

# Jason Barney, RRPT

Health Physicist

The University of Kansas Hospital

Kansas City, Kansas

**Ranked Best.**  
10 Years and Counting.



# A Strange Thing Happened on the Way Back from Last Year's OAS Meeting...

## Y-90 Therasphere Incident Aug 24, 2017

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# Objectives

## “ Describe the Incident

- . The place
- . The players
- . Chain of events

## “ Lessons Learned

- . Root Cause and Corrective Action
  - “ Training
  - “ Procedures

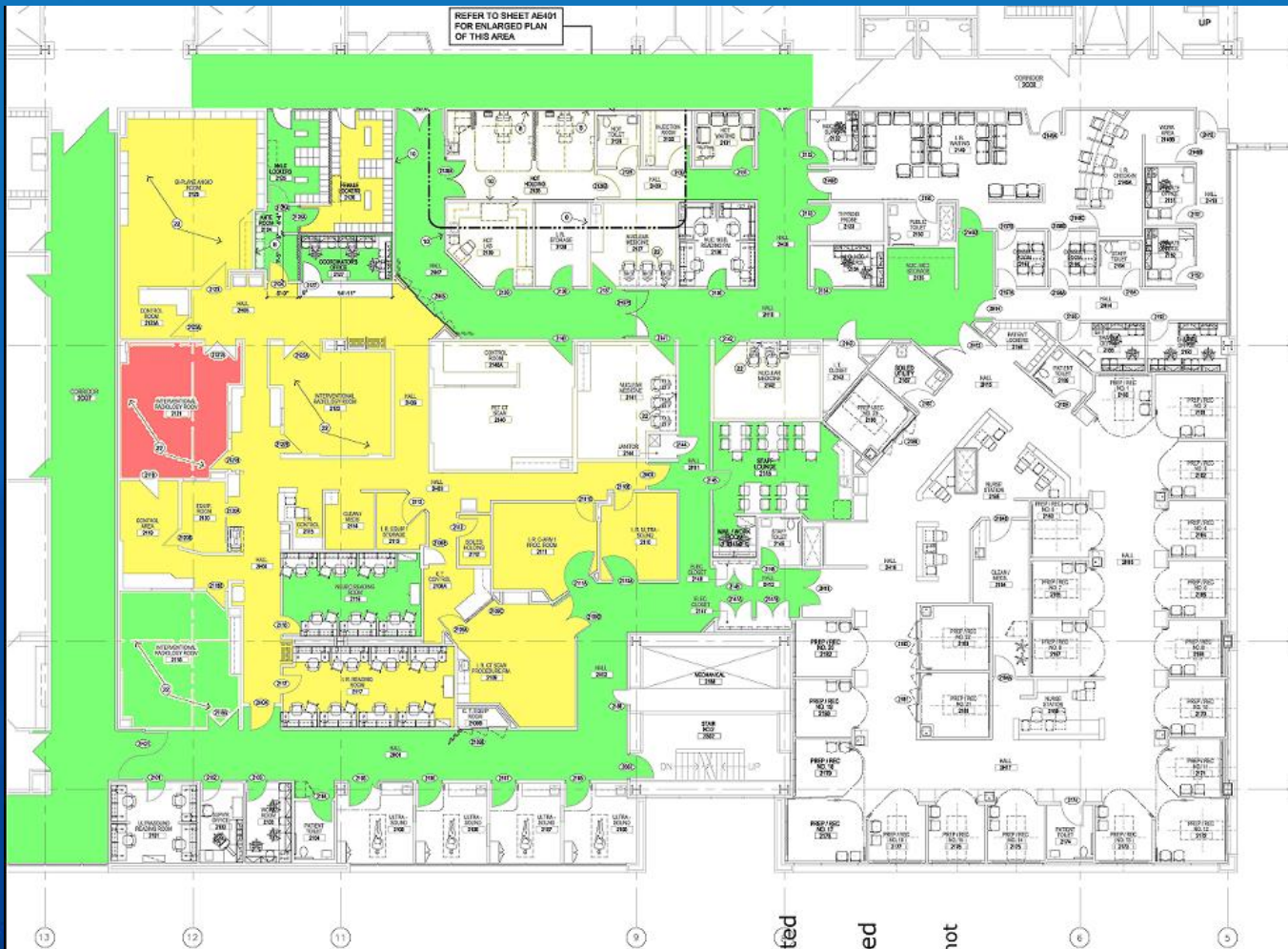


# THE PLACE and PROCESS

- University of Kansas Hospital
  - Interventional Radiology (IR)
    - 2<sup>nd</sup> Floor of Main Hospital
    - 6 IR suites affected
    - 3 IR suites primary Y-90 therapy



