HEWLETT-PACKARD CO.

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ER-DIV 43,USERS-DIV 43,B4

App. XI

GENERAL REQUIREMENTS

FOR RADIOACTIVE NICKEL 63 PLATING ON ELECTRON CAPTURE DETECTOR CELLS

SECTION	DESCRIPTION
1	GENERAL
2	TEST PROCEDURES
3	QUALIFICATION
4	PACKAGING & SHIPPING

			MODEL	STK # 19233-90570
			GENERAL REQUIREMENTS EC	
A	43-17410	SEEDS	06/28/88	BY BOB SEEDS	DATE AUG 15, 1988
LT	P.C. #	APPR	DATE	APPD	SHEET # 1 OF 15
REVISIONS			SUPERSEDES P0001179		DWG # A-19233-90570-1

INSPECTION PROCEDURES AND ACCEPTANCE CRITERIA

1. GENERAL

THIS SPECIFICATION ESTABLISHES THE GENERAL REQUIREMENTS FOR RADIOACTIVE NICKEL 63 PLATING ON ELECTRON CAPTURE DETECTOR CELLS. IT INCLUDES THE FOLLOWING:

A. TEST PROCEDURES AND ACCEPTANCE CRITERIA FOR PLATING THE CELLS.

B. PROCEDURES FOR PERFORMING VENDOR QUALIFICATION TESTS.

C. PROCEDURES FOR PACKAGING AND SHIPPING PLATED CELLS.

2. TEST PROCEDURES

THESE TESTS ARE TO ACHIEVE THE FOLLOWING OBJECTIVES:

* CONFIRM THAT THE REGIONS OF THE CELL THAT ARE SUPPOSED TO BE FREE OF RADIOACTIVITY HAVE RADIOACTIVITY LEVELS BELOW THE SPECIFIED LIMITS. THE TEST TO CONFIRM THIS SHALL BE KNOWN AS THE "WIPE TEST".

* EVALUATE VISUALLY, WITH THE AID OF 10X OPTICAL MAGNIFICATION, THE APPARENT QUALITY/INTEGRITY OF THE PLATING. THE TEST TO EVALUATE THIS SHALL BE KNOWN AS THE "VISUAL INSPECTION".

* ASCERTAIN THAT THE TOTAL RADIOACTIVITY OF THE SOURCE IS WITHIN THE APPROPRIATE LEVELS. THE TEST TO ASCERTAIN THIS SHALL BE KNOWN AS THE "SOURCE RADIOACTIVITY TEST".

SEE TABLE 1, "TEST SPECIFICATIONS SUMMARY" FOR ACCEPTANCE CRITERIA

WARNING

NOTE THAT THE PROCEDURES DESCRIBED HEREIN INVOLVE THE HANDLING OF UNSEALED RADIOACTIVE SOURCES WHICH CONTAIN APPROXIMATELY 15 MILLICURIES OF RADIOACTIVE NICKEL 63. THEREFORE THESE TESTS MUST BE PERFORMED IN AN APPROPRIATELY RESTRICTED AREA (HOT LAB) BY QUALIFIED PERSONNEL USING LAB COATS, FUME HOODS, GLOVES, SAFETY GLASSES, ETC. WHERE APPROPRIATE. **NEVER LOOK AT THE RADIOACTIVE MATERIAL WITHOUT WEARING SAFETY GLASSES OR OTHER EYE PROTECTION. ALWAYS KEEP THE OPEN END OF THE SOURCE 6 INCHES OR MORE AWAY FROM HANDS AND BODY.**

