12.0 RADIATION PROTECTION

This chapter provides information on the radiation protection features of the plant facility and equipment design, methods employed to achieve such protection, and estimated occupational radiation exposures to operating and construction personnel during normal operation and anticipated operational occurrences.

12.1 ENSURING THAT OCCUPATIONAL RADIATION EXPOSURES ARE AS LOW AS REASONABLY ACHIEVABLE (ALARA)

12.1.1 POLICY CONSIDERATIONS

Waterford 3 has committed to a policy of ensuring that occupational radiation exposures be kept as low as reasonably achievable. This commitment has been incorporated into the design of the plant and will continue throughout plant operation.

To ensure that the commitment would be incorporated into the plant design, Waterford 3 instituted an independent review of the shielding design and analysis performed by Ebasco. Additionally, Waterford 3 conducted an ALARA design review to identify those areas in plant layout, system design, etc. that may be of an ALARA concern, and will conduct an ongoing review and correct discrepancies to the extent possible.

Comments and information exchange, together with similar comments and information received from other clients and the industry, have been used by the architect/engineer to formulate a set of guidelines for the design of the Waterford 3 plant to minimize personnel exposures. These guidelines were prepared and applied by Ebasco engineers.

It is significant to note that these guidelines, summarized in Subsection 12.1.2 and cross referenced to the appropriate Regulatory Guide 8.8 section, paraphrase to a large extent Regulatory Guide 8.8, Information Relevant to Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable (Nuclear Power Reactors) March 1977, even though they preceded it. The guidelines have since been updated to meet the intent of Regulatory Guide 8.8. Waterford 3 will follow the guidelines of Regulatory Guide 8.10, Operating Philosophy For Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable, September 1975.

→(DRN 03-1135, R13)

The Radiation Protection Manager has the specific responsibility and authority for ensuring that the radiation protection program maintains exposures as low as reasonably achievable. He reports to the Technical Services Manager, and has a direct line of communication with the nuclear operations supervisors.

←(DRN 03-1135, R13)

The Vice President-Operations, Waterford 3 is ultimately responsible for establishing and implementing the ALARA program.

12.1.2 DESIGN CONSIDERATIONS

The following design guidelines have been used in the analysis of the plant to obtain as low as reasonably achievable personnel exposures.

Shielding walls have been designed so that the highest dose rate on the outside surface of the wall is less than or equal to the maximum permissible dose rate as per 10CFR20, considering occupancy requirements. For instance, in a controlled area of unrestricted occupancy, the design dose rate at the "hot spot" in the shielding wall would be at most 2.5 mrem/hr. The thickness required to achieve this desired dose rate is maintained throughout the extent of the particular wall (i.e., shielding walls are not contoured). (RG 8.8 paragraphs C.2.b.2 and C.2.b.3).

To the extent possible systems and components handling high activity fluids are located in the same general area of the plant, taking into account separation criteria. (RG 8.8 paragraphs C.2.b.2 and C.2.b.3).

Such systems and components are separated from low activity systems and components; in turn, the latter are located away from "clean" systems and components. With this arrangement, heavy shielding walls can be shared by various components, thus minimizing space requirements and costs. (RG 8.8 paragraphs C.2.b.2 and C.2.b.3).

To the extent possible all components and piping which do not normally contain radioactivity, nor can be expected to ever become radioactive, are separated from the radioactive portions of the plant. This simplified division of the plant into controlled and uncontrolled areas, aids in the unimpeded traffic within both portions, reduces the possibility that radioactive piping is run in clean areas, minimizes the need for shielded pipe chases, and helps in controlling contamination spread into clean areas. (RG 8.8 paragraphs C.2.b.2 and C.2.b.3).

Components belonging to a given system handling radioactivity are generally arranged on the same side, but outside of, corridors. This was done to minimize piping runs in corridors, and thereby to minimize the use of shielded pipe chases. (RG 8.8 paragraph C.2.b.6).

