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There are things in our surroundings and in our lifestyles that can affect an embryo/fetus. It is especially important that individuals who work with sources of radiation understand the risks of radiation to the embryo/fetus. Everyone is exposed daily to various kinds of radiation: heat, light, ultraviolet, microwave, ionizing, etc. People are exposed to different amounts of ionizing background radiation depending on how and where they live. This document explains the risks associated with radiation and pregnancy and compares these risks with other risks to the embryo/fetus. This will assist the “Prospective mother” in assessing the potential risk to the embryo/fetus during the course of employment and her rights on the decision whether or not to declare her pregnancy. Also discussed are methods of minimizing the radiation dose and the risk to the embryo/fetus and maintaining radiation dose as low as reasonably achievable.

State of California and Federal regulations require institutions holding radioactive material licenses instruct individuals working with radioactive material or radiation producing machines with regard to pregnancy as appropriate. “Prospective mothers” are workers who are pregnant or actively trying to become pregnant, whether or not they become “declared pregnant workers.” It is UC Berkeley’s policy to inform female radiation workers (employees and students) of the risks to the developing embryo/fetus from exposures to ionizing radiation and the options available to maintain such external and internal exposures as low as reasonably achievable (ALARA) below the legal limit of 500 mRem for “declared pregnant workers.”

***Who Can I Talk To At EH&S?***

Any radiation worker is strongly encouraged to contact the EH&S Radiation Safety Office if they have any questions regarding radiation exposures and pregnancy. These calls, and the medical status of all individuals, are kept strictly confidential. If you are pregnant and would like to declare your pregnancy or are considering pregnancy and would like to talk to someone, please contact the Dosimetry Coordinator, or Radiation Safety Officer, or send an e-mail to: radsafety@berkeley.edu.

The radiation exposure limit for the embryo/fetus can only be enforced if the pregnancy is declared in writing by the mother. A declared pregnancy is one in which a woman voluntarily informs her employer, in writing, of her pregnancy and gives the estimated date of conception by filling out a Declaration of Pregnancy form available at EH&S website.

***Making the Decision to Declare Your Pregnancy***

The decision to declare your pregnancy is completely yours. The State of California and the NRC have set a limit of 500 mRem for fetal exposure. This is 1/10 of the normal yearly exposure limit for radiation workers (see table below). This limit is set is to protect the embryo/fetus from unnecessary radiation levels that may cause developmental risk. There are many factors that should be taken into consideration including individual privacy rights regarding pregnancy/termination of pregnancy, equal employment opportunities, and the possible loss of income. In addition, the declaration of pregnancy may be removed at any time for any reason. The reason does not need to be disclosed.

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| --- | --- | --- |
| **Organ** | **Occupational Worker Dose Limit (mRem/year)** | **Comments** |
| Whole Body | 5,000 | Includes dose from both internal and external emitters |
| Lens of the Eye | 15,000 |  |
| Extremities | 50,000 | Extremities include the arm or leg above the knee or elbow |
| Skin | 50,000 |  |
| **Embryo/Fetus** | **500** | **This limit applies only when a** [**Declaration of Pregnancy**](http://web.princeton.edu/sites/ehs/radmanual/radman_app_e.htm) **has been submitted** |
| Occupational Exposure of a Minor | 500 | Applies to anyone under 18 years of age |
| Member of the General Public | 100 |  |

***Frequently Asked Questions:***

1. **Q:** Can I tell my supervisor or EH&S verbally, rather than in writing, that I am pregnant?
**A:** No, the declaration must be in writing for legal documentation reasons to monitor your dose.
2. **Q:** If I have not declared my pregnancy in writing, but my supervisor notices that I am pregnant, do the lower dose limits apply?
**A:** No. The lower dose limits can apply only if you have declared your pregnancy in writing.
3. **Q:** If I have declared my pregnancy in writing, can I revoke my declaration of pregnancy even if I am still pregnant?
**A:** Yes, it is your right to declare or revoke your pregnancy at any time without an explanation.
4. **Q:** What effect will formally declaring my pregnancy have on my job status?
**A:** You and your supervisor must make this decision. Very few people at UCB receive an annual dose of 500 mRem under normal working conditions. You and your supervisor should discuss ways that your dose may be limited. The Radiation Safety Officer or a member of the Radiation Safety Team will work with you and your supervisor to come up with the best solution.

***What Happens Once Pregnancy is Declared?***

When you have made the decision to declare your pregnancy, contact the EH&S Radiation Safety Team and ask to speak with someone regarding your Declaration of Pregnancy. Let a Radiation Safety Team member know you would like to complete a "Declaration of Pregnancy" form or have the form ready to submit. On the form we will need your name, RUA number (s), supervisor’s name, and your estimated date of conception. You will also need to provide us with the isotope(s) and amounts you will be using during your pregnancy and if you are planning to breast feed after the birth or the type of radiation producing machine that you plan to work with. If you have already received 450 mRem from the time of conception to the time of your declaration, you will only be allowed to receive an additional 50 mRem above background. We will keep your form until you both call and inform us of your child's birth, at least nine months have elapsed since your estimated date of conception, or you withdraw your Declaration of Pregnancy.

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A member from the Radiation Safety Team will review the risks and possible effects to the embryo/fetus due to ionizing radiation exposure as compared to other hazards (see the links at the bottom of the page for additional references). You will be issued a monthly dosimeter after you submit the "Declaration of Pregnancy" form. If you are already issued a dosimeter under an active RUA, you will continue to wear the dosimeter except the exchange frequency will be increased to monthly. You may be required to participate in the internal dosimetry program if you are working with low-energy beta-emitters (e.g., 3H) that cannot be measured using external dosimeters.