A. WIPE TEST (SEE FIGURE 1)

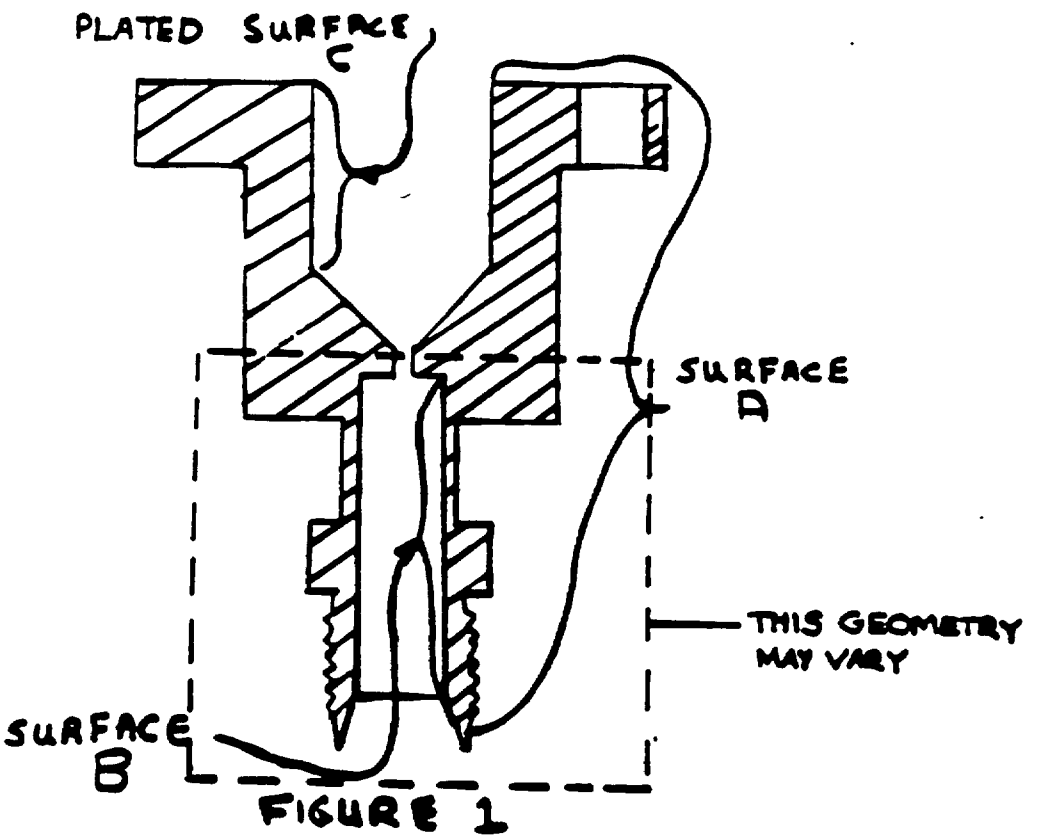

FIGURE 1

				MODEL	STK # 19233-90570
				GENERAL REQUIREMENTS EC	
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TEST SEPARATELY, BOTH SURFACES "A" AND "B" AS SHOWN IN FIGURE 1. USING THE FOLLOWING PROCEDURE:

A.1 USING COTTON TIPPED SWABS (Q-TIPS) MOISTENED WITH METHANOL, WIPE AT LEAST 2 SQUARE CENTIMETERS OF THE SURFACES ("A" OR "B").

A.2 PLACE THE Q-TIP IN A 2 ML POLYPROPYLENE SCINTILLATION VIAL.

A.3 FILL THE VIAL WITH SCINTILLATION LIQUID "OPTI-FLUOR"* OR EQUIVALENT.

A.4 USING A PACKARD INSTRUMENT CO. MODEL 1500 TRI-CARB (OR EQUIVALENT) SCINTILLATION COUNTER IN THE BETA COUNTING MODE MEASURE THE ACTIVITY OF EACH SAMPLE.

A.4.1 THE COUNTER SHALL BE CALIBRATED WITH A NICKEL 63 STANDARD ALSO CONTAINING A Q-TIP AND SCINTILLATION LIQUID OF THE SAME TYPE AND BATCH AS IN THE TEST MEASUREMENT. THIS CALIBRATION SHALL BE PERFORMED WITH EACH BATCH OF MEASUREMENTS MADE.

A.4.2 THE ACTIVITY OF THE SAMPLE IS TO BE CALCULATED AS FOLLOWS:

$$E = D \times (B-A) / (C-A)$$

WHERE:

A = ACTIVITY OF BACKGROUND (IN COUNTS PER MINUTE)
B = ACTIVITY OF SAMPLE (IN COUNTS PER MINUTE)
C = ACTIVITY OF STANDARD (IN COUNTS PER MINUTE)
D = ACTIVITY OF STANDARD (IN MICROCURIES)
E = ACTIVITY OF SAMPLE (IN MICROCURIES)

* AVAILABLE FROM PACKARD INSTRUMENT CO.

