

## ABR Oral Exam 2004 Therapeutic Radiological Physics Type

\* Picture of a typical patient's room. Dose rates are written in various places around the room and outside the room. If this were an Ir-192 implant, what would your nursing stay times be? Visitor stay time? What would you do about a patient in the room next door? What if this was Cs-137? I-125?

\* Graph with labels of cost on one ordinate, risk on the other ordinate. This comes from a very old figure in Hendee's book. The idea is if you shield to the extreme, the cost becomes prohibitive. If you don't shield enough, the risk becomes prohibitive. Where the two curves cross is theoretically where you should aim when trying to shield a facility. This question went into details about the shielding calculations (write them down for primary and secondary- explain head leakage, how do you measure it- film around the head of the gantry and then a meter etc...explain sky shine etc...) reading values from NCRP graphs for concrete and Pb. If you have a curve for one material, how would you estimate shielding for a different material? Ans: Figure out the attn coef and using the densities of the 2 materials- find the other attn coef.

\* Shown 2 plans of a lung, what were the differences between the plans. One was corrected for density. This question went into how the computer planning system did the calculation. What did you need to check? Draw a typical CT to density curve. How do you measure that?

\* Draw a 12e electron %DD curve. Label everything (dmax, Rp, etc...). Now superimpose a 12X photon beam on it. Label everything again. Explain in detail the differences. How is an electron vs. a photon produced in a linear accelerator?

\* Shown a picture of an accelerator waveguide with different lengths of compartments labeled L1, L2 etc... What kind of guide was it? It was a standing waveguide where you could electrically optimize the cavities. Explain the differences between a standing and traveling waveguide.

\* Shown a picture of a parallel plate chamber. What is this? How many electrodes? Point out all the parts. Which parts are conducting? What are typical materials of the insulator, the plates? What is the typical electrode spacing? What is an extrapolation chamber? What is a triax cable? Biax? What is the difference?

\* Draw a Kerma vs Dose curve. Explain all the areas of the graph. How do you calculate dose? Explain what Bragg Gray cavity theory is.

\* Question on TG51 vs 21. Picture of graph of well-guarded chambers versus other chambers. This was straight out of TG 51. Explain the graphs. I can't remember the details of the rest of the questions for this one. I just went through how to measure for each of these and what the differences were.

\* Picture of an electron beam hitting a surface obliquely. What is this? Explain what happens to the dose and various points the examiner pointed out. Underneath that, a graph with several %dd

curves at different oblique angles. Which one was the 0 degree? 30, 45 60 degree etc...? Why do the curves look like that?

\* IMRT. How would you commission an IMRT program? What measurements would you make? How would you do the QA. How would you determine that your solid water phantom was really made properly? I said you could CT it and check the density. You could also measure all the geometric components of the chamber hole etc...What kind of doses do you go to with Prostate? What do the femoral heads typically receive? More clinical questions like that.

\* How would you make a chamber? Cylindrical or whatever you want. What are the desirable characteristics? What happens to your measurement when the pressure increases? Decreases? How about temp? Why? Where did this come from ( $PV=nRT$ ). What is changing in the air (mass). What is the equation to correct for temp and press.

\* Shown two head and neck transverse images. What are they? One was CT and one was MRI. Label different components. Most were obvious, parotid etc... But then he asked for the carotid artery, this was very difficult to see. I pointed to a general region where I knew the artery had to be and he seemed satisfied.

\* Shown graphs of different dose models. What are they? Explain the theory behind each one (supralinear, linear quadratic, hormesis etc...) Where does the data come from? What did BEIR V report? Why was it a big deal?

\* What TP sytem do you have? Adac. Ok explain in excruciating detail the superposition convolution algorithm. Why is it called that? What about the electron calcs? Explain the Fermi-Eyges Pencil beam algorithm.

\* When doing a prostate implant with I-125 a seed gets lodged in the bottom of a toilet and is giving 10mR/hr to the rm below (not really feasible but I had to go with it). What would you do? I said take it out- you can't. I said empty the room below- you can't. I said put a few sheets of Pb up there to attenuate. Good. Now tell me exactly how much Pb you would need. Give various HVL's for all different brachy sources.

\* Explain step by step how you would accept and commission a linear accelerator. Make sure you get the order that you would do things correctly i.e. prelim survey as soon as the installer can make beam etc...). What kind of device do you use for survey. Explain GM meters. What are the differences between a GM and other chambers. This guy wanted a lot of detail about finding mechanical isocenter and how you know if radiation isocenter aligns with mechanical isocenter. He wanted to see all axis of rotation etc... What would you have to do extra for a higher energy beam. This went into neutron production. What energy has the highest cross section? How do you measure? Where do most of the neutrons come from? What is the most likely energy of a neutron?

\* How do you treat breast patients at your hospital? Explain 2, 3, 4 and 5 fields. How do you put on the superclav and IM fields. Give details of energy, table angle, gantry angle, collimator

angle. If you use a breast board explain why and what that does.  
Explain segmented forward planning.

\* What QA tests do you do for your MLC? How about if you did step and shoot IMRT? Sliding window IMRT? What document could you refer to? What do you do if something is wrong?

\* What does it mean to register a CT image with an MRI image? How does your tp accomplish this? Why do we do it? How do the automated versions work?

\* Question comparing different types of imagers. There was a graph that you had to explain. He wanted details about which imaging system gave you the best resolution, what was the pixel size etc... How did the different imaging systems work?

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Describe the necessary Acceptance tests for a Fletcher Applicator?

Shown two isodose Mediastinum pictures (single fields)- what is the difference? (homogeneity on vs off) describe the algorithm used (convolution superposition).

Design a safe for a 500 mCi Cesium Source?

You get a Water Equivalent Phantom - prove that it's water equivalent - what goes into this process? Break down what interactions and equations define.

A seed is flushed down the toilet (I-125) what do you do? What if the reading at the base of the toilet is 10mR/hr (in a hospital toilet)? What if a seed is lost in the garbage and headed to the dump?

EPID diagram - DQE - a-Se, a-Si, Video

Matched electron and 6x fields are shown. Talk about the setup

Geometric vs physical penumbra

Design HDR room shielding

Design Radiosurgery room shielding

T1 vs T2 images

5 diagnostic images given. Talk about them and explain how to increase the resolution of each one of them.

DRR given. Define structures shown on the DRR.