RADIATION MONITORING CALIBRATION TEST FOR NEW SCOPE AREA MONITORS	74ST-9SQ23	Revision 00.01

The intent of this procedure is to satisfy the Technical Specifications Surveillance requirements by providing detailed instructions in Channel Calibration and Functional Tests for the Main Steam Line Effluent Radiation Monitors (JSQNRU0139, JSQNRU0140) and the In Containment Area Radiation Monitors (JSQARU0148, JSQBRU0149).

This procedure supersedes 36ST-9SQ09.

9-28-92
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1.0 OBJECTIVE

The intent of this procedure is to satisfy the Technical Specifications Surveillance requirements by providing detailed instructions in Channel Calibration and Functional Tests for the Main Steam Line Effluent Radiation Monitors (XJSQNRU0139, XJSQNRU0140) and the In Containment Area Radiation Monitors (XJSQARU0148, XJSQBRU0149). (RCTS# 031006, 035118, 037057 and CRDR 920373.)

1.1 Technical Specification Requirements

1.1.1 This procedure satisfies Technical Specification Surveillance Requirement 4.3.3.1 and Table 4.3-3, items 1.D and 1.E.

1.1.2 The applicable Technical Specification Limiting Condition for Operation number is 3.3.3.1.

1.1.3 There are no LCO action statements satisfied by this surveillance test.

1.2 Plant Modes

1.2.1 The Technical Specification Surveillance Requirements are required when the plant is in modes 1, 2, 3 and 4.

1.2.2 This Surveillance Test procedure may be performed in any plant mode.

1.3 Normal Performance Intervals

1.3.1 The frequency at which this test will be routinely performed is once every 18 months. This test procedure may be performed at other times for system/subsystems verification of functional operability and/or historical data.

1.4 ASME Requirements

None

1.5 Department/Section Responsibilities

1.5.1 Performance

1.5.1.1 The OCS/RMS Department has primary performance responsibility for this Surveillance Procedure.

1.5.1.2 The Operations and RMS/Chemistry Departments have support responsibility.

2.0 REFERENCES

2.1 Implementing References

2.1.1 73AC-9ZZ04: Surveillance Testing

2.2 Developmental References

2.2.1 KAMAN Radiation Monitoring System Technical Manuals

2.2.1.1 Volume IV - Post Accident Radiation Monitoring System N997-261-5

2.2.1.2 Volume V - Post Accident Radiation Monitoring System N997-262-7

2.2.1.3 Volume VI - Post Accident Radiation Monitoring System N997-263-3

2.2.2 Drawings

2.2.2.1 XJSQNRU0139 and XJSQNRU0140

2.2.2.1.1 LOCATION: 13-J-ZMF-002-5

2.2.2.1.2 ELECTRICAL: 13-E-SQB-004-10

2.2.2.1.3 Microcomputer Configuration N997-658-4, 722-3, and 723-3.

2.2.2.1.4 CPU board N997-946-2, 947-2, and 948-1.

2.2.2.1.5 Systems board N997-726-2, and 727-2.

2.2.2.1.6 Motherboard N997-799-2, and 800-2.

2.2.2.1.7 High Voltage board N997-834-3.

2.2.2.1.8 Low Voltage P/S N997-893-2

2.2.2.2 XJSQARU0148 and XJSQBRU149

2.2.2.2.1 LOCATION: 13-J-ZJF-009-16, 13-J-ZCF-013-6, 13-J-ZCF-014-3

2.2.2.2.2 ELECTRIC : 13-E-SQB-003-13, 4-10

2.2.2.2.3 Microcomputer Configuration N997-697-2, 698-3 and 699-3.

2.2.2.2.4 Scam board N997-533-2 thru 543-2.

2.2.2.2.5 Power monitor board N997-840-2

2.2.3 Regulatory Commitment Tracking System (RCTS)

2.2.3.1 RCTS 031006, 037057 and 035118

2.2.3.2 CRDR 920373

2.2.4 UFSAR Section 11.5 Rev 4

2.2.5 Standards

2.2.5.1 KNP 18-72 MCAM Functional Test N997-256-3

2.2.5.2 KNP 18-71 SCAM Functional Test N997-255-4

2.2.5.3 KNP 18-54 DRMS KERIC and 1E Cabinet Functional Test N997-235-1

2.2.5.4 TOI 451081-001 PreAmp Assembly Test N997-408-1

2.2.6 Other References

2.2.6.1 SFR 1-SQ-099

2.2.6.2 EER 86-SQ-038

2.2.6.3 EER 90-SQ-107

2.2.6.4 Calculation 13-JC-SQ-214

2.2.6.5 Calculation 13-JC-SQ-216

3.0 DEFINITIONS AND ABBREVIATIONS

3.1 SCAM - Single Channel Area Monitor

3.2 MCAM - Multiple Channel Area Monitor

3.3 KELIC - KAMAN Electronic Local Indication and Control Unit

3.4 KEPIC - KAMAN Electronic Portable Indication and Control Unit

3.5 KERIC - KAMAN Electronic Remote Indication and Control Unit

3.6 PAMU - Post Accident Monitoring Unit

4.0 MEASURING, TEST AND SAFETY EQUIPMENT

4.1 Calibrated M&TE or Equivalent

4.1.1 DMM - Fluke 8600

4.1.2 Picoamp source - Keithly 261

4.2 Non-Calibrated M&TE or Equivalent

4.2.1 Kaman Preamp Test Fixture - ID #SQ106

4.2.2 Kaman Battery Test Fixture - ID #SQ105

4.2.3 KEPIC

4.2.4 KERIC Extension Cable

5.0 LIMITATIONS AND PRECAUTIONS

5.1 Secure testing if any unanticipated or unexpected alarm, unusual noise or vibration is observed.

5.2 Exercise extreme caution when working with detectors and detector connectors. Very high voltages are present.

5.3 Notify the Assistant/Shift Supervisor of the intention to commence, stop or resume testing.

5.4 Ensure there is no welding, grinding, or radio transmissions in the immediate area of the microcomputer during testing, all of which can interfere with microcomputer electronics.

5.5 Avoid exposing equipment being tested to dust, dirt, moisture or other hazardous conditions.

5.6 The Work Group Supervisor shall be notified as soon as possible if any AS FOUND data does not meet the acceptance criteria, if a problem or deficiency occurs that may affect the operability of the system or component under test, or if it is found that the surveillance requirement is not satisfied within the prescribed Technical Specification testing interval.

5.7 Always ensure the KEPIC is in REMOTE before connecting or disconnecting it from the monitor.

6.0 PERSONNEL INDOCTRINATION

The intent of this procedure is to meet the Technical Specification requirement for Channel Calibration and Functional Surveillance Tests for the Main Steam Line Effluent Radiation Monitors and the In Containment Area Radiation Monitors.

The Main Steam Line Effluent Radiation Monitors measure direct dose rates from the main steam line to identify radioactive material released to the environment from the atmospheric dump and main steam relief valves. There are two Main Steam Line Monitors installed. Each monitor has two detectors monitoring the main steam lines from steam generators A and B. The ion detectors are located in the Main Steam Support Structure building on the 120 foot elevation. The microcomputers for these radiation monitors are in the PAMU cabinet which is located in the breezeway between the turbine building and the auxiliary building on the 100 foot elevation.

The In Containment Area Radiation Monitors measure the dose rate in containment prior to and during a Loss of Coolant Accident and their intended function is for core damage assessment. There are two In Containment Area Radiation Monitor Channels, each with a single ion chamber detector. The detectors are located at the 140 foot elevation of containment. The microcomputers are located in the Control building, one on the 120 foot elevation and the other on the 160 foot elevation. Each channel has a Remote Indicating Control unit located in panel X-JSQA/B-C05 on the 140 foot elevation of the Control Room.

6.1 Personnel Required

6.1.1 Performance of this test will require two OCS/RMS technicians for a period of 48 hours for a total of 96/man hours.

6.2 Personnel Responsibilities

6.2.1 One of the technicians will be designated the Test Leader.

6.2.1.1 The Test Leader will be responsible for directing test personnel as the procedure warrants. The Test Leader is responsible for obtaining the Shift Supervisor's permission to perform the procedure.

6.2.1.2 The Test Leader and accompanying test performers shall ensure the test is conducted and completed in accordance with 73AC-9ZZ04 and that the procedure OBJECTIVES, PERSONNEL RESPONSIBILITIES and LIMITATIONS AND PRECAUTIONS sections are understood.

6.2.2 It is the responsibility of any test participant to notify the Work Group Supervisor and the Shift Supervisor as soon as possible if the test fails or any deficiency occurs.

6.2.3 Technical personnel performing this procedure will specifically acknowledge only those alarms which are generated within the body of the procedure. This action will ensure that: 1) valid alarms will not be inadvertently acknowledged and 2) that Operations personnel will remain cognizant of the status of the system.

6.3 General Indoctrination

6.3.1 As each data value/entry is recorded, it is the responsibility of the performer to evaluate that data for acceptability. If data is unacceptable, it should be promptly circled and the performer will immediately proceed to CONTINGENCIES, Section 10.0.

6.3.2 AS FOUND High and Alert alarm setpoints and background readings recorded in this procedure that have no acceptance criteria associated with them are being recorded for information only.

6.3.3 The DETERMINATION/RETERMINATION SHEET contained in Appendix A ensures documentation of identifying all wires/cables lifted and relanded. Extra DETERMINATION/ RETERMINATION sheets may be inserted for reperformances.

6.3.4 Unless specified by this procedure, leads landed are Second Party Validated by the functional check performed during the AS LEFT LOOP check. If performing a partial procedure, ensure leads landed are Second Party Validated.

6.3.5 If the requested LED display has non-operational segment(s), an alternate display unit (DCU, KELIC, KERIC or KEPIC) may be used for the requested readout. In addition, the LED may be replaced as 'skill of the craft' or a Maintenance Work Request should be generated and a Maintenance Required Tag should be affixed to the failed display.

6.3.6 Data base value changes to RU-148 and RU-149 must be entered at the KERIC.

6.3.7 System console alarms are to be acknowledged from the Control Room console only, unless otherwise instructed by Control Room personnel.

7.0 PREREQUISITES

_____7.1 The LIMITATIONS AND PRECAUTIONS, Section 5.0, and PERSONNEL INDOCTRINATION, Section 6.0, have been read and understood.

_____7.2 The calibration is current on all M&TE utilized in this test.

_____7.3 Ensure the PROCEDURE LOG/CONTINUATION SHEET (this documents the current revision, SS notification, etc. for this procedure) is used for documenting activities associated with procedure performance. A new PROCEDURE LOG/CONTINUATION SHEET shall be used for each work shift.

_____7.4 Verify this copy of this procedure is the current revision/decimal revision by checking the Nuclear Administrative and Technical Manual Index and the Daily Change List or by calling NRM-DDC. This verification shall be documented appropriately in the ST package within 4 hours prior to commencement of the Section 8.0 instructions.

_____7.5 Ensure that the DETERMINATION/RETERMINATION SHEET (Appendix A) is used for documenting all lifts, relands and second party validation associated with this procedure performance.

