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**RADIOACTIVE MATERIALS PROGRAM****GUIDE FOR INSTRUCTION CONCERNING PRENATAL RADIATION EXPOSURE**

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**Introduction**

This document issued by the Georgia Department of Natural Resources, Radioactive Materials Program (Department) provides guidance to licensees on instructions that must be provided concerning prenatal radiation exposure. In particular, the instructions described in this guide are intended to provide the information needed by women who become pregnant to help them make an informed decision on whether or not to formally declare their pregnancy in accordance with "Georgia Rules and Regulations for Radioactive Materials", Chapter 391-3-17.

Rule 391-3-17-.03(5)(h) requires that licensees "ensure that the dose equivalent to an embryo/fetus during the entire pregnancy, due to occupational exposure of a declared pregnant woman, does not exceed 0.5 rem (5 mSv)." The regulation also requires the licensee to make efforts to avoid substantial variation above a uniform monthly exposure rate to a declared pregnant woman.

A "declared pregnant woman" is defined in Rule 391-3-17-.03(2)(l) as "any woman who has voluntarily informed the licensee, in writing, of her pregnancy and the estimated date of conception. The declaration remains in effect until the declared pregnant woman withdraws the declaration in writing or is no longer pregnant."

The "embryo/fetus" is defined in Rule 391-3-17-.01((2)(ee) as "the developing human organism from conception until the time of birth." The embryo is an early stage of development, before the individual limbs and organs are recognizable. In humans, this development takes about eight weeks. The human organism is considered a fetus from that stage until birth.

Rule 391-3-17-.03(8)(b)1.(iii) specifies the requirements for monitoring for external occupational dose to a declared pregnant woman. Licensees must monitor the external occupational dose to a declared pregnant woman, using an individual monitoring device, if the woman is likely to receive during the entire pregnancy from sources external to the body, a deep dose equivalent in excess of 100 millirem (1 millisievert) during the pregnancy.

Licensees must also monitor the occupational intake of radioactive material by a declared pregnant woman likely to receive, during the entire pregnancy, a committed effective dose equivalent excess of 100 millirem (1 millisievert). For monitored declared pregnant women, the licensee must assess the effective dose equivalent delivered to the embryo/fetus during the pregnancy. The Nuclear Regulatory Commission's (NRC) Regulatory Guide 8.36, "Radiation Dose to the Embryo/Fetus" provides guidance on calculating the radiation dose to the embryo/fetus.

Rule 391-3-17-.03(14)(g)4. requires the licensee maintain records of dose to an embryo/fetus if monitoring was required, and it requires that the records of the dose to the embryo/fetus be kept with the records of the dose to the declared pregnant woman. The NRC's Regulatory Guide 8.7, "Instructions for Recording and Reporting Occupational Radiation Exposure Data, " includes recommendations concerning records of dose to the embryo/fetus. The declaration of pregnancy must also be kept on file but may be maintained separately from the dose records. The licensee must retain each required form or record until the Department terminates each pertinent license requiring the record.

## **WHO SHOULD RECEIVE INSTRUCTIONS**

Instructions concerning prenatal radiation exposure and its risks to the embryo/fetus should be provided to workers before they are allowed to work in a restricted area. Each supervisor of a female worker who will work in a restricted area should also receive the instruction.

## **HOW TO PROVIDE INSTRUCTION**

The instruction should be presented both orally and in written form and should include, as a minimum, the information in the Appendix to this guide. Each worker should be given a copy of this guide and given the opportunity to ask questions on the instructions.

## **EMPLOYER'S POLICY ON DECLARED PREGNANT WOMEN**

The instruction provided should describe the employer's specific policy on declared pregnant women. In particular, the instruction should include a description of the employer's policies with respect to changes, if any, that may affect the declared pregnant woman's work situation as a result of her filing a written declaration of pregnancy (see Chapter 391-3-17-.03(2)(l)).

