

OS/6

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PUNCHLIST

1. Appendix B and C to be completed as equipment is placed in the program.

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Results Supervisor

## PLANT EQUIPMENT MONITORING PROGRAM

### 0.0 DEFINITIONS

- 0.1 Monitor - regular measurement of unfiltered vibration level to determine machinery condition.
- 0.2 Diagnosis - detailed measurement of filtered vibration levels, spectra, and other generic data to identify problems with plant machinery.
- 0.3 Diagnostician - either the SE-4 or SE-6 equipment diagnostician or the mechanical engineer.
- 0.4 Mechanical Engineer - either the SD-3 or SD-4 mechanical engineer assigned cognizance of the equipment monitoring program.

### 1.0 SCOPE

This technical instruction defines and establishes the program that will be used to monitor the dynamic mechanical condition of major rotating equipment at Watts Bar Nuclear Plant. For convenience to avoid duplication of documentation and effort, non-CSSC equipment is included in this program. The fact that non-CSSC equipment is included in this instruction does not imply that the strict documentation and reporting requirements of the CSSC equipment set forth in this document are mandatory for non-CSSC equipment. In all cases where it is practical, the data sheets included in this instruction should be used for non-CSSC equipment as well as CSSC equipment. The major deviation between CSSC and non-CSSC requirements is that non-CSSC equipment will not be routinely listed in the Quarterly Equipment Condition Report, and non-CSSC data packages will be maintained in the Results section mechanical engineer's office.

### 2.0 PRECAUTIONS AND PREREQUISITES

- 2.1 Before entering a radiation, high radiation or contaminated zone, obtain the assistance of health physics.
- 2.2 If at anytime it becomes absolutely necessary to carry instruments into a contaminated zone, each instrument shall be carefully wrapped in plastic and securely taped.
- 2.3 When working around rotating equipment with the guards removed, use extreme caution. Do not wear loose clothing.
- 2.4 Obtain permission of shift engineer to perform monitoring. Provide the shift engineer with a list of equipment to be monitored on that day. Notify shift engineer when monitoring is completed.
- 2.5 This instruction may be performed in modes 1, 2, 3, 4, 5, or 6. When performed as part of an SI, the mode statement of the SI takes precedence.

### 3.0 ROUTINE MONITORING PROGRAM

- 3.1 As the need to provide regular monitoring of a piece of equipment is defined, the mechanical engineer shall initiate completion of an Equipment Information Sheet (Attachment 1). It is recognized that some of the information will not be immediately available from instruction manuals and contract data and may require disassembly of the machine to obtain. In these cases, the information should be left blank until machine disassembly becomes necessary for repair work. At that time, as much information as can be determined should be entered in the Equipment Information Sheet. All CSSC information sheets shall be reviewed by the mechanical engineer. All completed information sheets shall be filed in a notebook maintained in the mechanical engineer's office.
- 3.2 Major pieces of plant rotating equipment should be routinely monitored at least once per month. Some machines may require more frequent monitoring due to extreme pressures, high rotating speeds or large rotating weights. Machinery requiring more frequent monitoring should be monitored at least weekly. The mechanical engineer shall maintain a schedule showing which equipment is to be monitored during each week of the month.
- 3.3 As equipment is placed in the monitoring program, the mechanical engineer shall initiate an Equipment Survey Sheet (attachment 2) for each individual piece of equipment. The top portion, including a sketch showing bearing locations should be completed at this time. The lower portion will be filled out each time a machine is monitored. Monitoring mode should be mils displacement peak to peak for machinery operating below 600 rpm and displacement velocity peak for machinery operating above 600 rpm.
- 3.4 All readings for the monitoring program will be unfiltered readings, usually taken with a hand held meter. Use of more sophisticated instruments is allowable as long as the filter out mode is used.
- 3.5 Readings should be taken in the horizontal, vertical and axial directions at each accessible bearing cap. The sketch on the equipment survey sheet will identify bearing locations and orientation. The bearing caps should be clearly marked with a reference point to identify the location at which readings are to be taken.
- 3.6 When a piece of equipment cannot be placed in service for monitoring for some reason (such as license restrictions, construction or repair activities) the diagnostician should write "equipment unavailable" in the data column for that month. If the equipment is unavailable for more than two months in a row, the mechanical engineer shall explain the reason in the remarks section and initial and date.

