HOUSTON LIGHTING AND POWER COMPANY
SOUTH TEXAS PROJECT
ELECTRIC GENERATING STATION
PLANT PROCEDURES MANUAL

CONTROLLED
COPY NO. 21

NON SAFETY-RELATED

Standardization of the Tennelec Counter LB1000 and LB5110 Systems

PRP5-ZI-32
Rev. 0
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APPROVED: [signature] DM/DS — NA DATE APPROVED — 4/3/87 DATE EFFECTIVE

Field changes to this procedure must be approved by Radiological Services. This procedure is not described in the FSAR.

1.0 Purpose and Scope

1.1 This procedure outlines the steps required to standardize the Tennelec LB1000 and LB5110. Standardization will include, but will not be limited to, determination of operating voltages and efficiencies for nuclides of interest at these operating voltages.

1.2 Unless otherwise indicated, operation of the Tennelec LB5110 will be in accordance with References 7.1 and 7.2, and operation of the Tennelec LB1000 will be in accordance with References 7.6, 7.7, and 7.8 of this procedure.

2.0 Prerequisites

2.1 Leave all instrument settings (gain and discriminators) as indicated in the previous calibration form or as described in References 7.1, 7.2, and 7.6. Manipulation of these settings is beyond the scope of this procedure. If instrument settings appear to require evaluation, contact the cognizant health physicist for further instructions.

2.2 Any maintenance or setting changes will be recorded in the Tennelec LB1000 QC Log or LB5110 QC Log.

2.3 Equipment required

2.3.1 Ultra pure P-10 gas (90% argon/10% methane) - "certifiable"

2.3.2 Inline filter/desiccator for the P-10 gas

8507100449 850226
REG4 LIC30
42-23140-01 PDR

2.3.3 Standardization sources/standards for different nuclides and geometries which are directly or ultimately traceable to NBS will be utilized. Sources and/or standards supplied by a vendor may be utilized when accompanied by proper documentation or certificate.

3.0 Precautions

3.1 Check to make certain that a continuous flow of P-10 gas is and will be available during the operation of Tennelec LB5110 or LB1000. If this condition does not exist, reduce the high voltage on the detector and replace the exhausted cylinder with a new cylinder. Purge the detector for a minimum of 60 minutes, then increase the high voltage in a stepwise fashion to the routine operating voltage (1500 volts). Perform an instrument background check before continuing with the procedure.

3.2 Ensure the gas regulator (for the Tennelec LB5110 reads) 7 psi and the gas flow (FM 40A) reads between 0.05-0.15 SCFH. Ensure the gas regulator for the Tennelec LB1000 reads 5 psi and the gas flow reads 0.05-0.20 SCFH.

3.3 Always establish full operating voltage in a stepwise fashion of 500 volt increments.

3.4 Handle calibration sources with care to avoid damaging active surface of source.

4.0 Procedure

4.1 Determine the alpha operating voltage as described in the following steps:

4.1.1 Set the high voltage (H.V.) at 1200 volts.

4.1.2 Count the source for an appropriate amount of time (usually 1 minute) in order to achieve at least 1,000 counts in the channel of interest.

4.1.3 Record the observed counts on the Tennelec System Standardization Form (-01).

4.1.4 Increase the applied high voltage by 50 volts and repeat Steps 4.1.2 and 4.1.3 until 1800 volts is reached.

4.2 Repeat Steps 4.1 utilizing an appropriate beta source to determine the beta operating voltage.

4.3 Record all required information on the Tennelec System Standardization Form (-01) for alpha and beta.

4.4 Plot the high voltage versus the observed counts for alpha and beta. The plateau curves shall remain on file in the alpha/beta unit Q.C. log along with the Tennelec System Standardization Form (-01) and other pertinent information regarding this operation.

NOTE: SEMI-LOG GRAPH PAPER WILL ALLOW YOU TO PLOT BOTH A & B ON A SINGLE SHEET.

4.5 Determine and record the operating voltage for both alpha and beta plateaus.

NOTE: THE "SHARED" OPERATING VOLTAGE FOR ALPHA AND BETA WILL MAXIMIZE THE COUNTING EFFICIENCIES WHILE MINIMIZING "CROSSWALK." (§2/a§1/ ± 3%; §2/b§1/ ± 1%) FOR A PLATED SOURCE. SEE STEPS 4.7 AND 4.8 OF THIS PROCEDURE.

