Southern California Edison Company

P. O. BOX 800

2244 WALNUT GROVE AVENUE

ROSEMEAD, CALIFORNIA 91770

F. R. NANDY
MANAGER OF NUCLEAR LICENSING

TELEPHONE
(818) 302-1896

September 6, 1989

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

Gentlemen:

Subject: Docket No. 50-206
Interim Acceptance Criteria for the
Thermal Shield Monitoring Program
San Onofre Nuclear Generating Station
Unit 1

The purpose of this letter is to provide the NRC staff with the interim acceptance criteria for the reactor vessel thermal shield monitoring program. Provisional Operating License DPR-13 License Condition 3.M, "Cycle X Thermal Shield Monitoring Program" requires a program be established to monitor the condition of the thermal shield for Cycle X operation. Section 2 of this License Condition requires that the interim acceptance criteria for the thermal shield monitoring program be developed during the first 7 days of $\geq$85% power. By letter dated May 3, 1989 SCE committed to submit this interim acceptance criteria to the NRC staff.

The enclosure provides the interim acceptance criteria for the thermal shield monitoring program which were developed during the first 7 days of operation at $\geq$85% power, beginning on July 31, 1989, in accordance with the requirements of License Condition 3.M.

If you have any question or desire further information, please contact me.

Very truly yours,

Enclosure:

cc: J. B. Martin, Regional Administrator, NRC Region V
C. Caldwell, NRC Senior Resident Inspector, San Onofre Units 1, 2 and 3

A001
1/1

Enclosure

THERMAL SHIELD MONITORING INTERIM ACCEPTANCE CRITERIA

Monitoring of the San Onofre Unit 1 reactor vessel thermal shield consists of Neutron Noise Monitoring and Loose Parts Monitoring. The two methods are used in order to have two independent systems provide information in the unlikely event of thermal shield degradation.

Neutron Noise Monitoring

The excore detector signals are recorded on an FM tape recorder or directly on a personal computer. At least three neutron noise inputs are monitored for at least twenty minutes once a week according to license condition 3.M section 3.b. The recordings are analyzed using techniques such as Power Spectral Densities (PSD's), Cross Power Spectral Densities (CPSD's), and Coherence and Phase functions. In addition to the above mentioned techniques, SCE'S Thermal Shield Monitoring Program performs in-phase and out-of-phase PSD's, a subroutine that enhances signal analysis.

The processed data are provided to Westinghouse for review and evaluation. To ensure the data are analyzed as expediently as possible, the data are transferred to Westinghouse via telephone modem and hardcopies are sent via FAX. Floppy disks with data and hardcopies of the plots are mailed as a backup.

Neutron Noise Interim Acceptance Criteria

After analyzing the data obtained at 80 and 90% power, Westinghouse and SCE established the interim acceptance criteria limits. The neutron noise acceptance criteria is based on cumulative increases in noise PSD levels and/or changes of significant magnitude in the center frequency of spectral peaks.

The attached Figures A (fission chambers 1205 a and b), B (fission chambers 1207 a and b), C (ion chambers 1206 a and b), and D (ion chambers 1208 a and b) show baseline PSD levels (curve 1) and the interim acceptance PSD levels for monitoring (curves 2 and 3).

Curve 2 has been established for the interim at a level which is 80% above baseline (curve 1) and represents the point at which we would begin to analyze and evaluate the data trend.

Curve 3 represents a level of neutron noise that would require NRC notification as indicated in license condition 3.M section 4. The curve 3 levels are at or below the levels inferred from analytical results for thermal shield Beam Modes for the postulated thermal shield worst credible degraded case (failure of the remaining flexure, failure of all of the support block bolts, and loosening of the dowel pins), and the levels inferred from analytical results for the case of postulated failure of the intact flexure with three support blocks degraded.

1. If curve 2 levels are reached at any frequency, detailed examination of the trends of amplitudes and center frequencies of dominant peaks will be performed and the results compared with analysis results, accelerometer output, and the data which Westinghouse has obtained from other plants.