_____7.6 The Shift Supervisor has given permission and the Control Room Operator has been informed prior to the commencement of this test.

8.0 INSTRUCTIONS

8.1 Multiple Channel Area Monitors - RU-139 and RU-140

139 140

8.1.1 Initial Test Setup

____ ____ 8.1.1.1 Notify Operations and RMS/Chemistry that monitor being tested will be removed from service for calibration.

RU-139
RU-140

____ ____ 8.1.1.2 At the minicomputer terminal, take the monitor Off-Line by typing the monitor number then press the function key UNIT OFF.

RU-139 monitor number 25.
RU-140 monitor number 26.

____ ____ 8.1.1.3 Verify and record monitor identification tag number.

139/_____

140/_____

____ ____ 8.1.1.4 Verify the KEPIC's LOCAL/REMOTE keyswitch is in REMOTE, then connect the KEPIC to the microcomputer receptacle.

____ ____ 8.1.1.5 At the KEPIC, place the REMOTE/LOCAL keyswitch in the LOCAL position.

____ ____ 8.1.1.6 Record the AS FOUND Channel 1 radiation level.

139/_____mR/hr.

140/_____mR/hr.

____ ____ 8.1.1.7 At the KEPIC, place the monitor in the calibrate mode by pressing function keys "FTN 1 06 1 ENT" and record the AS FOUND Channel 1 Ion Chamber keep alive current.

139/_____Amps

140/_____Amps

139 140

____ ____	8.1.1.8	At the KEPIC, place the monitor in continuous display for Channel 2 by pressing function keys *FTN 2 01 ENT* and record the AS FOUND Channel 2 Ion Chamber keep alive current. 139/_____Amps. 140/_____Amps.
____ ____	8.1.1.9	At the KEPIC, place the monitor in normal mode by pressing function keys *FTN 1 06 0 ENT* and record the AS FOUND Channel 2 radiation level. 139/_____mR/hr. 140/_____mR/hr.
____ ____	8.1.1.10	Perform a memory self test by pressing function keys *TST ENT*.
____ ____	8.1.1.11	After a few seconds, verify the display indicates *O A OA* and then returns to normal.

139 140

8.1.2 Low Voltage Power Supply

NOTE

Refer to Appendix B for Low Voltage Power Supply Potentiometer locations.

____ ____ 8.1.2.1 Connect a DVM between J29 Pin 5 and Ground on the mother board. Record AS FOUND 5 VDC supply voltage.

ALLOWABLE RANGE 4.950 TO 5.050

	AS FOUND	AS LEFT
139/	_____	_____
140/	_____	_____

____ ____ 8.1.2.2 Adjust potentiometer R-26 on the low voltage power supply to 5.000 VDC (4.950 to 5.050). Record AS LEFT.

____ ____ 8.1.2.3 Disconnect the DVM installed in Step 8.1.2.1 and connect the DVM between J29 Pin 3 and Ground on the motherboard. Record AS FOUND 15 VDC supply voltage.

ALLOWABLE RANGE 14.950 TO 15.050

	AS FOUND	AS LEFT
139/	_____	_____
140/	_____	_____

____ ____ 8.1.2.4 Adjust potentiometer R-40 on the low voltage power supply to 15.000 VDC (14.950 to 15.050). Record AS LEFT.

139 140

____ ____ 8.1.2.5 Disconnect the DVM installed in Step 8.1.2.3 and connect the DVM between J29 Pin 2 and Ground on the motherboard. Record AS FOUND -15 VDC supply voltage.

ALLOWABLE RANGE -14.950 TO -15.050

	AS FOUND	AS LEFT
139/	_____	_____
140/	_____	_____

____ ____ 8.1.2.6 Adjust potentiometer R-45 on the low voltage power supply to -15.000 VDC (-14.950 to -15.050). Record AS LEFT.

____ ____ 8.1.2.7 Disconnect the DVM installed in Step 8.1.2.5 and connect the DVM between J29 Pin 8 and Ground on the motherboard. Record AS FOUND 12 VDC supply voltage.

ALLOWABLE RANGE 11.000 TO 13.000

	AS FOUND	AS LEFT
139/	_____	_____
140/	_____	_____

____ ____ 8.1.2.8 Adjust potentiometer R-4 on the Power Distribution board to 12.000 VDC (11.000 to 13.000). Record AS LEFT.

____ ____ 8.1.2.9 Disconnect the DVM installed in Step 8.1.2.7 and connect the DVM on the low voltage power supply to TB-1 terminals 10 (-V3) and 11 (+V3). Record AS FOUND 24 VDC supply voltage.

ALLOWABLE RANGE 23.50 TO 24.50

	AS FOUND	AS LEFT
139/	_____	_____
140/	_____	_____

____ ____ 8.1.2.10 Adjust potentiometer R-41 on the low voltage power supply to 24.00 VDC (23.50 to 24.50). Record AS LEFT.

____ ____ 8.1.2.11 Disconnect the DVM installed in Step 8.1.2.9.

139 140

8.1.3 Battery Test

____ ____ 8.1.3.1 Disconnect the battery cable from the microcomputer and document in Appendix A. Connect the battery test fixture in series with the battery cable.

____ ____ 8.1.3.2 With the test fixture switch in the OFF position, connect a DVM to TP-1(+) and TP-2(-) on the battery test fixture and record AS FOUND battery voltage.

ALLOWABLE RANGE 5.000 TO 11.000 VDC

	AS FOUND	AS LEFT
139/	_____	_____
140/	_____	_____

____ ____ 8.1.3.3 Connect the battery to the microcomputer by placing the test fixture switch to the ON position and record AS FOUND battery charge voltage.

ALLOWABLE RANGE 5.000 TO 11.000 VDC

	AS FOUND	AS LEFT
139/	_____	_____
140/	_____	_____

____ ____ 8.1.3.4 Place the test fixture switch in the OFF position.

____ ____ 8.1.3.5 Disconnect the DVM installed in Step 8.1.3.2 and connect the DVM between TP-2(+) and TP-3(-).

____ ____ 8.1.3.6 Set the DVM to read MADC and record AS FOUND battery charge current.

ALLOWABLE RANGE 0.000 TO 600.0 MADC

	AS FOUND	AS LEFT
139/	_____	_____
140/	_____	_____

139 140

____	____	8.1.3.7	If the values recorded for AS FOUND are not in tolerance, replace the battery with one obtained from stores part # 822945 or 450565 and repeat 8.1.3.1 through 8.1.3.6 and record values AS LEFT. Record ROS number below. Otherwise record AS FOUND values for AS LEFT and continue with step 8.1.3.8. 139/ROS#_____. 140/ROS#_____.
____	____	8.1.3.8	Disconnect the DMM and battery test fixture and reconnect the battery cable to the microcomputer and document in Appendix A.
____	____	8.1.3.9	At the KEPIC, display and record the last 2 ten minute averages using function keys "DSP 1 25 ENT" and then "EXP" for the second reading. 139/1)_____ 2)_____ 140/1)_____ 2)_____
____	____	8.1.3.10	Place the KEPIC in REMOTE and disconnect it from the microcomputer.
____	____	8.1.3.11	De-energize the monitor by placing the power switch SW-1 in the OFF position.
____	____	8.1.3.12	After leaving the monitor off for approximately 5 minutes, energize the monitor by placing the power switch in the ON position.
____	____	8.1.3.13	Connect the KEPIC to the monitor and verify the last 2 ten minute averages recorded in 8.1.3.9 are retained.

RU-139 RU-140
CH1 CH2 CH1 CH2

8.1.4 High Voltage Board Calibration

NOTE

The following sections are written for both channels 1 and 2. The format for test points, variable pots, and board slot numbers is "channel 1 value / channel 2 value".

____ ____ ____ ____ 8.1.4.1 Connect a DVM between TP-1 (ch1)/TP-3 (ch2) and TP-2 (Ground) on the High Voltage Board, slot 25. Record AS FOUND Proportional High Voltage.

ALLOWABLE RANGE 6.930 to 7.070

139/ch1/_____

139/ch2/_____

140/ch1/_____

140/ch2/_____

____ ____ ____ ____ 8.1.4.2 Adjust potentiometer, R-1 (ch1)/R-4 (ch2), to 7.700 VDC (7.630 to 7.770).

____ ____ ____ ____ 8.1.4.3 Slowly adjust potentiometer, R-2 (ch1)/R-5 (ch2), until the KEPIC EQUIP FAIL light illuminates.

____ ____ ____ ____ 8.1.4.4 Adjust potentiometer, R-1 (ch1)/R-4 (ch2), to approximately 7.0 VDC and verify the KEPIC EQUIP FAIL light extinguishes.

____ ____ ____ ____ 8.1.4.5 Adjust potentiometer, R-1 (ch1)/R-4 (ch2), to 6.300 VDC (6.230 to 6.370).

____ ____ ____ ____ 8.1.4.6 Slowly adjust potentiometer, R-3 (ch1)/R-6 (ch2), until the KEPIC EQUIP FAIL light illuminates.

RU-139 CH1	RU-139 CH2	RU-140 CH1	RU-140 CH2		
____	____	____	____	8.1.4.7	Adjust potentiometer, R-1 (ch1)/R-4 (ch2), to 7.000 VDC (6.930 to 7.070). Record AS LEFT Proportional High Voltage. ALLOWABLE RANGE 6.930 to 7.070 139/ch1/_____ 139/ch2/_____ 140/ch1/_____ 140/ch2/_____
____	____	____	____	8.1.4.8	Disconnect the DVM installed in Step 8.1.4.1.
				8.1.5	Ion Chamber Interface Board Calibration
____	____	____	____	8.1.5.1	Connect the DVM between TP-1 on the Interface Board in slot 12 (ch1)/slot 11 (ch2) and TP-2 (Ground) on the High Voltage Board. Record AS FOUND Up-Count voltage. ALLOWABLE RANGE 9.840 to 9.860 AS FOUND / AS LEFT 139/ch1/_____ _____ 139/ch2/_____ _____ 140/ch1/_____ _____ 140/ch2/_____ _____
____	____	____	____	8.1.5.2	Adjust potentiometer R-7 on the Interface Board to 9.850 VDC (9.840 to 9.860). Record AS LEFT Up-Count voltage.

RU-139 CH1	RU-139 CH2	RU-140 CH1	RU-140 CH2		
____	____	____	____	8.1.5.3	Move the test lead connected to TP-1 to TP-2 on the Interface Board. Record AS FOUND Down-Count voltage. ALLOWABLE RANGE 0.890 to 0.910 AS FOUND / AS LEFT 139/ch1/_____ _____ 139/ch2/_____ _____ 140/ch1/_____ _____ 140/ch2/_____ _____
____	____	____	____	8.1.5.4	Adjust potentiometer R-10 on the Interface Board to 0.900 VDC (0.890 to 0.910). Record AS LEFT Down-Count voltage.
____	____	____	____	8.1.5.5	Disconnect the DVM connected in step 8.1.5.1.
				8.1.6	Preamplifier Verification Test
____	____	____	____	8.1.6.1	At the KEPIC, turn the LOCAL/REMOTE keyswitch to LOCAL.
____	____	____	____	8.1.6.2	Place the KEPIC in continuous display for the channel being tested by entering "FTN (channel) 01 ENT".