## **DURATION OF LOWER DOSE LIMITS FOR EMBRYO/FETUS**

The lower dose limit is in effect until the declared pregnant woman:

- (1). Is known to have given birth;
- (2). Informs the licensee that she is no longer pregnant; or
- (3). Informs the licensee that she no longer wants to be considered a declared pregnant woman.

## **APPENDIX**

This Appendix describes information that you should know about the radiation exposure of pregnant women. In particular, radiation protection regulations allow a woman to decide whether she wants to formally declare her pregnancy to her employer, thereby taking advantage of the special lower dose limits provided to protect the developing embryo/fetus. This Appendix provides information on the potential effects of declaring a pregnancy in order to help women make informed decisions on whether or not to declare pregnancy. The information is provided in the form of commonly asked questions and answers.

### **MAKING THE DECISION TO DECLARE PREGNANCY**

#### **1. If I become pregnant, am I required to inform my employer of my pregnancy?**

No. It is your choice whether to declare your pregnancy to your employer. If you choose to declare your pregnancy, a lower radiation dose limit will apply to you. If you choose not to declare your pregnancy, you will continue to be subject to the same radiation dose limits that apply to nonpregnant workers even if you are visibly pregnant.

#### **2. If I inform my employer in writing of my pregnancy, what happens?**

The amount of radiation that you will be allowed to receive will decrease because there is a lower dose limit for the embryo/fetus of female workers who have formally declared their pregnancy in writing. Ordinarily, the radiation dose limit for a worker is 5 rem (50 millisieverts) in a year. But if you declare in writing that you are pregnant, the dose to the embryo/fetus is generally limited to 0.5 rem (5 millisieverts) during the nine month pregnancy, which is one-tenth of the dose limit that an adult worker may receive in a year. In addition, the licensee must make an effort to avoid substantial variation above a uniform monthly dose rate so that all the 0.5 rem (5 millisieverts) allowed dose does not occur in a short period during the pregnancy. This may mean that, if you declare your pregnancy, you may not be permitted to perform some of your normal job functions and you may not be able to have responsibilities related to emergency response.

#### **3. Why do the regulations have a lower dose limit for a woman who has declared her pregnancy than for a normal worker?**

The purpose of the lower limit is to protect the embryo/fetus. Scientific advisory groups recommend (References 1 and 2) that the dose before birth be limited to about 0.5 rem rather than the 5 rem (50 millisievert) occupational annual dose limit because of the sensitivity of the embryo/fetus to radiation. Possible effects include deficiencies in the child's development, especially the child's neurological development, and an increase in the likelihood of cancer.

#### **4. What effects on development can be caused by radiation exposure?**

The effects of large doses of radiation on human development are quite evident and easily measurable, whereas at low doses the effects are not evident or measurable and therefore must be inferred. For example, studies of the effects of radiation on animals and humans demonstrate clearly and conclusively that large doses of radiation-- such as 100 rem (1 sievert)-- cause serious developmental defects in many of the body's organs when the radiation is delivered during the period of rapid organ development (References 2, 3, 4, and 5).

The developing human brain has been shown to be especially sensitive to radiation. Mental retardation has been observed in the survivors of the atomic bombing in Japan in utero during sensitive periods. Additionally, some other groups exposed to radiation in utero have shown lower than average intelligence scores and poor performance in school (Reference 4).

The sensitivity of the brain undoubtedly reflects its structural complexity and its long developmental period (and hence long sensitive period.) The most sensitive period is during the 8th to 15th weeks of gestation followed by a substantially less sensitive period for the 2 months after the 15th week (Reference 4). There is no known effect on the embryo/fetus' developing brain during the first two months of pregnancy or the last three months of pregnancy (Reference 4).

