tions were maintained in the RCS as shown in Figure 2-1 for approximately seven and one half hours after boration before commencing cooldown. During this time frame significant cooling took place in the reactor vessel upper head due to the operation of the CEDM cooling fans. (Refer to Section 5.0 below for a detailed evaluation of RVUH cooldown during natural circulation with the CEDM cooling fans in operation and with the CEDM cooling fans secured.) Just prior to cooldown, the normal air supply to the atmospheric dump valves was secured and the safety-grade nitrogen gas bottles were placed in operation, see Figure 2-4 (p.18) for a simplified system schematic. The intent of this last evolution was to demonstrate the adequacy of the ADV nitrogen supply.

As stated above, approximately seven and one half hours after completion of the boron mixing experiment a symmetric cooldown was commenced, i.e., a two steam generator cooldown using both atmospheric dump valves. ADV position was recorded and nitrogen usage was monitored in order to determine the adequacy of the capacity of the safety-grade supply bottles. The plant was cooled from an average cold leg temperature of approximately 535^{O}F to an average cold leg temperature of approximately 334^{O}F in slightly greater than four hours. The RCS was thus taken from Mode 3, hot standby, to Mode 4, hot shutdown, with an average cooldown rate of 48^{O}F per hour. Figure 2-5 (p. 19) shows ADV position and accumulator pressure during the cooldown portion of the test. The average rate of nitrogen usage was about 62.5 psi per hour with the average accumulator pressure decreasing from approximately 1050 psig to approximately 800 psig between the start and the completion of the cooldown. At that rate of usage, a full nitrogen accumulator, initial nominal pressure 1100 psig, would take 16 hours to discharge to the minimum usable pressure of 100 psig. (Section 6.0 below contains a discussion of nitrogen usage by the atmospheric dump valves with respect to the requirements of Branch Technical Position RSB 5-1.)

versus time. Curve I in that figure is a plot of standard decay heat and Curve II is a plot of the actual decay heat levels that existed during the SONGS Natural Circulation Test based upon measure loop differential temperatures. Integrating the area under Curve I from 10 minutes to 1200 minutes and dividing by the area under Curve II from 10 minutes to 1200 minutes yields a multiplication factor of 2.06, i.e., over twice the amount of heat would have to be removed following a trip from 100% of RTP with full decay heat than was removed during the actual natural circulation test. The third step then is to calculate the final adjusted feedwater usage. This is done in Table 6-5 (p. 88). Note that the result, 246,000 gallons, is 98,000 gallons less than the total condensate available as specified in Reference 3.

The final item identified by the NRC Staff for post-test evaluation was the adequacy of the safety-grade nitrogen supply to the atmospheric dump valves. As previously seen, valve position and accumulator pressure during the cooldown portion of the SONGS test is presented in Figure 2-5 (p. 19). At the rates of usage noted during the cooldown and steady state portions of the test, between 13.5 and 19.5 hours would be required to discharge an accumulator, charged to an initial nominal pressure of 1100 psig, to the minimum usable pressure of 100 psig. Enough nitrogen capacity should be available to perform an entire BTP RSB 5-1 evolution, including the limiting evolution per Figure 5-6 (p. 67). If the nitrogen supply should become depleted, manual local control via manual handwheels is possible as demonstrated during the SONGS test, see Section 2.2 above.

6.3 Applicability of SONGS Test to Waterford 3

6.3.1 Introduction

During the course of the NRC Staff's review of the Waterford Unit 3 shutdown cooling system, see Section 5.4.3 of Reference 14, Louisiana Power & Light was requested to demonstrate how the requirements of Branch Technical Position RSB 5-1, "Design Requirements of the Residual Heat Removal