Equipment and components which require manual operation, visual inspection or are expected to need servicing are arranged in the lowest possible radiation field. For example, a system handling radioactive fluid consisting of a tank, pump, associated valving, sampling lines, and instrumentation is laid out as follows:

The tank, requiring the least servicing, is normally placed in a separate shielded cubicle. Serviceable valving and piping is excluded from this cubicle to the maximum practical extent. The pump and valves, which require maintenance, are placed in a separate cubicle. If practicable or when required, further compartmentalization is achieved by placing the pumps and valves in their own individual cubicles. Sampling lines and instrumentation requiring personnel attendance are brought outside the shield walls to low level radiation zones (II or III), with the exception of inside the containment. A description of each radiation zone is provided in Subsection 12.3.2.2. Even within the containment, such instrumentation is brought to the lowest possible radiation area. (RG 8.8 paragraphs C.2.b.1, C.2.C.2 and C.2.i.5)

Where it was impractical to locate items requiring servicing in low radiation areas, such items were designed so that they can be moved to a low radiation area. Any problems which may occur with rapid removal, local flushing, and decontamination for pieces of equipment (i.e., small pumps, large pumps, etc.) will be reviewed during operation. (RG 8.8 paragraphs C.2.b.9 and C.2.i).

Sufficient clearance is provided within shielding cubicles housing components potentially requiring maintenance and repair (such as valves, pumps heat exchangers, etc.), so that unimpeded and efficient work on the particular component is allowed. Overly restrictive compartments while saving space, require lengthier stays by maintenance or repair personnel, since their work will be hampered and inefficient. Furthermore, large compartments will ease installation of temporary shielding barriers should they be re-quired. Provisions for a sling, chain, and hoist, etc. are provided for all pieces of equipment with consideration given to their size, expected frequency of maintenance, and handling problems. (RG 8.8 paragraphs C.2.b.8 and C.2.i).

All instrumentation (flow meters, level gauges) is located in the lowest practical radiation area and will be readily accessible to operators. Operators will not normally be required to enter cubicles housing radioactive components to read or activate instruments. The only exception is instrumentation located by necessity within the containment; and even there, all efforts are made to locate it in the lowest possible radiation field. (RG 8.8 paragraph C.2.b.2).

Radioactive piping is either run in shielded pipe chases or within shielded cubicles housing low maintenance equipment, where practical. Radioactive piping is not run in accessways, and the amount of radioactive piping near frequent maintenance equipment has been minimized. (RG 8.8 paragraph C.2.b.6).

To the largest extent possible, but especially for components and piping handling primary coolant, radioactive resins, and concentrates, connections are provided for flushing portions of the system. The portion of the system to be flushed is dictated by the expected frequency of maintenance of the component(s) housed in a shielded cubicle, the size of the cubicle, the number of components housed therein, the geometry of piping, and the valving arrangement. (RG 8.8 paragraphs C.2.f.3 and C.2.h).

→ (DRN 99-2362)

The piping diameter utilized for resin and sludge transfer lines has been sized to minimize plugging. Other provisions such as flushing of the lines after resin or sludge transfer also contribute to the minimization of the plugging problem. We do not believe that oversizing of the piping would significantly decrease the potential for plugging, but would adversely affect the processing function, and possibly worsen the plugging situation by virtue of the resulting lower flow velocities.

← (DRN 99-2362)

In general, all components and piping within a single cubicle are flushable. Flushing with demineralized water will be the preferred manner, since other water or solutions may introduce chemicals which may, if activated, result in further radioactive crud. Flexible hoses from the low drain point to the floor drain are considered acceptable for flushing procedures except for resin carrying lines. These are flushed back to their respective tanks (spent resin and dewatering tanks). If hose is used to flush, the flushing connection will be brought out to a relatively accessible area. (RG 8.8 paragraph C.2.h).

Labyrinths and/or shielding doors are used to eliminate radiation streaming through access openings to the shielded cubicles. (RG 8.8 paragraph C.2.b.4).

Penetrations for piping and ducts in shielding walls are designed so as not to be on a direct line with a major radioactive source. Openings for the penetrations are kept as small as possible. Packing of the opening will be done, when required, to meet exposure criteria. (RG 8.8 paragraph C.2.b.5).

The extent and degree to which the two following guidelines concerning pumps and valves are used are dependent on the expected radiation levels of any given system. More stringent adherence to these guidelines is paid for highly radioactive systems, with progressive relaxation paralleling a lessening in expected activity.

Pumps serving potentially radioactive systems are housed in shielded areas outside cubicles containing radioactive components. Radioactive piping within the shielded pump cubicle is kept to a minimum. (RG 8.8 paragraph C.2.b.1).