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B. VISUAL INSPECTION TEST

INSPECT THE INSIDE SURFACE OF THE CELL IN THE REGION OF THE RADIOACTIVE PLATING USING A STEREO-OPTIC MICROSCOPE AT THE 10X MAGNIFICATION.

B.1 PLATING FAULTS

THERE MUST BE NO FLAKING, LOOSE PARTICLES, BUBBLES, BLISTERS OR CRACKS ANYWHERE WITHIN THE CAVITY, NOR ANY VOIDS IN THE PLATED REGION.

B.2 CLEANLINESS FAULTS

THERE MUST BE NO FOREIGN MATERIAL INCLUDING PLATING; RESIST IN THE CELL. PLATER SHALL REMOVE ALL PLATING RESIST AND PROTECT CELL FROM ENTRY OF FOREIGN MATERIAL.

B.3 GENERAL APPEARANCE FAULTS

THERE MUST BE NO DISCOLORATION OR OTHER VISUAL EFFECTS THAT MIGHT INDICATE THAT THE PLATING PROCESS WAS NOT IN CONTROL.

C. SOURCE RADIOACTIVITY TEST

THE RADIOACTIVITY LEVEL WILL NOT BE MEASURED DIRECTLY. INSTEAD, A BRASS OR STAINLESS STEEL ROD (ANODE) IS TO BE PLACED INSIDE THE CYLINDRICAL BORE OF THE CELL WITH THE AXIS OF THE ROD COINCIDENT WITH THE AXIS OF THE CELL'S CYLINDRICAL BORE. WITH A VOLTAGE APPLIED FROM THE CELL WALL TO THE METAL ROD, THE IONIZATION CURRENT IS TO BE MEASURED AND USED AS AN INDICATION OF THE RADIOACTIVITY LEVEL.

THE PHYSICAL SETUP IS AS FOLLOWS:

- THE BRASS OR STAINLESS STEEL ROD SHALL PROTRUDE VERTICALLY FROM A FLAT HORIZONTAL SURFACE MADE OF TEFLON (PTFE). THE

CELL WHEN IN PLACE FOR MEASUREMENT SHALL REST ON THE TEFLON SURFACE SURROUNDING THE PROTRUDING ROD WITH THE CELL FLANGE FACING DOWNWARD AND SUPPORTED BY THE TEFLON SURFACE. (THE ELECTRICAL RESISTANCE BETWEEN THE ROD AND GROUND SHALL BE 10 TO THE 12TH POWER OHMS RESISTANCE OR HIGHER. THE TEFLON SURFACE SHALL BE KEPT CLEAN AND FREE OF FINGERPRINTS SO AS TO MINIMIZE THE CURRENT LEAKAGE ACROSS ITS SURFACE.

- ROD (ANODE) DIAMETER = 3.175MM (0.125 INCHES)
- ROD END GEOMETRY IS HEMISPHERICAL
- PENETRATION OF TIP OF ROD INTO CELL = 12.7MM (0.5 INCHES)
- CENTERING OF ROD IN CELL: THE CENTERLINE OF THE ROD SHALL LIE WITHIN A 0.76MM DIA. CYLINDRICAL VOLUME CONCENTRIC WITH THE CENTERLINE OF THE CELL.
- VOLTAGE APPLIED ANODE TO GROUND: +100 VDC (+ OR -1 VDC)
- CURRENT MEASURING DEVICE: "KEITHLEY" MODEL 617 PROGRAMMABLE ELECTROMETER (OR SIMILAR).

THE ACTIVITY OF THE PLATING OF THE SOURCE SHALL BE CONSIDERED TO BE WITHIN SPECIFICATIONS, THAT IS TO BE BETWEEN 12 MILLICURIES AND 15 MILLICURIES, IF THE IONIZATION CURRENT AS MEASURED IN THE ABOVE SETUP IS BETWEEN 8.1 NANOAMPS (MIN) AND 9.9 NANOMPS (MAX).