3.0 ROUTINE MONITORING PROGRAM (Cont.)

- 3.7 The Equipment Survey Sheets will be maintained in a notebook in the mechanical engineer's office. For CSSC equipment, the mechanical engineer shall review each Equipment Survey Sheet when all the data columns are completed. Completed CSSC Equipment Survey Sheets will be maintained in a two hour rated fire proof cabinet in the mechanical engineer's office for a period of six months, then transferred to life time record storage.
- 3.8 The mechanical engineer or diagnostician will maintain a trend log by plotting periodic survey data on a regular basis to show vibration trends. These trend log charts will be maintained in a notebook in the mechanical engineer's office.
- 3.9 Within 5 working days of the end of each quarter the mechanical engineer shall prepare a Quarterly Equipment Condition Report (Attachment 3). This report will include the most recent survey data for all CSSC machinery included in the program. Any important vibration trends which are evident from the trend log charts should be noted in the remarks section. This report will be reviewed by the Results Section supervisor and routed to the Mechanical Maintenance supervisor and Operations supervisor. It will then be transferred to life-time record storage.
- 3.10 In addition to the previously listed monitoring a preliminary spectrum should be taken approximately once per quarter for major pieces of equipment using the portable signature analyzer on the bearing cap with the highest readings. These spectra will be maintained in a card file in the mechanical engineer's office.
- 3.11 For equipment which is part of the plant surveillance program, the monitoring will be interfaced with the surveillance test where possible. An appropriate step will be added to the SI's to note at what point the vibration data should be taken. SI's which have been or will be revised to include this step are listed in Appendix A.
- 3.12 For equipment which is trained, with one train in service and one train in standby, data on the equipment in service may be taken with no additional instructions beyond what is on the Equipment Survey Sheet. Operations normally rotates the equipment that is in service and equipment that is in standby. Monitoring of the equipment that is in standby will be coordinated with Operations in order to avoid excessive start/stop operations. CSSC equipment falling in this category is listed in Appendix B.

3.0 ROUTINE MONITORING PROGRAM (Cont.)

- 3.13 For equipment that is normally in service, no additional instructions beyond what is on the Equipment Survey Sheet is required. CSSC equipment falling in this category is listed in Appendix C.
- 3.14 For engineered safety feature pumps which are part of the Section XI program, acceptance criteria are specifically addressed in the SI. For all other equipment, the acceptance criteria of Table 1 applies. Upon failing "alert" criteria, the Results supervisor shall be informed and the monitoring frequency will be increased to once per week as a minimum for equipment normally monitored monthly and to three times weekly for equipment monitored weekly. If repairs can be initiated without affecting unit availability, a diagnosis should be performed and repairs completed. If the equipment cannot be repaired without shutting down the unit, it may be left in service with the increased monitoring frequency until the "alarm" criteria is exceeded. At that point, the equipment should be removed from service for immediate diagnosis and repairs. Notify shift engineer of alert/alarm conditions.

TABLE 1  
MONITORING PROGRAM ACCEPTANCE CRITERIA

	ALERT	ALARM
Eqpt. operating below 600 rpm	5 mills P-T-P	8 mills P-T-P
Eqpt. operating above 600 rpm	.20 in/sec peak	.40 in/sec peak

- 3.15 A preliminary diagnosis should be performed on major pieces of equipment at approximately 12 month intervals. Equipment having a very good mechanical history need not have this preliminary diagnosis performed if the trend log chart and the preliminary spectra show no significant changes in the previous six months.