RU-139		RU-140	
CH1	CH2	CH1	CH2

NOTE

If this section is being performed following Section 8.1.7, Preamp Calibration, steps 8.1.6.3 and 8.1.6.4 are N/A.

CAUTION

EXERCISE CAUTION WHEN WORKING WITH SIGNAL CONNECTORS. VERY HIGH VOLTAGES MAY BE PRESENT AND CONNECTORS MAY BE DAMAGED IF OVERSTRESSED.

____	____	____	____	8.1.6.3	Disconnect the detector signal cable from connector J10A (ch1)/J11A (ch2) at the microcomputer and document in Appendix A.
____	____	____	____	8.1.6.4	After several minutes, verify the equipment fail light illuminates.
____	____	____	____	8.1.6.5	At the microcomputer KEPIC, press function keys "TST (channel) 01 ENT" to self test the preamp electronics. This test will run for approximately 2 minutes. If the test is successful, the FUNCT CHAN PARAMETER display will indicate "A A AA" as the VALUE display increments from E-11 to E-05. If the display panel indicates an "E" in any field, proceed to Section 8.1.7, Preamp Calibration.
____	____	____	____	8.1.6.6	Verify/connect the picoamp source to the microcomputer signal connector.
____	____	____	____	8.1.6.7	At the KEPIC, place the monitor in Calibrate mode by pressing function keys "FTN 1 06 1 ENT".

RU-139 RU-140
CH1 CH2 CH1 CH2

____ ____ ____ ____ 8.1.6.8 Turn the picoamp source ON, place the polarity switch in the + position, and adjust the current output in accordance with the values below. Record AS FOUND data.

		RU-139 CH 1		RU-139 CH 2	
PICO AMP INPUT	ALLOWABLE RANGE	AS FOUND	AS LEFT	AS FOUND	AS LEFT
8.00 E-11	7.80 E-11 TO 8.20 E-11				
8.00 E-10	7.80 E-10 to 8.20 E-10				
8.00 E-09	7.80 E-9 to 8.20 E-9				
8.00 E-08	7.80 E-8 to 8.20 E-8				
8.00 E-07	7.80 E-7 to 8.20 E-7				
8.00 E-06	7.80 E-6 to 8.20 E-6				
8.00 E-05	7.80 E-5 to 8.20 E-5				

(CRDR 920373)

		RU-140 CH 1		RU-140 CH 2	
PICO AMP INPUT	ALLOWABLE RANGE	AS FOUND	AS LEFT	AS FOUND	AS LEFT
8.00 E-11	7.80 E-11 TO 8.20 E-11				
8.00 E-10	7.80 E-10 to 8.20 E-10				
8.00 E-09	7.80 E-9 to 8.20 E-9				
8.00 E-08	7.80 E-8 to 8.20 E-8				
8.00 E-07	7.80 E-7 to 8.20 E-7				
8.00 E-06	7.80 E-6 to 8.20 E-6				
8.00 E-05	7.80 E-5 to 8.20 E-5				

(CRDR 920373)

RU-139		RU-140			
CH1	CH2	CH1	CH2		
____	____	____	____	8.1.6.9	If the data recorded in step 8.1.6.8 is within tolerance, record data AS LEFT and proceed to step 8.1.6.10. If the data is not within tolerance, perform section 8.1.7, Preamp Calibration.
____	____	____	____	8.1.6.10	Disconnect the picoamp source from the detector signal connector, reconnect the detector signal cable at the microcomputer, document in Appendix A and proceed to section 8.1.8, As Left Keep Alive Check.

8.1.7 Preamp Calibration

NOTE

Perform this section if steps 8.1.6.5 or 8.1.6.8 of the Preamplifier Verification Test are not within tolerance.

____	____	____	____	8.1.7.1	Turn the microcomputer power switch, S-1, to the OFF position.

NOTE

To facilitate removal of the preamplifier, the microcomputer power supply may need to be repositioned, but should not be removed.

____	____	____	____	8.1.7.2	Remove the preamplifier from the microcomputer assembly.

CAUTION

DO NOT HANDLE THE INTERNAL COMPONENTS OF THE PREAMP ASSEMBLY WITHOUT RUBBER SURGICAL GLOVES.

____	____	____	____	8.1.7.3	Remove the preamp assembly cover and connect the preamp into the test fixture.

RU-139 CH1	RU-139 CH2	RU-140 CH1	RU-140 CH2		
____	____	____	____	8.1.7.4	Place test fixture switches S-1 thru S-9 in OFF (0 = OFF and 1 = ON).
____	____	____	____	8.1.7.5	Turn on power to the test fixture.
____	____	____	____	8.1.7.6	Connect a picoamp source to the triax connector on the preamp.
____	____	____	____	8.1.7.7	Turn picoamp source ON and turn polarity switch to OFF.
____	____	____	____	8.1.7.8	Set picoamp source for an output of 0.00 E-12 amps.

NOTE

The preamplifier assembly is extremely sensitive to RFI, EMI, and/or technician body movements. To efficiently calibrate the preamplifier these conditions must be minimized.

____	____	____	____	8.1.7.9	Connect a DVM between TP-2 and Ground (R-9 lead closest to parametric amplifier) and record AS FOUND voltage.

ALLOWABLE RANGE -0.009 to 0.009

	AS FOUND	AS LEFT
139/ch1/	_____	_____
139/ch2/	_____	_____
140/ch1/	_____	_____
140/ch2/	_____	_____

____	____	____	____	8.1.7.10	Adjust potentiometer, R-18, on the preamp to 0.000 VDC (-0.009 to 0.009). Record AS LEFT voltage.
____	____	____	____	8.1.7.11	Disconnect the DVM installed in step 8.1.7.9, connect the DVM between TP-3 and Ground and adjust potentiometer R-21, so the polarity and value are equally displaced around zero.

RU-139 CH1	RU-139 CH2	RU-140 CH1	RU-140 CH2		
____	____	____	____	8.1.7.12	Set the picoamp source for an output of 6.50 E-10 amps and turn polarity switch to (+).
____	____	____	____	8.1.7.13	Turn test fixture switch, S-1, to ON and record AS FOUND voltage.

ALLOWABLE RANGE 6.450 to 6.550

	AS FOUND	AS LEFT
139/ch1/	_____	_____
139/ch2/	_____	_____
140/ch1/	_____	_____
140/ch2/	_____	_____

____ ____ ____ ____	8.1.7.14	Adjust potentiometer, R-19, for an output of 6.500 VDC (6.450 to 6.550).
____ ____ ____ ____	8.1.7.15	Set the picoamp source for an output of 6.50 E-6 amps.
____ ____ ____ ____	8.1.7.16	Turn test fixture switch, S-3, to ON and record the AS FOUND voltage.

ALLOWABLE RANGE 6.450 to 6.550

	AS FOUND	AS LEFT
139/ch1/	_____	_____
139/ch2/	_____	_____
140/ch1/	_____	_____
140/ch2/	_____	_____

____ ____ ____ ____	8.1.7.17	Adjust potentiometer, R-20, for an output of 6.500 VDC (6.450 to 6.550).

RU-139 RU-140
CH1 CH2 CH1 CH2

____ ____ ____ ____ 8.1.7.18 Turn test fixture switches S-1 and S-3 to OFF.

____ ____ ____ ____ 8.1.7.19 Repeat steps 8.1.7.12 thru 8.1.7.18 until all values are within tolerance. Record final values AS LEFT.

____ ____ ____ ____ 8.1.7.20 Set the picoamp source and the test fixture switches to the values and positions listed and record preamp voltages.

S-1	S-2	S-3	PICOAMP INPUT	ALLOWABLE RANGE (VDC)	139 CH1	139 CH2	140 CH1	140 CH2
OFF	OFF	OFF	3.00 E-11	2.800 TO 3.200				
OFF	OFF	OFF	8.00 E-11	7.800 TO 8.200				
ON	OFF	OFF	8.00 E-10	7.800 TO 8.200				
ON	OFF	OFF	3.00 E-10	2.800 TO 3.200				
OFF	ON	OFF	3.00 E-9	2.920 TO 3.080				
OFF	ON	OFF	8.00 E-9	7.920 TO 8.080				
ON	ON	OFF	8.00 E-8	7.920 TO 8.080				
ON	ON	OFF	3.00 E-8	2.920 TO 3.080				
OFF	OFF	ON	3.00 E-7	2.920 TO 3.080				
OFF	OFF	ON	8.00 E-7	7.920 TO 8.080				
ON	OFF	ON	8.00 E-6	7.920 TO 8.080				
ON	OFF	ON	3.00 E-6	2.920 TO 3.080				
OFF	ON	ON	3.00 E-5	2.920 TO 3.080				
OFF	ON	ON	8.00 E-5	7.920 TO 8.080				

____ ____ ____ ____ 8.1.7.21 Turn polarity switch on the picoamp source to OFF.

RU-139 RU-140
CH1 CH2 CH1 CH2

____ ____ ____ ____ 8.1.7.22 Turn test fixture switches S-4 and S-5 to ON and S-1, S-2, and S-3 to OFF. Record AS FOUND voltage.

ALLOWABLE RANGE 7.000 to 8.000

	AS FOUND	AS LEFT
139/ch1/		
139/ch2/		
140/ch1/		
140/ch2/		

____ ____ ____ ____ 8.1.7.23 Adjust potentiometer, R-30, for an output of 7.500 VDC (7.000 to 8.000). Record AS LEFT voltage. R-30 is accessible from a hole in the back of preamp cover.

____ ____ ____ ____ 8.1.7.24 Set the test fixture switches in accordance with the following table and record Test Current Board voltages.

S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	ALLOWABLE RANGE	139 CH1	139 CH2	140 CH1	140 CH2
ON	OFF	OFF	ON	OFF	ON	OFF	OFF	OFF	7.000 TO 8.000				
OFF	ON	OFF	ON	OFF	OFF	ON	OFF	OFF	7.000 TO 8.000				
ON	ON	OFF	ON	ON	OFF	OFF	OFF	ON	7.400 TO 7.600				
OFF	OFF	ON	ON	OFF	ON	OFF	OFF	ON	7.400 TO 7.600				
ON	OFF	ON	ON	OFF	OFF	ON	OFF	ON	7.400 TO 7.600				
OFF	ON	ON	ON	OFF	OFF	OFF	ON	ON	7.400 TO 7.600				

____ ____ ____ ____ 8.1.7.25 Deenergize and disconnect the test fixture and DVM.

____ ____ ____ ____ 8.1.7.26 Reinstall the preamp into the microcomputer.

RU-139 CH1	RU-139 CH2	RU-140 CH1	RU-140 CH2		
____	____	____	____	8.1.7.27	If the microcomputer power supply was repositioned, restore the power supply to its original position. If the power supply has not been repositioned, N/A this step.
____	____	____	____	8.1.7.27.1	Independent verification that the power supply is in its original position.
____	____	____	____	8.1.7.28	Connect the picoamp source to the microcomputer signal connector.
____	____	____	____	8.1.7.29	Turn microcomputer power switch, S-1, to the ON position.
____	____	____	____	8.1.7.30	Repeat Section 8.1.6 and record data AS LEFT.