2. If curve 3 levels are reached or exceeded at any frequency, the NRC will be informed within one day as indicated in license condition 3.M section 4.a, and within 14 days the conditions will be evaluated and a report provided to the NRC documenting future plans and actions per license condition 3.M section 4.b.

These criteria are based primarily on three sets of data acquired at 85% power or greater. The data have been filtered using a High Pass filter with a center frequency of 0.8 Hz. Adjustments to the acceptance criteria will be made for cycle burnup and boron concentration changes throughout the cycle.

Loose Parts Monitoring

The second method of detecting potential thermal shield problems is with the use of the loose parts monitoring system. The signals from the four (4) accelerometers which are mounted on the reactor vessel upper flange opposite to the core barrel seating flange at 90 degree intervals are used to monitor for loose parts. The monitoring of each accelerometer consists of the following:

1. Spectral characteristics at normal background levels have been recorded. This was initially done when the unit reached 85% power and will be used as a basis for comparison with subsequent spectral plots when the situation warrants, i.e. alarm limits are exceeded or abnormal noise is noted.

2. RMS voltage values are recorded at least five minutes twice a day in accordance with License Condition 3.M section 3.a. The values are trended to determine if the noise baseline changes, and are analyzed for possible loose parts activity. The trends will also be used to determine if there is any signal degradation from the accelerometers.

3. The recording of all loose parts monitoring activity, including RMS values and audio background noise comments, are performed twice daily. Once a week the cognizant Engineer and a member from the Performance Monitoring Group (PMG) review the data for any anomalies.

4. Audio recordings have been collected at 15, 30, 70 and 85% power to establish an audio background noise baseline. If anomalies are noted, recordings will be compared to the baseline recordings.

Accelerometer Impact Sensitivity

Essential to early loose part detection is the question of sensitivity. The Regulatory Guide 1.133 provides for the minimum sensitivity requirements for a Loose Parts Monitoring system. The requirement is that an impact force of 0.5 (ft-lb) at a distance of three feet from the sensor be detected. On July 19, 1989, with the unit at normal operating pressure and temperature, testing was performed at a distance well in excess of the three feet requirement and also at a location which had a transmission path to the sensors which had several component interfaces. This path provided many sources of impact signal reflections and attenuation. Despite these conditions the impact signal is evident in Figure 1L as detectable well above the normal background level.

The results of this impact test clearly indicates that the Regulatory Guide sensitivity requirement is met.

Loose Parts Monitoring System Interim Acceptance Criteria

Impact test data collected in Modes 3 and 5 (used to determine accelerometer sensitivity), in addition to data collected at 30 and 85% power were sent to Combustion Engineering (CE) for review and evaluation. The data were used to establish the basis for the acceptance criteria.

1. If Recorded RMS value peak signals reach or exceed four times the average RMS background level, The NRC will be informed within 1 day as indicated in License Condition 3.M section 4.a, and within 14 days the condition will be evaluated and a report provided to the NRC documenting future plans and actions per License Condition 3.M section 4.b.

2. In the event of Loose Parts Monitoring (LPM) alarm activity during the baseline period of 45 days at $\geq$85% power, the following LPM event characteristics will be measured:
   a) Event inter-channel delays
   b) Peak amplitude ranges (per channel basis).
   c) Time interval between successive impacts (histogram).
   Monitoring the rate of change of these impact event values will dictate when remedial action is warranted.

Based on the evaluation of the data collected it was determined that signals two times the standard deviation of the RMS values are normal activity due to the background noise.

Attached Figure 2L is an example of the recorded RMS values. These recordings are plotted vs time to establish a trend and to observe possible increases in the RMS values.

