TENNESSEE VALLEY AUTHORITY

KNOXVILLE, TENNESSEE 37902

FEB 29 1988

50-390, 391

Mr. Philip L. Stewart, Manager
Chattanooga Field Office
Division of Water Pollution Control
2501 Milne Street
Chattanooga, Tennessee 37406-3399

Dear Mr. Stewart:

WATTS BAR NUCLEAR PLANT (WBN) - NPDES PERMIT NO. TN0020168 - COMPLIANCE EVALUATION INSPECTION REPORT AND NOTICE OF VIOLATION

This is in follow up to my November 17, 1987, letter to you in which TVA committed to send to you by February 29 a brief report on the effects of modifications to the flow splitter box on settleable solids of the four sewage treatment plants. The report is enclosed.

The modifications were made on November 28, 1987, and have allowed better distribution of the flow among the four treatment plants. Improvement in the settleability of the sludge was not observed. Therefore, it does not appear that flow distribution is the controlling factor in improving the poor settleability of the sludge in plants B, C, and D. We will continue to try to increase the efficiency of the sludge settling by controlling the sludge return and wasting rates.

If your staff has any questions regarding this response, please have them call Madonna Martin at (615) 632-6695 in Knoxville.

Sincerely,

ORIGINAL SIGNED BY
RALPH H. BROOKS

Ralph H. Brooks, Director
Environmental Quality

Enclosure
cc (Enclosure):
Mr. K. P. Barr, Acting Assistant Director
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Mr. Philip L. Stewart

cc (Enclosure):

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Watts Bar Nuclear Plant
Sewage Treatment Plant
Flow Splitter Box Modifications Report

In response to Deficiency 4.C of the Tennessee Division of Water Pollution Control's (TDWPC) June 30, 1987, compliance evaluation inspection (CEI) report, TVA committed to modify the flow splitter box on the sewage treatment plant in a November 17, 1987, letter to the TDWPC. The splitter box, which had apparently settled somewhat since its initial installation in February 1986, was to be modified by installing adjustable baffles to allow the flow to the four treatment plants to be more equitably distributed. It was suspected that the poor distribution of flow to the plants was partially responsible for the variability in the settling characteristics of the sludge in the four plants. Plant A, whose sludge settled relatively well, received the least flow; whereas plant D, which received the most flow, had sludge which settled the worst.

On November 28, 1987, adjustable baffles were installed in the splitter box. Also, the inflow pipe to the box was leveled by welding a ring to the top of the pipe. Table 1 shows the effect of these changes on the flow distribution. These data indicate that the flow distribution to the four units in December 1987 and January 1988 was substantially improved over the November 1987 performance (although the flow data on the individual plants is of limited accuracy, as discussed in detail below). However, the companion data on sludge settleability presented in Table 2 indicated that a concomitant improvement in sludge settling did not occur in December and January. In actuality, the settleability of sludge in the four plants increased somewhat, on the average, from 577 ml/L in November to 664 ml/L in January, an increase of about 15 percent. The average sludge volume index (SVI), the ratio of the mixed liquor settleable solids to mixed liquor suspended solids, also increased from 189 ml/g to 207 ml/g, or about 10 percent. References on sewage treatment recommend that the SVI should be in the range of about 35-150 ml/g, with values of 200 ml/g or greater being indicative of bulking sludge. Caution should be used when comparing the SVI at different plants unless operating conditions are known to be similar. We believe that the SVI values in this range are applicable to our plants.

It appears that the plants have "bulking" sludge, the cause for which has multiple possibilities: too high or low pH, high or low dissolved oxygen (DO) in the aeration tank, improper sludge return rate, insufficient sludge wasting, insufficient nitrogen and/or phosphorus in the influent, wide fluctuations in pH or organic loading, improper food-to-microorganism ratio, etc. We are presently conducting studies and consulting with the plants' manufacturer, L. C. Hammock and Company, in an effort to determine the appropriate action(s) to correct this problem.

Despite the poor settleability of the sludge, the plant has produced a consistently excellent effluent over the past two years since the plant capacity was expanded to 120,000 gpd. The biochemical oxygen demand $(BOD)_5$ and total suspended solids (TSS) concentrations have typically averaged 2-3 mg/L (compared to the permit limits of 30 mg/L average and 45 mg/L maximum) with a treatment efficiency of 98-99 percent. Therefore, we do not believe that the poor settleability of the plant's sludge is a compliance problem. However, we do recognize that this sludge could cause problems in the future, particularly under significantly higher hydraulic loading rates.

