REPLACEMENT PAGES FOR APPENDIX A
CRYSTAL RIVER UNIT 3
TECHNICAL SPECIFICATIONS

3.7 PLANT SYSTEMS

3.7.15 Spent Fuel Assembly Storage

LCO 3.7.15 The combination of initial enrichment and burnup of each spent fuel assembly stored in Storage Pool A and Storage Pool B shall be within the acceptable region of Figure 3.7.15-1, Figure 3.7.15-2, Figure 3.7.15-3, or stored in accordance with the FSAR.

APPLICABILITY: Whenever any fuel assembly is stored in Storage Pool A or Storage Pool B of the spent fuel pool.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. Requirements of the LCO not met.	A.1	--------NOTE-------- LCO 3.0.3 is not applicable. ---------- Initiate action to move the noncomplying fuel assembly from Storage Pool A, or Storage Pool B.	Immediately

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.15.1	Verify by administrative means the initial enrichment and burnup of the fuel assembly is in accordance with Figure 3.7.15-1, Figure 3.7.15-2, Figure 3.7.15-3, or in accordance with the FSAR.	Prior to storing the fuel assembly in Storage Pool A or Storage Pool B.

MINIMUM BURNUP REQUIRED FOR
"A" POOL STORAGE

Minimum Burnup vs Initial Enrichment

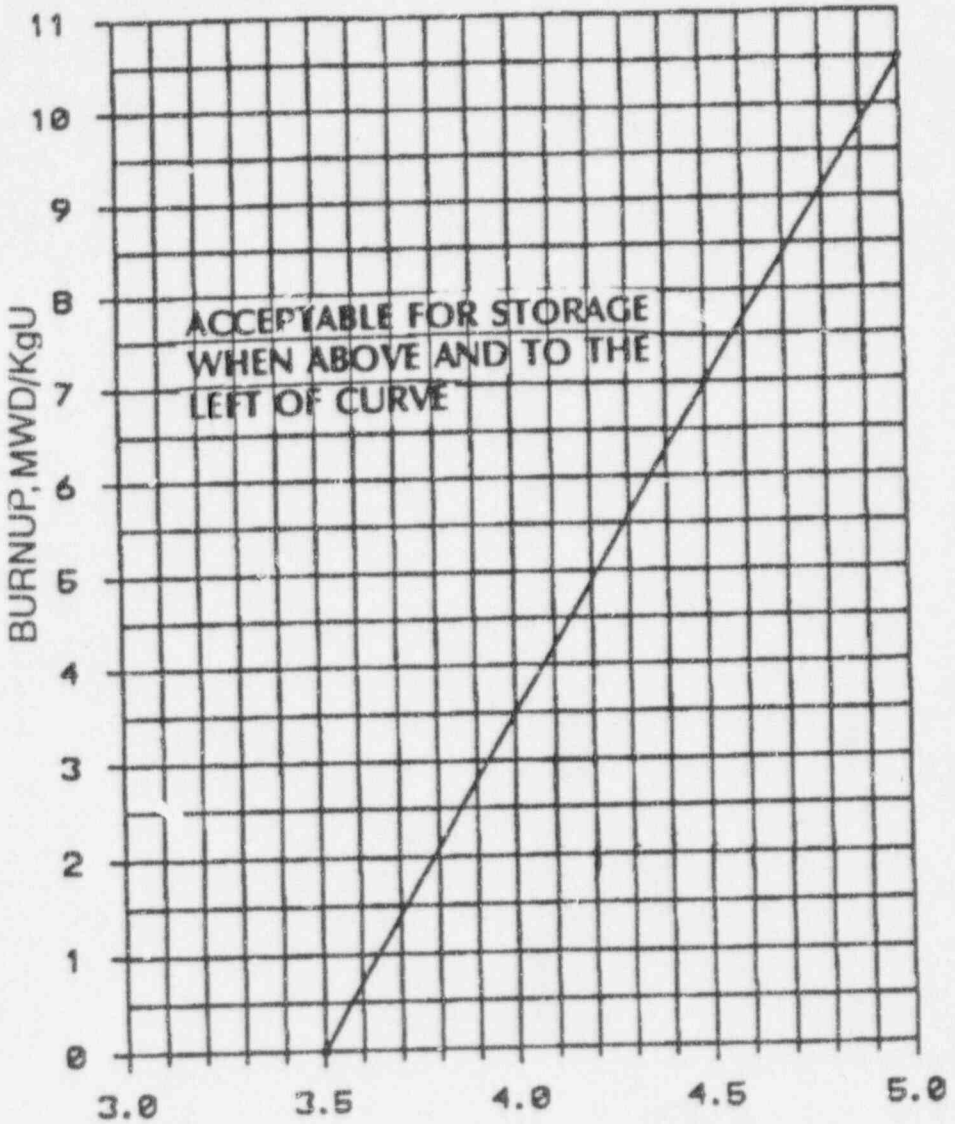

Figure 3.7.15-1 (page 1 of 3)
Burnup versus Enrichment Curve for
Spent Fuel Storage Pool A

MINIMUM BURNUP REQUIRED FOR
REGION 1 OF "B" POOL

Minimum Burnup vs Initial Enrichment

Burned Fuel in checkerboard Configuration with 5.0 wt% Fresh Fuel

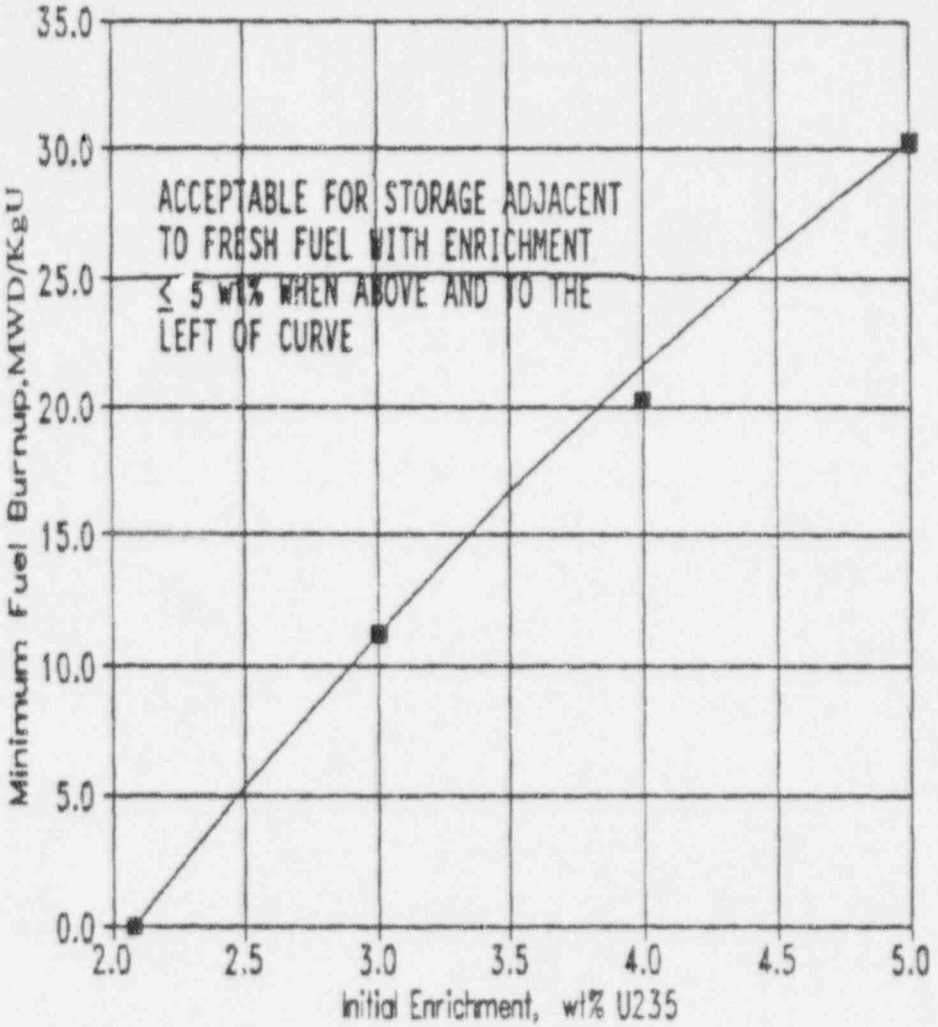

Figure 3.7.15-2 (page 2 of 3)
Burnup versus Enrichment Curve for
Spent Fuel Storage Pool B, Region 1