TABLE 1
TEST SPECIFICATIONS SUMMARY

TEST NAME	ACCEPTANCE CRITERIA
"WIPE TEST"	THE ACTIVITY (CALCULATED AS E IN SECTION A.4.2) FOR EACH OF SURFACES A & B (FIGURE 1) SHALL NOT EXCEED 2 NANOCURIES.

"VISUAL INSPECTION"

PLATING:

THERE MUST BE NO FLAKING, LOOSE PARTICLES, BUBBLES, BLISTERS OR CRACKS ANYWHERE WITHIN THE CAVITY, NOR ANY VOIDS IN THE PLATED REGION.

CLEANLINESS

THERE MUST BE NO FOREIGN MATERIAL INCLUDING PLATING RESIST IN THE CELL. PLATER SHALL REMOVE ALL PLATING RESIST AND PROTECT CELL FROM ENTRY OF FOREIGN MATERIAL.

GENERAL APPEARANCE

THERE MUST BE NO DISCOLORATION OR OTHER VISUAL EFFECTS THAT MIGHT INDICATE THAT THE PLATING PROCESS WAS NOT IN CONTROL.

"SOURCE RADIOACTIVITY TEST"

THE ACTIVITY OF THE PLATING OF THE SOURCE MEASURED BY IONIZATION CURRENT USING PROCEDURE 2.C SHALL BE BETWEEN 8.1 NANOAMPS (MIN) AND 9.9 NANOAMPS (MAX).

3. QUALIFICATION

HEWLETT-PACKARD WILL DO AN INITIAL QUALIFICATION OF EACH RADIOACTIVE MATERIAL PLATING VENDOR AND THEN WILL "REQUALIFY" EACH VENDOR PERIODICALLY THEREAFTER. REQUALIFICATION MAY ALSO BE PERFORMED AT ANY TIME THAT THERE IS REASON TO BELIEVE THAT A QUALITY PROBLEM MAY EXIST.

THE QUALIFICATION PROCESS CONSISTS OF THOSE TESTS DESCRIBED IN SECTION 2 ABOVE PLUS THE ADDITIONAL ONES DESCRIBED BELOW:

A. SOLVENT SOAKING

PLACE THE SOURCE IN A 100 ML BEAKER, FLANGE DOWN. GENTLY POUR 25 ML OF LC GRADE METHANOL, 10 PPM MAX ACIDITY CALCULATED AS ACETIC ACID (OR OTHER LIQUID AS REQUIRED BY SPECIFICATION) INTO THE BEAKER AND ALLOW TO SOAK FOR 15 MINUTES WITHOUT AGITATION. AFTER THE 15 MINUTE TIME PERIOD HAS ELAPSED GENTLY SWIRL THE BEAKER TO MIX THE LIQUID. NEXT PIPETTE A 1 ML SAMPLE INTO A 2 ML SCINTILLATION VIAL.

NEXT ADD 1 ML OF "OPTI-FLUOR" SCINTILLATION LIQUID OR EQUIVALENT TO THE VIAL AND CAP SECURELY. COUNT THE SAMPLE AND CALCULATE THE ACTIVITY AS IN SECTION A.4 THRU A.4.2 (ABOVE).

THE RESULT THUS CALCULATED IS NEXT MULTIPLIED BY 25 TO GIVE TOTAL NICKEL 63 REMOVED IN SOLVENT WASH. IF OTHER THAN 25 ML OF METHANOL WAS ADDED (SEE ABOVE) MULTIPLY BY THE ACTUAL VOLUME USED.

B. HOT WIPE OF THE ACTUAL NICKEL 63 PLATED SURFACE

MOISTEN A Q-TIP WITH METHANOL AND SHAKE IT BRISKLY TO REMOVE EXCESS LIQUID. GRASP THE Q-TIP 3 TO 4 INCHES FROM THE COTTON END AND USING A SPIRAL MOTION WIPE ACROSS THE PLATED SURFACE WHILE MOVING FROM THE CLOSED TO OPEN END OF THE CAVITY AND MAKING THREE FULL REVOLUTIONS. (THE PATH

THUS FOLLOWED WILL BE A THREE TURN HELIX WITH A PITCH OF APPROXIMATELY ONE THIRD OF THE LENGTH OF THE PLATED REGION). THE PRESSURE ON THE Q-TIP DURING THIS "WIPE" SHOULD BE CONSTANT AND LIGHT; IT IS NOT INTENDED TO ABRADE THE SURFACE BUT RATHER TO LIGHTLY WIPE ACROSS IT.

