

# COMMUNICATING RISK: TO PREGNANT STAFF

UF Health

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## Primary Assumption

- Radiology staff have received education regarding radiation risks during pregnancy.
- Personnel from other departments may not have received this education.

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NCRP Report No. 107  
(1990)

**A**s  
**L**ow  
**A**s  
**R**easonably  
**A**chievable,

economic and **social factors**  
being taken into account.

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### Social factors: Rules and Regulations

**Regulations = Government.**

NRC: Standards for Protection Against Radiation Subpart C—Occupational Dose Limits §20.1208

- (a) The licensee shall ensure that the dose equivalent to the embryo/fetus during the entire pregnancy, due to the occupational exposure of a declared pregnant woman, does not exceed 0.5 rem (5 mSv). (For recordkeeping requirements, see § 20.2106.)
- (b) The licensee shall make efforts to avoid substantial variation above a uniform monthly exposure rate to a declared pregnant woman so as to satisfy the limits in paragraph (a) of this section.
- (c) The dose equivalent to the embryo/fetus is:
  - (1) The deep-dose equivalent to the embryo/fetus of a pregnant woman; and
  - (2) The dose equivalent to the embryo/fetus resulting from radionuclides in the embryo/fetus and radionuclides in the declared pregnant woman.
- (d) If the dose equivalent to the embryo/fetus is found to have exceeded 0.5 rem (5 mSv), or is within 0.05 rem (0.5 mSv) of this dose, by the time the woman declares the pregnancy to the licensee, the licensee shall be deemed to be in compliance with paragraph (a) of this section if the additional dose equivalent to the embryo/fetus does not exceed 0.05 rem (0.5 mSv) during the remainder of the pregnancy.

*BLAH! BLAH! BLAH!*

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### Social factors: Regulations = Government

- NRC: Standards for Protection Against Radiation Subpart C—Occupational Dose Limits §20.1208 (a) The licensee shall ensure that the dose equivalent to the embryo/fetus during the entire pregnancy, due to the occupational exposure of a declared pregnant woman, does not exceed 0.5 rem (5 mSv).

Although Subpart A—General Provisions §20.1003 (a) Definitions include SI units of radiation dose, note:

**NRC: Title 10 CFR Part 20, Subpart L—Records §20.2101(a): Each licensee shall use the units: curie, rem, including multiples and subdivisions, and shall clearly indicate the units of all quantities on records required by the part.**

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### Sample Dosimetry Report

Dose Equivalent (mrem) for Periods Shown Below

		Period Shown Below						Lifetime to Date					
		2014-04-01 to 2014-04-30			QUARTER			YEAR			LIFETIME		
		DDE	LDE	SDE	DDE	LDE	SDE	DDE	LDE	SDE	DDE	LDE	SDE
COLLAR RATAL ASSIGNED	Estimated Conception to Declaration												
	Cumulative Fetal Dose to Date												
CHEST ASSIGNED	Estimated Conception to Declaration												
	Cumulative Fetal Dose to Date										22		

*“Isn't 22 a large number?”*

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## Nowhere are units in mrem!

NRC: Standards for Protection Against Radiation Subpart C—Occupational Dose Limits §20.1208

(a) The licensee shall ensure that the dose equivalent to the embryo/fetus during the entire pregnancy, due to the occupational exposure of a declared pregnant woman, does not exceed 0.5 rem (5 mSv). (For recordkeeping requirements, see § 20.2106.)

(b) The licensee shall make efforts to avoid substantial variation above a uniform monthly exposure rate to a declared pregnant woman so as to satisfy the limit in paragraph (a) of this section.

(c) The dose equivalent to the embryo/fetus is the sum of--

- (1) The deep-dose equivalent to the declared pregnant woman; and
- (2) The dose equivalent to the embryo/fetus resulting from radionuclides in the embryo/fetus and radionuclides in the declared pregnant woman.

(a) If the dose equivalent to the embryo/fetus is found to have exceeded 0.5 rem (5 mSv), or is within 0.05 rem (0.5 mSv) of this dose, by the time the woman declares the pregnancy to the licensee, the licensee shall be deemed to be in compliance with paragraph (a) of this section if the additional dose equivalent to the embryo/fetus does not exceed 0.05 rem (0.5 mSv) during the remainder of the pregnancy.

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## Keeping ALARA from going AWRY

1. Keep units consistent in educational materials, with consideration of the audience.

(Don't worry about Gy vs. Sv, rem and mrem for x rays except in radiology.)

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## The probability of having healthy children is high

Convert from  
mGy to mrem

Occupational  
Dose Limit for  
Embryo/Fetus

Conceptus Dose in mrem:	0 - 500	1,000	5,000
No malformation, %	97	97	97
No cancer (age 0-19), %	99.7	99.6	99.4

0-500 = 0, 50, 100, 250, 500 mrem

From Table 4, ICRP 84 (2000)

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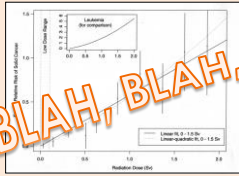
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## Social factors: Science and Probabilities



“Doesn't LNT mean that one photon has the potential to harm my baby?”  
Her perception is her reality!

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## Keeping ALARA from going AWRY

1. Keep units consistent in educational materials, with particular consideration of the audience.
2. Error bars and probabilities may not help the discussion, even with radiologists!