Shielded valve stations for systems handling radioactive fluids are employed, wherever it is feasible, in order to perform valve maintenance without drainage of associated equipment. To further minimize personnel exposure remotely operated valves are utilized where practical and necessary. If manual valves are employed, extension rods through a shield wall to an accessible low radiation area are utilized as necessary. In order to greatly decrease the problems of radiation streaming, the reach rod penetrations are generally offset from the major source of radiation (usually a tank), or are provided with an internal offset. (RG 8.8 paragraphs C.2.c.1 and C.2.i.5).

Equipment and piping which handle radioactive fluids are designed, as indicated below, in a manner conducive to reducing the retention of radioactive crud, and making decontamination easier and efficient. (RG 8.8 paragraphs C.2.e, C.2.f.3 and C.2.h).

a) Piping runs are sloped wherever possible to prevent accumulation and assist in the removal of radioactive crud deposits.

b) The number of elbows, tees, V's, deadlegs, standpipes, etc. are minimized since these act as crud traps, and also render decontamination difficult.

c) Where elbows are required, large radius elbows are employed if possible with flow moving down through a vertical elbow, rather than up, as the elbow would then act as a crud trap. Flat-bending of pipes is used when possible.

d) Orifices are installed in vertical runs as opposed to horizontal ones, when there is an option.

e) Horizontal piping expansion joints are preferentially used.

   If vertical expansion joints are required, configurations resembling traps (e.g., filled joints) are avoided.

f) For pipes carrying resins, a smooth interior finish is specified, or the pipe is lined with a suitable polymer.

g) Consumable inserts are employed at welds, where this technique is possible. Use of backing rings will be minimized.

h) Low leakage valves are employed. ALARA design considerations have included use of low leakage valves with back seats wherever possible. The type of valve and valve arrangement generally used requirements of the system to which the valve belongs.

→ (DRN 99-0815)

i) All valve packing glands have provisions to adjust packing compression to reduce leakage. Valves in highly radioactive systems such as Waste or Boron Management Systems are packless diaphragm valves or are provided with stem below seals to reduce leakage (RG 8.8 paragraph C.2.i.6).

← (DRN 99-0815)

Use has been made of radiation resistant seals and gaskets when practical.

Preferential use is made of round bottomed tanks and vessels to minimize crud buildup in the tank bottom. Effluent process lines are placed as close as possible to the bottom, preferably at the lowest point in tank. Drain valves are positioned away from the tank bottom, and preferably located in an accessible area. Operators will not normally be forced to crouch below tanks to operate any valve, and to receive high exposures from the crud deposited therein. (RG 8.8 paragraph C.2.i.7).

The plant ventilation system is designed so that air flow is from areas of low to higher potential airborne contamination. (RG 8.8 paragraph C.2.d.1).

The operation of the Solid Waste Management System is discussed in FSAR Section 11.4.

Single traps are not used in the floor drainage system. This subsystem is entirely free of any radioactive noble gases because radioactive halogens are in solution. Hence no transport of radioactive gases from one cubicle to another through the floor drain system is foreseen. A single trap between the drain tanks and the drain header is deemed sufficient to prevent transport of any radioactive volatiles evolving in those tanks. (RG 8.8 paragraph C.2.b.10).

Equipment drains selectively employ a minimum number of traps to prevent transport of radioactive gases from component to component through the equipment drainage system, which could result in noble gas releases when components are maintained or repaired. Typically, the traps are at the equipment sump. (RG 8.8 paragraphs C.2.b.10 and C.2.d.6).

Open sumps are not used as receivers of equipment drains. (RG 8.8 paragraph C.2.d.6).

The plant areas are divided into two zones, controlled and uncontrolled, separated by access control points. (RG 8.8 paragraph C.2.a).

The controlled zones encompass all areas which either house radioactive equipment, or which can become contaminated during movement of personnel or components. The checkpoint acts as the last point at which contamination is detected. All efforts are made to control contamination at its point of origin by posting the extent of contamination and following the normal health physics procedures. (RG 8.8 paragraph C.2.a).

Sufficient space is provided at shielded cubicles exits to accessways, to place bins to collect protective clothing.

Proper provisions to control access to high radiation areas, in compliance with Section 20.1601 of 10CFR20, are provided. (RG 8.8 paragraph C.2.a).

