



Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381-2000

JUL 30 2002

10 CFR 50.90

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D. C. 20555

Gentlemen:

In the Matter of) Docket No.50-390
Tennessee Valley Authority)

SUBJECT: WATTS BAR NUCLEAR PLANT - TRITIUM PRODUCTION - POST-
LOCA HOT LEG EMERGENCY CORE COOLING SYSTEM (ECCS)
RECIRCULATION TIME - SUPPLEMENTAL INFORMATION (TAC No. MB
1884)

The purpose of this letter is to revise the Watts Bar Hot Leg
ECCS Recirculation time. Accordingly, the new WBN switchover
time will be 3 hours rather than the 5.5 hours that was
provided in the WBN License Amendment Request dated
August 20, 2001.

Further details of this supplemental information can be found
in Enclosure 1. This enclosure contains information which
supplements Westinghouse Report NDP-00-0344, Revision 1,
"Implementation and Utilization of Tritium Producing Burnable
Absorber Rods (TPBARs) in Watts Bar Unit 1," which was
contained in the previously mentioned amendment request. This
enclosure contains information proprietary to Westinghouse
Electric Company, LLC, the owner of the information
(Westinghouse Proprietary Class 2).

Enclosure 2 contains the Westinghouse authorization letter,
CAW-02-1541, Revision 1, Westinghouse affidavit, Proprietary
Information Notice, and Copyright Notice. The affidavit sets
forth the basis on which the information may be withheld from
public disclosure by the Commission and addresses, with

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specificity, the considerations listed in paragraph (b)(4) of 10 CFR Section 2.790 of the Commission's regulations. Accordingly, we request that the information which is proprietary to Westinghouse be withheld from public disclosure in accordance with 10 CFR Section 2.790 of the Commission's regulations.

Correspondence with respect to the copyright or proprietary aspects of the items listed above or the supporting Westinghouse affidavit should reference CAW-02-1541, Revision 1 and should be addressed to H. A. Sepp, Manager of Regulatory and Licensing Engineering, Westinghouse Electric Company, P.O. Box 355, Pittsburgh, Pennsylvania 15210-0355.

Enclosure 3 provides the non proprietary version of the Westinghouse Report (Westinghouse Proprietary Class 3) contained Enclosure 1.

There are no regulatory commitments made by this letter. If you have any questions, please contact me at (423) 365-1824.

Sincerely,



P. L. Pace
Manager, Site Licensing
and Industry Affairs

Enclosures

cc: See page 3

Subscribed and sworn to before me
on this 30 day of July, 02


Notary Public

My Commission expires 2-23-05

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cc (Enclosure):

NRC Resident Inspector
Watts Bar Nuclear Plant
1260 Nuclear Plant Road
Spring City, Tennessee 37381

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ENCLOSURE 2
WATTS BAR NUCLEAR PLANT
WESTINGHOUSE AUTHORIZATION LETTER CAW-02-1541, REVISION 1
WESTINGHOUSE AFFIDAVIT
PROPRIETARY INFORMATION NOTICE
COPYRIGHT NOTICE



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Attention: Mr. Samuel J. Collins

Our ref: CAW-02-1541, Rev. 1

July 30, 2002

**APPLICATION FOR WITHHOLDING PROPRIETARY
INFORMATION FROM PUBLIC DISCLOSURE**

Subject: Supplemental Information for NDP-00-0344, Revision 1, "Implementation and Utilization of Tritium Producing Burnable Absorber Rods (TPBARS) in Watts Bar Unit 1", dated July 2001 (Non-Proprietary)

Dear Mr. Collins:

The proprietary information for which withholding is being requested in the above-referenced report is further identified in Affidavit CAW-02-1541, Rev. 1 signed by the owner of the proprietary information, Westinghouse Electric Company LLC. The affidavit, which accompanies this letter, sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of 10 CFR Section 2.790 of the Commission's regulations.

Accordingly, this letter authorizes the utilization of the accompanying Affidavit by the Tennessee Valley Authority.

Correspondence with respect to the proprietary aspects of the application for withholding or the Westinghouse affidavit should reference this letter, CAW-02-1541, Rev. 1 and should be addressed to the undersigned.

Very truly yours,

A handwritten signature in black ink, appearing to read 'H. A. Sepp'.