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## Radiology Resident in GI Fluoroscopy

- Priorities and Policies

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## Not Following Policies

- Request from Radiology Director re unacceptably long wait time (6 hr) for patient's GI exam on previous day.
- Pregnant resident had expected unofficial coverage for fluoro procedure from male resident (volunteer).
  - ▣ This had apparently been going on for some time with others.
- Male resident had to cover for sick resident elsewhere.
- Pregnant resident refused to perform patient exam.
- Attending radiologist performed exam at 2 pm.
- Chairman advised resident to understand that her response was based on emotion rather than science.
- All female residents became angry!

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## Keeping ALARA from going AWRY

1. Keep units consistent in educational materials, with particular consideration of the audience.
2. Error bars and probabilities do not help the discussion, even with radiologists!
3. What are peers doing?

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## Surgical Technicians with C-Arm Fluoroscopy

- ALARA and Precedence

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## Problems in OR Staffing

- Request from HR to intervene in staffing problem in OR.
- Two pregnant surgical technicians refused to participate in C-arm procedures.
  - ▣ One had received letter from OB resident stating that she should be excused from working in fluoro, as it was hazardous.
- A third surgical technician was on maternity leave. She had been excused from participation in C-arm procedures.
- OR supervisor was short-staffed.
- OB residency program director (specialist in maternal and fetal medicine) knew the rules & had resident rescind letter.
- Many unhappy people!

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## Pregnant Anesthesiologist in Intra-beam Therapy in OR

- ALARA and Discrimination?

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## Pregnant Anesthesiology Resident in Intra-beam Therapy Cases

- Request from OR Director to defuse problem: Resident concerned because all other surgery staff left the OR during the 45-minute treatments.
  - ▣ Staff left because of ALARA.
- “Why do I have to stay, especially because I am pregnant?”
  - ▣ Worried about dose but had not been wearing a dosimeter.
- Refused to participate in future procedures.

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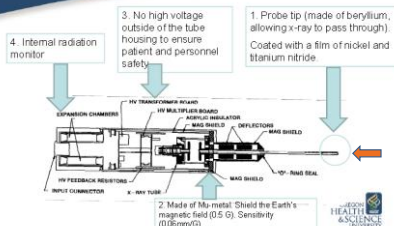
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## The Intrabeam X-Ray Source

### Cutaway view of the intrabeam probe



Slide courtesy of Susha Pillai and Junan Zhang

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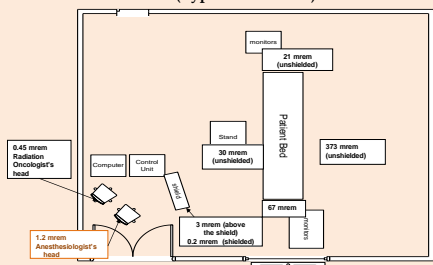
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### Occupational Doses for a 45-minute treatment (Typical Procedure):



Derived from data from August, 2012, survey

Embryo/fetus dose limit: 500 mrem

Survey data from UF Office of Radiation Control August, 2012 by Dr. William Properzio & Dr. David Paulus

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## Personal Responsibility

If you don't wear your dosimeter and turn it in, you cannot know your own occupational dose.

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## Keeping ALARA from going AWRY

1. Keep units consistent in educational materials, with particular consideration of the audience.
2. Error bars and probabilities do not help the discussion, even with radiologists!
3. What are peers doing?
4. What is the social environment?

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## Pregnant Technologist in Radiology

- Pregnant technologist has declared pregnancy
- Senior attending radiologist's comment:  
"I wouldn't do that [fluoroscopy] if I were you!"

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## Policies Regarding Pregnant Workers

- The U. S. Supreme Court ruled in 1991 (*UAW v. Johnson Controls*) that employers could not discriminate against pregnant workers with respect to work assignments:  
"Decisions about the welfare of future children must be left to the parents who conceive, bear, support and raise them rather than to the employers who hire those parents."

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## SPECIAL RULES APPLY FOR PREGNANT WORKERS

...but only if they formally declare pregnancy.

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### Federal Register 1/27/87:

“The health protection objectives...for the unborn should be achieved in accordance with the provisions of Title VII of the Civil Rights Act of 1964...with respect to discrimination in employment practices.”

Declaration of pregnancy must be voluntary!

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### Official Declaration of Pregnancy

- Voluntary
- In writing
- Estimated date of conception

This is a legal document.



- May be withdrawn at any time for any reason!

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## Federal Register 1/27/87:

“Protection of the unborn is a joint responsibility of the employer and the worker.”

Protection may be achieved through:

- ♦ worker self-selection
- ♦ temporary job rotation
- ♦ use of protective equipment

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## Surprising Findings in Job Rotation

- Radiologist shifted work from fluoroscopy to US
- US patients came to US after nuclear medicine injections prior to scanning
- Surprisingly tableside high exposure rates for some patients.

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## Protective Equipment



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### Appropriate Maternity Shielding



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### Inappropriate Shielding



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### Policies Regarding Pregnant Workers

- The American Association for Women Radiologists (AAWR) discourages special work assignments for pregnancy, as they may lead to job discrimination.
- It is most important for the individual to make an agreement with the employer about her work assignment -- and then stick to it!

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## Keeping ALARA from going AWRY

1. Keep units consistent in educational materials, with particular consideration of the audience.
2. Error bars and probabilities do not help the discussion, even with radiologists!
3. What are peers doing?
4. What is the social environment?
5. Provide education, or identify who will.

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