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MEDICAL EXAMINATION OF NUCLEAR POWER PLANT PERSONNEL AND ACTIONS IN CASE OF OVEREXPOSURE AND ACCIDENTS

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1 GENERAL

Health monitoring at a nuclear power plant concerns all employees whose work is classified as involving exposure to radiation. Health monitoring consists of medical examinations (the first examination and subsequent examinations to be performed later as needed) and an annual blood examination. The Resolution (594/68) of the Ministry of Social Affairs and Health defines dose limits and provides general regulations for health monitoring.

Individual dose monitoring and reporting is dealt with in Guide YVL 7.10 of the Finnish Centre for Radiation and Nuclear Safety (STUK). Guidance for reporting abnormal occurrences is given in Guide YVL 1.5.

2 SCOPE

This guide provides guidelines for implementation of the health monitoring of nuclear power plant personnel, including medical action in case of accidents and situations where a dose limit may have been exceeded. Rules for reporting such cases and situations are given as well.

The requirements concerning individuals who are engaged in work involving exposure to radiation are in this guide applied to persons who regularly work in the controlled area, and to those persons, temporarily working in the controlled area, whose exposure may exceed one third of the allowable maximum annual dose (for instance, if the annual dose exceeds 15 mSv, or the dose received at one plant site exceeds 7.5 mSv) or whose work involves a significant risk of internal contamination.

3 GENERAL OBJECTIVES AND PROCEDURES

The objective of the medical examination is to protect the worker against being employed in work for which he may be unfit on medical grounds and, whenever possible, to protect the worker and his surroundings against accidents which might be caused by poor health. The general objectives and methods of the medical examinations of nuclear power plant personnel are the same as in other medical examinations performed for reasons of ocuupational safety. However, special attention shall be given to factors that may be significant from the standpoint of radiation safety (section 4 in this guide).

A nuclear power plant is responsible for the health monitorin of its own personnel. As concerns other personnel, the licensee shall see to it that health monitoring is carried out in accordance with legislation and this guide.

3.1 First examination

The first medical examination should be performed as close to the beginning of employment as possible, as a rule within one month after the commencement of the work involving exposure to radiation or after the work has been classified as involving exposure to radiation. At the first examination, the anamnestic information, including occupational record, previous exposures to radiation, and state of health, shall be confirmed by the worker with his signature. Because the first examination is a full general examination performed to determine a persons's fitness for a specific job, the person being examined is required, whenever possible, to inform the physician of the type of work he will be engaged in at a nuclear power plant. A blood examination is always performed as part of the first examination.

3.2 Periodic examination

The periodic examinations shall be performed as advised by the physician in charge of the examination, depending on the results of the first examination and on the type of work. It is recommended that persons who are regularly engaged in work involving radiation should be examined approximately once in every three years. The examination shall again be a good general examination of the worker's health. Regardless of the periodic examinations, a blood examination shall be performed annually.

3.3 Blood examination

Examination of the blood of a worker engaged in work involving exposure to radiation is significant only in case of high overexposures. It must be noted, however, that the blood examination (haemoglobin, erythrocytes, haematocrit value, leucocytes, differential count, trombocytes, and sedimentation rate) provides information on the person's general state of health and is part of a thorough medical examination. The results obtained in the blood examintaions also serve as reference data in the event of an accident.

3.4 Compilation of results

A medical examination shall be recorded in such a manner that its results are obtainable from the examining physician, if need be.

The examining physician shall give a brief description of the results both to the employee and to the employer. If the medical examination reveals an impediment to the performance of work involving exposure to radiation, the results of the examination shall also be sent to the Finnish Centre for Radiation and Nuclear Safety (Radiobiological Laboratory).

The results of the annual blood examinations shall be sent to the Finnish Centre for Radiation and Nuclear Safety (Radiobiological Laboratory).

4 SPECIAL REQUIREMENTS CONCERNING STATE OF HEALTH

To protect a worker and his surroundings against accidents, attention shall be paid to possibly existing physical and mental handicaps and illnesses and to the misuse of intoxicants.

In assessing a person's fitness to work which involves a significant risk of internal contamination, it is required from the standpoint of radiation safety that attention be paid to illnesses which either make it easy for radioactive substances to enter the body or make it difficult for them to be discharged from the body or affect the use of protective equipment.

Illnesses of this kind are:

- skin diseases, especially if they are located in those parts of the body that cannot be protected,

- skin rashes that are caused by an allergy to materials used in necessary protective equipment,

- chronic lung diseases which seriously reduce the ability of the lungs to purify themselves, and

- seriously reduced function of the kidneys.

A medical examination cannot reveal detrimental effects that might originate in a normal, work-induced exposure to radiation.

5 SPCIAL REGULATIONS APPLIED TO PREGNANT WOMEN

Acccording to the Resolution (594/68) of the Ministry of Social Affairs and Health, a woman in fertile age can be employed in work where the radiation dose of three months will not exceed 13 mSv (1.3 rem), and after a pregnancy has been diagnosed, the dose will not exceed 10 mSv (1 rem).

The licensee is advised against using pregnant women in work involving a considerable risk of contamination. Such a restriction is justified because the knowledge concerning the passage of radionuclides through the placenta and in the foetus is largely insufficient.

6 ACTIONS IN CASE OF ACCIDENTS AND SUSPECTED OVEREXPOSURES

6.1 General

The first action to be taken in accidents involving a potential overexposure is to evaluate the magnitude of the dose by means of suitable mesurements or other observations. The following observations are of importance as well:

- clinical symptoms
- changes in the blood
- number of chromosome aberrations.