8.1.8 Detector As Left Keep Alive Source

____	____	____	____	8.1.8.1	When the value displayed at the KEPIC is stable, record the ion chamber amps paying particular attention to the sign of the exponent. ALLOWABLE RANGE ≥ 2.40 E-12 amps 139/ch1/_____amps 139/ch2/_____amps 140/ch1/_____amps 140/ch2/_____amps
____	____	____	____	8.1.8.2	Place the monitor in normal mode by entering "FTN 1 06 ENT" at the KEPIC.

RU-139 CH1	RU-139 CH2	RU-140 CH1	RU-140 CH2		
____	____	____	____	8.1.8.3	When the value displayed at the KEPIC is stable, record the radiation level paying particular attention to the sign of the exponent. ALLOWABLE RANGE ≥ 1.00 E 00 mr/hr 139/ch1/_____mr/hr 139/ch2/_____mr/hr 140/ch1/_____mr/hr 140/ch2/_____mr/hr
____ N/A	____ N/A			8.1.8.4	Return to section 8.1.4 High Voltage Board Calibration and continue for channel 2.

139	140		
____	____	8.1.8.5	At the KEPIC, turn the LOCAL/REMOTE keyswitch to REMOTE and disconnect the KEPIC from the monitor.
____	____	8.1.8.6	Ensure the monitor has been returned to normal and all alarms and indications appear normal.
____	____	8.1.8.7	At the minicomputer terminal, place the monitor On-Line by typing the monitor number then press the function key UNIT ON. RU-139 monitor number 25. RU-140 monitor number 26.
____ N/A		8.1.8.8	For RU-139, proceed to section 8.2, RU-139 Functional Test.
N/A	____	8.1.8.9	For RU-140, proceed to section 8.3, RU-140 Functional Test.

8.2 RU-139 Functional Test

_____ 8.2.1 Put the Control Room console in database display by entering "25 1" and pressing the DATABASE key.

_____ 8.2.2 If required, acknowledge RU-139 alarms and as a minimum verify that RU-139 displays "ON-LINE" in the upper right corner of the screen.

_____ 8.2.3 At the Control Room console, obtain and record the RU-139, channel 1, High and Alert Level setpoints from the database display.

High Level Setpoint _____

Alert Level Setpoint _____

_____ 8.2.4 Enter the privilege mode as follows:

8.2.4.1 Turn the console keyswitch to PRIVILEGE.

8.2.4.2 Press function key EPM.

8.2.4.3 When prompted, enter the password.

8.2.4.4 Press the RETURN key.

_____ 8.2.5 At the Control Room console, create a High alarm on RU-139, channel 1, by typing "LVL 25 1 A 0" , pressing the RETURN key, typing "LVL 25 1 H 0", and pressing the RETURN key again.

_____(TS) 8.2.6 After several seconds, verify that the Control Room console database display for RU-139, channel 1 LEVEL ALARMS for HIGH LVL changes to YES and the audible alarm sounds.

_____ 8.2.7 Acknowledge the RU-139, channel 1 alarm(s) at the Control Room console.

_____ 8.2.8 Utilizing the Control Room printer, verify that no alarms other than those created by this test have been acknowledged by test personnel. Notify the Control Room Operator if an alarm not generated by this test has been acknowledged by test personnel.

_____ 8.2.9 At the Control Room console, reset the High Level setpoint by typing "LVL 25 1 H (8.2.3 value)" and then pressing the RETURN key.

_____ 8.2.10 At the Control Room console, reset the Alert Level setpoint by typing "LVL 25 1 A (8.2.3 value)" and then pressing the RETURN key.

_____	8.2.11	At the Control Room console, obtain and record the RU-139, channel 2, High and Alert Level setpoints by entering "25 2" and pressing the DATA BASE key. High Level Setpoint _____ Alert Level Setpoint _____
_____	8.2.12	At the Control Room console, create a High Alarm on RU-139, channel 2, by typing "LVL 25 2 A 0", pressing the RETURN key, typing "LVL 25 2 H 0", and pressing the RETURN key again.
_____(TS)	8.2.13	After several seconds, verify that the Control Room console database display for RU-139, channel 2 LEVEL ALARMS for HIGH LVL changes to YES and the audible alarm sounds.
_____	8.2.14	At the Control Room console, acknowledge the RU-139, channel 2, alarm(s).
_____	8.2.15	Utilizing the Control Room printer, verify that no alarms other than those created by this test have been acknowledged by test personnel. Notify the Control Room Operator if an alarm not generated by this test has been acknowledged by test personnel.
_____	8.2.16	At the Control Room console, reset the High Level setpoint by typing "LVL 25 2 H (8.2.11 value)" and then pressing the RETURN key.
_____	8.2.17	At the Control Room console, reset the Alert Level setpoint by typing "LVL 25 2 A (8.2.11 value)" and then pressing the RETURN key.
_____	8.2.18	At the Control Room console, press the EXT key and return the keyswitch to PROTECT.

_____(TS) 8.2.19 Contact the shift RMS/Chemistry Technician for notification that Testing is complete and verification that the setpoints have been restored to the values specified in accordance with 74RM-9EF42, "Radiation Monitor Setpoint Determination."

8.2.19.1 RMS/Chemistry Technician to record the following setpoints for RU-139.

RU-139	CHANNEL 1	CHANNEL 2
HIGH ALARM SETPOINT		
ALERT ALARM SETPOINT		
RAD LEVEL CONV FACTOR		

8.2.19.2 Signature of the RMS/Chemistry Technician recording the above setpoints and verifying that the other RMS database parameters for RU-139 are correct.

_____
Signature of RMS/Chemistry Technician/Date/Time

_____ 8.2.20 Verify that all Control Room console alarms associated with RU-139 testing are clear.

_____ 8.2.21 The Test Leader shall ensure that all procedure steps and sign-offs have been completed or marked N/A as applicable for RU-139.

_____ 8.2.22 Notify the Shift Supervisor or Assistant Shift Supervisor that testing of RU-139 is complete and that a Channel Check may be required.

8.3 RU-140 Functional Test

____ 8.3.1 Put the Control Room console in database display by entering "26 1" and pressing the DATABASE key.

____ 8.3.2 If required, acknowledge RU-140 alarms and as a minimum verify that RU-140 displays "ON-LINE" in the upper right corner of the screen.

____ 8.3.3 At the Control Room console, obtain and record the RU-140, channel 1, High and Alert Level setpoints from the database display.

High Level Setpoint _____

Alert Level Setpoint _____

____ 8.3.4 Enter the privilege mode as follows:

8.3.4.1 Turn the console keyswitch to PRIVILEGE.

8.3.4.2 Press function key EPM.

8.3.4.3 When prompted, enter the password.

8.3.4.4 Press the RETURN key.

____ 8.3.5 At the Control Room console, create a High alarm on RU-140, channel 1, by typing "LVL 26 1 A 0", pressing the RETURN key, typing "LVL 26 1 H 0", and pressing the RETURN key again.

____(TS) 8.3.6 After several seconds, verify that the Control Room console database display for RU-140, channel 1 LEVEL ALARMS for HIGH LVL changes to YES and the audible alarm sounds.

____ 8.3.7 At the Control Room console, acknowledge the RU-140, channel 1, alarm(s).

____ 8.3.8 Utilizing the Control Room printer, verify that no alarms other than those created by this test have been acknowledged by test personnel. Notify the Control Room Operator if an alarm not generated by this test has been acknowledged by test personnel.

____ 8.3.9 At the Control Room console, reset the High Level setpoint by typing "LVL 26 1 H (8.3.3 value)" and then pressing the RETURN key.

____ 8.3.10 At the Control Room console, reset the Alert Level setpoint by typing "LVL 26 1 A (8.3.3 value)" and then pressing the RETURN key.

____	8.3.11	At the Control Room console, obtain and record the RU-140, channel 2, High and Alert Level setpoints by entering "26 2" and pressing the DATA BASE key. High Level Setpoint _____ Alert Level Setpoint _____
____	8.3.12	At the Control Room console, create a High Alarm on RU-140, channel 2, by typing "LVL 26 2 A 0", pressing the RETURN key, typing "LVL 26 2 H 0", and pressing RETURN key again.
____(TS)	8.3.13	After several seconds, verify the Control Room console database display for RU-140, channel 2 LEVEL ALARMS for HIGH LVL changes to YES and the audible alarm sounds.
____	8.3.14	At the Control Room console, acknowledge the RU-140, channel 2, alarm(s).
____	8.3.15	Utilizing the Control Room printer, verify that no alarms other than those created by this test have been acknowledged by test personnel. Notify the Control Room Operator if an alarm not generated by this test has been acknowledged by test personnel.
____	8.3.16	At the Control Room console, reset the High Level setpoint by typing "LVL 26 2 H (8.3.11 value)" and then pressing the RETURN key.
____	8.3.17	At the Control Room console, reset the Alert Level setpoint by typing "LVL 26 2 A (8.3.11 value)" and then pressing the RETURN key.
____	8.3.18	At the Control Room console, press the EXT key and return the keyswitch to PROTECT.

_____(TS) 8.3.19 Contact the shift RMS/Chemistry Technician for notification that Testing is complete and verification that the setpoints have been restored to the values specified in accordance with 74RM-9EF42, "Radiation Monitor Setpoint Determination."

8.3.19.1 RMS/Chemistry Technician to record the following setpoints for RU-140.

RU-140	CHANNEL 1	CHANNEL 2
HIGH ALARM SETPOINT		
ALERT ALARM SETPOINT		
RAD LEVEL CONV FACTOR		

8.3.19.2 Signature of the RMS/Chemistry Technician recording the above setpoints and verifying that the other RMS database parameters for RU-140 are correct.

_____
Signature of RMS/Chemistry Technician/Date/Time

_____ 8.3.20 Verify that all Control Room console alarms associated with RU-140 testing are clear.

_____ 8.3.21 The Test Leader shall ensure that all procedure steps and sign-offs have been completed or marked N/A as applicable for RU-140.

_____ 8.3.22 Notify the Shift Supervisor or Assistant Shift Supervisor that testing of RU-140 is complete and that a Channel Check may be required.

8.4 Single Channel Area Monitors RU-148 and RU-149

148 149

8.4.1 Initial Test Setup

____ ____ 8.4.1.1 Notify Operations and RMS/Chemistry that the monitor will be removed from service for calibration.

RU-148
RU-149

____ ____ 8.4.1.2 At the minicomputer terminal, take the monitor Off Line by typing the monitor number then press the function key UNIT OFF.

RU-148 monitor number 42.
RU-149 monitor number 50.