H. A. Sepp, Manager
Regulatory and Licensing Engineering

Enclosures

Cc: G. Shukla/NRR

AFFIDAVIT

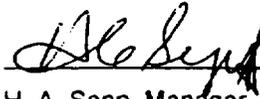
COMMONWEALTH OF PENNSYLVANIA:

SS

COUNTY OF ALLEGHENY:

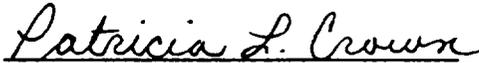
Before me, the undersigned authority, personally appeared H. A. Sepp, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Company LLC ("Westinghouse"), and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:





H. A. Sepp, Manager
Regulatory and Licensing Engineering

Sworn to and subscribed
before me this 30th day
of July, 2002



Notary Public

Notarial Seal
Patricia L. Crown, Notary Public
Monroeville Boro, Allegheny County
My Commission Expires Feb. 7, 2005
Member, Pennsylvania Association of Notaries

- (1) I am Manager, Regulatory and Licensing Engineering, in Nuclear Services, Westinghouse Electric Company LLC ("Westinghouse"), and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing and rule making proceedings, and am authorized to apply for its withholding on behalf of the Westinghouse Electric Company LLC.
- (2) I am making this Affidavit in conformance with the provisions of 10CFR Section 2.790 of the Commission's regulations and in conjunction with the Westinghouse application for withholding accompanying this Affidavit.
- (3) I have personal knowledge of the criteria and procedures utilized by the Westinghouse Electric Company LLC in designating information as a trade secret, privileged or as confidential commercial or financial information.
- (4) Pursuant to the provisions of paragraph (b)(4) of Section 2.790 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.
 - (i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.
 - (ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

 - (a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

- (b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.
- (c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.
- (d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.
- (e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.
- (f) It contains patentable ideas, for which patent protection may be desirable.

There are sound policy reasons behind the Westinghouse system which include the following:

- (a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.
- (b) It is information that is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.
- (c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.
- (d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

- (e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition of those countries.
- (f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.
- (iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10CFR Section 2.790, it is to be received in confidence by the Commission.
- (iv) The information sought to be protected is not available in public sources or available information has not been previously employed in the same original manner or method to the best of our knowledge and belief.
- (v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in the Supplemental Information for NDP-00-0344, Revision 1, "Implementation and Utilization of Tritium Producing Burnable Absorber Rods (TPBARS) In Watts Bar Unit 1", Dated July 2001 (Non-Proprietary) being transmitted by the Tennessee Valley Authority letter and Application for Withholding Proprietary Information from Public Disclosure, to the Document Control Desk, Attention Mr. Samuel J. Collins. The proprietary information as submitted for use by Westinghouse Electric Company LLC for Watts Bar Unit 1 expected to be applicable for other licensees in confirming post-LOCA long term core cooling capabilities.

This information is part of that which will enable Westinghouse to:

- (a) Provide responses to NRC questions on post-LOCA Hot Leg Switchover time for Watts Bar Unit 1.
- (b) Provide a quantitative technical justification for the adequacy of the post-LOCA Hot Leg Switchover time.
- (c) Assist the Tennessee Valley Authority in obtaining a license amendment for the Tritium Production Core.

Further this information has substantial commercial value as follows:

- (a) Westinghouse plans to sell the use of similar information to its customers for purposes of establishing post-LOCA Hot Leg Switchover times.
- (b) Westinghouse can sell support and defense of the methodology for establishing post-LOCA Hot Leg Switchover times.
- (c) The information requested to be withheld reveals the distinguishing aspects of a methodology which was developed by Westinghouse.

Public disclosure of this proprietary information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to provide similar calculations and licensing defense services for commercial power reactors without commensurate expenses. Also, public disclosure of the information would enable others to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the technology described in part by the information is the result of applying the results of many years of experience in an intensive Westinghouse effort and the expenditure of a considerable sum of money.

In order for competitors of Westinghouse to duplicate this information, similar technical programs would have to be performed and a significant manpower effort, having the requisite talent and experience, would have to be expended.

Further the deponent sayeth not.

PROPRIETARY INFORMATION NOTICE

Transmitted herewith are proprietary and/or non-proprietary versions of documents furnished to the NRC in connection with requests for generic and/or plant-specific review and approval.

In order to conform to the requirements of 10 CFR 2.790 of the Commission's regulations concerning the protection of proprietary information so submitted to the NRC, the information which is proprietary in the proprietary versions is contained within brackets, and where the proprietary information has been deleted in the non-proprietary versions, only the brackets remain (the information that was contained within the brackets in the proprietary versions having been deleted). The justification for claiming the information so designated as proprietary is indicated in both versions by means of lower case letters (a) through (f) contained within parentheses located as a superscript immediately following the brackets enclosing each item of information being identified as proprietary or in the margin opposite such information. These lower case letters refer to the types of information Westinghouse customarily holds in confidence identified in Sections (4)(ii)(a) through (4)(ii)(f) of the affidavit accompanying this transmittal pursuant to 10 CFR 2.790(b)(1).

