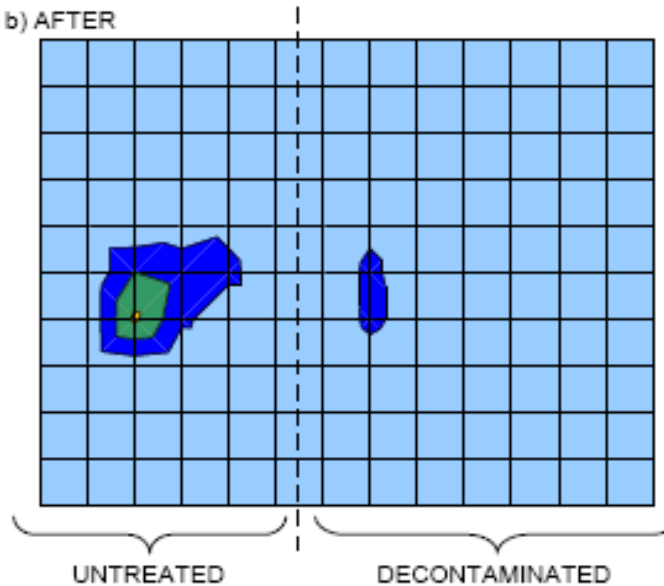
a) BEFORE



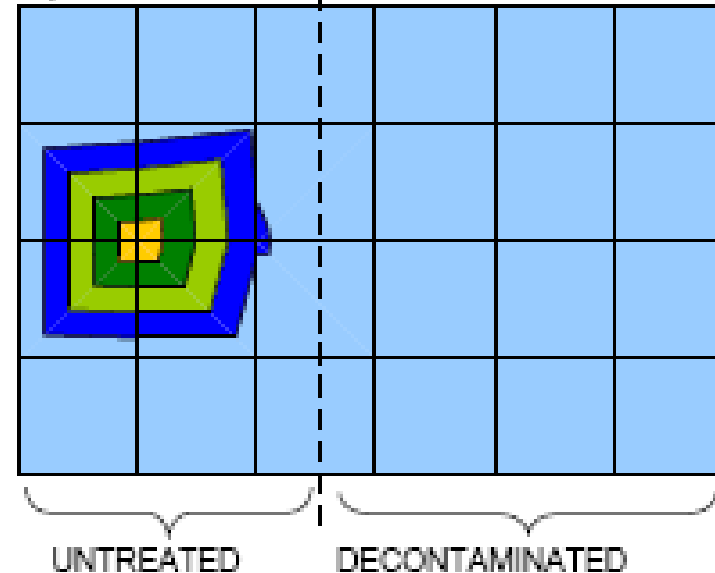
a) BEFORE



b) AFTER



b) AFTER



2) In situ ward contamination

Aim

- Establish floor surface contamination levels in the room to evaluate the effectiveness of the robot and assess the benefits of automated surface decontamination



Method - Measurement Times

- GM and wipe testing measurements made at several stages during the therapy and decontamination:
 1. BEFORE: Before patient admission for therapy
 2. DISCHARGE: Immediately following discharge of the patient
 3. DECON1: after one pass of decontamination by the robot
 4. DECON2: after a second pass of decontamination by the robot

