COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-178830

August 31, 1973

Mr. John L. Howland
Counsel, Government Affairs
Westinghouse Electric Corporation
1801 K Street, NW.
Washington, DC. 20006

Dear Mr. Howland:

This is in response to your letter of June 6, 1973, and subsequent correspondence, on behalf of Westinghouse Electric Corporation (Westinghouse), protesting the award of a contract under invitation for bids (IFB) No. D3-7001, issued by the Bureau of Reclamation, United States Department of the Interior, Denver, Colorado, for the furnishing and installation of three turbine-generator units for the Grand Coulee Third Powerplant, Columbia Basin Project, Washington. Westinghouse has protested an award to any bidder who had proposed a design which provides an operating speed in excess of 78.2 r.p.m. In effect, the protest is against an award to any other bidder since the three remaining bidders proposed designs having operating speeds of 85.7 r.p.m.

Pursuant to section 20.9 of our Interim Bid Protest Procedures and Standards, 4 CFR part 20, Westinghouse requested a conference on the protest. On August 15, 1973, a conference was held with representatives of Westinghouse, Allis-Chalmers Corporation (Allis-Chalmers), Canadian General Electric Company, Ltd. (Canadian GE), Leningrad Metal Works, the Department of the Interior, and our Office. To the extent possible, all interested parties were provided with opportunities to make oral presentations of their respective engineering positions concerning the Allis-Chalmers turbine. Based on our review of the entire record, and considering that the weight of engineering judgment supports the acceptability of the Allis-Chalmers turbine, we have concluded that the protest must be denied.

The advertising notice issued on February 12, 1973, specifically requested the furnishing of turbines, "speed open," and generators at "any synchronous speed." Thereafter, the solicitation was issued on March 19, 1973, with the bid opening, as extended, on May 30, 1973. Bids were requested as follows:

"1. e. Furnishing, installing, and testing three 820,000 to 960,000 rated horsepower at 235 foot head, vertical-shaft, hydraulic turbines, including building and testing a hydraulic turbine model unless an acceptable model and tests have been previously furnished in accordance with Paragraphs B-1 and B-12; and

[Contract Award Protest]

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"b. Furnishing, installing, and testing three 615,385- to 717,949-kva 97.5 percent power factor, 15,000- to 22,500-volt, any synchronous speed 60-hertz, vertical-shaft, hydraulic turbine-driven, alternating-current synchronous generators; in designated Units 22, 23, and 24"

Five offers were submitted in response to the solicitation as follows:

Bidder	Price
Canadian General Electric	$57,829,398
Allis-Chalmers	63,000,000
Westinghouse-V/O Energomachexport (joint venture)	63,130,294
Hitachi America-Wismer and Becker (joint venture)	
Foreign	64,313,604
Domestic	73,313,604

Allis-Chalmers is the turbine subcontractor for the low bidder, Canadian GE. Leningrad Metal Works is the turbine manufacturer for the joint venture of Westinghouse-V/O Energomachexport. Although the second low bid was submitted by Allis-Chalmers, the participation of that company in this protest is only in its capacity as subcontractor for Canadian GE.

With the exception of Westinghouse, all the bidders certified in the bidding schedules submitted pursuant to the solicitation that their price offers were based upon the following:

"* * * a turbine having a full-gate rated capacity of 960,000 horsepower at 285-foot rated head and operating at 85.7 rpm; and a generator having a rating of 717,949 kva at 100 percent load, 97.5 percent power factor, 15,000 volts, 85.7 rpm, and 60 hertz for a 700 megawatt (mw) generator."

Westinghouse certified that its price offer was based upon the following:

"* * * a turbine having a full-gate rated capacity of 960,000 horsepower at 285-foot rated head and operating at 75 rpm; and a generator having a rating of

717,949 kva at 100 percent load, 97.5 percent power factor, 15,000 volts, 75 rpm, and 60 hertz for a 700 megawatt (mw) generator."

The Department of the Interior reported that the options for supplying the units at various ratings and speeds were provided in order to encourage bids on the highest capacity units consistent with the current state-of-the-art. It is further reported that all offers have been determined by the contracting officer to be responsive.

Westinghouse contends that a hydro-turbine capable of output of 960,000 horsepower (700 mw) at 85.7 r.p.m. operating under the conditions specified in the subject solicitation will not perform in accordance with the requirements of the specifications and that such unsatisfactory performance will result in substantial project delay thereby causing the Government to risk extensive loss of revenues. More specifically, Westinghouse contends that the units will be subject to excessive cavitation resulting, in part, from the high "K" factor of the units proposed. Cavitation, as discussed in Westinghouse's protest letter of June 13, 1973, can be described as follows:

> "* * * the phenomenon which occurs when a liquid is subjected to a decrease in pressure and resultingly expands into a vapor and increases tremendously in volume. When the vapor is subsequently subjected to an increase in pressure, it collapses to its original liquid form and volume with such rapidity as to result in extreme shock, shock sufficient to create a mechanical force which will cause the turbine blades to erode and pit to the extent that holes several inches in diameter develop."