COPYRIGHT NOTICE

The reports transmitted herewith each bear a Westinghouse copyright notice. The NRC is permitted to make the number of copies of the information contained in these reports which are necessary for its internal use in connection with generic and plant-specific reviews and approvals as well as the issuance, denial, amendment, transfer, renewal, modification, suspension, revocation, or violation of a license, permit, order, or regulation subject to the requirements of 10 CFR 2.790 regarding restrictions on public disclosure to the extent such information has been identified as proprietary by Westinghouse, copyright protection notwithstanding. With respect to the non-proprietary versions of these reports, the NRC is permitted to make the number of copies beyond those necessary for its internal use which are necessary in order to have one copy available for public viewing in the appropriate docket files in the public document room in Washington, DC and in local public document rooms as may be required by NRC regulations if the number of copies submitted is insufficient for this purpose. Copies made by the NRC must include the copyright notice in all instances and the proprietary notice if the original was identified as proprietary.

ENCLOSURE 3
WATTS BAR NUCLEAR PLANT
WESTINGHOUSE SUMMARY REPORT
WESTINGHOUSE PROPRIETARY CLASS 3
(NON-PROPRIETARY VERSION)

Summary of the Westinghouse Post-LOCA HLSO Methodology and Watts Bar Evaluation Results:

The methodology used to confirm post-LOCA long term core cooling capabilities for Watts Bar establishes a post-LOCA Hot Leg Switchover (HLSO) time to support realignment of the recirculation safety injection (SI) flow from the cold legs to the hot legs. This realignment is required to preclude boron precipitation in the reactor vessel following a large-break LOCA. For a cold leg break where injected SI water boils off due to decay heat, the potential exists for the boric acid solution in the reactor vessel to reach the boron precipitation point and block core cooling flow. The Westinghouse emergency core cooling system (ECCS) long term core cooling model confirms the existence of a coolable core geometry by establishing HLSO times which ensure that boron precipitation does not occur.

The HLSO analytical model used as part of the long term core cooling methodology is based on the following assumptions:

- A boric acid concentration level is computed over time for a core-region mixing volume. Other than the steam exiting through the hot legs and the corresponding makeup SI entering through the lower plenum, there are no assumed flow paths in or out of the mixing volume. All boric acid entering the mixing volume remains in the mixing volume prior to initiation of hot leg recirculation. The water/boric acid solution is well mixed in the mixing volume region. The water/boric acid solution in the vessel is assumed to be at atmospheric conditions, at a temperature of 212°F. The collapsed mixture level of the core/upper plenum region is at the bottom of the hot leg flow area at the reactor vessel outlet nozzle. This level is the top of the mixing volume. The bottom of the mixing volume is at the level of the top of the lower core support plate. The lower plenum volume and barrel baffle region volume are not included in the mixing volume.
- The boric acid concentration limit is the experimentally determined boric acid saturation concentration with an additional []^{a,c} weight-percent margin factor. The calculation neglects any elevation of boiling temperature due to concentration of boric acid in the core or due to backpressure from containment.
- The decay heat generation rate is based on the 1971 ANS Standard for a finite operating time. The decay heat generation includes a core power multiplier to address instrumentation uncertainty as identified by Section I.A of 10 CFR 50 Appendix K.
- The boron concentration of the make-up SI is a calculated sump mixed mean boron concentration. The calculation of the sump mixed mean boron concentration assumes maximum mass and maximum boron concentrations for significant boron sources and minimum mass and maximum boron concentration for significant dilution sources.
- Once realigned to hot leg recirculation, boron precipitation is precluded and core cooling is assured by established minimum recirculation flow criteria for the hot legs, cold legs, or simultaneous hot and cold leg injection.

The methodology described above is consistent with, or otherwise conservative with respect to, the methodology described in Reference 1. This methodology contains the following conservatisms.

1. All boric acid entering the mixing volume remains in the mixing volume. The simplified analytical model assumes that there are no paths for the boron or boric acid to leave the mixing volume. In fact, there are a number of paths for boric acid to leave the mixing volume. They include:

- []

]a.c

- [

]a.c

- [

]a.c

2. The assumed mixing volume is conservatively small. The simplified analytical model assumes a mixing volume that extends from the top of the lower core support plate to the bottom of the hot leg flow area at the reactor vessel outlet nozzle. A number of additional regions ([]a.c) would see at least some mixing. Flow through these regions would result from thermal and density gradients throughout the core region.
3. The boric acid solubility limit is conservatively chosen. A []a.c weight-percent margin factor has been added to the experimentally determined boric acid saturation limit. The boric acid saturation limit is based on 14.7 pounds per square inch absolute (psia) conditions. The boric acid solubility limit increases significantly with pressure (i.e., the limit increases more than []a.c for each 10 pounds per square inch (psi) increase in assumed pressure).
4. All heat removed from the core is assumed to be due only to the boiloff of saturated pure water at 14.7 psia. The simplified analytical model assumes that all heat removed from the core is due to the boil-off of pure water at 14.7 psia. In fact, there are a number of mechanisms for heat removal including:
 - []a.c
 - []a.c
 - []a.c
 - []a.c

The methodology also contains the following non-conservatisms.