____ ____ 8.4.1.3 Verify and record monitor identification tag number.

148/_____

149/_____

____ ____ 8.4.1.4 At the KELIC, place the REMOTE/LOCAL keyswitch in the LOCAL position.

____ ____ 8.4.1.5 Record the AS FOUND radiation level.

148/_____mR/hr.

149/_____mR/hr.

____ ____ 8.4.1.6 At the KELIC, place the monitor in the calibrate mode by pressing function keys "FTN 1 06 1 ENT" and record the AS FOUND Ion Chamber keep alive current.

148/_____Amps

149/_____Amps

____ ____ 8.4.1.7 Perform a memory self test by pressing function keys "TST ENT".

____ ____ 8.4.1.8 After a few seconds, verify the display indicates "O A OA" and then returns to normal.

148 149

8.4.2 Low Voltage Power Supply

____ ____ 8.4.2.1 Connect a DVM between J8 PIN 5 and TP-5 (Ground) on the SCAM Board. Record AS FOUND 5 VDC supply.

ALLOWABLE RANGE 4.950 TO 5.050

	AS FOUND	AS LEFT
148/	_____	_____
149/	_____	_____

____ ____ 8.4.2.2 Adjust potentiometer VR-1 on the 5/15/-15 VDC power supply to 5.000 VDC (4.950 to 5.050). Record AS LEFT.

____ ____ 8.4.2.3 Disconnect the DVM installed in step 8.4.2.1 and connect the DVM between J8 PIN 4 and TP-5 on the SCAM Board. Record AS FOUND 15 VDC supply.

ALLOWABLE RANGE 14.950 TO 15.050

	AS FOUND	AS LEFT
148/	_____	_____
149/	_____	_____

____ ____ 8.4.2.4 Adjust potentiometer VR-2 on the 5/15/-15 VDC power supply to 15.000 VDC (14.950 to 15.050). Record AS LEFT.

____ ____ 8.4.2.5 Disconnect the DVM installed in step 8.4.2.3 and connect the DVM between J8 PIN 3 and TP-5 on the SCAM Board. Record AS FOUND -15 VDC supply.

ALLOWABLE RANGE -14.950 TO -15.050

	AS FOUND	AS LEFT
148/	_____	_____
149/	_____	_____

____ ____ 8.4.2.6 Adjust potentiometer VR-3 on the 5/15/-15 VDC power supply to -15.000 VDC (-14.950 to -15.050). Record AS LEFT.

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____ ____ 8.4.2.7 Disconnect the DVM installed in step 8.4.2.5 and connect the DVM between J8 PIN 2 and TP-5 on the SCAM Board. Record AS FOUND 24 VDC supply.

ALLOWABLE RANGE 23.50 TO 24.50

	AS FOUND	AS LEFT
148/	_____	_____
149/	_____	_____

____ ____ 8.4.2.8 Adjust potentiometer "Adjust Volt" on the 24 VDC power supply to 24.00 VDC (23.50 to 24.50). Record AS LEFT.

____ ____ 8.4.2.9 Disconnect the DVM installed in step 8.4.2.7.

8.4.3 Battery Test

____ ____ 8.4.3.1 Connect the DVM between the anode of CR-1 and the negative side of capacitor C-4 (Ground) on the Power Monitor Board. Record battery charge voltage.

ALLOWABLE RANGE 4.950 TO 5.050

148/_____

149/_____

____ ____ 8.4.3.2 Turn the microcomputer power switch, S-1, to the OFF position.

____ ____ 8.4.3.3 Disconnect the DVM installed in step 8.4.3.1 and connect the DVM between the anode of CR-2 and the negative side of capacitor C-4 on the Power Monitor Board. Record battery voltage.

ALLOWABLE RANGE Greater than 3.100 VDC

148/_____

149/_____

____ ____ 8.4.3.4 Turn the microcomputer power switch, S-1, to the ON position.

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____ ____	8.4.3.5	Disconnect the DVM installed in step 8.4.3.3, set the DVM to read MADC and connect the DVM across CR-1 on the Power Monitor Board. Record charge current. ALLOWABLE RANGE 1.000 TO 7.000 MADC 148/_____ 149/_____
____ ____	8.4.3.6	Disconnect DVM installed in step 8.4.3.5.
____ ____	8.4.3.7	At the KELIC, display and record the last 2 ten minute averages using function keys "DSP 1 25 ENT" and then "EXP" for the second reading. 148/1)_____ 2)_____ 149/1)_____ 2)_____
____ ____	8.4.3.8	De-energize the monitor by placing the power switch SW-1 in the OFF position.
____ ____	8.4.3.9	After leaving the monitor off for approximately 5 minutes, energize the monitor by placing the power switch in the ON position.
____ ____	8.4.3.10	Verify the last 2 ten minute averages recorded in 8.4.3.7 are retained.

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8.4.4 High Voltage Adjustment

____ ____ 8.4.4.1 Connect a DVM between TP-4 and TP-5 (Ground) on the SCAM Board. Record AS FOUND Proportional High Voltage.

ALLOWABLE RANGE 5.530 TO 5.670

148/_____

149/_____

____ ____ 8.4.4.2 Adjust potentiometer, R-69, to 6.160 VDC (6.090 to 6.230).

____ ____ 8.4.4.3 Slowly adjust potentiometer, R-83, until the KELIC EQUIP FAIL light illuminates.

____ ____ 8.4.4.4 Adjust potentiometer, R-69, to approximately 5.6 VDC and verify the KELIC EQUIP FAIL light extinguishes.

____ ____ 8.4.4.5 Adjust potentiometer, R-69, to 5.040 VDC (4.970 to 5.110).

____ ____ 8.4.4.6 Slowly adjust potentiometer, R-88, until the KELIC EQUIP FAIL light illuminates.

____ ____ 8.4.4.7 Adjust potentiometer, R-69, to 5.600 VDC (5.530 to 5.670). Record AS LEFT Proportional High Voltage.

ALLOWABLE RANGE 5.530 TO 5.670

148/_____

149/_____

____ ____ 8.4.4.8 Disconnect the DVM installed in step 8.4.4.1.

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8.4.5 Ion Chamber Interface Board

____ ____ 8.4.5.1 Connect the DMM between TP-1 on the Ion Chamber Interface Board and TP-5 (Ground) on the SCAM Board. Record AS FOUND Up Count Voltage.

ALLOWABLE RANGE 9.840 TO 9.860

	AS FOUND	AS LEFT
148/	_____	_____
149/	_____	_____

____ ____ 8.4.5.2 Adjust potentiometer, R-7, on the Interface Board to 9.850 VDC (9.840 to 9.860). Record AS LEFT Up Count Voltage.

____ ____ 8.4.5.3 Move the test lead connected at TP-1 to TP-2 on the Interface Board. Record AS FOUND Down Count Voltage.

ALLOWABLE RANGE 0.890 TO 0.910

	AS FOUND	AS LEFT
148/	_____	_____
149/	_____	_____

____ ____ 8.4.5.4 Adjust potentiometer, R-10, on the Interface Board to 0.900 VDC (0.890 to 0.910). Record AS LEFT Down Count Voltage.

____ ____ 8.4.5.5 Disconnect the DMM installed in step 8.4.5.1.

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8.4.6 Preamplifier Verification Test

____ ____ 8.4.6.1 At the KELIC, turn the LOCAL/REMOTE keyswitch to LOCAL.

NOTE

If this section is being performed following Section 8.4.7, Preamp Calibration, steps 8.4.6.2 and 8.4.6.3 are N/A.

CAUTION

EXERCISE CAUTION WHEN WORKING WITH SIGNAL CONNECTORS. VERY HIGH VOLTAGES MAY BE PRESENT AND CONNECTORS MAY BE DAMAGED IF OVERSTRESSED.

____ ____ 8.4.6.2 Disconnect the detector signal cable from connector J-10A at the microcomputer. Document in Appendix A.

____ ____ 8.4.6.3 After several minutes, verify the equipment fail light illuminates.

____ ____ 8.4.6.4 At the microcomputer KELIC, press function keys "TST 1 01 ENT" to self test the preamp electronics. This test will run for approximately 2 minutes. If the test is successful, the FUNCT CHAN PARAMETER display will indicate "A A AA" as the VALUE display increments from E-11 to E-05. If the display panel indicates an "E" in any field, proceed to Section 8.4.7, Preamp Calibration.

____ ____ 8.4.6.5 Verify/connect the picoamp source to the microcomputer signal connector.

____ ____ 8.4.6.6 At the KELIC, place the microcomputer in Calibrate mode by pressing function keys "FTN 1 06 1 ENT".

148 149

_____ _____ 8.4.6.7 Turn the picoamp source ON, place the polarity switch in the "+" position, and adjust the current output in accordance with the values specified below. Record AS FOUND data.

		RU-148		RU-149	
PICO AMP INPUT	ALLOWABLE RANGE	AS FOUND	AS LEFT	AS FOUND	AS LEFT
8.00 E-11	7.80 E-11 TO 8.20 E-11				
8.00 E-10	7.80 E-10 to 8.20 E-10				
8.00 E-09	7.80 E-9 to 8.20 E-9				
8.00 E-08	7.80 E-8 to 8.20 E-8				
8.00 E-07	7.80 E-7 to 8.20 E-7				
8.00 E-06	7.80 E-6 to 8.20 E-6				
8.00 E-05	7.80 E-5 to 8.20 E-5				

(CRDR 920373)

_____ _____ 8.4.6.8 If the data recorded in step 8.4.6.7 is within tolerance, record data AS LEFT. If the data is not within tolerance, proceed to section 8.4.7, Preamp Calibration.

_____ _____ 8.4.6.9 Place monitor back in Normal mode by pressing function keys "FTN 1 06 0 ENT".

_____ _____ 8.4.6.10 At the KELIC, place the LOCAL/REMOTE keyswitch in REMOTE.

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8.4.7 Preamp Calibration

NOTE

Perform this section if steps 8.4.6.4 or 8.4.6.7 of the Preamplifier Verification Test are not within tolerance.

____ ____ 8.4.7.1 Turn the microcomputer power switch, S-1, to the OFF position and remove the preamp from the microcomputer assembly.

CAUTION

DO NOT HANDLE THE INTERNAL COMPONENTS OF THE PREAMP ASSEMBLY WITHOUT RUBBER SURGICAL GLOVES.

____ ____ 8.4.7.2 Remove the preamp assembly cover and connect the preamp into the test fixture.

____ ____ 8.4.7.3 Place test fixture switches S-1 thru S-9 in OFF (0 = OFF and 1 = ON).

____ ____ 8.4.7.4 Turn on power to the test fixture.

____ ____ 8.4.7.5 Connect a picoamp source to the triax connector on the preamp.

____ ____ 8.4.7.6 Turn picoamp source ON and turn polarity switch to OFF.

____ ____ 8.4.7.7 Set picoamp source for an output of 0.00 E-12 amps.

NOTE

The preamplifier assembly is extremely sensitive to RFI, EMI and/or technician body movements. To efficiently calibrate the preamplifier these conditions must be minimized.