Communication outlets are strategically located in the plant. Typically, they are near cubicles housing radioactive equipment (especially high radiation areas) or equipment which operates intermittently and which is actuated remotely.

Equipment decontamination areas are provided at selected locations in the plant. The choice of these locations is based on:

a) a low radiation area,

b) a location central to equipment which is likely to require decontamination,

c) a vicinity near the hot machine shop, and/or

d) the capability of routing drain and ventilation lines from the decontamination area to processing systems. The equipment decontamination facility is located in the +21 west wing area adjacent to the Hot Machine Shop. Other temporary areas may be established to expedite equipment decon.

Each decontamination area consists of the decontamination area and a storage area, where equipment can be stored prior to decontamination.

Suitable coatings are used on all floor surfaces of areas in the controlled zone. Personnel decontamination facilities and shielded cubicles have surfaces suitably treated for easy decontamination.

The preceding guidelines were derived utilizing experience from prior plant design and from operating plants.

→(DRN 99-2362; 02-264)

Note: The following is historical information pursuant to NEI-98-03, which is identified by a designation of "Start" and "End."

Start of Historical Information

These guidelines were used in the design of the facility. The design was reviewed by the Waterford 3 and Ebasco engineers assigned to the project. These engineers, besides performing shielding and exposure calculations, worked with the designers and other engineers to ensure that the guidelines were followed. They advised on the most desirable design option for radiation protection when alternate designs were possible in satisfying the process requirements. Typically, this involved a study of the exposures which were likely to be derived from alternate designs and the selection of the option resulting in the lowest exposure.

The lead applied physics engineer of Ebasco was responsible for the radiation protection design and review. He originally established the general and specific objectives of the shielding, access, and contamination control design of the project.

He established these objectives in concert with Waterford 3 cognizant personnel. He provided other disciplines involved in the plant design with guidelines and directives which they followed and which were intended to result in ALARA exposures. He, and the engineers assigned to him, monitored the implementation of the guidelines and directives.

The lead applied physics engineer was responsible for recommendations to the project engineer, who was responsible for the overall design of the power plant. In such recommendations he requested concurrence of the cognizant engineers assigned by Waterford 3 to review his work.

The radiation protection design review was an ongoing review throughout all phases of the design. The radiation protection cognizant personnel worked side by side with the other discipline engineers and designers to ensure that all necessary radiation protection considerations were taken into account. In addition, more formal shielding reviews were conducted at selected intervals during the design of the project. The formal reviews were performed to ensure that the guidelines stated above were not compromised to ensure ALARA dose rates. Waterford 3 had direct input in these reviews. Calculations, which form the bases for such reviews, were made on the basis of the information available at that point in time in the following categories:

a) source calculation and/or verification for each system involved in the review,

b) shield thickness calculations,

c) activation calculations if the system involves neutron radiation, and/or

d) mapping of dose rate calculation of exposure for the particular layout.

Comments from the engineer performing the review or from Waterford 3 were transmitted to the appropriate discipline either by separate memorandum which refered to the particular drawing or specification, if the comments were very extensive, or were made directly on the specifications or drawings. In either case, the drawing or specification transmittal sheet would bear a note that comments were made which required resolution. Both the transmittal sheets and the comments were retained by the discipline affected by the comments. The success of the normal review for radiation protection design was measured by the paucity of instances where a design had to be modified or improved after it has been completed. While certainly these instances have occurred in the Waterford 3 project, the objectives of the review was indeed to minimize them by effecting whatever changes or improvements were deemed necessary during the conceptual phase of the design, prior to the design being released. As a result of this approach, depiction of many illustrative examples of specific design improvements which resulted from the radiation protection design review is difficult, without documentation of the day by day interaction of the radiation protection engineer with the designer, and the evolution of the radiation protection design. Most of these examples are documented by comparison of areas and systems at different degrees of completion of the design, with the same areas and systems when the design is complete.

Many changes and improvements were made to the Waterford 3 design to minimize personnel exposures. Since the finished drawings and specifications reflect only the finished product, listed below are just a few of the major changes and improvements:

NOTE: End of Historical Information.