No developmental effects caused by radiation have been observed in human groups at doses at or below the 5 rem (50

millisievert) occupational dose limit. Scientists are uncertain whether there are developmental effects at doses below 5 rem (50 millisieverts). It may be that the effects are present but are too mild to measure because of the normal variability from one person to the next and because the tools to measure the effects are not sensitive enough. Or, it may be that there is some threshold dose below which there are no developmental effects whatsoever.

In view of the possibility of developmental effects, even if very mild, at doses below 5 rem (50 millisieverts), scientific advisory groups consider it prudent to limit the dose to the embryo/fetus to 0.5 rem (5 millisieverts) (Reference 1 and 2). At doses greater than 5 rem (50 millisieverts), such as might be received during an accident or during emergency response activities, the possibility of developmental effects increases.

**5. How much will the likelihood of cancer be increased?**

Radiation exposure has been found to increase the likelihood of cancer in many studies of adult human and animal groups. At doses below the occupational dose limit, an increase in cancer incidence has not been proven, but is presumed to exist even if it is too small to be measured. The question here is whether the embryo/fetus is more sensitive to radiation than an adult. While evidence for increased sensitivity of the embryo/fetus to cancer induction from radiation exposure is inconclusive, it is prudent to assume that there is some increased sensitivity. Scientific advisory groups assume that radiation exposure before birth may be 2 or 3 times more likely to cause cancer over a person's lifetime than the same amount of radiation received as an adult (Reference 1).

**6. How does the risk to the embryo/fetus from occupational radiation exposure compare to other avoidable risks?**

The risk to the embryo/fetus from 0.5 rem or even 5 rem of radiation exposure is relatively small compared to some other avoidable risks. Of particular concern is excessive consumption of alcohol during pregnancy. The U.S. Public Health Service has concluded that heavy alcohol consumption during pregnancy (three drinks per day and above) is the leading known cause of mental retardation (Reference 6). Children whose mothers drank heavily during pregnancy may exhibit developmental problems such as hyperactivity, distractibility, short attention spans, language difficulties, and delayed maturation, even when their intelligence is normal.

In studies tracking the development of children born to light or moderate drinkers, researchers have also correlated their mothers' drinking patterns during pregnancy with low birth weight, decreased attention spans, delayed reaction times, and lower IQ scores at age 4 years. Youngsters whose mothers averaged three drinks per day during pregnancy were likely to have IQ's averaging five points lower than normal.

Cigarette smoking may also harm the unborn (Reference 6). There is a direct correlation between the amount of smoking during pregnancy and the frequency of spontaneous abortion and fetal death. Children of mothers who smoke while pregnant are more likely to have impaired intellectual and physical growth. Maternal smoking has also been associated with such behavioral problems in offspring as lack of self-control, irritability, hyperactivity and disinterest. Long-term studies indicate that these children perform less well than matched youngsters of nonsmokers on tests of cognitive, psychomotor, language and general academic functioning.

Alcohol and smoking are only examples of other risks in pregnancy, many other toxic agents and drugs also present risk. In addition, many factors that cannot be controlled present risk. There is an increased risk in pregnancy with increasing maternal age. Maternal disease may be an important risk factor. Malnutrition, toxemia, and congenital rubella may be associated with birth defects. Maternal diabetes and high blood pressure have been associated with problems in the newborn. In addition, many birth defects and developmental problems occur without an obvious cause and without any obvious risk factors. For example, viruses that we may not even be aware of can cause defects, and defects can arise from spontaneous random errors in cell reproduction. But these are things that we cannot do anything about.

**7. What if I decide that I do not want any radiation exposure at all during my pregnancy?**

You may ask your employer for a job that does not involve any exposure to occupational radiation at all, but your employer may not have such a position or may not be willing to provide you with a job involving no radiation exposure. Even if you receive no occupational exposure at all, you will receive a dose around 0.3 rem (3

millisieverts) from unavoidable natural background radiation (Reference 7).