148 149

____ ____	8.4.7.8	Connect a DVM between TP-2 and Ground (R-9 lead closest to parametric amplifier) and record AS FOUND voltage. ALLOWABLE RANGE -0.009 to 0.009 AS FOUND AS LEFT 148/_____ _____ 149/_____ _____
____ ____	8.4.7.9	Adjust potentiometer, R-18, on the preamp to 0.000 VDC (-0.009 to 0.009). Record AS LEFT voltage.
____ ____	8.4.7.10	Disconnect the DVM installed in step 8.4.7.8, connect the DVM between TP-3 and Ground and adjust potentiometer R-21, so the polarity and value are equally displaced around zero.
____ ____	8.4.7.11	Set the picoamp source for an output of 6.50 E-10 amps and turn polarity switch to (+).
____ ____	8.4.7.12	Turn test fixture switch, S-1, to ON and record AS FOUND voltage. ALLOWABLE RANGE 6.450 to 6.550 AS FOUND AS LEFT 148/_____ _____ 149/_____ _____
____ ____	8.4.7.13	Adjust potentiometer, R-19, for an output of 6.500 VDC (6.450 to 6.550).
____ ____	8.4.7.14	Set the picoamp source for an output of 6.50 E-6 amps.
____ ____	8.4.7.15	Turn test fixture switch, S-3, to ON and record AS FOUND voltage. ALLOWABLE RANGE 6.450 to 6.550 AS FOUND AS LEFT 148/_____ _____ 149/_____ _____

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____ ____ 8.4.7.16 Adjust potentiometer, R-20, for an output of 6.500 VDC (6.450 to 6.550).

____ ____ 8.4.7.17 Turn test fixture switches S-1 and S-3 to OFF.

____ ____ 8.4.7.18 Repeat steps 8.4.7.11 thru 8.4.7.17 until all values are within tolerance. Record final values AS LEFT.

____ ____ 8.4.7.19 Set the picoamp source and the test fixture switches to the values and positions listed and record preamp voltages.

S-1	S-2	S-3	PICOAMP INPUT	ALLOWABLE RANGE	RU-148	RU-149
OFF	OFF	OFF	3.00 E-11	2.800 TO 3.200 VDC		
OFF	OFF	OFF	8.00 E-11	7.800 TO 8.200 VDC		
ON	OFF	OFF	8.00 E-10	7.800 TO 8.200 VDC		
ON	OFF	OFF	3.00 E-10	2.800 TO 3.200 VDC		
OFF	ON	OFF	3.00 E-9	2.920 TO 3.080 VDC		
OFF	ON	OFF	8.00 E-9	7.920 TO 8.080 VDC		
ON	ON	OFF	8.00 E-8	7.920 TO 8.080 VDC		
ON	ON	OFF	3.00 E-8	2.920 TO 3.080 VDC		
OFF	OFF	ON	3.00 E-7	2.920 TO 3.080 VDC		
OFF	OFF	ON	8.00 E-7	7.920 TO 8.080 VDC		
ON	OFF	ON	8.00 E-6	7.920 TO 8.080 VDC		
ON	OFF	ON	3.00 E-6	2.920 TO 3.080 VDC		
OFF	ON	ON	3.00 E-5	2.920 TO 3.080 VDC		
OFF	ON	ON	8.00 E-5	7.920 TO 8.080 VDC		

____ ____ 8.4.7.20 Turn polarity switch on the picoamp source OFF.

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____ ____ 8.4.7.21 Turn test fixture switches S-4 and S-5 to ON and S-1, S-2, and S-3 to OFF. Record AS FOUND voltage.

ALLOWABLE RANGE 7.000 to 8.000

	AS FOUND	AS LEFT
148/		
149/		

____ ____ 8.4.7.22 Adjust potentiometer, R-30, for an output of 7.500 VDC (7.000 to 8.000). Record AS LEFT voltage. R-30 is accessible from a hole in the back of preamp cover.

____ ____ 8.4.7.23 Set the test fixture switches in accordance with the following table and record Test Current Board voltages.

S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8	S-9	ALLOWABLE RANGE	RU-148	RU-149
ON	OFF	OFF	ON	OFF	ON	OFF	OFF	OFF	7.000 TO 8.000		
OFF	ON	OFF	ON	OFF	OFF	ON	OFF	OFF	7.000 TO 8.000		
ON	ON	OFF	ON	ON	OFF	OFF	OFF	ON	7.400 TO 7.600		
OFF	OFF	ON	ON	OFF	ON	OFF	OFF	ON	7.400 TO 7.600		
ON	OFF	ON	ON	OFF	OFF	ON	OFF	ON	7.400 TO 7.600		
OFF	ON	ON	ON	OFF	OFF	OFF	ON	ON	7.400 TO 7.600		

____ ____ 8.4.7.24 Deenergize and disconnect the test fixture and DVM.

____ ____ 8.4.7.25 Reinstall the preamp into the microcomputer.

____ ____ 8.4.7.26 Connect the picoamp source to the detector signal connector.

____ ____ 8.4.7.27 Turn microcomputer power switch, S-1, to the ON position.

____ ____ 8.4.7.28 Repeat Section 8.4.6 and record data AS LEFT.

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8.4.8 Analog Output Calibration

NOTE

Radiation levels displayed on the KERIC and KELIC are in mR/hr units. Radiation levels displayed on the QSPDS terminals are in R/hr units.

____ ____ 8.4.8.1 Remove the KERIC from cabinet J-SQA/B-C05 to gain access to potentiometers R-35 and R-36.

____ ____ 8.4.8.2 Use the KERIC Extension Cable to connect the KERIC to the connector in the back of cabinet J-SQA/B-C05.

____ ____ 8.4.8.3 Attach a DVM to TB-43 for RU-148 or TB-[illegible] for RU-149, Terminals 7(+) and 8(-) at panel J-SQA/B-C05.

____ ____ 8.4.8.4 Adjust the Picoamp source current, while observing the KELIC, until 2.00 E 03 mR/hr is reached. Record AS FOUND voltage and KERIC radiation level.

		RU-148		RU-149	
DESIRED VALUE	ALLOWABLE RANGE	AS FOUND	AS LEFT	AS FOUND	AS LEFT
0.400 VDC	0.360 TO 0.440				
2.00 E 03 mr/hr	1.40 E 03 TO 2.60 E 03				

____ ____ 8.4.8.5 Adjust potentiometer, R-36, on the KERIC Interface Board to 0.400 VDC (0.360 to 0.440).

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____ ____ 8.4.8.6 Adjust the Picoamp source current, while observing the KELIC, until the monitor's upper range is reached (1.00 E 10mR/hr). Record AS FOUND voltage and KERIC radiation level.

		RU-148		RU-149	
DESIRED VALUE	ALLOWABLE RANGE	AS FOUND	AS LEFT	AS FOUND	AS LEFT
10.000 VDC	9.000 TO 11.000				
1.00 E 10 mr/hr	7.00 E 09 TO 1.30 E 10				

____ ____ 8.4.8.7 Adjust potentiometer, R-35, on the KERIC Interface Board, to 10.000 VDC (9.000 to 11.000).

____ ____ 8.4.8.8 Repeat steps 8.4.8.4 thru 8.4.8.7 as necessary until both values are within tolerance and record AS LEFT.

____ ____ 8.4.8.9 While observing the KELIC, adjust the picoamp source current for a radiation level of 1.30 E06 mR/Hr and allow the system to stabilize for approximately three minutes.

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NOTE

RU-148 is an "A" train and RU-149 is a "B" train QSPDS point "Containment Area Radiation" found on page display 104.

____ ____ 8.4.8.10 Record the KERIC and QSPDS indications and verify that the values recorded are within the allowable range.

DEVICE	ALLOWABLE RANGE	RU-148	RU-149
KERIC	9.09E05 TO 1.69E06		
QSPDS	9.09E02 TO 1.69E03		

____ ____ 8.4.8.11 Disconnect the DVM installed in step 8.4.8.3.

____ ____ 8.4.8.12 Disconnect the KERIC Extension Cable and install the KERIC back into cabinet J-SQA/B-C05.

____ ____ 8.4.8.13 Disconnect the picoamp source from the detector signal connector, reconnect the detector signal cable at the microcomputer, document in Appendix A.

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8.4.9 As Left Keep Alive

____ ____ 8.4.9.1 Using SIMS, verify that the detector has not been replaced since the last calibration.

____ ____ 8.4.9.1.1 If the detector has been replaced, verify that the detector serial number listed in step 8.4.9.4 matches the serial number of the current detector. (If the detector is inaccessible, obtain the serial number from a DDC file copy of the work package used to replace the detector.)

____ ____ 8.4.9.2 At the KELIC, record the radiation level.

ALLOWABLE ≥1.00 E03 mr/hr

148/_____

149/_____ _____

____ ____ 8.4.9.3 At the KELIC, place the LOCAL/REMOTE keyswitch in LOCAL.

____ ____ 8.4.9.4 At the KELIC, place the monitor in the Calibrate Mode by pressing function keys "FTN 1 06 1 ENT". Record the Ion Chamber current level for the detector being checked. Mark the other unit detectors "N/A".

RU-148 DETECTOR

	DETECTOR SERIAL NUMBER	ALLOWABLE RANGE (IN AMPS)	AS LEFT VALUE
UNIT 1	22706	9.66E-12 TO 1.79E-11	
UNIT 2	22709	7.00E-12 TO 1.30E-11	
UNIT 3	62165	1.57E-11 TO 3.09E-11	

Acceptance Criteria (Ref. 2.2.6.3)

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RU-149 DETECTOR

	DETECTOR SERIAL NUMBER	ALLOWABLE RANGE (IN AMPS)	AS LEFT VALUE
UNIT 1	22711	8.12E-12 TO 1.51E-11	
UNIT 2	53364	1.40E-11 TO 2.60E-11	
UNIT 3	62163	1.40E-11 TO 2.60E-11	

Acceptance Criteria (Ref. 2.2.6.3)

____ ____ 8.4.9.5 At the KELIC, place the monitor in the Normal mode by pressing function keys "FTN 1 06 0 ENT".

____ ____ 8.4.9.6 At the KELIC, turn the LOCAL/REMOTE keyswitch to REMOTE.

8.4.10 Restoration of Monitor

____ ____ 8.4.10.1 Ensure the monitor alarms and indications appear normal.

____ ____ 8.4.10.2 Ensure the KERIC has been returned to normal and all alarms and indications appear normal.

____ ____ 8.4.10.3 At the minicomputer terminal, place the monitor On Line by typing the monitor number then press function key UNIT ON.

RU-148 monitor number 42.
RU-149 monitor number 50.

____ N/A 8.4.10.4 For RU-148, proceed to section 8.5, RU-148 Functional Test.

N/A ____ 8.4.10.5 For RU-149, proceed to section 8.6, RU-149 Functional Test.