# THE PLACE and PROCESS



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# THE PLACE and PROCESS

- Y-90 Therasphere Therapy
  - Treatment of liver cancer (HCC)
  - Delivered by catheter through the hepatic artery
    - High energy beta-emitter with 64 hour T1/2
    - Neutron activated from Y-89
    - Glass microspheres 20 – 30 microns
    - THERA – High Specific Activity vs SIRSPHERE
      - 2500 Bq per sphere vs 50
  - Approximately 7 procedures a week



# THE PEOPLE

- Interventional Radiology
  - Two MDs (with fellows)
  - Nurses, techs, anesthesiologists
- Radiation Safety
  - Radiation Safety Officer (RSO)
  - Health Physicist (HP)
  - Two Rad Safety Program Coordinators (RSPC)
- Radiology Staff
  - Director
  - Assistant Director
  - Managers





# THE PEOPLE



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THE INCIDENT  
Aug 24, 2017  
Approximately 4:00 PM

Boarding the plane when suddenly the  
phone rings...



# TIMELINE

- “ Layover Dallas Ft. Worth
  - . Hospital Incident Command activated
  - . RSO (Tom Conley) receives call from VP
    - “ Considered bringing in a Hazmat team
    - “ RSO advised against until an assessment could be done
  - . HP reestablishes contact with RSPC
  - . Received conflicting information on status and scale
    - “ The RUMOR MILL was in full swing
    - “ Through RSPCs, able to determine actual extent and assess situation
    - “ Gave direction to begin clean up

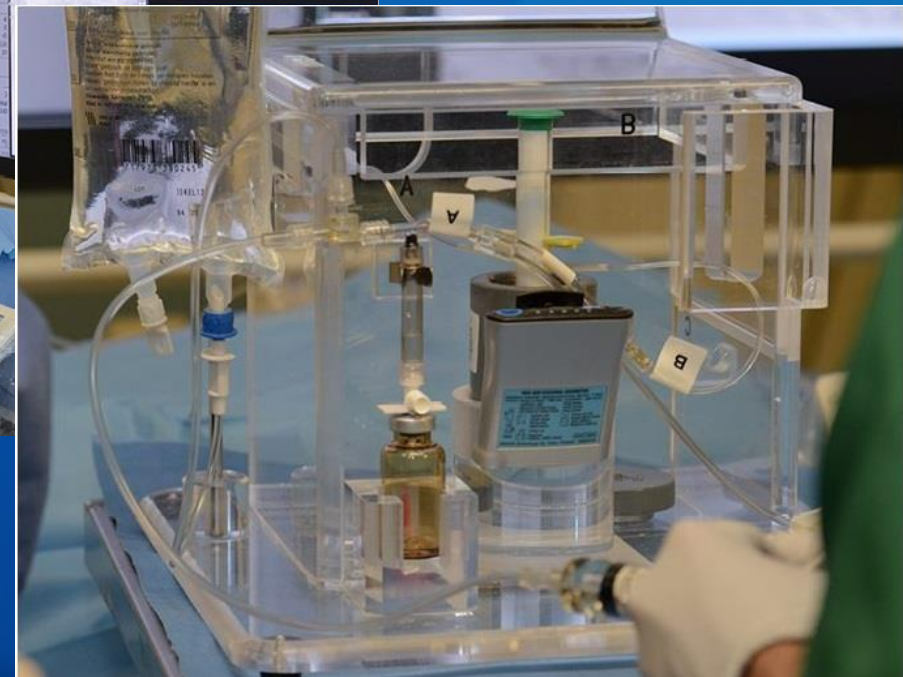


# TIMELINE - Thursday

- “ Approximately 3:15 PM August 24, 2017
- “ Therasphere setup in IR procedure room 2
- “ *Vial pierced prior to priming the system*
  - . *Technologist attempted to prime the system*
- “ Release of ~ 40 mCi of Y-90 microspheres in liquid
- “ Tech left the room to consult with physician AU
- “ Contamination into the central core hallway
- “ Staff spread contamination to other areas within IR.



# TIMELINE - Thursday



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# TIMELINE - Thursday

- “ Tech was surveyed and found to be contaminated
  - . Placed into a bunny suit and booties
  - . Escorted to ED decon shower
- “ Perimeter established through physical controls and onsite security.
  - . Surveys continued to further establish non-contamination zones



# TIMELINE - Thursday

**BACK ON THE PLANE!!!**



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# TIMELINE . Thursday 10:30 PM

- . RSO and HP onsite
- . Confirmation from RSPCs that no contamination outside of IR.
  - “ Extensive surveys of hallway, stairwells, walls, floors, personnel.
- . No other personnel contaminated
  - “ All personnel leaving IR surveyed
  - “ About 4 pair of shoes confiscated
- . Determination made by RSO and administrative staff to shut down IR until department could be adequately assessed and cleared of contamination.