MINIMUM BURNUP REQUIRED FOR
REGION 2 OF "B" POOL

Minimum Burnup vs Initial Enrichment

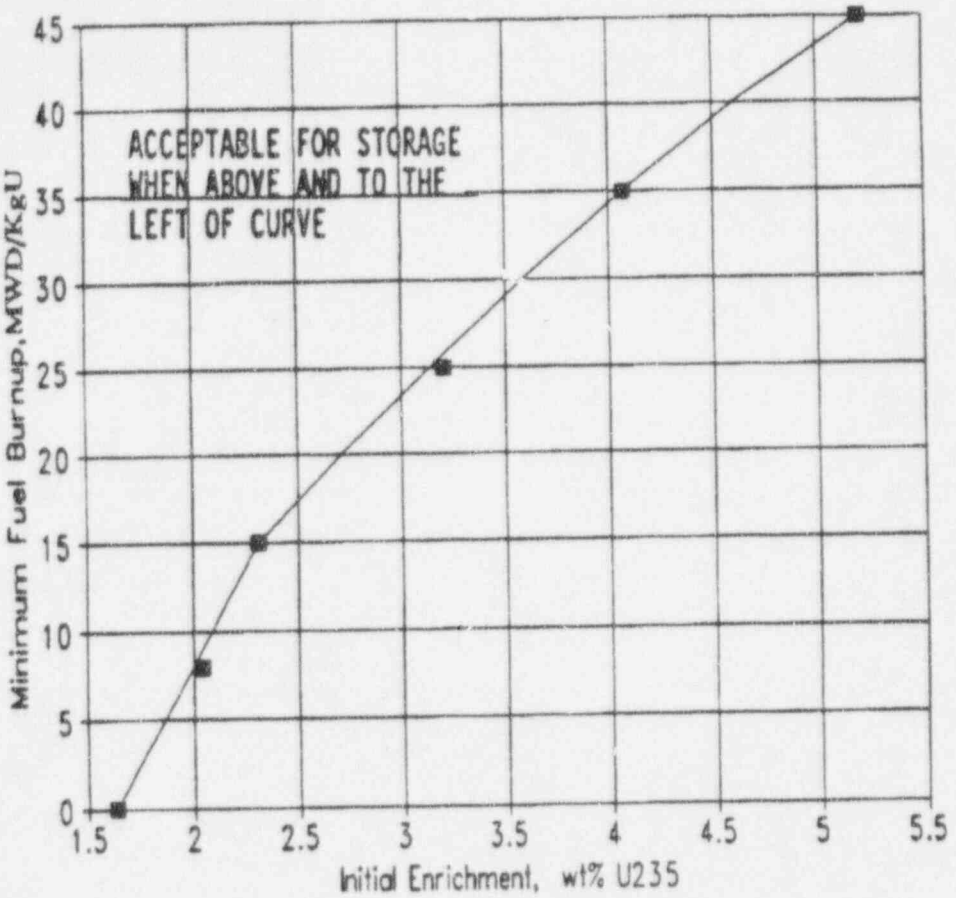

Figure 3.7.15-3 (page 3 of 3)
Burnup versus Enrichment Curve for
Spent Fuel Storage Pool B, Region 2

4.0 DESIGN FEATURES

4.1 Site

The 4,738 acre site is characterized by a 4,400 foot minimum exclusion radius centered on the Reactor Building; isolation from nearby population centers; sound foundation for structures; an abundant supply of cooling water; an ample supply of emergency power; and favorable conditions of hydrology, geology, seismology, and meteorology.

