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Safety Evaluation Report

General

12.0 The Radiation Protection Program of the Davis Besse Nuclear Power Station is discussed in Chapter 12 of their FSAR. In that Chapter the applicant has described the methods by which he controls radiation exposures within the limits of 10 CFR 20 and his plans to maintain exposures as low as practicable (ALAP). Accordingly, he discusses his design features including shielding and layout of facilities, his area monitoring program which details his radiological and airborne radioactivity monitoring system, his ventilation system for providing a suitable radiological environment and his health physics program to assure that exposures will be ALAP. This section of the Safety Evaluation Report presents our evaluation of the adequacy of this program in terms of the radiation protection design and equipment features and the health physics program at Davis Besse. The review emphasis is on the applicants program for planning, designing and operating his facility to control and maintain occupational radiation exposure to as low as practicable.

Shield wall thicknesses were determined using our accepted criteria for assumptions, mathematical models and codes.

The applicant has designated his areas in terms of access during normal plant operation at power, hot standby, refueling, maintenance and component and systems testing. Consistent with the design, the applicant has pipes and valves carrying radioactive liquids (e.g., filters, demineralizers, tanks, etc.) and sampling areas designed to be located in shielded compartments. Each equipment compartment is individually shielded to reduce radiation levels inside adjacent compartments. This isolation will allow maintenance, inspection, and some non-routine operations with no significant radiation interference from other compartments. In addition manually operated valves of contaminated equipment have reach rods which penetrate through shield walls or are located in accessible corridors. Gages or other instruments can be inspected from corridors or a central control board. No process piping is normally field run. Existing process piping layouts and radiation zone diagrams will be used to guide proper installation of new piping whenever required.

In addition to the above, the following measures are taken to reduce exposures; penetrations through shield walls are made at angles to prevent streaming, and, if possible, piping makes a 90° bend after penetration and bulk shielding installed behind it, also to preclude streaming; spent fuel pool penetrations are located so that their failure will not drain the pool to a point of insufficient water shielding. Portable shields will also be used whenever required to reduce exposures to ALAP. From the plant as designed, the applicant's occupational radiation exposure to plant operating and maintenance crews from normal plant operation, is predicted to be about 200 man-rem per year.

On the basis of the applicant's description of the design and the operating philosophy of the Davis Besse Nuclear Plant, we conclude that sufficient consideration has been given to the shielding and layout of the facility and components to keep exposures to operating personnel within the applicable limits of 10 CFR Part 20 and to reduce unnecessary exposures during normal operation of the facility to as low as practicable. While the applicant's estimate of occupational man-rem exposure is 200 man-rem per year our studies show that the average dose to all onsite personnel at a typical large operating nuclear power plant has been about 450 man-rem per year. This value may be higher in a given year depending upon unexpected maintenance, repair or inspection, or lower during unusually trouble free years. Our evaluation of ALAP however is based on stated design and operating principles and thus we find the Davis Besse man-rem estimate to be ALAP and acceptable.

12.2 Area Monitoring

The radiological monitoring systems are designed to continuously measure the radiation levels in areas coordinated with the station radiation access control requirements. In general, area radiation monitors are located where radiation levels could possibly increase due to postulated occurrences. Thus, operating personnel will have continuous knowledge of radiation zone compromise. In addition, the monitors will provide some surveillance on radioactive materials that enter or exit the plant.

Each instrument of the system will have a sensor whose dose rate output is recorded in the control cabinet room and the main control room with multipoint recorders. Both audible and visual alarms are available at the fixed location and control room. Calibration is performed semi-annually or on an as-required basis with a portable source calibrated against National Bureau of Standards sources.

The in-plant continuous airborne radioactivity monitoring system (CAM's) is designed to provide operating personnel with a continuous indication of airborne radioactivity in selected station areas. The system will detect and record airborne radioactivity concentrations so that appropriate action can be taken whenever alarm set-point levels are reached. These levels are set well below MPC relative to 10 CFR 20 Appendix B Table 1. The system consists of ventilation monitors, upstream of HEPA filters, in the fuel handling area exhaust, radwaste area exhaust, penetration room exhaust, the control room ventilation system, as well as the containment vessel. Each monitoring system is equipped with capability to monitor particulates, iodines and noble gases. Control, read-out, recording and alarm annunciation is installed in the control room. This program will be combined with grab sampling and continuous air sampling monitoring techniques that will be employed during operations where significant airborne radioactivity could occur and CAMs are not available for use.

Based on the location of all radiological and airborne radioactivity monitors, their sensitivity, range, recording and alarm annunciation features supplemented by an air sampling program, we conclude that the scope of the area monitoring program is satisfactory.