4.0 REFERENCES

N-OQAM, Section 2, Part 2.1

SI CROSSREFERENCE

<u>SI Number</u>	<u>Equipment</u>
4.0.5.3.p	Aux. Feedwater Pumps
4.0.5.26.p	HPFP Pumps
4.0.5.62.p.1	Centrifugal Chg. Pumps
4.0.5.62.p.2	BAT Pumps
4.0.5.63.p	SIS Pumps
4.0.5.67.p	ERCW Pumps
4.0.5.70.p	Component Cooling Pumps
4.0.5.72.p	Containment Spray Pumps
4.0.5.74.p	RHR Pumps
4.0.5.78.p	Spent Fuel Pit Pumps
4.6.1.8.a	EGTS Fans
4.7.8.1.a	ABGTS Fans
4.8.1.1.2.a	Diesel Generators and D/G Room Exhaust Fans

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## TRAINED CSSC EQUIPMENT WITH PROCESS/STANDBY STATUS

(LATER)



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## CSSC EQUIPMENT NORMALLY IN SERVICE

D/G Battery Hood Exhaust Fans  
D/G Elec. Board Room Exhaust Fans  
D/G Lube Oil Storage Room/Rad. Shelter Exhaust Fan

PLANT EQUIPMENT MONITORING PROGRAM  
EQUIPMENT INFORMATION SHEET

Name:  
Manufacturer:  
Contract No.:  
Identification Nos./Data:

Operational Data:  
Direction of Rotation:  
RPM (min/design/max):  
No. of Rotor Blades:  
No. of Diffuser Vanes:  
No. of Stages:

Physical Data:  
Weight of Rotor:  
Weight of Casing:  
Critical Speed:  
No. of Bearings:

Driver:  
Manufacturer  
Contract No.:  
Identification Nos./Data:

Physical Data:  
Rotor Weight:  
Casing Weight:  
Critical Speed:  
No. of Bearings:  
Bearing Data (ID)

(OD)  
Additional Information:

Reviewed by Mechanical Engineer:

Required for CSSC only

Date

[illegible]

Notify shift engineer of failure of either criteria.

[illegible]

Remarks: \_\_\_\_\_

PLANT EQUIPMENT MONITORING PROGRAM  
QUARTERLY EQUIPMENT CONDITION REPORT

Report for Month of \_\_\_\_\_ 19 \_\_\_\_\_ Submitted \_\_\_\_\_ Date \_\_\_\_\_

Equipment		Bearing A	Bearing B	Bearing C	Bearing D	Bearing E	Bearing F
	H						
Vel / /	V						
Dis / /	A						
	H						
Vel / /	V						
Dis / /	A						
	H						
Vel / /	V						
Dis / /	A						
	H						
Vel / /	V						
Dis / /	A						
	H						
Vel / /	V						
Dis / /	A						
	H						
Vel / /	V						
Dis / /	A						
	H						
Vel / /	V						
Dis / /	A						
	H						
Vel / /	V						
Dis / /	A						
	H						
Vel / /	V						
Dis / /	A						
	H						
Vel / /	V						
Dis / /	A						

Reviewed by Results Supervisor: \_\_\_\_\_ Date \_\_\_\_\_

Remarks \_\_\_\_\_

PLANT EQUIPMENT MONITORING PROGRAM  
 QUARTERLY EQUIPMENT CONDITION REPORT

Report for Month of \_\_\_\_\_ 19 \_\_\_\_\_ Submitted \_\_\_\_\_ Date \_\_\_\_\_

Equipment		Bearing A	Bearing B	Bearing C	Bearing D	Bearing E	Bearing F
	H						
Vel / /	V						
Dis / /	A						
	H						
Vel / /	V						
Dis / /	A						
	H						
Vel / /	V						
Dis / /	A						
	H						
Vel / /	V						
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	H						
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Dis / /	A						

Reviewed by Results Supervisor: \_\_\_\_\_ Date \_\_\_\_\_

Remarks \_\_\_\_\_  
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