12.4 Dose Assessment

The information in this section of the reference ABWR DCD, including all subsections and tables, is incorporated by reference with the following departures and supplements.

STD DEP Admin

STD DEP 9.1-1

STD DEP 11.2-1 (Table 12.4-1)

STP DEP 10.4-4

12.4.1 Drywell Dose

STD DEP Admin

The following provides the basis by which the drywell dose estimates for occupational exposure were made.

(1) Early studies on dose rates during MSIV maintenance showed increases in dose rate directly proportional to recirculation line activity. The ABWR has deleted the recirculation lines entirely, thereby removing the singly most significant source of radiation in the drywell. The second most significant dose for MSIV operations will be the deposited and suspended activity in the feedwater lines. The deposited activity in the feedwater lines is expected to be lower than typical BWRs owing to an enhanced condensate polishing *system ~~with full cleanup of all condensate water~~, a 2% CUW System, and titanium* or stainless steel *condenser tubes. Additionally, the ABWR is designed to limit the use of cobalt bearing materials on moving components which have historically been identified as major sources of in-water contamination. Overall, the feedwater line radiation is expected to be a factor of three lower than current BWRs. Because of these factors, it is expected that the effective dose rate in the drywell will be 18 µGy/h and 13 µGy/h in the steam tunnel outboard of the primary containment.*

12.4.2 Reactor Building Dose

STD DEP 9.1-1

The following provides the basis by which the Reactor Building dose estimates for occupational exposure were made.

(2) ABWR refueling is accomplished via an automated refueling ~~bridge~~ machine*. All operations for refueling are accomplished ~~from an enclosed automation center off the refueling floor~~* as described in Section 9.1.4.2.7.1*. Time for refueling is reduced from a typical 4,400 person-hours down to 2,000 person*-hours *and from an effective dose rate of 25 µGy/h to less than 2 µGy/h.*

12.4.3 Radwaste Building Dose

STD DEP 11.2-1

This subsection is replaced in its entirety with the following.

Radwaste Building work consists of water processing, pump and valve maintenance, shipment handling, radwaste management, and general cleanup activity. Radwaste building doses result from routine surveillance, testing, and maintenance of the solid and liquid waste treatment equipment. The liquid treatment system collects liquid wastes from equipment drains, floor drains, filter backwashes, and other sources within the facility. The solid treatment system processes resins, backwash slurries, and sludge from the phase separator. It also processes dry active waste from the plant. Some examples of radwaste activities include resin dewatering, movement of casks and liners, filter handling, resin movement, and installation and removal of mobile radwaste processing skids. Both waste treatment systems are based on current mobile radwaste processing technology and avoid complex permanently installed components. All radwaste tankage and support systems are permanently installed. More of the radwaste operations involve remote handling than in a typical BWR. This, as well as improved maintenance procedures and a more flexible radwaste system and building design, leads to the estimated value shown in Table 12.4-1 for maintenance tasks in the Radwaste Building. The average dose rate shown in Table 12.4-1 is estimated for all operations.

12.4.4 Turbine Building Dose

STP DEP 10.4-4

(3) *Work on the turbine hall condensate system typically requires 2,000 hours per year at an effective dose rate of 75 µGy/h. The condensate system in the ABWR uses a* filter and polishing process ~~*hollow-fiber filled filters*~~ *which* ~~*require*~~ requires *half the maintenance of a typical system. In addition, with the plant incorporating Fe control in the Feedwater System and a significant reduction in cobalt bearing materials, the overall effective dose rate is estimated at half the above value.*

12.4.5 Work at Power

STP DEP Admin

Work at power typically requires 5,000 hours per year at an effective dose rate of 66 µGy/h for the BWR. This category covers literally all aspects of plant maintenance performed during normal operations from health physics coverage to surveillance, to minor equipment adjustment, and minor equipment repair. Overall, the ABWR has been designed to use more automatic and remote equipment. It is expected that items of routine monitoring will be performed by camera or additional instrumentation. Most equipment in the ABWR is palatalized, which permits quick and easy replacement and removal for decontamination and repair. Therefore, a reduction in actual hours needed at power is estimated at 1,000 hours less than the typical value. In the area of effective dose rate, the ABWR is expected to have significantly lower general radiation levels *over current plants, owing to more stringent water chemistry controls, a full flow condensate flow system, a 2% cleanup water program, titanium* or stainless steel *condenser tubes, Fe feedwater control, and low cobalt usage. In addition, the ABWR has in the basic design, compartmentalized all major pieces of equipment so that any piece of equipment can be maintained or removed for maintenance without affecting normal plant operations. This design concept thereby reduces radiation exposure to personnel maintaining or testing one piece of equipment from both shine and airborne contamination from other equipment. Finally, the ABWR has incorporated in the basic design the use of hydrogen water chemistry (HWC) and the additional shielding necessary to protect from the factor of six increase in N-16 shine produced through the steamlines into the Turbine Building. For normally occupied areas, sufficient shielding is provided to protect from N-16 shine. In areas which may be occupied temporarily for specific maintenance or surveillance tasks and where additional shielding is not appropriate (for the surveillance function) or deemed reasonable, the HWC injection can be stopped causing the N-16 shine to decrease to within normal operating BWR limits within 90 seconds and thus permitting those actions needed. Overall, it is estimated that the effective dose rate for work at power will be slightly over two thirds the typical rate or 40 µGy/h.*

Table 12.4-1 Projected Annual Radiation Exposure

Operation Task	Tier 2 Section	hours per year	µGy/h	person-mSv/yr
Drywell				
MSIV	(1)	~4,200	15	63
SRV, RIP, etc	(2)	1,150	75	86
FMCRD	(3)	370	65	24
LPRM/TIP	(4)	200	500	100
ISI	(5)	1,200	55	66
Other	(6)	3,500	35	123
Total		10,620		462
Reactor Building				
Vessel	(1)	1,200	15	18
Refueling	(2)	2,000	2	4
RHR/CUW	(3)	400	54	22
FMCRD	(4)	120	45	5
Instrument	(5)	1,000	30	30
Other	(6)	4,400	15	66
Total		9,120		145
Radwaste Building		~~4200~~ **1,000**	25	~~105~~ **25**
Turbine Building				
Valve Maintenance	(1)	1,000	39	39
Turbine Overhaul	(2)	15,500	2	31
Condensate	(3)	1,000	35	35
Other	(4)	11,800	1	12
Total		29,300		117
Work at Power		4,000	40	160
Totals		~~57,240~~ **54,040**		~~989~~ **909**