4.2 Reactor Core

4.2.1 Fuel Assemblies

The reactor shall contain 177 fuel assemblies. Each fuel assembly shall consist of a matrix of Zircaloy-4 clad fuel rods with an initial composition of natural or slightly enriched uranium dioxide (UO_2) as fuel material, with a maximum enrichment of 5.0 weight percent U-235. Limited substitutions of stainless steel filler rods for fuel rods, in accordance with approved applications of fuel rod configurations, may be used. Fuel assemblies shall be limited to those fuel designs that have been analyzed with applicable NRC staff approved codes and methods and shown by tests or analyses to comply with all fuel safety design bases. Each fuel rod shall have a nominal active fuel length of 144 inches and shall contain a maximum total weight of 2253 grams uranium.

4.2.2 CONTROL RODS

The reactor core shall contain 60 safety and regulating (including extended life CONTROL RODS) and 8 AXIAL POWER SHAPING (APSR) rods. Except for the extended life CONTROL RODS, the CONTROL RODS shall contain a nominal 134 inches of absorber material. The extended life CONTROL RODS shall contain a nominal 139 inches of absorber material. The nominal values of absorber material shall be 80 percent silver, 15 percent indium, and 5 percent cadmium. Except for extended life CONTROL RODS, all CONTROL RODS shall be clad with stainless steel tubing. The extended life CONTROL RODS shall be clad with Inconel. The APSRs shall contain a nominal 63 inches of absorber material at their lower ends. The absorber material for the APSRs shall be 100 % Inconel.

(continued)

4.0 DESIGN FEATURES (continued)

4.3 Fuel Storage

4.3.1 Criticality

4.3.1.1 The spent fuel storage racks are designed and shall be maintained with:

a. Fuel assemblies having a maximum U-235 enrichment of 5.0 weight percent;

b. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 9.6 of the FSAR;

c. A nominal 10.6 inch center to center distance between fuel assemblies placed in Region 1 of the B pool;

d. A nominal 9.17 inch center to center distance between fuel assemblies placed in Region 2 of the B pool; and

e. A nominal 10.5 inch center to center distance between fuel assemblies placed in the A pool.

4.3.1.2 The new fuel storage racks are designed and shall be maintained with:

a. Fuel assemblies having a maximum U-235 enrichment of 5.0 weight percent;

b. $k_{eff} \leq 0.95$ if fully flooded with unborated water, which includes an allowance for uncertainties as described in Section 9.6 of the FSAR;

c. $k_{eff} \leq 0.98$ if moderated by aqueous foam, which includes an allowance for uncertainties as described in Section 9.6 of the FSAR; and

d. A nominal 21.125 inch center to center distance between fuel assemblies placed in the storage racks.

(continued)

BASES
(INFORMATION ONLY)

B 3.7 PLANT SYSTEMS

B 3.7.15 Spent Fuel Assembly Storage

BASES

BACKGROUND

This document describes the Bases for the Spent Fuel Assembly Storage which imposes storage requirements upon irradiated and unirradiated fuel assemblies stored in the fuel storage pools containing high density racks. The storage areas, which are part of the Spent Fuel System, governed by this Specification are:

a. Fuel storage pool "A" and
b. Fuel storage pool "B".

In general, the function of the storage racks is to support and protect new and spent fuel from the time it is placed in the storage area until it is shipped offsite.

Spent fuel is stored underwater in either fuel storage pool A or B. Only fuel pool A has the capability to store failed fuel in containers. Spent fuel pool A features high density poison storage racks with a 10 1/2 inch center-to-center distance capable of storing 542 assemblies. Fuel pool A is capable of storing fuel with enrichments up to 5.0 weight percent U-235 (Ref. 1) without exceeding the criticality criteria of Reference 3 providing the fuel has sufficient burnup.

Spent fuel pool B also contains high density racks separated into 2 regions. The racks in Region 1 have a 10.60 inch center-to-center spacing capable of storing 174 assemblies. The high density racks in Region 2 have 9.17 inch center-to-center distance capable of storing 641 assemblies. Fuel pool B is capable of storing fuel with enrichments up to 5.0 weight percent U-235 (Ref. 2) without exceeding the criticality criteria of Reference 3, providing the fuel has sufficient burnup and required storage configuration.