Among the initial clinical symptoms, the most important are nausea and vomiting, caused by disturbances in the gastrointestinal tract and pylorospasms.

As concerns radiation damage, immediate first aid is not necessary in the case of radiation accidents. Conventional injuries sustained in the accident shall be treated normally, regardless of radiation injuries or radioactive contamination. Localized radiation injuries are treated accor-

ding to symptoms; injuries of this kind should also be photographed for documentation purposes.

If a person has received a radiation dose exceeding 1 Sv (100 rem), he shall be immediately taken to a central hospital.

A complete blood examination shall be performed as soon as possible after the exposure, followed by another after 24 hours. Depending on the changes in the blood, the treatment should be continued as presented in Figure 1.

The most sensitive biological indicator of the magnitude of the dose is the chromosome analysis to be performed on the lymphocytes of the blood. The analysis requires a special laboratory with specialized personnel. The Finnish Centre for Radiation and Nuclear Safety performs a chromosome analysis if it deems it necessary. A fee prescribed in law is charged for the analysis.

6.2 Reporting to STUK

If a dose limit is found to be exceeded, STUK shall be immediately notified thereof, as provided in Guide YVL 1.5.

The special report to be prepared on such an incident shall describe the course of events and the results and interpretation of measurements made to determine the doses. In case the person involved is taken to a central hospital, STUK (Radiobiological Laboratory) shall be provided with complete data on the examinations that the victim of the acccident has been subject to, on the results of the examinations and on the treatment given.

7 CO-OPERATION BETWEEN A NUCLEAR POWER PLANT AND A HOSPITAL

During the operating license review, the license applicant shall provide plans in the form of a separate document describing how the medical expertise and resources necessary for the treatment of radiation injuries and overexposures are organized.

The power plant shall, together with the authorities (Ministry of the Interior, National Board of Health, STUK) ensure that the hospital responsible for treatment has the necessary equipment and expertise and that it can, in the event of an accident, receive the victims of a radiation accident who require hospitalization.

8 BIBLIOGRAPHY

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In case of differences in interpretation of this guide, the Finnish version shall taken precedence over this translation.

ACTIONS IN CASE OF ACCIDENTS

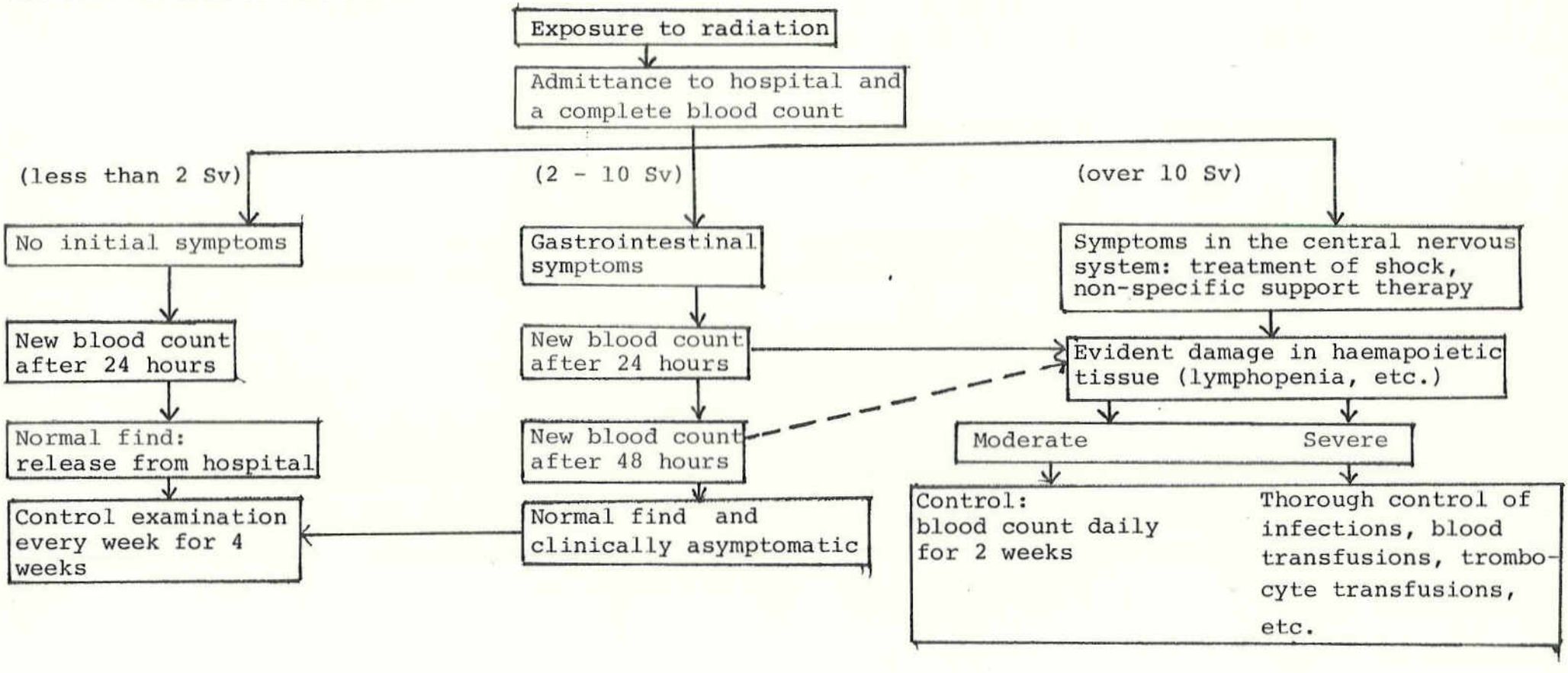

FIGURE 1