PDR 71-9007

AUTOMATION INDUSTRIES, INC.
SPERRY DIVISION
P.O. BOX 245
PHOENIXVILLE, PA. 19460
(215) 933-8961

May 8, 1980

Mr. Charles E. MacDonald, Chief
Transportation Branch
Div. of Fuel Cycle & Material Safety
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Ref: Your Docket #71-9007
Renewal of Certificate of Compliance
Package Ident. No. USA/9007/B
Expires May 31, 1980.

Dear Mr. MacDonald:

Confirming our telecon of May 6, 1980, I am submitting eight (8) complete sets of Test Data with results which were used for qualifying the above referenced package. The above data has been revised to incorporate all applicable supplemental data which is referenced on the present Certificate of Compliance.

Please note that the above revision does not consolidate the supplementary data covered in my letter to the NRC dated Nov. 28, 1973. This referenced data was to clarify source pigtail models and various connector types which do not relate to the structural integrity of the package. However, by revision, I have incorporated the additional test data which is referenced in my letters to your office dated Feb. 18 and April 4, 1975. These two (2) referenced letters relate to additional drop tests perfomed on the Model 520 device to assure that impact occurred to the most vulnerable part of the shielded device (ie., Lockbox and protruding seal plug.)

The above test data with results have been added by revision to Page 1 of the Test Report and by adding an appendix to Page 8.

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AUTOMATION INDUSTRIES, INC.
SPERRY DIVISION
P.O. BOX 245
PHOENIXVILLE, PA. 19460
(215) 933-6961

May 8, 1980

We will appreciate your prompt attention regarding renewal of the USA/9007/B Certificate of Compliance due to the impending expiration date of May 31, 1980.

Sincerely,

Michael P. Santoro

Michael P. Santoro, Gen'l Mgr.,
Nuclear Products.

MPS:deb

cc: NRC File
J. Dwight
S. Boyko

Enc: (8) Test results for Type "B" Packaging.

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TEST RESULTS-FOR TYPE "B" PACKAGING

IRIDIUM SOURCE CHANGER-SPENT URANIUM TYPE

AND MODEL 520 IRIDITRON EXPOSURE DEVICE

In an effort to reduce transportation costs and also as an effort towards product improvement, Automation Industries, Inc has designed and constructed a new Iridium Source Changer for servicing our Iridium-192 customers.

Our new Source Changer will use Spent Uranium as the shielding medium. By utilizing Spent Uranium, our new changer is approximately one-quarter the volume and one-third the weight of our present lead shielded Changers. The gross shipping weight of the new Source Changer will be sixty (60) pounds. This reduction in size and weight renders a very compact, rugged, and structurally sound design, capable of withstanding severe abuse encountered during shipment and in field use.

The container design consists of a rectangular box, approximately 5" wide x 7" high x 11" long, fitted with a hinged cover to permit access to the internal compartment. The entire unit is fabricated from type 18-8 Stainless Steel sheet, #10 Gage, (0.140" thick), with all corners and seams continuously welded. The Spent Uranium shield is completely encased in an all-welded leak tight compartment. The shield is fixed in the compartment by seal welding the two (2) exit tubes through the partitioning sheet, and then potting with a high temperature solid epoxy. The unit is designed to meet the requirements of D.O.T.-55 Specification.

In essence, this new changer is a miniature version of our present lead shielded changer. All threaded connections, threaded seal caps, transfer tubes, method of packaging, securing and sealing are the same for both units. The procedures to be followed for effecting a source change in the field are also the same for both units. The same operating instructions will apply for both Source Changers.

As designed, the Spent Uranium Changer is a D.O.T.-55 shipping container; however, at this time, Automation Industries, Inc. would also like to qualify it as a Type "B" shipping container. In order to substantiate this qualification, the Spent Uranium Source Changer was subjected to the following test requirements of the International Atomic Energy Agency. Tests were performed sequentially in the order listed below:

A. MECHANICAL TEST

Free Drop #1——The package was dropped from a height of thirty-four (34) feet onto a flat, horizontal, 5/8 inch thick steel plate.