It is Westinghouse's position that with proper analysis, "K" factor can serve as a guide for the selection of turbine speed. The "K" factor can be explained by the following formula: $"K" = N_s \sqrt{H}$ (where N_s is the specific speed and H is the head, the elevation differential between headwater of the dam and tailwater). Since the present highest "K" factor for in-service equipment is in the 1,000 range, Westinghouse contends that the units prepared by Allis-Chalmers, which have a "K" factor of 1,210, are beyond the state-of-the-art for the industry in general and for Allis-Chalmers in particular.

In substantiation of its contention that the proposed units exceed the state-of-the-art, Westinghouse maintains that an extrapolation of Allis-Chalmers' operational experience with units in the 250,000- to 350,000-horsepower range to the proposed 960,000-horsepower requirement in and of itself is a design effort faced with numerous challenges and

that such an effort is further complicated by a proposal of turbines operating at 85.7 r.p.m.

In reply, Allis-Chalmers contends that a hydro-turbine capable of output of 960,000 horsepower (700 mw) at 85.7 r.p.m. operating under the conditions specified in the solicitation will perform in accordance with the requirements of the specifications and that such a unit is not beyond the state-of-the-art either for the industry in general, or for Allis-Chalmers in particular. In support of its contentions, Allis-Chalmers submitted a rebuttal of the allegations made by Westinghouse in which it stated the following: The use of the "K" factor by Westinghouse as the controlling element for r.p.m. and satisfactory performance is incorrect. "K" factor is only a relative measure of the speed of hydraulic machinery and is entirely unrelated to capacity and size of the equipment. Furthermore, the highest "K" factors of units presently in operation are not 1,000 and 1,059, as alleged, since Allis-Chalmers and other responsible manufacturers have built many Francis-type turbines which operate at "K" factors significantly higher than those in the 1,000 range, mentioned above. Consequently, the "K" factor of 1,210 associated with the Allis-Chalmers proposal does not extend the state-of-the-art either for the industry or for Allis-Chalmers. High "K" factor and excessive cavitation are not synonymous; nor is there a relationship between "K" and vibration. Inadequate design, lack of good model testing, and errors in manufacturing are the primary causes of cavitation and pitting.

It is Allis-Chalmers' position that Westinghouse has not proved that Allis-Chalmers will be unable to satisfactorily build the 85.7-r.p.m. turbines proposed for Grand Coulee. On the contrary, Allis-Chalmers contends that its design for Grand Coulee is supported by extensive engineering studies and also by model tests. It concludes that the practicality of a turbine design at 85.7 r.p.m. is supported not only by the willingness of Canadian GE and Allis-Chalmers to contract to build such turbines for Grand Coulee Dam under the conditions set forth by the Bureau of Reclamation in the specifications of the subject solicitation, but also by the fact that the other bidder on this project, Hitachi, also proposed 85.7-r.p.m. turbines.

The Bureau of Reclamation has reported that it conducted a survey of the turbine industry beginning in March 1971 concerning the feasibility of providing units of higher capacity and higher speed than those provided for the third powerplant under contract at that time. (The capacity and speed of the units under contract is 820,000 horsepower (600 mw), 72 r.p.m.) Many of the technical questions raised by the protest of Westinghouse were addressed by representatives of the industry in response to the survey and, accordingly, had been under consideration at the Bureau for approximately 2 years prior to the issuance of the

subject solicitation. Technical data submitted by representatives of industry in response to the survey indicated that an increase in both the capacity and speed of the units was feasible. Furthermore, based upon the data submitted, the engineering staff of the Bureau of Reclamation verified to its own satisfaction that the units of the capacity and speed offered under the subject solicitation are presently attainable. Consequently, the Bureau of Reclamation has taken the position that units with a capacity of 960,000 horsepower (700 mw) at a speed of 85.7 r.p.m. are feasible, that the capability to produce such units exists within the industry, and that, consequently, units of this capacity and speed are within the present state-of-the-art.

In addition, it has not been proved to the satisfaction of the Bureau of Reclamation that the higher speeds offered will necessarily result in excessive cavitation or be otherwise unacceptable. Since the specifications for DS-7001, as developed by the Bureau of Reclamation, insure that the Government will have close control over the contractor's initial design, model design, and testing, the Bureau is confident that the final design will result in an acceptable product. Therefore, it is the position of the Bureau of Reclamation that the protest of Westinghouse should be denied.

In summary, Westinghouse contends that a hydro-turbine capable of 960,000 horsepower (700 mw) at 85.7 r.p.m. operating under the conditions specified in the solicitation exceeds the state-of-the-art, while Allis-Chalmers believes that it is possible to produce such a unit and is prepared to produce such a unit which will be able to meet the requirements of the specifications.

As evidenced by the position taken by the procurement agency, the Bureau of Reclamation is prepared to provide Canadian GE and its subcontractor, Allis-Chalmers, with an opportunity to achieve this result. Further, a staff engineer of our Office has considered the voluminous record and written arguments advanced by the parties and has concluded that the Allis-Chalmers proposed turbine is, conceptually, within the present state-of-the-art. In the circumstances, we are unable to conclude that Canadian GE and Allis-Chalmers cannot perform as promised. B-170528, May 18, 1971,,copy enclosed.

Sincerely yours,

(SIGNED) ELMER B. STAATS

Comptroller General
of the United States