8.5 RU-148 Functional Test

_____ 8.5.1 Put the Control Room console in database display by entering "42 1" and pressing the DATABASE key.

_____ 8.5.2 If required, acknowledge RU-148 alarms and as a minimum verify that RU-148 displays "ON-LINE" in the upper right corner of the screen.

_____ 8.5.3 At panel J-SQA-C05, verify and record the KERIC identification tag number for monitor RU-148.

Id. Number _____

_____ 8.5.4 Turn the KERIC ENABLE/DISABLE keyswitch to ENABLE.

_____ 8.5.5 Press the KERIC TEST-LT CK light/switch and verify:

8.5.5.1 All indicator lamps light.

8.5.5.2 FUNCT CHAN PARAMETER displays "8 8 88"

8.5.5.3 VALUE displays "8.88E-88"

_____ 8.5.6 Display and record the RU-148, channel 1, High Level setpoint by pressing KERIC function keys "DSP 1 01 ENT". Pay particular attention to the sign of the exponent.

High Level Setpoint _____

_____ 8.5.7 Create a High Alarm on RU-148, channel 1, by pressing KERIC function keys "SET 1 01 ENT".

_____(TS) 8.5.8 After several seconds, verify that the Control Room console database display for RU-148 LEVEL ALARMS for HIGH LVL changes to YES and the audible alarm sounds.

_____ 8.5.9 Acknowledge the RU-148 alarm(s) at the Control Room console.

_____ 8.5.10 Utilizing the Control Room printer, verify that no alarms other than those created by this test have been acknowledged by test personnel. Notify the Control Room Operator if an alarm not generated by this test has been acknowledged by test personnel.

_____ 8.5.11 Press KERIC function keys "SET 1 01 (value recorded in 8.5.6) ENT" to reset the High Level setpoint.

_____ 8.5.12 Acknowledge the RU-148 alarm at the KERIC by pressing the "HIGH/ACK" button.

_____ 8.5.13 Return the KERIC ENABLE/DISABLE keyswitch to DISABLE.

_____(TS) 8.5.14 Contact the shift RMS/Chemistry Technician for notification that Testing is complete and verification that the setpoints have been restored to the values specified in accordance with 74RM-9EF42, "Radiation Monitor Setpoint Determination."

8.5.14.1 RMS/Chemistry Technician to record the following setpoints for RU-148.

RU-148	CHANNEL 1
HIGH ALARM SETPOINT	
ALERT ALARM SETPOINT	
RAD LEVEL CONV FACTOR	

8.5.14.2 Signature of the RMS/Chemistry Technician recording the above setpoints and verifying that the other RMS database parameters for RU-148 are correct.

_____
Signature of RMS/Chemistry Technician/Date/Time

_____ 8.5.15 Verify that all Control Room console alarms associated with RU-148 testing are clear.

_____ 8.5.16 Notify the Shift Supervisor or Assistant Shift Supervisor that testing of RU-148 is complete and that a Channel Check may be required.

_____ 8.5.17 The Test Leader shall ensure that all procedure steps and sign-offs have been completed or marked N/A as applicable for RU-148.

8.6 RU-149 Functional Test

____ 8.6.1 Put the Control Room console in database display by entering "50 1" and pressing the DATABASE key.

____ 8.6.2 If required, acknowledge RU-149 alarms and as a minimum verify that RU-149 displays "ON-LINE" in the upper right corner of the screen.

____ 8.6.3 At panel J-SQB-C05, verify and record the KERIC identification tag number for monitor RU-149.

Id. Number _____

____ 8.6.4 Turn the KERIC ENABLE/DISABLE keyswitch to ENABLE.

____ 8.6.5 Press the KERIC TEST-LT CK light/switch and verify:

8.6.5.1 All indicator lamps light.

8.6.5.2 FUNCT CHAN PARAMETER displays "8 8 88".

8.6.5.3 VALUE displays "8.88E-88".

____ 8.6.6 Display and record the RU-149, channel 1, High Level setpoint by pressing KERIC function keys "DSP 1 01 ENT". Pay particular attention to the sign of the exponent.

High Level Setpoint _____

____ 8.6.7 Create a High Alarm on RU-149, channel 1, by pressing KERIC function keys "SET 1 01 ENT".

____(TS) 8.6.8 After several seconds, verify that the Control Room console database display for RU-149 LEVEL ALARMS for HIGH LVL changes to YES and the audible alarm sounds.

____ 8.6.9 Acknowledge the RU-149 alarm(s) at the Control Room console.

____ 8.6.10 Utilizing the Control Room printer, verify that no alarms other than those created by this test have been acknowledged by test personnel. Notify the Control Room Operator if an alarm not generated by this test has been acknowledged by test personnel.

____ 8.6.11 Press KERIC function keys "SET 1 01 (value recorded in 8.6.6) ENT" To reset the High Level setpoint.

____ 8.6.12 Acknowledge the RU-149 alarm at the KERIC by pressing the "HIGH/ACK" button.

____ 8.6.13 Return the KERIC ENABLE/DISABLE keyswitch to DISABLE.

____(TS) 8.6.14 Contact the shift RMS/Chemistry Technician for notification that Testing is complete and verification that the setpoints have been restored to the values specified in accordance with 74RM-9EF42, "Radiation Monitor Setpoint Determination."

8.6.14.1 RMS/Chemistry Technician to record the following setpoints for RU-149.

RU-149	CHANNEL 1
HIGH ALARM SETPOINT	
ALERT ALARM SETPOINT	
RAD LEVEL CONV FACTOR	

8.6.14.2 Signature of the RMS/Chemistry Technician recording the above setpoints and verifying that the other RMS database parameters for RU-149 are correct.

_____
Signature of RMS/Chemistry Technician/Date/Time

____ 8.6.15 Verify that all Control Room console alarms associated with RU-149 testing are clear.

____ 8.6.16 Notify the Shift Supervisor or Assistant Shift Supervisor that testing of RU-149 is complete and that a Channel Check may be required.

____ 8.6.17 The Test Leader shall ensure that all procedure steps and sign-offs have been completed or marked N/A as applicable for RU-149.

9.0 SYSTEM RESTORATION

____9.1 The M&TE Usage Forms have been completed and a copy inserted in the test package.

____9.2 Review the data sheets or computer printouts, as applicable, and circle and initial all out of tolerance readings. Review circled readings with OCS/RMS Work Group Supervisor and the Shift Supervisor.

____9.3 The Test Leader shall ensure that all procedure steps, signoffs, and data sheets have been completed or marked N/A as applicable, and that the test package is complete. The Test Leader will deliver the test package to his immediate Work Group Supervisor as soon as possible for the acceptance review.

____9.4 Notify RMS/Chemistry to update the Database parameter sheets to reflect the current calibration date for all monitors/channels calibrated in this performance.

____9.5 Notify the Assistant/Shift Supervisor of the completion of this test.

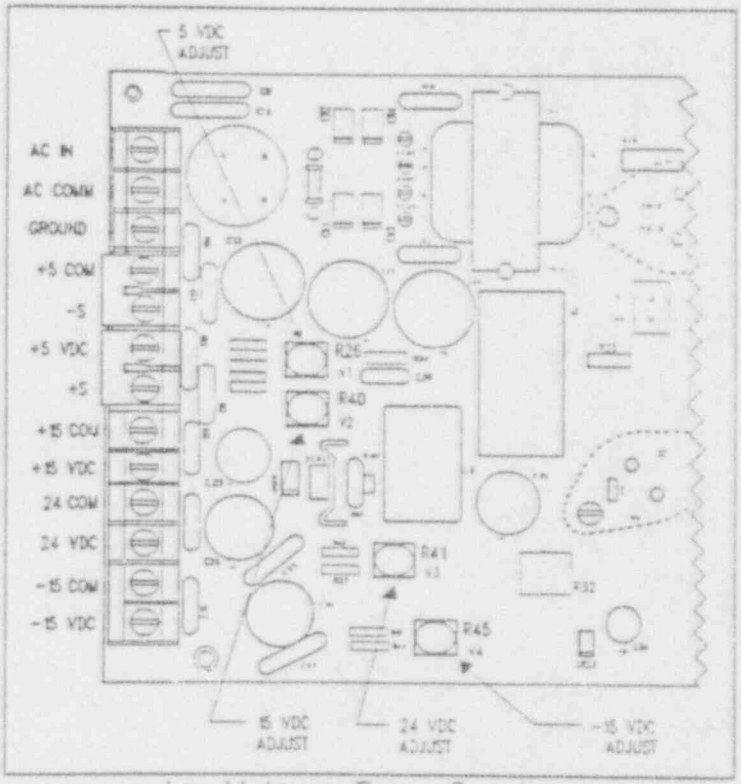
10.0 CONTINGENCIES

10.1 If a problem or deficiency has the potential to affect the outcome of the test, affect plant safety, or if the test performer is unable to make that determination, he is responsible to stop the test and notify his immediate Work Group Supervisor. His Work Group Supervisor shall evaluate the problem or deficiency as to its significance in accordance with 73AC-9ZZ04, Surveillance Testing, and initiate pertinent actions or documents to resolve the problem.

APPENDIX A - DETERM/RETERM SHEET

			DETERM		RETERM		2ND PARTY	
DESCRIPTION	STEP #	CABLE ID	INIT	DATE	INIT	DATE	INIT	DATE
RU-139 BATTERY	8.1.3.1/ 8.1.3.8							
RU-139 J10A	8.1.6.3/ 8.1.6.10							
RU-139 J11A	8.1.6.3/ 8.1.6.10							
RU-140 BATTERY	8.1.3.1/ 8.1.3.8							
RU-140 J10A	8.1.6.3/ 8.1.6.10							
RU-140 J11A	8.1.6.3/ 8.1.6.10							
RU-148 J10A	8.4.6.2/ 8.4.8.14							
RU-149 J11A	8.4.6.2/ 8.4.8.14							

APPENDIX B - LOW VOLTAGE POWER SUPPLY



Low Voltage Power Supply

U-1 RV-148

Kaman Instrumentation Corporation	DOCUMENT: STANDARD PRACTICE PROCEDURE	KIMP NO. 18-104
		PAGE 14 OF 14 / REV. A

10.0 DATA SHEET - KDI-1000 PRIMARY CALIBRATION, Cs-137

Calibration Date 09 MAY 85 Customer/Channel HJ-SQA-RE-150

KI Detector Part No. 824636-003 Mfgr. Serial No. 32706

ITEM	MFGR	MODEL	S/N	CAL DUE
Picoammeter	KEITHLEY	616	627239	10 JUN 85
HV Supply	CANBERRA	3002	10784052	02 SEP 85
DVM	KEITHLEY	130	LV927	13 JAN 86

Keep-Alive Current (Acceptance Limits = 0.9 to 5.5 x E-11A):

18. Initial Reading .10 (E-9 Coulombs)
20. Final Reading 1.19 (E-9 Coulombs)
21. Time Interval 79 Second (60 seconds minimum)
22. Current = (Step 20 - Step 18)/Step 21 = 1.38 E-11 Amperes