Therefore, we will continue to try to increase the efficiency of the sludge settling. Also, to prevent solids from escaping in the effluent, as pointed out in our original August 5, 1987, letter responding to the inspection report, wasting of sludge from the clarifiers to the sludge holding tanks is done daily and sludge is pumped from the chlorine contact tanks as often as needed.

We have discovered several problems in obtaining accurate flow measurements of the individual units, which is obviously important in flow equalization. In the past, we have focused on obtaining accurate flow measurements on the final combined effluent weir (discharge serial number 111), since this location is the final plant effluent release point and the point of compliance. As indicated in Table 1, the sum of the four individual plant flows is only 50-60 percent of the total flow as measured at the final combined effluent weir. The primary reason for this is the way the head on the weir of each of the four plants is determined. The operator currently measures the flow by sticking a ruler down in each V-notch weir, rather than using the standard practice of measuring the head on the weir at a distance of four times the head behind the weir. Also, since the weirs are about 1-1/2 to 2 feet below the ground, the operator has to read the ruler at a severe angle, which further distorts his reading of the head on the weir. This method of measuring the head on each weir causes lower flow readings on the individual plants, because the drawdown of the water as it goes over the weir causes a significant difference in the head reading. This is especially crucial when the head measurement is only 0.1 to 0.2 feet as is currently the case with the existing three 90° weirs and one 60° weir.

To correct this problem, four precise 45° weirs are being made and will be properly installed on the individual plants, increasing the typical head readings to within the 0.2 to 0.3 feet range. We are also installing hook gauges on the four individual plants at the proper distance behind the new 45° weirs. These gauges will enable the operator to look at the gauge at eye level. (The final effluent weir is 45° and already has a properly installed staff gauge which can be read at eye level.) This should greatly simplify and improve flow measurement at the plants.

In summary, the adjustable baffles were installed in the splitter box and new weirs are being installed on the four individual plants. This will enable us to more accurately distribute and measure the flow through the four individual plants. However, it does not appear that flow distribution is a controlling factor in improving the poor settleability of the sludge in plants B, C, and D. We will continue to try to increase the efficiency of the sludge settling by controlling the sludge return and wasting rates.

TABLE 1

Watts Bar Nuclear Plant Sewage Treatment Plant
Comparison of Average Flows Before and After
Modifications to the Flow Splitter Box on 11/28/87

PLANT	Before Modifications November FLOW (GPD)	% OF SUM	After Modifications December FLOW (GPD)	% OF SUM	January FLOW (GPD)	% OF SUM
A	1,400	5	4,500	16	6,000	15
B	4,100	15	7,600	27	10,000	26
C	5,000	19	5,600	20	8,000	21
D	16,400	61	10,900	38	15,000	38
Sum[a]	26,900	100	28,600	100	39,000	100
Total Flow[b]	53,300	---	49,000	---	60,800	---

[a]Total of the four individual plant flows listed above.

[b]Total flow measured at final effluent weir (discharge serial number 111). See discussion in text regarding reasons for the difference between these values and the ones obtained by summing the individual plant flows.

TABLE 2

Watts Bar Nuclear Plant Sewage Treatment Plant Average Mixed Liquor Settleable Solids (SS), Mixed Liquor Total Suspended Solids (TSS), and Sludge Volume Indices (SVI) Before and After Flow Splitter Box Modifications on 11/28/87

	Before Modifications			After Modifications					
	November			December			January		
	SS (ml/L)	TSS (mg/L)	SVI[a] (ml/g)	SS (ml/L)	TSS (mg/L)	SVI (ml/g)	SS (ml/L)	TSS (mg/L)	SVI (ml/g)
A	235	2000	118	221	2000	110	383	2875	133
B	700	3750	187	676	3600	188	736	3825	192
C	672	3200	210	696	2940	237	785	3175	247
D	701	3300	212	788	3360	265	753	2925	257
AVG.	577	3060	182	595	2975	200	664	3200	207

[a] $SVI = \frac{SS}{TSS} \times 1000$