**8. What effect will formally declaring my pregnancy have on my job status?**

Only your employer can tell you what effect a declaration of pregnancy will have on your job status. As part of your radiation safety training, your employer should tell you its policies with respect to the job status of declared pregnant women. In addition, we recommend that, before you declare your pregnancy, you talk to your employer and ask what a declaration of pregnancy would mean specifically for you and your job status. However, if you do not declare your pregnancy, the lower exposure limit of 0.5 rem (5 millisieverts) does not apply.

It is most likely that your employer will tell you that you can continue to perform your job with no changes and still meet the regulatory limit for exposure to declared pregnant women. A large majority of licensee employees (greater than 90%) receive, in nine months, occupational radiation doses that are below the 0.5 rem (5 millisievert) limit for a declared pregnant woman.

If the dose you currently receive is above the 0.5 rem (5 millisievert) dose allowed for a declared pregnant woman, it is quite likely that your employer can and will make a reasonable accommodation that will allow you to continue performing your current job, for example, by having another qualified employee perform a small part of the job that accounts for much of the radiation exposure.

On the other hand, it is possible, although not common, that your employer will conclude that there is no reasonable accommodation that can be made without undue hardship that would allow you to do your job and remain within the dose limits for a declared pregnant woman. In these few instances, your employer may conclude that you can no longer be permitted to do your current job, that you must be removed from your job, and that there is no other job available for someone with your training and job skills.

If your employer concludes that you must be removed from your current job in order to comply with the lower dose limits for declared pregnant women, you may be concerned about what will happen to you and your job. The answer to that depends on your particular situation. In addition, telephone numbers that may be useful for obtaining information are listed in the additional information section of this appendix.

**9. What information must I provide in my declaration of pregnancy?**

You must provide your name, a written statement that you are pregnant, the estimated date of conception (only the month and year need be given), and the date that you give the letter to your employer. A sample form letter that you can use is included at the end of these questions and answers. You may use the letter or write your own letter.

**10. To declare my pregnancy, do I have to have documented medical proof that I am pregnant?**

No. No proof is necessary.

**11. Can I tell my employer orally rather than in writing that I am pregnant?**

No, the regulations require that the statement must be in writing.

**12. If I have not declared my pregnancy in writing, but my employer notices that I am pregnant, do the lower dose limits apply?**

No, the lower dose limits for pregnant women apply only if you have declared your pregnancy in writing. The choice of whether to declare your pregnancy and thereby work under the lower dose limits is your choice, not your employer's. Your employer may not remove you from a specific job because you appear pregnant.

**13. If I am planning to become pregnant, but am not yet pregnant, and I inform my employer of that in writing, do the lower dose limits apply?**

No, the lower limits apply only if you declare that you are already pregnant.

**14. What if I have a miscarriage or find out I am not pregnant?**

If you have declared your pregnancy in writing, you should promptly inform your employer that you are no longer pregnant. The regulations do not require the revocation of a declaration be in writing, but we recommend that you revoke the declaration in writing to avoid confusion. Also, employers may insist upon a written revocation for their own protection. If you have not declared your pregnancy in writing there is no need to inform your employer of your new, nonpregnant status.

If you have a miscarriage and become pregnant again before you have revoked your original declaration of pregnancy, you should submit a new declaration of pregnancy because the date of conception has changed.

**15. How long is the lower dose limit in effect?**

The dose to the embryo/fetus must be limited until (1) your employer knows you have given birth, (2) you inform your employer that you are no longer pregnant, or (3) you inform your employer that you no longer wish to be considered pregnant.

**16. If I have declared my pregnancy in writing, can I revoke my declaration of pregnancy even if I am still pregnant?**

Yes, you may. The choice is entirely yours. If you revoke your declaration of pregnancy, the lower dose limits no longer apply.

**17. What if I work under contract at the licensed facility and my employer is not the licensee?**

The regulations state that you should formally declare your pregnancy to your employer in writing. You can ask your employer to give a copy of your declaration to the licensee, or you may give a copy of your written statement directly to the licensee.