3.04 R/hr readings:

28. Initial Reading 1.00 (E-9) Coulombs
30. Final Reading 3.58 (E-9) Coulombs
31. Time Interval 60 Seconds (60 seconds minimum)
33. Current = (Step 30 - Step 28)/Step 31 = 4.30 E-11 Amperes
34. Net current (Step 33 - Step 22) = 2.92 E-11 Amperes
35. Efficiency (Step 34/3.04)) = .96 E-11 A/R/hr *

30.1 R/hr readings:

41. Gross current = 3.20 E-10 Amperes
43. Net current (Step 41 - Step 22) = 3.06 E-10 Amperes
44. Efficiency (Step 43/30.1) = 1.02 E-11 A/R/hr *

299 R/hr readings:

50. Gross current = 3.19 E-9 Amperes
52. Net current (Step 50 - Step 22) = 3.18 E-9 Amperes
53. Efficiency (Step 52/299) = 1.06 E-11 A/R/hr *

* Acceptance Limits = 0.8 to 1.2 x E-11 A/R/hr

By R. Wagaman Date 09 MAY 85 QA [illegible] Date 5-16-85

U-1 RU-149

Kansas Instrumentation Corporation	DOCUMENT: STANDARD PRACTICE PROCEDURE	KNP NO. 18-104
		PAGE 14 OF 14 / REV. A

10.0 DATA SHEET - KDI-1000 PRIMARY CALIBRATION, Cs-137

Calibration Date 09 MAY 85 — Customer/Channel U-SQB-RE-149

KI Detector Part No. 8286-203 — Mfgr. Serial No. 22711

ITEM	MFGR	MODEL	S/N	CAL DUE
Picoammeter	KEITHLEY	616	627234	10 JUN 85
HV Supply	CANBERRA	3002	10784052	02 SEP 85
DVM	KEITHLEY	130	LV427	13 JAN 86

Keep-Alive Current (Acceptance Limits = 0.9 to 5.5 x E-11A):

18. Initial Reading .10 (E-9 Coulombs)
20. Final Reading 1.14 (E-9 Coulombs)
21. Time Interval 90 Second (60 seconds minimum)
22. Current = (Step 20 - Step 18)/Step 21 = 1.16 E-11 Amperes

3.04 R/hr readings:

28. Initial Reading 1.00 (E-9) Coulombs
30. Final Reading 3.38 (E-9) Coulombs
31. Time Interval 60 Seconds (60 seconds minimum)
33. Current = (Step 30 - Step 28)/Step 31 = 3.97 E-11 Amperes
34. Net current (Step 33 - Step 22) = 2.81 E-11 Amperes
35. Efficiency (Step 34/3.04)) = .92 E-11 A/R/hr *

30.1 R/hr readings:

41. Gross current = 3.13 E-10 Amperes
43. Net current (Step 41 - Step 22) = 3.01 E-10 Amperes
44. Efficiency (Step 43/30.1) = 1.00 E-11 A/R/hr *

299 R/hr readings:

50. Gross current = 3.03 E-9 Amperes
52. Net current (Step 50 - Step 22) = 3.02 E-9 Amperes
53. Efficiency (Step 52/299) = 1.01 E-11 A/R/hr *

* Acceptance Limits = 0.8 to 1.2 x E-11 A/R/hr

By R. Weisman Date 09 MAY 85 QA G. E. Bryan Date 5-16-85

2-3-30A-RE-150
450593-003
SW 7820-4

AREA MONITOR CALIBRATION: DATA SHEET
Palo Verde Unit 2, Ch. RE-150

Detector Type Ion Chamber
Mfgr. GND
Model 50314 S/N 22704
KIC Part No. 824636-002
Readout Type Picoammeter

High Voltage Mfgr. H/P
Model 6516A
S/N 1824A04064
Cal. Due Functional *
Check Source/Live Zero

~~Source~~ Source:
Mfgr. Keithley
Model 616
S/N 62723A
Cal. Due 11/83

Nuclide ^{241}Am Activity .08 μC
Date 1982

Test Location Pinnacle Hosp. Calibration Date 6/9/83
Temperature 25°C Pressure 607.5 mm Hg Relative Humidity <30%
Calibration Source I.D. Thermo-Fin
Nuclide ^{60}Co Activity 6802C Date 12/77
Beam Measuring Detector: Mfgr. Eurodin Model .6 no S/N 1D-1000
(For Verification of radiation field---NBS traceable) Type Ion Ch. Certificate See addendum pg

TEST DATA

High Voltage Setting +800 V
Other Instrument Settings (if applicable)
Check Source/Live Zero Reading 1.0 E-11 A

Acceptance Criteria
.8 to 1.2 (10^{-8}) A/R/hr

Measured Field	Instrument Reading (A) GROSS	NET	A/R/HR
.706 (10^3) mR/hr	1.7 E-11	.7 E-11	.99 E-11
.566 (10^4) mR/hr	6.5 E-11	5.5 E-11	.97 E-4
.584 (10^5) mR/hr	6.20 E-10	6.10 E-10	1.04 E-11
.756 (10^6) mR/hr	7.84 E-9	7.83 E-9	1.04 E-11

Tested with DVM Fluke Mod. 8020A s/n LV 4831, Cal due 10/24/83, at +800 V, 6/9/83

BECHTEL
631

Performer J. Miller Date 6/9/83
QA E. Engle Date 6-21-83

U-2 RU-149

10.0 DATA SHEET - KDI-1000 PRIMARY CALIBRATION, Cs-137

Calibration Date 10-25-85 Customer/Channel PV

KI Detector Part No. 824626-2009 Mfgr. Serial No. 53264

ITEM	MFGR	MODEL	S/N	CAL DUE
Picoammeter	Keithley	616	12059	6/10/86
HV Supply	Canberra	3002	24468	10/20/86
DVM				

Keep-Alive Current (Acceptance Limits = 0.9 to 5.5 x E-11A):

18. Initial Reading .11 (E-9 Coulombs)
20. Final Reading 1.40 (E-9 Coulombs)
21. Time Interval 64.3 Second (60 seconds minimum)
22. Current = (Step 20 - Step 18)/Step 21 = 2.00E-11 Amperes

3.04 R/hr readings:

28. Initial Reading 1.13 (E-9) Coulombs
30. Final Reading 4.02 (E-9) Coulombs
31. Time Interval 63.79 Seconds (60 seconds minimum)
33. Current = (Step 30 - Step 28)/Step 31 = 4.55E-11 Amperes
34. Net current (Step 33 - Step 22) = 2.55E-11 Amperes
35. Efficiency (Step 34/3.04)) = .839 E-11 A/R/hr *

30.1 R/hr readings:

41. Gross current = 2.70 E-10 Amperes
43. Net current (Step 41 - Step 22) = 2.50 E-10 Amperes
44. Efficiency (Step 43/30.1) = .830 E-11 A/R/hr *

299 R/hr readings:

50. Gross current = 2.66 E-9 Amperes
52. Net current (Step 50 - Step 22) = 2.66 E-9 Amperes
53. Efficiency (Step 52/299) = .889 E-11 A/R/hr *

* Acceptance Limits = 0.8 to 1.7 x E-11 A/R/hr

By Roy P Dodge Date 10/25/85 QA QC Date

U-3 RL-148

10.0 DATA SHEET - [illegible]-1300 PRIMARY CALIBRATION, Cs-137

Calibration Date 5-30 86 Customer/Owner N/A

KI Detector Part No. 824636-003 Mfgr. Serial No. 62165

ITEM	MFGR	MODEL	S/N	CAL DUE
Picoammeter	KEITHLEY	616	12159	6-1 86
HV Supply	CANBERRA	3002	LV468	10-20-86
DVM	FLUKE	8020A	LV302	2-9-87

Keep-Alive Current (Acceptance Limits = 0.9 to 5.5 x E-11A):

18. Initial Reading .10 (E-9 Coulombs)
20. Final Reading 1.53 (E-9 Coulombs)
21. Time Interval 60 Second (60 seconds minimum)
22. Current = (Step 20 - Step 18)/Step 21 = .0238E-9 Amperes

3.04 R/hr readings:

29. Initial Reading 1.0 (E-9) Coulombs
30. Final Reading 3.89 (E-9) Coulombs
31. Time Interval 60 Seconds (60 seconds minimum)
33. Current = (Step 30 - Step 29)/Step 31 = .0482E-9 Amperes
34. Net current (Step 33 - Step 22) = .0244E-9 Amperes
35. Efficiency (Step 34/3.04)) = .802E-11 A/R/hr *

30.1 R/hr readings:

41. Gross current = 2.60 E-10 Amperes
43. Net current (Step 41 - Step 22) = 2.762 E-10 Amperes
44. Efficiency (Step 43/30.1) = .918E-11 A/R/hr *

299 R/hr readings:

50. Gross current = 2.80 E-9 Amperes
52. Net current (Step 50 - Step 22) = 2.78 E-9 Amperes
53. Efficiency (Step 52/299) = .9289E-11 A/R/hr *

* Acceptance Limits = 0.8 to 1.2 x E-11 A/R/hr

By [signature] Date 5-30-86 QA [signature] Date [illegible]

U-3 RU-149 1074

10.0 DATA SHEET - NDI-1000 PRIMARY CALIBRATION, Cs-137

Calibration Date 5-30-86 Customer/Channel N/A

KI Detector Part No. 824636-003 Mfgr. Serial No. 62163

ITEM	MFGR	MODEL	S/N	CAL DUE
Picoammeter	KEITHLEY	616	12059	6-1-86
HV Supply	CANBERRA	3002	LV468	10-20-86
DVM	FLUKE	8020A	LV302	2-9-87

Keep-Alive Current (Acceptance Limits = 0.9 to 5.5 x E-11A):

18. Initial Reading .10 (E-9 Coulombs)
20. Final Reading 1.30 (E-9 Coulombs)
21. Time Interval 60 Second (60 seconds minimum)
22. Current = (Step 20 - Step 18)/Step 21 = .020E-9 Amperes

3.04 R/hr readings:

28. Initial Reading 6.0 (E-9) Coulombs
30. Final Reading 3.81 (E-9) Coulombs
31. Time Interval 60 Seconds (60 seconds minimum)
33. Current = (Step 30 - Step 28)/Step 31 = .0468E-9 Amperes
34. Net current (Step 33 - Step 22) = .0268E-9 Amperes
35. Efficiency (Step 34/3.04) = ~~.0937E-11~~ .8816E-11 A/R/hr *

30.1 R/hr readings:

41. Gross current = 3.10 E-10 Amperes
43. Net current (Step 41 - Step 22) = 2.90 E-10 Amperes
44. Efficiency (Step 43/30.1) = .963E-11 A/R/hr *

299 R/hr readings:

50. Gross current = 2.92 E-9 Amperes
52. Net current (Step 50 - Step 22) = 2.90 E-9 Amperes
53. Efficiency (Step 52/299) = .969E-11 A/R/hr *

* Acceptance Limits = 0.8 to 1.2 x E-11 A/R/hr

By [signature] (18) Date 5-30-86 QA _____ (QC 18) Date 5-30-86