It should be noted that the maximum enrichment limits are actually nominal values. The tolerance of fuel supplied by DOE is $\pm$ 0.013 weight percent. Thus, it is possible to have fuel with an initial enrichment slightly in excess of the stated limit. This is accounted for in the criticality analysis and is therefore acceptable.

(continued)

BASES

BACKGROUND (continued)

Both of the spent fuel pools are constructed of reinforced concrete and lined with stainless steel plate. They are located in the fuel handling area of the auxiliary building (Ref. 2).

New fuel storage requirements are addressed in Section 4.0, "Design Features".

APPLICABLE SAFETY ANALYSES

The function of the spent fuel storage racks are to support and protect spent fuel assemblies from the time they are placed in the pool until they are shipped offsite. The spent fuel assembly storage LCO was derived from the need to establish limiting conditions on fuel storage to assure sufficient safety margin exists to prevent inadvertent criticality. The spent fuel assemblies are stored entirely underwater in a configuration that has been shown to result in a reactivity of less than 0.95 under worse case conditions (Ref. 1 and 2). The spent fuel assembly enrichment requirements in this LCO are required to ensure inadvertent criticality does not occur in the spent fuel pool.

Inadvertent criticality within the fuel storage area could result in offsite radiation doses exceeding 10 CFR 100 limits.

The spent fuel assembly storage satisfies Criterion 2 of the NRC Policy Statement.

LCO

Limits on the irradiated fuel assembly storage in high density racks were established to ensure the assumptions of the criticality safety analysis of the spent fuel pools is maintained.

Limits on initial fuel enrichment and burnup for spent fuel stored in pool A have been established. Two limits are defined:

1. Initial fuel enrichment must be less than or equal to 5.0 weight percent U-235, and

(continued)

BASES

LCO
(continued)

2. For spent fuel with initial enrichment less than or equal to 5.0 weight percent and greater than or equal to 3.5 weight percent, fuel burnup must be within the limits specified in Figure 3.7.15-1. (Figure 3.7.15-1 presents required fuel assembly burnup as a function of initial enrichment.)

Fuel enrichment limits are based on avoiding inadvertent criticality in the spent fuel pool. The CR-3 spent fuel storage system was initially designed to a maximum enrichment of 3.5 weight percent. Enrichments of up to 5.0 weight percent are permissible for storage in spent fuel pool A as long as the fuel burnup is sufficient to limit the worst case reactivity in the storage pool to less than 0.95. Fuel burnup reduces the reactivity of the fuel due to the accumulation of fission product poisons. Reference 1 documents that the required burnup varies linearly as a function of enrichment with 10500 megawatt days per metric ton uranium (Mwd/mtU) required for fuel with 5.0 weight percent enrichment and 0 burnup required for 3.5 weight percent enriched fuel.

Similar types of restrictions have been established for Pool B.

1. Initial fuel enrichment must be $\leq$ 5.0 weight percent U-235,

2. For Region 1, fuel with initial enrichment $\leq$ 5.0 weight percent and $\geq$ 2.08 weight percent fuel burnup must be within the limits specified in Figure 3.7.15-2 and arranged in a required checkerboard configuration with new fuel or burned fuel of $\leq$ 5.0 weight percent, and

3. For spent fuel with initial enrichment $\leq$ 5.0 weight percent and $\geq$ 1.63 weight percent in Region 2, fuel burnup must be within the limits specified in Figure 3.7.15-3. (Figure 3.7.15-3 presents required fuel assembly burnup as a function of initial enrichment.)

(continued)

BASES

LCO (continued)

The LCO allows compensatory loading techniques, specified in the FSAR and applicable fuel handling procedures as an alternative to storing fuel assemblies in accordance with Figures 3.7.15-1, 3.7.15-2 and 3.7.15-3. This is acceptable since these loading patterns assure the same degree of subcriticality within the pool.

APPLICABILITY

In general, limiting fuel enrichment of stored fuel prevents inadvertent criticality in the storage pools. Inadvertent criticality is dependent on whether fuel is stored in the pools and is completely independent of plant MODE.