2) In situ ward contamination



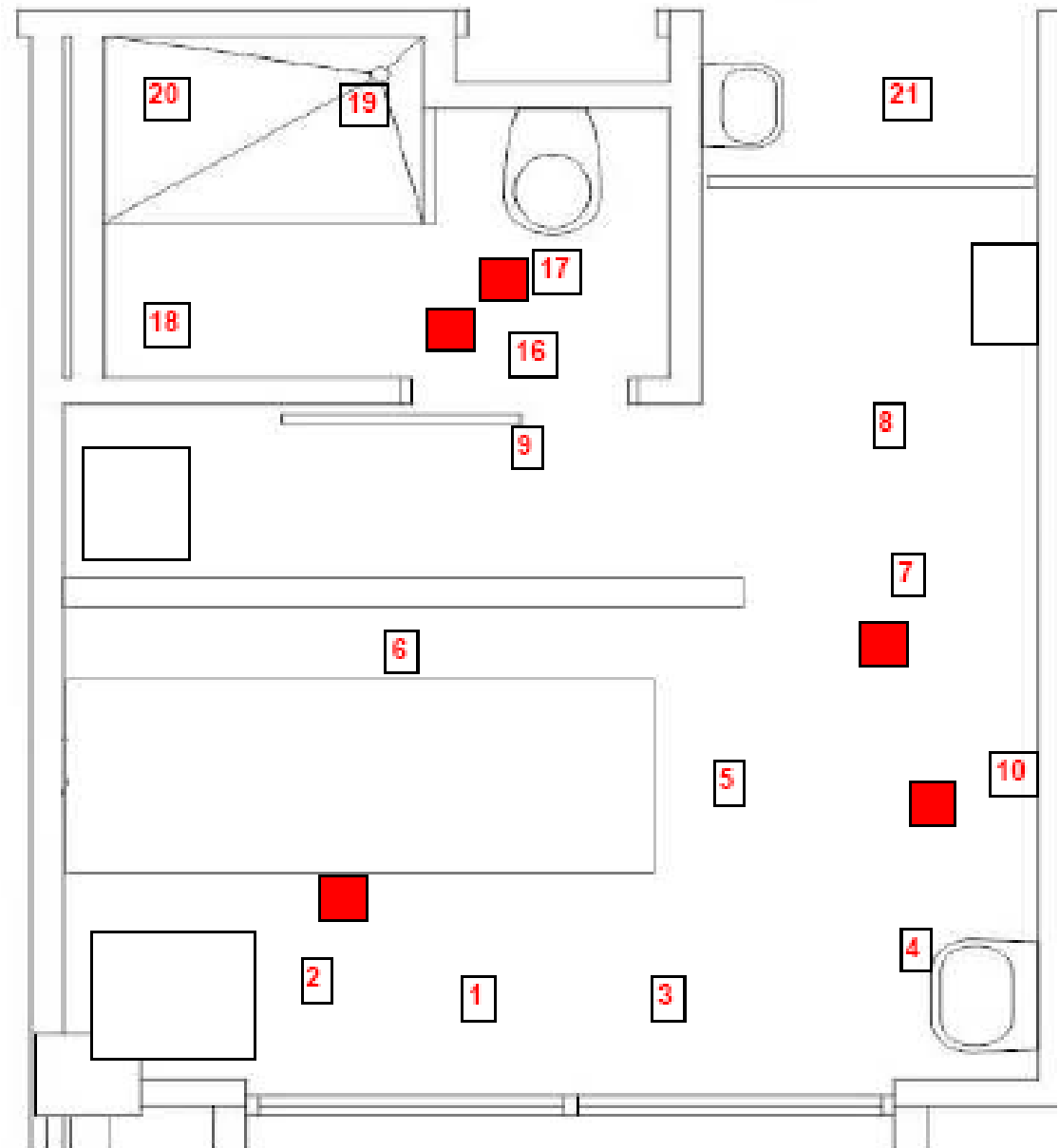
Method - Measurement Locations

- 15 typical locations 
- 5 hotspots 
- background

Method - Standard Curve

- Calibrated wipe tests

Room 18B



Conclusions

1. ✓ *Effective decontamination*

Removed rather than spreading contaminants

60 - 80 % removed

Contamination within limits



2. ✓ *Time effective*

5 mins Scooba intervention vs 30 min



3. ✓ *Cost effective*

Reduction in physicist's time offset the initial outlay within a few months

4. ✓ *Occupational safety and health*

Minimised time spent in the contaminated room

Minimised risk of internal exposure

Acknowledgements

Collaborators

Cameron Storm (Radiation Health, Department of Health, WA) for counting the wipe tests

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Steve Crossley (Medical Technology & Physics, SCGH) for the seemingly outlandish idea to replace ourselves with robots

References

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24 November 2009 Slide 14



Thank you
for your
attention!