1. The decay heat standard used in the Standard Westinghouse HLSO methodology uses a 1971 ANS Standard decay heat based on "finite" operation. This decay heat is calculated using []a.c core regions with []a.c hours operating time respectively. This decay heat assumption is non-conservative in the following respects:

• [

] ^{a,c}

• [

] ^{a,c}

The Watts Bar long term cooling analysis prepared for the tritium production core used the standard Westinghouse evaluation methodology described above and established a required HLSO time of 5.56 hours post-LOCA (with [] ^{a,c} weight-percent boron margin to the solubility limit). (It is significant to note that the boric acid accumulation model predicted that the actual boron precipitation point (i.e. no margin to the boric acid solubility limit) is not reached until 7.23 hours post-LOCA.) For additional conservatism and convenience, a revised HLSO time of 5.5 hours post-LOCA was planned for incorporation into the Watts Bar emergency operating procedures for the tritium production core.

To address the effects of the analysis non-conservatism discussed above, an additional HLSO evaluation has been performed for Watts Bar. This evaluation adds considerable conservatism to the original tritium production core long term cooling analysis and is considered non-standard with respect to the Westinghouse post-LOCA analysis methodology. Consistent with the standard evaluation methodology, the original Watts Bar tritium production core post-LOCA long term cooling analysis used the 1971 ANS decay heat for finite operation without residual fissions and 0% uncertainty. The evaluation performed revised this input and used the 10 CFR 50, Appendix K prescribed decay heat model (1971 ANS decay heat for infinite operation with 20% uncertainty). It is noted that both the initial analysis and the evaluation used a core power of 3459 MWt with a 1.006 calorimetric uncertainty factor and conservatively ignored the lower fuel nozzle volume as part of the effective mixing volume.

Table 1 shows a comparison of the HLSO evaluation results to the original HLSO analysis results.

Table 1: Summary of the HLSO Evaluation Results

Case	HLSO Time	Margin to the 27.53 w/o precipitation limit
Analysis	7.23 hr	0.00 w/o
Analysis	5.56 hr	[] ^{a,c} w/o
Appendix K Decay Heat Evaluation	5.38 hr	0.00 w/o
Appendix K Decay Heat Evaluation	4.16 hr	[] ^{a,c} w/o
Appendix K Decay Heat Evaluation	3.00 hr	[] ^{a,c} w/o

As seen in Table 1, using the 10 CFR 50, Appendix K prescribed decay heat, the Watts Bar tritium production core HLSO time was established to be 4.16 hours post-LOCA with a [] ^{a,c} weight-percent margin to the boron precipitation limit. This is compared to the original tritium production core HLSO analysis which predicted boron precipitation to occur at 5.56 hours with the same margin to the boron precipitation limit. With a further reduction of the HLSO time to 3.0 hours, the margin to the boron precipitation limit increased to [] ^{a,c} weight-percent.

With the reduction in HLSO time, the ECCS performance at hot leg recirculation was also evaluated. All the minimum flow requirements were satisfied for a HLSO time of 3.0 hours. Since the core boil-off due to decay heat is greater at an earlier HLSO time, the minimum flow requirements are satisfied for a HLSO time ≥ 3.0 hours. (Note that the prescribed Appendix K decay heat model is used for ECCS recirculation performance calculations.)

Based on the results of the evaluation discussed above, the Watts Bar emergency operating procedures will be revised to require initiation of hot leg ECCS recirculation 3.0 hours following a large break LOCA for the tritium production core rather than 5.5 hours. The 3.0 hour switchover time requirement does not increase operator burden during LOCA mitigation and recovery and will provide an added measure of conservatism with respect to the tritium production core long term cooling analysis.

References

1. Letter from C. L. Caso (W) to T. M. Novak, (NRC), CLC-NS-309, "Long-term Boric Acid Buildup in the Core, Basic Phenomena", April 1, 1975.
2. WCAP-8471-P-A, "The Westinghouse ECCS Evaluation Model: Supplementary Information", April 1975 (WCAP-8472-A, Non-Proprietary Class 3).
3. WCAP-8339, "Westinghouse Emergency Core Cooling System Evaluation Model – Summary", June 1974.