Therefore, this LCO is applicable whenever any fuel assembly is stored in high density fuel storage locations.

ACTIONS

A.1

Required Action A.1 is modified by a Note indicating LCO 3.0.3 does not apply. Since the design basis accident of concern in this Specification is an inadvertent criticality, and since the possibility or consequences of this event are independent of plant MODE, there is no reason to shutdown the plant if the LCO or Required Actions cannot be met.

When the configuration of fuel assemblies stored in the spent fuel pool is not in accordance with Figure 3.7.15-1, Figure 3.7.15-2, Figure 3.7.15-3, or the FSAR, immediate action must be taken to make the necessary fuel assembly movement(s) to bring the configuration into compliance. The Immediate Completion Time underscores the necessity of restoring spent fuel pool irradiated fuel loading to within the initial assumptions of the criticality analysis.

The ACTIONS do not specify a time limit for completing movement of the affected fuel assemblies to their correct location. This is not meant to allow an unnecessary delay in resolution, but is a reflection of the fact that the complexity of the corrective actions is unknown.

(continued)

BASES (continued)

SURVEILLANCE REQUIREMENTS

SR 3.7.15.1

Verification by administrative means that initial enrichment and burnup of fuel assemblies in accordance with Figure 3.7.15-1, Figure 3.7.15-2, and Figure 3.7.15-3 is required prior to storage of spent fuel in storage pool A or pool B, (as applicable). This surveillance ensures that fuel enrichment limits, as specified in the criticality safety analysis (Ref. 2), are not exceeded. The surveillance Frequency (prior to storage in high density region of the fuel storage pool) is appropriate since the initial fuel enrichment and burnup cannot change after removal from the core.

REFERENCES

1. Criticality Safety Evaluation of the Pool A Spent Fuel Storage Racks in Crystal River Unit 3 with Fuel of 5.0% Enrichment, S.E. Turner, Holtec Report HI 931111, December 1993.

2. Crystal River Unit 3 Spent Fuel Storage Pool B Criticality Analysis, W.A. Wittkopf, L.A. Hassler, B&W Fuel Company, BAW-2209P, October 1993.

3. NUREG 0800, Standard Review Plan, Section 9.1.1 and 9.1.2, Rev.2, July 1981.

4. 10 CFR 100.

5. CR-3 FSAR, Section 9.6, Revision 11.

AFFIDAVIT OF JAMES H. TAYLOR

A. My name is James H. Taylor. I am Manager of Licensing Services for B&W Nuclear Technologies (BWNT). The B&W Fuel Company is administratively responsible to B&W Nuclear Technologies. Therefore, I am authorized to execute this Affidavit.

B. I am familiar with the criteria applied by BWNT to determine whether certain information of BWNT is proprietary and I am familiar with the procedures established within BWNT to ensure the proper application of these criteria.

C. In determining whether a BWNT document is to be classified as proprietary information, an initial determination is made by the Unit Manager, who is responsible for originating the document, as to whether it falls within the criteria set forth in Paragraph D hereof. If the information falls within any one of these criteria, it is classified as proprietary by the originating Unit Manager. This initial determination is reviewed by the cognizant Section Manager. If the document is designated as proprietary, it is reviewed again by Licensing personnel and other management within BWNT as designated by the Manager of Licensing Services to assure that the regulatory requirements of 10 CFR Section 2.790 are met.

D. The following information is provided to demonstrate that the provisions of 10 CFR Section 2.790 of the Commission's regulations have been considered:

(i) The information has been held in confidence by BWNT. Copies of the document are clearly identified as proprietary. In addition, whenever BWNT transmits the

information to a customer, customer's agent, potential customer or regulatory agency, the transmittal requests the recipient to hold the information as proprietary. Also, in order to strictly limit any potential or actual customer's use of proprietary information, the following provision is included in all proposals submitted by BWNT, and an applicable version of the proprietary provision is included in all of B&W's contracts:

> "Purchaser may retain Company's proposal for use in connection with any contract resulting therefrom, and, for that purpose, make such copies thereof as may be necessary. Any proprietary information concerning Company's or its Supplier's products or manufacturing processes which is so designated by Company or its Suppliers and disclosed to Purchaser incident to the performance of such contract shall remain the property of Company or its Suppliers and is disclosed in confidence, and Purchaser shall not publish or otherwise disclose it to others without the written approval of Company, and no rights, implied or otherwise, are granted to produce or have produced any products or to practice or cause to be practiced any manufacturing processes covered thereby.
>
> Notwithstanding the above, Purchaser may provide the NRC or any other regulatory agency with any such proprietary information as the NRC or such other agency may require; provided, however, that Purchaser shall first give Company written notice of such proposed disclosure and Company shall have the right to amend such proprietary information so as to make it non-proprietary. In the event that Company cannot amend such proprietary information, Purchaser

shall, prior to disclosing such information, use its best efforts to obtain a commitment from NRC or such other agency to have such information withheld from public inspection.

Company shall be given the right to participate in pursuit of such confidential treatment."

(ii) The following criteria are customarily applied by BWNT in a rational decision process to determine whether the information should be classified as proprietary. Information may be classified as proprietary if one or more of the following criteria are met:

a. Information reveals cost or price information, commercial strategies, production capabilities, or budget levels of B&W, its customers or suppliers.

b. The information reveals data or material concerning BWNT research or development plans or programs of present or potential competitive advantage to BWNT.

c. The use of the information by a competitor would decrease his expenditures, in time or resources, in designing, producing or marketing a similar product.

d. The information consists of test data or other similar data concerning a process, method or component, the application of which results in a competitive advantage to BWNT.

e. The information reveals special aspects of a process, method, component or the like, the exclusive use of which results in a competitive advantage to BWNT.

f. The information contains ideas for which patent protection may be sought.

The document(s) listed on Exhibit "A", which is attached hereto and made a part hereof, has been evaluated in accordance with normal BWNT procedures with respect to classification and has been found to contain information which falls within one or more of the criteria enumerated above. Exhibit "B", which is attached hereto and made a part hereof, specifically identifies the criteria applicable to the document(s) listed in Exhibit "A".

(iii) The document(s) listed in Exhibit "A", which has been made available to the United States Nuclear Regulatory Commission was made available in confidence with a request that the document(s) and the information contained therein be withheld from public disclosure.

(iv) The information is not available in the open literature and to the best of our knowledge is not known by Combustion Engineering, EXXON, General Electric, Westinghouse or other current or potential domestic or foreign competitors of B&W Nuclear Technologies.

(v) Specific information with regard to whether public disclosure of the information is likely to cause harm to the competitive position of BWNT, taking into account the value of the information to BWNT; the amount of effort or money expended by BWNT developing the information; and the ease or difficulty with which the information could be properly duplicated by others is given in Exhibit "B".

E. I have personally reviewed the document(s) listed on Exhibit "A" and have found that it is considered proprietary by BWNT because it contains information which falls within one or more of the

AFFIDAVIT OF JAMES H. TAYLOR (Cont'd.)

criteria enumerated in Paragraph D, and it is information which is customarily held in confidence and protected as proprietary information by BWNT This report comprises information utilized by BWNT in its business which afford BWNT an opportunity to obtain a competitive advantage over those who may wish to know or use the information contained in the document(s).

JAMES H. TAYLOR

State of Virginia)
) SS. Lynchburg
City of Lynchburg)

James H. Taylor, being duly sworn, on his oath deposes and says that he is the person who subscribed his name to the foregoing statement, and that the matters and facts set forth in the statement are true.

JAMES H. TAYLOR

Subscribed and sworn before me
this 15th day of August 1994.

Notary Public in and for the City
of Lynchburg, State of Virginia.

My Commission Expires July 31, 1995

Exhibit A

Crystal River Unit 3
Spent Fuel Storage Pool B
Criticality Analysis

BAW-2209P

October 1993

Exhibit B

Description of Material	Applicable Criteria
Crystal River Unit 3 Spent Fuel Storage Pool B Criticality Analysis	c,d

BAW-2209P

October 1993

ATTACHMENT 1