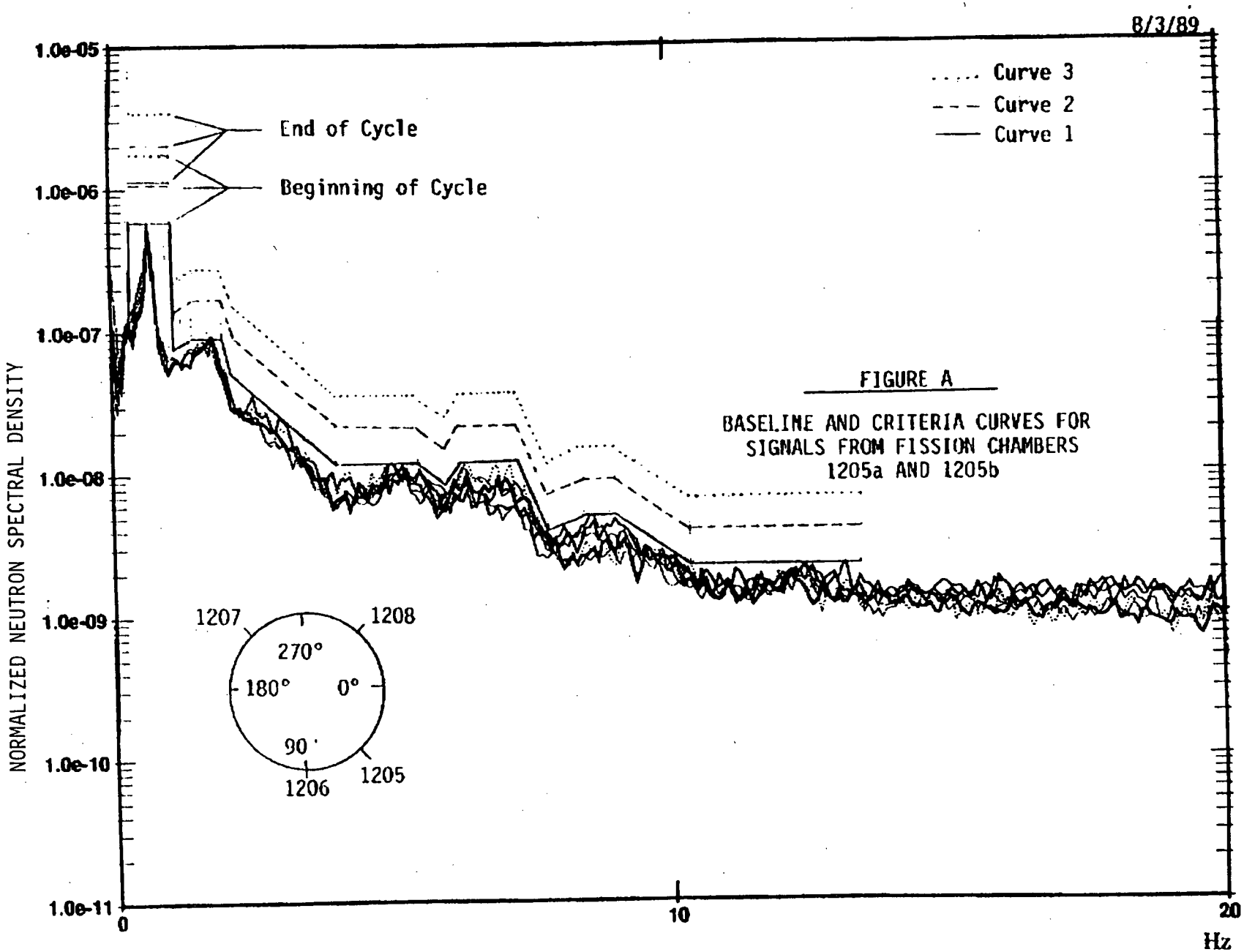

FIGURE A

BASELINE AND CRITERIA CURVES FOR SIGNALS FROM FISSION CHAMBERS 1205a AND 1205b