←(DRN 99-2362; 02-264)

a) The ion exchanger area was redesigned to provide a shielded valve gallery and a location from which the valves could be operated remotely.

b) The Solidification System was originally designed in the drumming station. The System has been abandoned in place and the drumming station converted to the Hot Tool Room.

c) The filter cubicles were redesigned to a blockhouse configuration for simpler handling of the filter cartridges with a concomitant decrease in personnel exposure.

d) The reactor vessel cavity and ring girder support were redesigned to minimize the air activation (Ar^{41})in containment, and the neutron streaming problem. With the present design, neutron dose rates calculated at similar locations in the containment are comparable to those which have been predicted to occur after installation of special shields above the reactor flange level. Such shields, however, would require removal for refueling operations with the attendant personnel exposures. The present shield design which utilizes the support ring girder is considered optimum in that the man-rem saved by installation of an additional above-the-flange shield, estimated to be two man-rem/yr, on the basis of a dose rate reduction of approximately 150 mrem/hr at an average containment location requiring access and an occupancy of 15 minutes/week, is comparable to the increase in man-rem necessitated for the removal of the above-the-flange shield, which has been estimated to be between 0.6 and 1.2 man-rem. The cost of an additional shield would be inordinate with respect to the man-rem saved.

e) Permanent shielding has been installed on the spent resin recirc/discharge line in the drumming station and on the spent resin tank discharge line in the spent resin tank pump room –35 elevation RAB.

12.1.3 OPERATIONAL CONSIDERATIONS

To the greatest extent, all efforts are made to factor operational considerations of radiation exposure in the plant layout and system design, by utilizing the guidelines of Subsection 12.1.2 throughout the design effort. These guidelines incorporate known operational considerations derived from experience. Information from operating plants have continuously been factored in the design as it progressed to reflect new operational considerations, not well known or appreciated at the time the guidelines were initially developed. In this regard, the guidelines of Regulatory Guides 8.8 and 8.10 will continue to be factored in the design.

Administrative procedures will be established in the plant, which along with design shielding, will ensure that the exposures to personnel will be kept as low as reasonably achievable during plant operation and maintenance. These procedures will be completed prior to initial plant startup, and will be updated to reflect Waterford 3s operating exposure experience.

Stationary and portable detectors are provided for monitoring direct, surface and airborne activity in operating and maintenance locations, particularly in those locations susceptible to radioactive contamination.

Detailed written procedures, shall be prepared and approved as specified in Section 12.5.

→(DRN 03-1135, R13

Implementation of these procedures is the specific responsibility of the Radiation Protection Manager.

←(DRN 03-1135, R13

The Health Physics program and a detailed description of procedures for radiation exposure-related operation is given in Section 12.5. Summarized below, however, are the salient points.

→ (LBDCR 16-016, R309)

Health physics personnel will periodically observe jobs in progress in the radiation controlled areas and will perform radiation surveys to ensure that exposure to radiation and contamination levels are kept ALARA. Administrative exposure guidelines are designed to evenly distribute each individual's exposure. When personnel are assigned to a job or a location where there exists the possibility that administrative guidelines may be exceeded, health physics personnel shall investigate the exposure records of the personnel involved and authorize work by such personnel only after the current exposure history, the amount the guidelines might be exceeded, and the alternatives that are available to complete the job under consideration have all been considered. This will call for consultation and pre-job planning between the supervisor in charge of the job and health physics personnel.

← (LBDCR 16-016, R309)

12.1.4 DECOMMISSIONING CONSIDERATIONS

While decommissioning will occur only after the termination of plant operation (the estimated facility lifetime is 40 years from the date of the construction permit), it is expected that it will be accomplished through the application of one of the presently available alternative methods. The experience gained in the continued application of these methods, and any developing variations, to nuclear plant decommissionings in the interim years will further ensure that ultimate acceptability of the mode of decommissioning.

At present there are three primary methods for decommissioning commercial power reactors - mothballing, in-place entombment, and removal of radioactive components and dismantling. The major characteristics of each of these methods are described below. A fourth alternative - conversion to a new nuclear system or a fossil fuel system may prove practicable at selected sites given favorable conditions. This alternative utilizes the existing turbine-generator system with a new steam supply system. The original Nuclear Steam Supply System is separated from the Electric Generating System and disposed of in accordance with one of the three primary methods. This alternative is not treated separately here since with respect Nuclear Steam Supply System decommissioning it is not distinct from the primary methods.