NEXT PLACE THE Q-TIP IN A 2 ML POLYPROPYLENE SCINTILLATION VIAL. (CUT OR BREAK OFF A PORTION OF THE UNUSED END OF THE Q-TIP AS IT IS TOO LONG TO FIT INTO THE VIAL). THEN FILL THE VIAL TO WITHIN A FEW MILLIMETERS OF ITS MOUTH WITH OPTI-FLUOR SCINTILLATION FLUID OR EQUIVALENT. CAP THE VIAL AND SHAKE IT THOROUGHLY.

COUNT AND CALCULATE THE RADIOACTIVITY AS PER SECTION A.4. ABOVE. IF THE RADIOACTIVITY IS BEYOND THE RANGE OF THE COUNTING INSTRUMENT THE SAMPLE MUST BE DILUTED AND REMEASURED. IN THIS CASE THE CAPPED VIAL SHOULD BE THOROUGHLY SHAKEN AGAIN TO ASSURE THAT THE RADIOACTIVE MATERIAL IS RELEASED FROM THE Q-TIP AND UNIFORMLY DISPERSED THROUGHOUT THE LIQUID. NEXT PIPETTE 0.5 ML OF THE LIQUID INTO A CLEAN 2 ML SCINTILLATION VIAL AND ADD 1.5 ML OF OPTI-FLUOR. AFTER CAPPING THE VIAL AND SHAKING IT THOROUGHLY, COUNT AND CALCULATE THE RADIOACTIVITY AS PER SECTION A.4 ABOVE. IF THE DILUTION STEP DESCRIBED IS REQUIRED THEN THE RESULTS CALCULATED ABOVE MUST BE MULTIPLIED BY THE RATIO OF THE INITIAL VOLUME OF THE SAMPLE TO THAT WITHDRAWN FOR DILUTION. (IN THIS CASE THE FACTOR IS APPROXIMATELY 4 IGNORING THE VOLUME DISPLACED BY THE Q-TIP AND THE VOID SPACE IN THE VIAL. RESULTS OBTAINED THRU DIVISION OF THE ORIGINAL SAMPLE AND DILUTION ARE APPROXIMATE ONLY).

C. VIBRATION

ANY SUITABLE COMMERCIAL SHAKE TABLE CAN BE USED. MOUNT THE SOURCE INLET DOWNWARD IN A METAL FIXTURE WITH A GLASS FIBER FILTER PAPER BETWEEN THE SOURCE AND FIXTURE. THIS PREVENTS CONTAMINATION OF THE FIXTURE IN THE EVENT OF A PLATING FAILURE.

SEAL THE COLUMN FITTING WITH A BLANK PLUG. THEN SHAKE THE SOURCE IN ALL THREE MUTUALLY PERPENDICULAR AXES BY CYCLING FROM 10-55 Hz FOR ONE MINUTE. REPEAT THIS 15 TIMES IN EACH AXIS AT 0.015 INCH PEAK TO PEAK OSCILLATION.

USE CARE TO ENSURE THAT NO RADIOACTIVE CONTAMINATION OF THE VIBRATION EQUIPMENT OCCURS AND THEN WIPE AND TEST THE SUBJECTED AREA AFTER THE TEST TO CHECK FOR CONTAMINATION. AFTER THE SHAKE TEST RETURN THE FIXTURE TO THE HOT LAB AND REMOVE THE CELL. CAREFULLY REMOVE THE INLET PLUG AND WIPE AND COUNT BOTH THE PLUG AND INLET FITTING AS IN SECTION 2.A WIPE TEST (ABOVE).