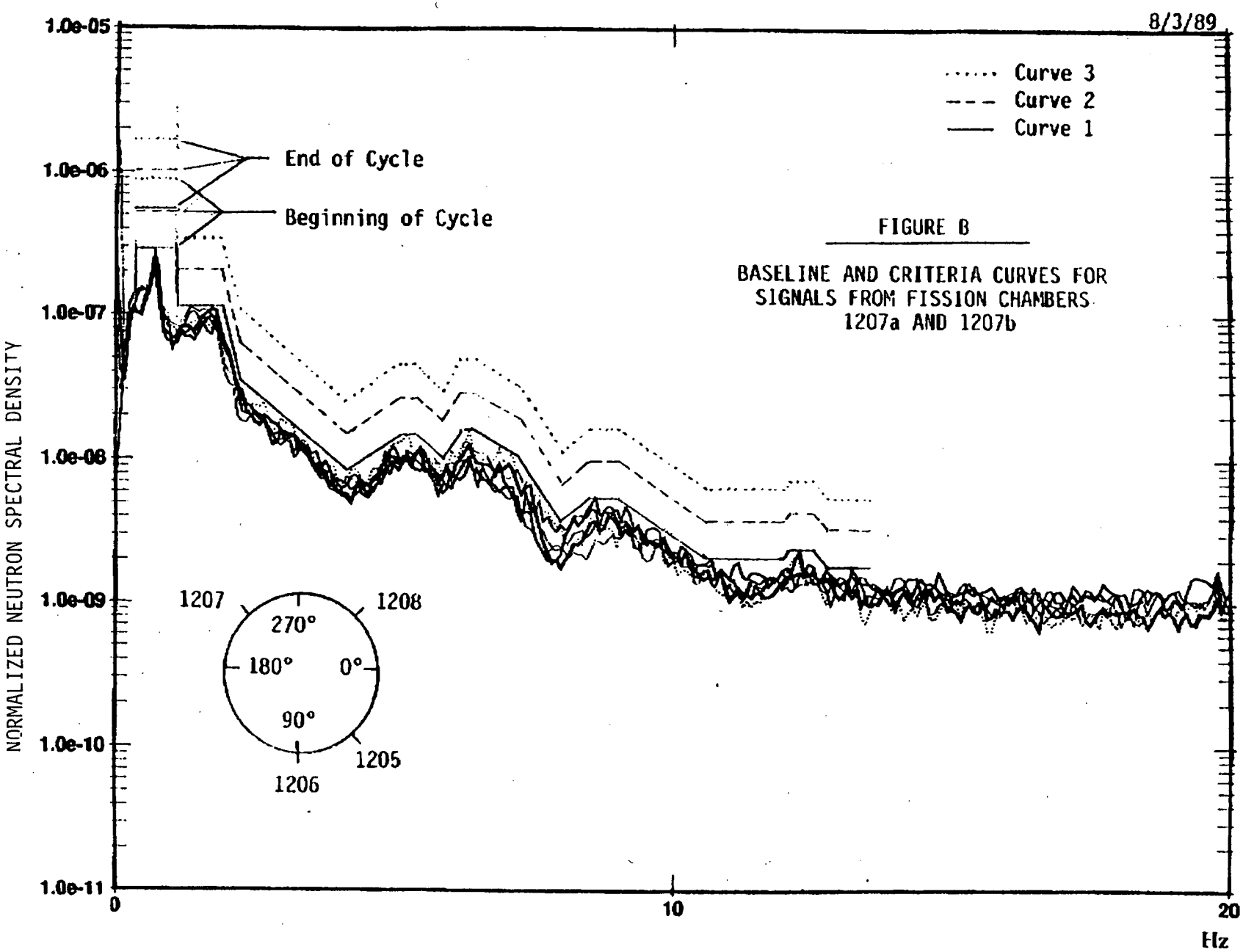

FIGURE B

BASELINE AND CRITERIA CURVES FOR SIGNALS FROM