We will notify you of any positive doses and if you are approaching the maximum dose limit during your pregnancy. If you accumulate the maximum dose of 500 mRem, you may not be allowed to continue working with radioactive material or around radiation producing machines. The Dosimetry Coordinator will contact you to set up an appointment for additional review of your work practices. The Radiation Safety Officer may need to work with your supervisor regarding any additional work activities.

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***Radiation Biology & Allowed Radiation Doses***

1. Natural Background and Man Made Radiation Doses - Each of us receives ~ 300-600 mRem/year from naturally occurring radioactive material. These include solar cosmic radiation, radon (gases) from soils, and internal dose from K-40. We also receive ~ 70-300 mRem from man-made sources, primarily from medical applications. Your altitude above sea level and the location and construction materials in your home also can influence your background dose (e.g., in Denver [the “mile high city”], the background dose is about twice the dose is in Berkeley.)
2. Internal verses External Exposure - External exposure is the passage of radiation into or through the body tissue from radiation sources that are located outside of the body. Internal exposure results from isotopes which have been deposited inside the body from one of the four entry pathways: ingestion, inhalation, absorption through the skin, and skin punctures. You should be aware that radiation exposure to the fetus could be from internal sources as well as from external sources. In workplaces where unsealed radioactive material is routinely used, there is a greater risk of radioactive material entering the body.
3. Acute verses Chronic Doses and Effects - Chronic radiation doses are received over many years. The biological effects of chronic whole body doses up to regulatory limits (150 Rem over 30 years) have proven undetectable and may not exist. Acute radiation doses are received in a very short duration (e.g., a few minutes or hours). The biological effects of acute whole body doses under 10 Rem have been proven to be almost undetectable.



1. Somatic verses Genetic Effects - Somatic effects occur in the person (or fetus) receiving the radiation dose. Somatic effects can be caused by acute or chronic exposure. Cataracts and cancer are somatic effects identified with radiation exposure. Genetic effects of radiation have been observed in animals. These are effects to the offspring of male or female animals that were exposed before conception occurred and are due to damage to the egg or sperm. Genetic effects have not been observed in humans, but are believed to occur based on animal studies.
2. ***![C:\Users\dinneljones\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\0QN8QUDW\MC900301442[1].wmf]()***Effects on the Embryo/Fetus of Exposure to Radiation and Other Environmental Hazards - To better understand the potential effects of different levels of radiation on an embryo/fetus; it is helpful to compare them to the naturally occurring effects and the environmentally produced risks (e.g., smoking and drinking). This allows someone to contrast these risks with those produced by exposure to ionizing radiation. The natural risks for birth defects are as follows: 3-5% of all births have some type of abnormality detectable at birth and 3-5% of all births have some type of condition or disease that develops later in life (not detectable at birth).

***Special Precautions for Prospective Mothers***

UC Berkeley recommends certain precautions for prospective mothers (whether or not they are “declared pregnant workers”) that choose to continue working with or around radioactive materials and/or radiation-producing equipment. The prospective mother who uses or works around radioactive material or radiation producing machines should:

* + Consult with the EH&S Radiation Safety Team regarding any radiation safety questions and concerns.
	+ Avoid situations in which the abdomen may be exposed to penetrating radiation (gamma, X-ray, neutron) levels greater than two (2) mRem per hour or 10 mRem per week.
	+ Wear a radiation dosimeter as a “fetal dose monitor.” This monitor assesses penetrating radiation exposures from external sources (gamma, X-ray, neutron) to the abdomen.
	+ Contact EH&S about working with volatile or reactive radiochemicals that could result in the inhalation, ingestion, or absorption of radioactive materials through her skin.
	+ Follow standard lab procedures as follows:
		- No smoking, eating, drinking, or applying cosmetics where radioactive materials are used.
		- No pipetting by mouth.
		- Use disposable gloves while handling radioactive materials.
		- Wash hands and monitor for radioactive contamination frequently.
		- Wear lab coats or other protective clothing around radioactive material.
		- Use certified ventilation hoods when handling volatile or potentially volatile radionuclides.
	+ Immediately contact the Radiation Safety Officer or the EH&S (642-3073) in any case of suspected accidental exposure to radiation sources or uptake of radioactive materials. Campus police (UCPD) can contact EH&S during off hours.

**EH&S RST is here to assist you.**

**Remember, the decision to declare your pregnancy is completely yours.**

***Links and Other Information:***

* “[NRC Regulatory Guide 8.13 Instruction Concerning Prenatal Radiation Exposure](http://www.nrc.gov/reading-rm/doc-collections/reg-guides/occupational-health/rg/8-13/)” (http://pbadupws.nrc.gov/docs/ML0037/ML003739505.pdf)
* “[NRC Regulatory Guide 8.29 Instruction Concerning Risks from Occupational Radiation Exposure](http://www.nrc.gov/reading-rm/doc-collections/reg-guides/occupational-health/rg/8-29/08-029.pdf)” (http://pbadupws.nrc.gov/docs/ML0037/ML003739438.pdf) - Part 11 has a section on health risks from radiation exposure to the embryo/fetus
* “Prenatal Radiation Exposure Policy” (<http://ehs.berkeley.edu/rs/129-radiation-safety-forms-and-additional-resources.html>) - UC Berkeley’s Radiation Safety Manual
* “[Radiation: Risks and Realities](http://www.epa.gov/rpdweb00/docs/402-k-07-006.pdf)” (<http://www.epa.gov/rpdweb00/docs/402-k-07-006.pdf>) - EPA general radiation information page
* “[Radioactivity in Nature](http://www.umich.edu/~radinfo/introduction/natural.htm)” (<http://www.umich.edu/~radinfo/introduction/natural.htm>) – Health Physics Society link to the University of Michigan page with great listing of everyday exposures.