12.3 Ventilation

The Davis Besse ventilation system has been designed to provide a suitable radiological environment for personnel and equipment and to assure compliance with the limits of airborne radioactivity as set forth in 10 CFR 20 for restricted areas. Throughout the station the path of the ventilation air will be from areas of low radioactivity towards areas of higher activity to prevent the spread of airborne radioactive materials and thereby ensure contamination control. . The fuel handling and radwaste area exhaust systems are once-through systems and are provided with prefilter and HEPA filter banks. Non-radioactive areas are served by a separate ventilation system. The containment purge subsystem will provide a means of reducing airborne contamination inside containment to allow personnel access.

On-site inhalation exposures are intended to be kept as low as practicable during normal operations and maintenance by personnel training, airborne radioactivity monitoring, contamination control and special work permits. Respiratory protective devices will be worn whenever airborne radioactivity levels warrant their use. Since noble gas exposures are limited by whole body exposure criteria, their dose will be controlled within the limits of personnel exposure in accordance to 10 CFR 20.101. Tritium exposures will be controlled by supplied air masks and special plastic suits.

We conclude that the ventilation system is based on a design criteria that provides reasonable assurance that the system has the capability to maintain concentrations of airborne activity, in areas normally occupied, in accordance with 10 CFR 20. Also, radiation protection operating procedures should keep inhalation exposures to personnel as low as practicable.

G.M. and proportional counters for gross alpha, beta and gamma counting as required for in-plant radiation protection. A TLD reader is also in the counting room to read-out TLD crystals for personnel dosimetry and radiation surveys. Protective clothing and respiratory protection is available to all personnel. A respirator fitting program will be adopted and instructions will be given to all operations personnel on care and use of each type of respirator.

Continuous evaluation and review of the radiological status of the station will be carried out by health physics personnel, so that the levels of radiation will be known at all times in all areas where personnel will be working. Control of radiation exposures will be maintained by use of such devices as roping, tagging, signs, alarms, and other access control measures to preclude unauthorized entry into high contamination areas. Special work permits and procedures will be issued to allow work in radiation control areas, and trained personnel will be authorized to handle licensed radiation sources and by-product material.

Health physics instruments for radiation surveys consist of alpha, beta and gamma survey meters that include G.M. and proportional counters and ionization chambers. Neutron dose equivalent will be measured using a spherical type rem-counter. All personnel will be

12.4 Health Physics

This section of the Davis Besse SAR has been reviewed to determine that the health physics program will assure that occupational exposures will be ALAP. The review covered the organizational structure, the health physics program, facilities, and monitoring equipment, and procedures related to contamination control and radiation exposures.

The health physics program and responsibilities are carried out by the Health Physics Section that reports directly to the Station Superintendent on matters concerning any phase of radiological protection. The applicants stated policy for radiation protection is based on appropriate NRC regulations. Accordingly, health physics programs and radiation safety procedures will be adopted conforming to the principles of keeping radiation exposures ALAP. Consistent with these programs and procedures, the health physics f maintains the following facilities for conducting their routine operations; a counting room for counting smears and air samples, a calibration room for checking health physics instruments, a central access control point for changing clothes, and a storage area for radiation protection equipment. The counting room has radiation detection systems to perform gamma spectrometry by use of NaI and GE(Li) detectors, a liquid scintillation counter for tritium, and assigned a thermoluminescence dosimeter (TLD) to be worn at all times. Self-reading dosimeters will be issued to those individuals whose work conditions make day to day indication of exposures desirable and will be maintained by the health physics staff for recording daily exposures. Dosimeter records will furnish the exposure data necessary for better administration of control of radiation exposures. A bioassay program consisting of whole body counting will be conducted annually on individuals who have occasion to work in a radiation access control area where airborne radioactivity is likely to be present. A program of this type is necessary to provide complete data on the effectiveness of the in-plant air monitoring program. A urinalysis bioassay program for tritium will also be conducted on selected individuals who work in areas where there is a possibility for tritium inhalation based on tritium monitoring surveys.

We conclude that the applicants health physics program and related procedures and equipment for in-plant radiation safety is of sufficient scope to recude personnel exposures to levels that are as low as practicable as required by 10 CFR Part 20 and is acceptable.

12.5 Radioactive Material Safety

The applicant will implement a radioactive material safety program to assure the safe storage and handling of radioactive sources.

All licensed source and by-product material, including neutron and gamma sources, used for sample analysis and calibration will be stored in shielded containers in a locked storage room. The containers will be posted or locked in accordance with 10 CFR 20 regulations. When handling sources, remote handling devices and shields will be used to keep personnel exposures ALAP. Only personnel with special training shall handle licensed radioactive sources and by-product material. Unsealed sources will be handled in the fume hood of the hot laboratory designed to handle these type sources.

On the basis of the proposed program for handling and storage of sealed and unsealed special radioactive materials, we conclude that the applicant will conduct a satisfactory radioactive material safety program.