M P Santoro July 24, 1973

Michael P. Santoro
Product Manager, Nuclear

Rev. #1 Dated 5-8-80

See added Appendix "A" Page 8

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Free Drop #2——The package was dropped from a height of forty (40) inches onto the upper end of a steel circular bar which was perpendicular to the concrete pad. The target surface of the circular bar was flat with its outer edges rounded off to a radius of six (6) mm.

Deviations:

(a) For the Free Drop #1, the 5/8" steel plate was not wet floated onto the concrete pad. However, the eight (8) inch thick concrete apron was flat and horizontal, as was the steel plate, and the contact interface was intimate.

(b) For the Free Drop #2, the circular steel bar was three (3) inch diameter in lieu of the fifteen (15) cm. diameter called for.

OBSERVATIONS:

Subsequent to Drops #1 and #2, visual inspection and radiation surveys indicate, that the container and/or containers, as presently designed, would have sustained more severe test conditions, and still maintained integrity. Results of the drop tests showed negligible effects.

B. THERMAL TEST

The container and/or containers were suspended by wire rope from an "A" frame, centered over a 66 inch by 66 inch fuel pan, having five (5) inch sides. The container and/or containers were positioned approximately twelve (12) inches above the surface of the fuel. The fuel consisted of a 50/50 percent mixture of Kerosene and #2 Fuel Oil. Total time of exposure to flame was fourty-seven (47) minutes. This exceeded the required test period by seventeen (17) minutes, since we were unable to extinguish the flame by use of three (3) conventional CO_2 extinguishers. Two (2) local Fire Companies arrived with suitable foam generating equipment to blanket the flame. The container and/or containers were allowed to cool naturally for a period of three (3) hours.

Deviations:

Total time of exposure to flame was fourty-seven (47) minutes, due to difficulty encountered in attempting to extinguish the fire at the thirty (30) minute mark.

M. P. Santoro July 24, 1973

Michael P. Santoro
Product Manager, Nuclear

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For ecological reasons and also potential fire hazards, the same fire was used to expose two (2) different containers simultaneously. (The Spent Uranium Source Changer and Our Model 520 Iriditron Exposure Device.)
An attempt to monitor the flame temperature, using a Weed Model 8000 Temperature Indicator with platinum resistance probe (0 to 1600 °F) failed, due to a malfunction in the instrument or a short in the probe element.

OBSERVATIONS:
After the three (3) hour cooling period, both containers were inspected visually for structural damage, and also monitored for any radiation hazards. There were no apparent high surface radiation levels. Both containers exhibited bulged or "pregnant" attitudes, due to extremely high internal pressures resulting from the decomposition of the trapped epoxy potting resins at the elevated temperatures. The internal gas pressures had to be exceedingly high in order to permanently set a convex bow on all surfaces of the containment shells (#10 Gage, 0.140 inch thick, type 304 Stainless Steel Plate).

The Spent Uranium Source Changer showed no structural failure, nor any loss of shielding integrity, as a result of the fire test.

The Model 520 Iriditron did spring about 50% of the weld seam on the bottom portion of the rear end plate, (Lock Box End).

This occurred at approximately the fourty (40) minute elapsed time mark, while the firemen were preparing to blanket the fire with foam. The weld failure was clearly evidenced by a muffled explosion, followed by a rapid release of expanding gases or epoxy vapors. Close up inspection showed that the lower segment of the rear end plate had pulled away from the shell tube, forming an angle of approximately 15° off the perpendicular. Accordingly, this rotation of the rear end plate caused the lockbox to be cocked upward approximately 15° off the horizontal.

One end of each hold down tube on either side of the Model 520 base, had separated from the end plates. These separations are not relevant to containment of shielding integrity, however, they do attest to the tremendous forces that were built up and released, in order to cause these weld failures.

July 24, 1973

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It was also noted that the leather handles, and aluminum Radiation Warning Tags and Labels, had completely disintegrated. Stainless Steel Nameplates and chemically etched engravings remained legible. On the Model 520, the aluminum Source Identification Plate was 60% melted away, and the remaining portion not legible.