FISSION CHAMBERS 1207a AND 1207b

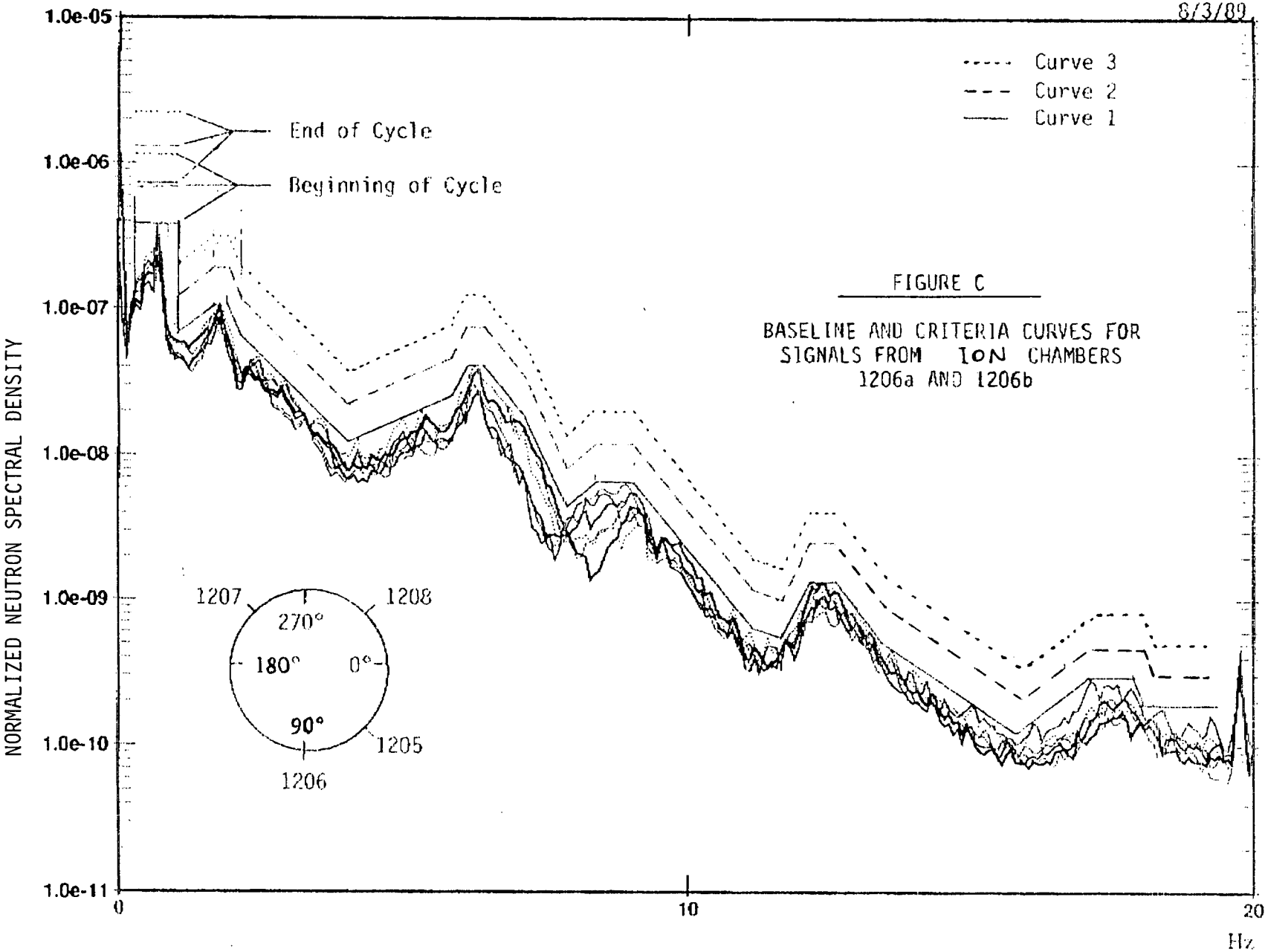

FIGURE C

BASELINE AND CRITERIA CURVES