# TIMELINE - Friday

## THE ASSESSMENT AND CLEANUP

- “ Friday . Aug 25
- “ State agency (KDHE) notified
- “ SURVEYS! MORE SURVEYS!
  - . All Rooms and areas within IR cleared by survey and wipe test.
    - “ EXCEPTION - IR suite #2 (location of spill)
  - . Several contamination areas found outside of IR 2
    - “ In front of sink
    - “ Carpet in reading room
    - “ Hallway in main corridor (multiple)
  - . IR suite 3



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# TIMELINE - Monday

## State Regulatory Agency

- “ KDHE reactionary inspection
  - . Through interviews the team confirmed the timeline
  - . Confirmed assessment of contamination
  - . Determined root cause to be inadequate training
- “ State cognizant of allowing us to adequately assess and begin cleanup with a focus on patient care
  - . Discussed definition of abnormal occurrence and medical event.
  - . Determined the incident did not meet either criteria



# TIMELINE . Monday/Tuesday IR Suite 2 DECON

“ IR Suite 2 - Extensive Contamination



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# TIMELINE . Monday/Tuesday IR Suite 2 DECON

“ IR Suite 2 - Extensive Contamination

“ Masslin wipes

“ Dawn dish soap

“ Scrape and survey



This is my Ludlum Model 26-1!  
There are many like it but this one is mine!



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# DOSE TO TECHNOLOGIST

Skin Dose equation

$$H_{T(skin)} = \frac{C_{skin} \times CF_{Beta-skin} \times t}{SF_{Beta}}$$

Where

$H_{T(skin)}$  = Equivalent dose to the skin [ $\mu\text{Gy}$ ].

$C_{skin}$  = Average surface concentration of radionuclide on skin or clothing [ $\text{Bq}/\text{cm}^2$ ].

$CF_{Beta-skin}$  = Conversion factor: skin beta dose rate [ $(\mu\text{Gy}/\text{h})/(\text{Bq}/\text{cm}^2)$ ].

$SF_{Beta}$  = Shielding factor for beta radiation due to clothing; representative values of shielding factors are approximately 3 - 5 for light clothing and 1000 for heavy clothing.

$t$  = Time of exposure [h]

ncpm	Probe area $\text{cm}^2$	Probe eff.	$C_{skin}$ ( $\text{Bq}/\text{cm}^2$ )	$C_{beta-skin}$ [ $(\mu\text{Gy}/\text{h})/(\text{Bq}/\text{cm}^2)$ ]	$Sf_{beta}$	$t$ (h)	Skin Dose ( $\mu\text{Gy}$ )	Skin Dose (rad)	Assumptions
90000	12.25	0.22	557	2	5	2	445	0.045	All contamination was on clothing
660	12.25	0.22	4	2	5	2	3	0.000	Skin contamination found after initial decon



# ROOT CAUSE ANALYSIS

“ Entire process reviewed including written procedures and policies.

Determination of lack of adequate training on specifics of process during set up.

Determination that Y-90 procedures were inadequate in certain areas (box set-up in particular)



# LESSONS LEARNED and CHANGES IMPLEMENTED

- . Hands-on Vendor training on box prep and setup for both types of Y-90 microspheres
- . Developed extensive and specific training for Y-90 techs, nurses, and physicians on Y-90 and radiation contamination control fundamentals.





# LESSONS LEARNED and CHANGES IMPLEMENTED

## Procedural changes .

- “ Hand and foot monitor after vial pierce
- “ Only MD pierce the vial
- “ Spill kits specific to RAD developed (small/large)
- “ Use of updated checklist TIMEOUT sheet to be read/reviewed prior to each proc
- “ Flow and accuracy of information



# NOT DONE YET

## “ DECON SHOWER WASTE WATER

- . Sampled and released

## “ THERASPHERE WASTE

- . Due to manufacturing process
- . Long lived impurities
- . Disposed about 2 cubic yards through waste broker



# Would be Done Differently

- “ Survey and decon the tech in the IR locker room
  - . Reduce further risk of contamination increase by keeping tech within IR
  - . Only send to ER decon shower if unable to decon
- “ Instrumentation
  - . MCA (waste constituent analysis)
  - . Gas flow proportional counter
    - “ Floor surveys



# QUESTIONS?



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