D. DROP TEST

SAME AS A.N.S. N542-1977, TABLE 1. ASSEMBLE A SOURCE IN FINAL FORM WITH UPPER BLOCK AND THE COLUMN INLET AND GAS OUTLET PLUGGED WITH A STRONG METAL PLUG. DROP THE CELL ("FREE DROP") FROM A HEIGHT OF 1.5M (4.92 FEET) ONTO A MILD STEEL PLATE OF 1/4" THICKNESS OR GREATER. REPEAT FOR TEN DROPS TOTAL. THE CELL ORIENTATION SHOULD BE VARIED FROM DROP TO DROP IN RANDOM FASHION. REMOVE THE INLET AND OUTLET PLUGS AND DISMANTLE THE DETECTOR. DISCARD THE ANODE SECTION AS CRACKS IN THE ALUMINA WILL RENDER IT USELESS FOR ANY FURTHER USE.

E. FREEZE TEST

CAP THE ASSEMBLED CELL AT THE INLET AND EXIT FITTINGS WITH METAL CAPS AND PLACE IT IN A SEALED PLASTIC BAG. NEXT PLACE THE CELL (IN THE PLASTIC BAG) IN A -40 ± 10 DEGREE C CHAMBER FOR A PERIOD OF 20 MINUTES. (A REFRIGERATOR-FREEZER OR ENVIRONMENTAL CHAMBER MAY BE SUITABLE). REMOVE THE CELL AND BAG AND ALLOW TO REACH ROOM TEMPERATURE. (THIS WILL TAKE AN HOUR OR MORE). REMOVE THE CELL FROM THE BAG. REMOVE THE INLET AND OUTLET FITTINGS AND WIPE THEIR INSIDE SURFACES WITH Q-TIPS SOAKED IN METHANOL. COUNT THE Q-TIPS AS IN 2.A.2 THROUGH 2.A.4.2. DISPOSE OF THE PLASTIC BAG IN A RADIATION DISPOSAL CONTAINER.

F. HIGH TEMPERATURE NICKEL LOSS

(THIS TEST SIMULATES WORST CASE THERMAL RUNAWAY OF ALL TEMPERATURE CONTROL SYSTEMS.) PERFORM ALL TESTS IN A LAB HOOD.

MOUNT THE DETECTOR CONTAINING THE CELL ON A METAL BRACKET AND PLACE THE ASSEMBLY IN A HIGH TEMPERATURE (625 ± 25 DEG. C) OVEN. ALLOW THE INLET FITTING OF THE DETECTOR TO BE OPEN. ATTACH A 1/8" O.D. STAINLESS STEEL TUBE TO THE DETECTOR EXIT, WITH THE OTHER END OF THE TUBE PROTRUDING OUTSIDE OF THE HEATED ZONE. CONNECT THE 1/8" O.D. STAINLESS STEEL TUBE TO THE FIRST OF A SERIES OF 4 FRITTED GLASS WASHING BOTTLES (FISHER 3.040 SIZE 125 ML). MAKE THE BOTTLE INTERCONNECTIONS WITH SMALL PIECES OF SURGICAL RUBBER TUBING.

ARRANGE ALL OF THE BOTTLES SO THAT THE FRIT IS ON THE INLET SIDE OF EACH BOTTLE. CONNECT A VACUUM PUMP TO BOTTLE #4 THRU A "T" FITTING. VALVE THE THIRD LEG OF THE "T" FITTING. THROTTLING THE VALVE ALLOWS THE FLOW OF AIR THRU THE BOTTLES TO BE REGULATED SO THAT MODERATE BUBBLING OCCURS THRU THE BOTTLES. THE CONTENTS OF THE WASH BOTTLES ARE TO BE AS FOLLOWS:

FIRST BOTTLE:	EMPTY
SECOND BOTTLE:	60 ML OF 15% NITRIC ACID
THIRD BOTTLE:	60 ML OF WATER
FOURTH BOTTLE:	60 ML OF 1% ALCOHOLIC DIMETHYL GLYOXIME SOLUTION

NOTE THAT THE ABOVE SIMULATES THE THERMAL RUNAWAY OF A GAS CHROMATOGRAPH OVEN IN THAT IN SUCH A SITUATION THE FAILURE OF GLASS GC COLUMNS, O-RINGS, FERRULES, ETC. WILL INTRODUCE AIR INTO THE SYSTEM.