FOR SIGNALS FROM ION CHAMBERS 1206a AND 1206b

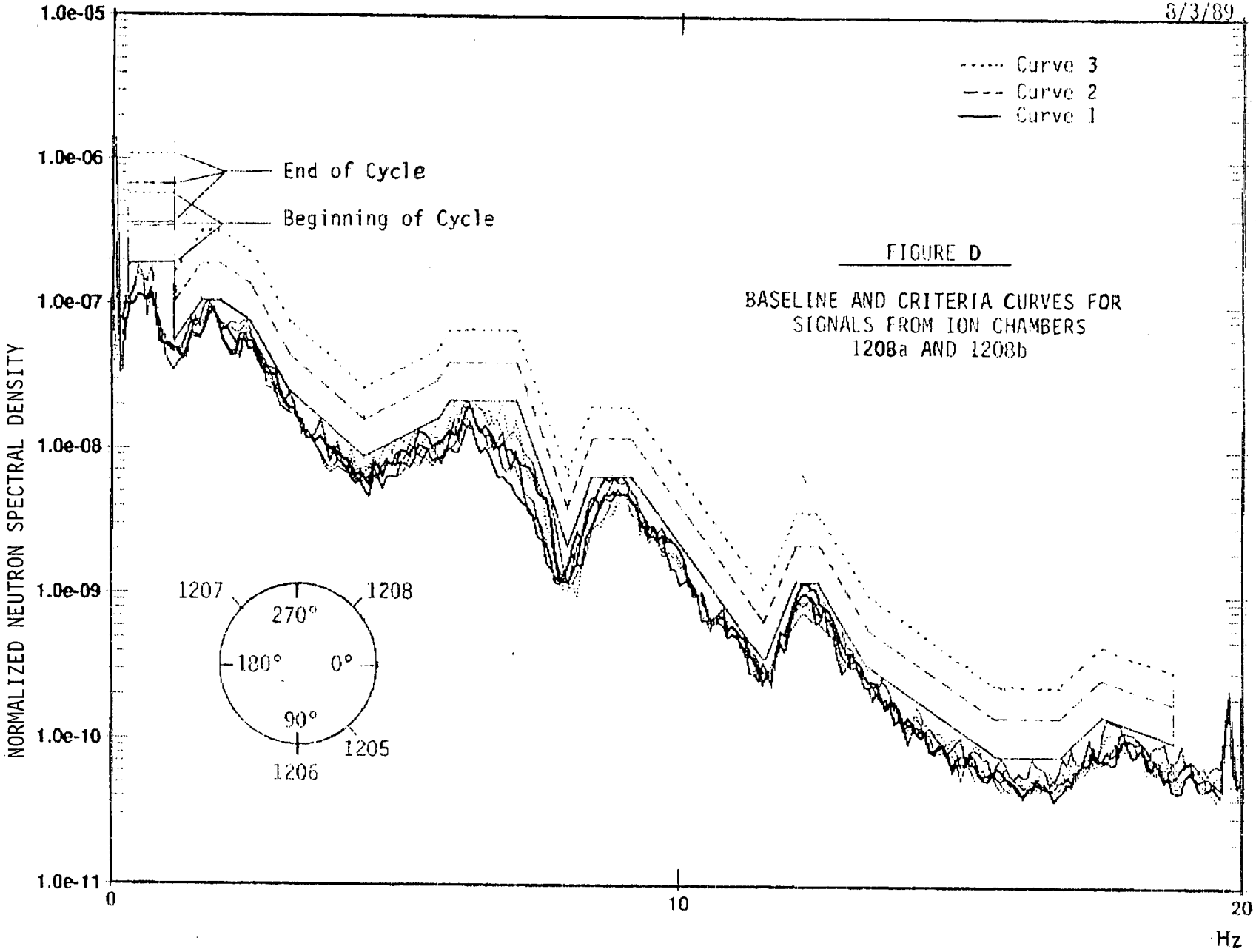

FIGURE D

BASELINE AND CRITERIA CURVES FOR