**18. Can I tell my employer I am pregnant when I know I am not, in order to work under the lower dose limit?**

The purpose of this regulation is to allow a woman to choose a heightened level of protection from radiation exposure for the embryo/fetus during her pregnancy. That purpose would not be served by intentionally declaring yourself to be a pregnant woman when you know you are not pregnant. There are no Department regulatory requirements specifically addressing the actions your employer might take if you provide a false declaration. Also, nothing in the Department's regulations would prevent your employer from taking adverse action against you for deliberately lying.

## **STEPS TO LOWER RADIATION DOSE**

**19. What steps can I take to lower my radiation dose?**

Your employer should already have explained that to you as part of the instructions that licensees must give to all workers. However, you should ask your supervisor or the radiation safety officer whether any additional steps can be taken.

The general principles for maintaining exposure to radiation as low as reasonable achievable are summarized below. You should already be applying these principles to your job.

### **External Radiation Exposure**

External radiation is radiation you receive from radiation sources or radioactive materials that are outside your body. The basic principles for reducing external radiation exposure are time, distance, and shielding--decrease your time near radiation sources, increase your distance from the radiation source, and increase the shielding between yourself and the radiation source. You should work quickly and efficiently in a radiation area so that you are not exposed to the radiation any longer than necessary. As the distance is increased from the source of radiation, the dose decreases.

When possible, you should work behind shielding. The shielding will absorb some of the radiation, thus reducing the amount that reaches you.

## **Internal Radiation Exposure**

Internal radiation is radiation you receive from radioactive materials that have gotten into your body, generally entering with the air you breathe, the food you eat, or the water you drink. Your employer will have specific procedures to minimize internal radiation exposure. Those procedures probably incorporate the following general precautions that should be taken when you are working with radioactive materials that are not encapsulated:

1. Wear lab coats or other protective clothing if there is a possibility of spills.
2. Use gloves while handling unencapsulated radioactive materials.
3. Wash hands after working with unencapsulated radioactive materials.
4. Do not eat, drink, smoke, or apply cosmetics in areas with unencapsulated radioactive material.
5. Do not pipette radioactive solutions by mouth.

These basic principles should be incorporated into the specific methods and procedures for doing your individual work. Your employer should have trained you in those specific rules and procedures.

If you become pregnant, it is a good time to review the training materials on the methods and procedures that you were provided in your training. You can also talk to your supervisor about getting refresher training on how to keep radiation doses as low as reasonably achievable.

## **ADDITIONAL INFORMATION**

You can find additional information on the risk of radiation in NRC's Regulatory Guide 8.29, "Instruction Concerning Risks from Occupational Radiation Exposure."

You can also telephone our Department at (404) 362-2675.

If you believe you have been discriminated against, you should contact the U.S. Equal Employment Opportunity Commission (EEOC), 100 Atlanta Street, Suite 4R30, Atlanta, GA., 30303, phone number (404) 562-6800, or an EEOC Field Office by calling 1-800-669-4000. For individuals with hearing impairments, the EEOC's field office TDD number is 1-800-669-6820.

## REFERENCES

1. National Council on Radiological Protection and Measurements, Limitation of Exposure to Ionizing Radiation, Report No.116, Bethesda, MD. 1993. [The National Council on Radiological Protection and Measurements (NCRP) is a nonprofit corporation chartered by Congress in 1964 to collect information and make recommendations on protection against radiation. This publication, on pages 37-39, summarizes the conclusions of the NCRP with respect to protection of the human embryo/fetus against radiation. This publication should be available through most good public library systems and university libraries. Your employer may also have a copy.]
2. ICRP Publication 60 -- 1990 Recommendations of the International Commission on Radiological Protection, Ann. ICRP 21:No. 1-3, Pergamon Press, 1991. [This publication, on pages 146-149, summarizes the conclusions of the ICRP on the effects of radiation on the human embryo/fetus.]
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