NEXT RAISE THE CELL TEMPERATURE TO 625 +/- 25 DEGREES C AND MAINTAIN FOR 24 HOURS. (THE FULL TEST TIME). THEN COOL THE CELL AND DISCONNECT THE VACUUM SOURCE. ADD 60 MILLI-

LITERS OF 15% NITRIC ACID TO THE FIRST (EMPTY) BOTTLE AND ALLOW TO STAND FOR 15 MINUTES. NEXT CHECK ALL BOTTLES FOR RADIATION WITH A GEIGER TUBE.

THEN PIPETTE 1 ML OF EACH OF THE FIRST THREE BOTTLES INTO TYREE SEPARATE 2 ML SCINTILLATION VIALS. THEN ADD A NORMAL SOLUTION OF SODIUM HYDROXIDE USING PHENOLPTHALEIN AS AN EXTERNAL INDICATOR TO EACH VIAL.

NEXT TOP OFF EACH OF THE THREE VIALS WITH OPTI-FLUOR SCINTILLATION LIQUID OR EQUIVALENT. IF THE VIAL REPRESENTING THE FOURTH BOTTLE TURNS PINK OR RED (INDICATING THAT NICKEL HAS REACHED THIS BOTTLE) ADDITIONAL CAUTION SHOULD BE TAKEN AS LARGE AMOUNTS OF NICKEL MAY HAVE BEEN RELEASED. COUNT AND CALCULATE THE SAMPLES AS IN SECTION A.4 WITH THE ADDITIONAL STEP OF MULTIPLYING EACH RESULT BY THE VOLUME OF THE LIQUID IN EACH BOTTLE AFTER THE TEST BUT BEFORE THE REMOVAL OF THE 1 ML SAMPLE. EVEN THOUGH 60 ML PER BOTTLE WAS USED TO START THE TEST, THE BOTTLES MAY EXPERIENCE DISSIMILAR EVAPORATION RATES.

ACCEPTANCE CRITERIA FOR VENDOR QUALIFICATION

TEST	MINIMUM NUMBER OF CELLS TO BE TESTED	ACCEPTANCE CRITERIA
WIPE TEST	3	SAME AS IN TABLE I (SHEET 6). ALL THREE CELLS MUST PASS.
VISUAL INSPECTION	3	PLATING: SAME AS IN TABLE I (SHEET 7). ALL THREE CELLS MUST PASS. CLEANINESS: SAME AS IN TABLE I (SHEET 7). ALL THREE CELLS MUST PASS. GENERAL APPEARANCE: SAME AS IN TABLE I (SHEET 7). ALL THREE CELLS MUST PASS.
SOURCE RADIOACTIVITY	3	SAME AS IN TABLE I (SHEET 7). ALL THREE CELLS MUST PASS.
SOLVENT SOAKING	10	10 NANOCURIES MAX PER CELL. (ALL 10 CELLS MUST PASS)
HOT WIPE OF THE ACTUAL NICKEL 63 PLATED SURFACE	3	5 MICROCURIES MAX (ALL 3 CELLS MUST PASS)
VIBRATION TEST	1	5 NANOCURIES MAX

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DROP TEST	1	5 NANOCURIES MAX. ALSO PASS B. VISUAL INSPECTION AFTER DROP.
FREEZE TEST	1	5 NANOCURIES MAX. ALSO PASS B. VISUAL INSPECTION AFTER FREEZING.
HIGH TEMPERATURE NICKEL LOSS	1	0.5 MICROCURIES MAX

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4. PACKAGING & SHIPPING PROCEDURES

1. EACH CELL SHALL BE PACKAGED IN ITS OWN INDIVIDUAL CONTAINER. THE CONTAINER SHALL BE CYLINDRICALLY SHAPED WITH A CLOSE FITTING CAP.

2. THE SERIAL NUMBER OF EACH CELL SHALL BE CLEARLY MARKED ON THE OUTSIDE OF ITS CONTAINER.

3. EACH CELL SHALL BE SHIPPED ACCOMPANIED BY DOCUMENTS REPORTING THE FOLLOWING MEASUREMENTS FOR THAT CELL:

   A. THE RESULTS OF THE "WIPE TEST" STATED IN MICROCURIES

   B. THE RESULTS OF THE "SOURCE RADIOACTIVITY TEST" STATED IN NANOAMPS