4.6 Using the determined operating voltage count source (§2/a§1/ and/or §2/b§1/) for 10,000 counts.

4.7 Determine the non-attenuated alpha and/or beta efficiencies according to the following formula; and then record that valve on corresponding calibration form.

$$E = \frac{\text{Gross cpm}}{S \times 1C \times D}$$

where E = decimal fraction efficiency
S = source strength (dpm)
1C = correction factor for internal conversion elections (if applicable)
D = decay factor

NOTE: BACKGROUND CPM IS INSIGNIFICANT IN THIS CALCULATION DUE TO THE LOW BACKGROUND OF THE SYSTEM AND RELATIVELY HIGH COUNT RATE OF THE SOURCE.

4.8 Determine and record the alpha to beta cross-talk ratio on the Tennelec System Standardization Form (-01).

4.9 Determine and record the beta to alpha cross-talk ratio on the Tennelec System Standardization Form (-01).

4.10 After the standardization forms have been completed and reviewed, set up the LB1000 or LB5110 in accordance with the operating parameters on the standardization forms.

4.11 Using the appropriate alpha and beta sources and/or standards, prepare quality control charts and/or tables for the unit of interest in accordance with References 7.3 of this procedure.

5.0 Acceptance Criteria

5.1 If values for parameters described below are not within stated ranges, contact cognizant Health Physicist.

5.1.1 Shared operating voltage for alpha and beta shall be between 1400V - 1500V.

5.1.2 The crosstalk for alpha & beta shall be less than or equal to 3% and 1% respectively.

5.1.3 The counting efficiencies for alpha and beta shall be greater than or equal to 30% and 55% respectively using plated Pu-239 and Sr-90/4-90 sources.

6.0 Documentation

6.1 Record information on Tennelec System Standardization Form (-01) and keep as permanent record.

7.0 References

7.1 Tennelec Instruction Manual - LB5110 Low Background Counting System

7.2 Tennelec Instruction Manual - LB5110 Operating Instructions

7.3 PRP10-ZL-14 (The Preparation of Control Charts and/or Control Tables for the Tennelec LB1000 or LB5110)

7.4 PRP5-ZO-32 (Operation of the Tennelec LB5110)

7.5 Tennelec Acceptance Test Procedure for the LB5110, Rev. 1, 10/03/79

7.6 Tennelec Instruction Manual - LB1000 Low Background Counting System

7.7 Tennelec Instruction Manual - [illegible]P Multi-Scaler

7.8 Tennelec Instruction Manual - TC576/TC576L Buffered Printer

8.0 Support Documents

8.1 Tennelec System Standardization Form (-01)

α/β CALIBRATION

Unit Type _____ Unit # _____

Date Performed _____ Performed by _____ Reviewed by _____

Isotope (α) _____ Source ID (α) _____ dpm (α) _____ Count Time (α) _____

Isotope (β) _____ Source ID (β) _____ dpm (β) _____ Count Time (β) _____

α Plateau, Operating Voltage _____ $\frac{\alpha \text{ on } \beta}{\alpha \text{ on } \alpha}$ = _____ % Counting Efficiency (α) _____ %

β Plateau, Operating Voltage _____ $\frac{\beta \text{ on } \alpha}{\beta \text{ on } \beta}$ = _____ % Counting Efficiency (β) _____ %

H.V.	α Gross Count	β Gross Count	H.V.	α Gross Count	β Gross Count	H.V.	α Gross Count	β Gross Count
250			850			1450		
300			900			1500		
350			950			1550		
400			1000			1600		
450			1050			1650		
500			1100			1700		
550			1150			1750		
600			1200			1800		
650			1250			1850		
700			1300			1900		
750			1350			1950		
800			1400			2000		

Instrument/P-10 Conditions

Available gas _____ psi
Regulator Setting _____ psi
FM 40A Reading _____ SCFH
IC 264A Gain _____
IC 264A Discriminator _____
IC 265A Gain _____
IC 265A α Discriminator _____
IC 265A α/β Discriminator _____

REMARKS

This form shall be retained for the life of the plant.