SIGNALS FROM ION CHAMBERS
1208a AND 1208b

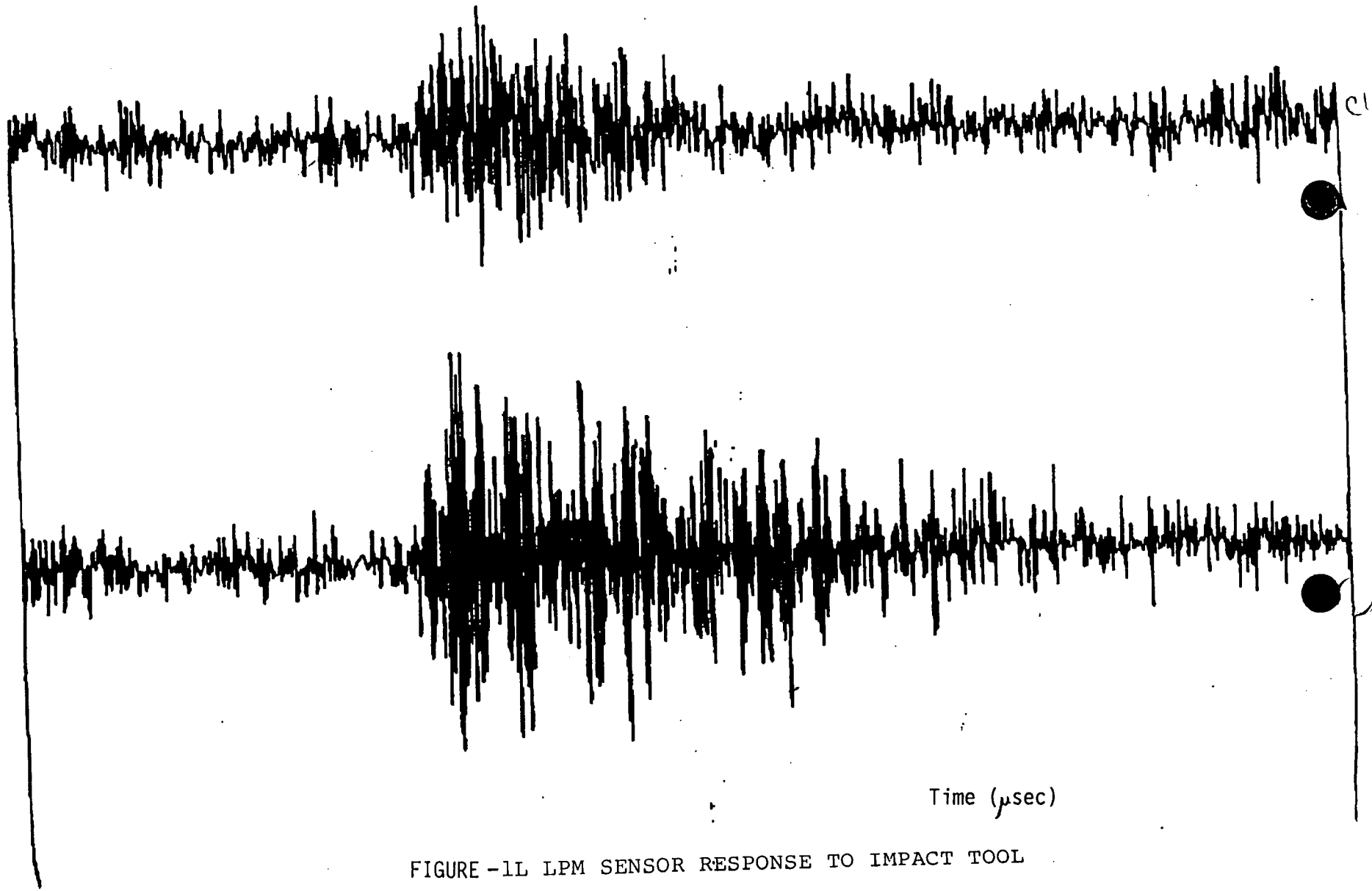