Mothballing of a nuclear reactor facility consists of putting the facility in a state of protective storage. In general, the facility may be left intact except that all fuel assemblies and the radioactive fluids would be removed from the site. Adequate radiation monitoring, environmental surveillance, and appropriate security procedures would be established to ensure that the health and safety of the public is not endangered.

In-place entombment consists of sealing all the remaining radioactive or contaminated components (e.g., the pressure vessel and reactor internals) within a structure integral with the biological shield. All fuel assemblies, radioactive fluids and wastes, and certain selected components would be shipped offsite. The sealing structure must provide integrity over the period of time in which significant quantities of radioactivity remain with the material in the entombment. An appropriate and continuing surveillance program would be required.

→ (LBDCR 16-016, R309)
In the removal/dismantling method, all fuel assemblies, radioactive fluids and waste, and other materials having activities above accepted unrestricted activity levels would be removed from the site. The utility would then have unrestricted use of the site and long-term surveillance would not be required. In the extreme application of this method, the utility may desire to dismantle the remainder of the facility and remove or otherwise dispose of all structural material and components.
← (LBDCR 16-016, R309)

To date, experience with decommissioning of civilian nuclear power reactors in the United States includes the shutdown or dismantling of six facilities. In these decommissionings each of the three primary methods described above have been employed. The Carolina Virginia Tube Reactor (CVTR) and Pathfinder Reactor decommissionings are examples of the mothballing method, while the Hallam Nuclear Power Facility, Boiling Nuclear Superheater (BONUS) Power Station, and Piqua Reactor decommissioning is most nearly exemplary of application of the removal/dismantling technology. Although the sizes of the facilities decommissioned to date have been relatively small, the experience reinforces the conclusion that the facility can be decommissioned while ensuring that in-plant exposures are kept ALARA.

Whichever mode of decommissioning is used, there is assurance that the operation could be performed in a manner consistent with the ALARA philosophy. The assurance stems from the fact that the facility has been designed in accordance with the philosophy outlined in Regulatory Guide 8.8. Since operating conditions present much more limiting radiological conditions than shutdown and decommissioning, it is anticipated that all exposures associated with decommissioning will be ALARA.

→ (DRN 03-2066, R14)
Estimates of the in-plant and offsite exposures for a reference PWR has been performed by Battelle Northwest Institute. These estimates reveal that the total exposures could range from 1300 man rem for immediate dismantlement to about 500 man rem for preparing the facility for safe storage 30 years and then dismantling. Figures 12.1-1 and -2 present the results of the BNW study. These results are based on the Trojan Nuclear Power Plant as the reference plant. Since Waterford 3 is a more recently designed plant and incorporates many of the design features recommended in Regulatory Guide 8.8, it is reasonable to assume that the exposures would be lower than predicted.
← (DRN 03-2066, R14)

As described in the above subsections specific designs and policies are provided to keep in-plant exposures ALARA. Subsection 12.1.2 presents a detailed description of the design considerations. The following summarizes the design features which would be effective in reducing in-plant exposures during decommissioning.

a) Components containing high activity, low activity and no activity are physically separated.

b) Shield walls are not contoured to the radiation field of a particular component, instead the shield walls for a particular component are of uniform thickness based on the highest dose rate at any point.

c) Sufficient spacing is provided within cubicles to facilitate inspection and maintenance and to allow the installation of portable shielding.

d) Radioactive piping is either run in shielded pipe chases or within shielded cubicles.

e) Components and piping containing radioactive material, such as primary coolant, resin and concentrates are provided with connections for flushing with demineralized water.

f) Equipment and piping are designed to minimize crud buildup and facilitate decontamination. For example pipes are sloped, elbows and T's in pipes are minimized, round bottom tanks are used.

g) Plant ventilation is designed so that air flow is from low to potentially higher areas of airborne activity.

h) Several equipment decontamination areas are provided. The ventilation and drainage from these areas can be routed for processing.

i) Sampling lines and instrumentation requiring personnel attendance are brought outside shield walls.

J) Surfaces are suitably coated for ease of decontamination.

k) In order to reduce neutron activation of materials, shielding is specifically provided to reduce neutron streaming.

l) Filtration is provided on major HVAC exhaust points. This includes filtration on the large containment purge and the exhaust from the Reactor Auxiliary Building. In addition the Airborne Radioactivity Removal System (i.e., a kidney system) is provided inside the containment.