FIGURE -1L LPM SENSOR RESPONSE TO IMPACT TOOL

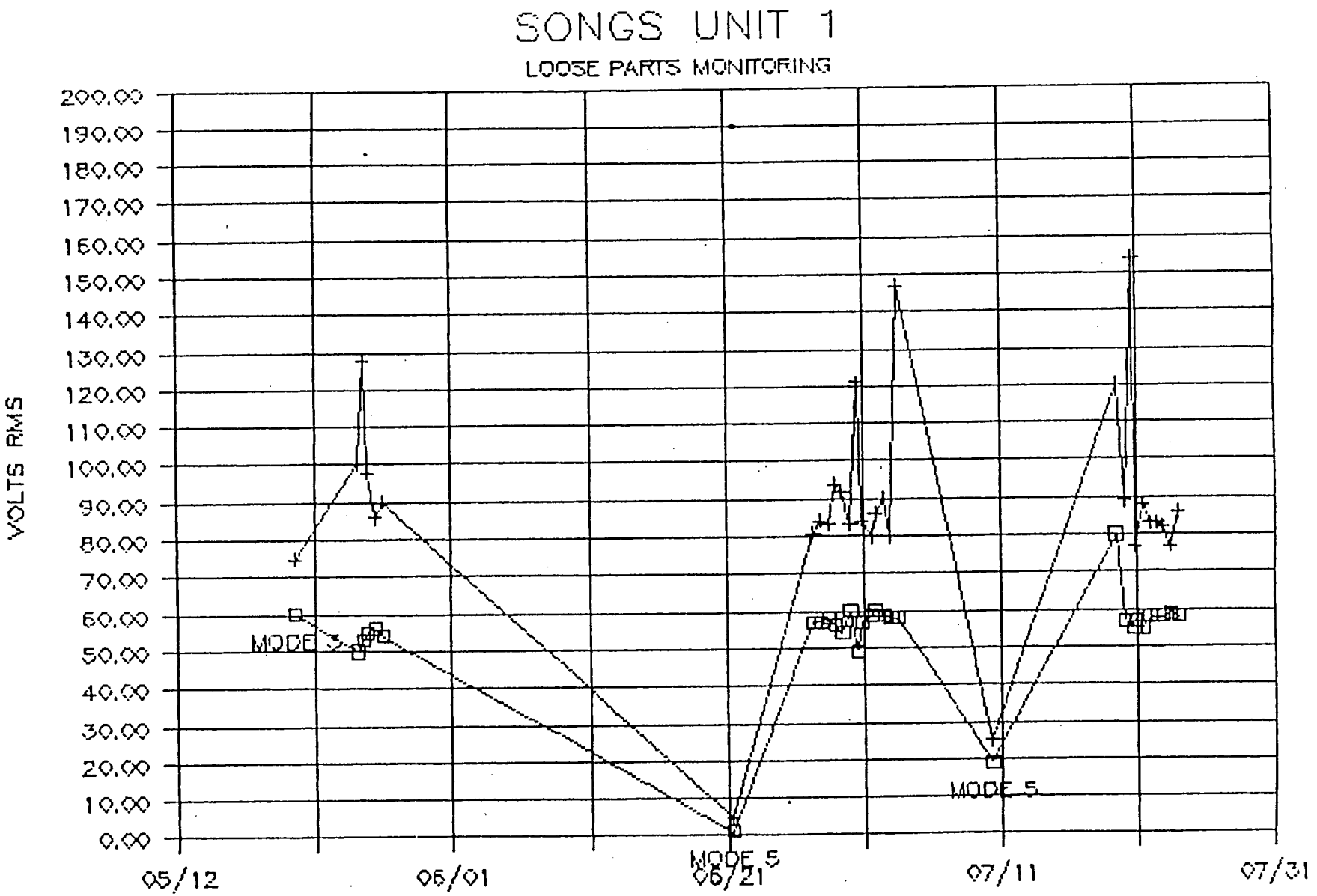

FIGURE-2L RMS VALUES VS TIME

□ MIN + MAX