C. CONTAINMENT AND SHIELDING INTEGRITY

During each test, each container was loaded with a sealed source of Iridium-192 of following strengths:

1. SPENT URANIUM SOURCE CHANGER

Drop Tests 1 and 2, 34 Curies of Iridium-192
(See Chart "A")

30 Minute Fire Test, 30.7 Curies of Iridium-192
(See Chart "C")

2. MODEL 520 IRIDITRON (EXPOSURE DEVICE)

Drop Tests 1 and 2, 24 Curies of Iridium-192
(See Chart "B")

30 Minute Fire Test, 21.5 Curies of Iridium-192
(See Chart "D")

Radiation Surveys were performed on both containers, prior to and after being subjected to each test. Dose rates were measured and recorded for surface levels; at six (6) inches from external surface, and at one (1) meter from the external surface. See Charts "A" to "D" for radiation survey results.

(a) The Spent Uranium Source Changer did not exhibit in any significant change in dose rates after each and cumulative tests.

(b) The Model 520 Iriditron did not exhibit any significant change in dose rates after Drop Tests 1 and 2. However, after the Thermal Test, some of the surface and six (6) inch dose rates increased, while others directly opposite in location decreased, (see Chart "D"). The cumulative average of dose rates did not shift more than 15%. This could be considered negligible. This change in radiation dose levels can be attributed partly to the complete loss of epoxy resin, when the rear end plate seal weld ruptured and relieved the internal pressure. It was calculated

M. P. Santoro July 24, 1973
Michael P. Santoro
Product Manager, Nuclear

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that the epoxy offered approximately 1% of the shielding value. The major cause of shift in dose levels was caused when the lockbox cocked upwards. This motion of the lockbox pulled the Iridium-192 source capsule out of center position in the shield; approximately 3/16" off center. The source pigtail is positioned and fixed into the shield by means of the lock prongs and limiting orifice when the unit is in locked position. Accordingly, when the locking mechanism rotated upward, the source pigtail was displaced an equal amount. This explains why some dose readings increased, while others decreased. Since the Model 520 Shield is overdesigned, with resulting good safety factor; and a 1/2" safe dwell position in the center of the "S" tube, the source capsule can be translated at least 1/4" to eigher side of the theoretical center before appreciable changes in radiation dose levels are noticed. This feature was designed into the unit.

D. PHOTOGRAPHS

The following photographs numbered one (1) through twenty-three (23), illustrate the set-up, progress, and effects of tests on the containers:

#1----------30 Foot Free Drop
#2----------Spent Uranium Changer - Prior To Test
#3----------Model 520 Iriditron - Prior To Test
#4, #5----------Model 520 Iriditron - After 34 Foot Free Drop
#6----------Spent Uranium Changer - After 34 Foot Free Drop
#7----------Model 520 And Source Changer - After All Mechanical Tests
#8, #9----------Model 520 Iriditron - Before And After Drop Onto Circular Pin
#10, #11----------Source Changer - Before And After Drop Onto Circular Pin
#12, #13----------Close Up Of Fuel Pan - Prior To Thermal Test
#14, #15, #16-------Progress Of Thermal Test
#17, #18----------Source Changer And Model 520 - After Thermal Test
Note Source Pigtail Connectors Protruding From Lockboxes.
Note Seam Weld Rupture On Model 520 Iriditron.

M. P. Santoro July 24, 1973

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Product Manager, Nuclear

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#19----------Side View Of Model 520 -
After Thermal Test
Note Cocked Position Of Lockbox
#20, #21----------Radiation Surveys
#22, #23----------Radiation Surveys

E. INTEGRITY OF SOURCE CAPSULE (ENCAPSULATION)

After completion of all tests, both source capsules were leak tested to determine whether there was any leakage of radioactive contents. Both leak test results were negative with respect to leakage.

Source Serial Number IR-6964, contained in Model 520 Iriditron.
Leak Tested on June 6, 1973 After Fire Test
Removable Contamination: Less than 0.001 micro curies

Source Serial Number IR-7056, contained in Spent Uranium Source Changer.
Leak Tested on June 6, 1973 After Fire Test
Removable Contamination: Less than 0.001 micro curies

Visual inspection of the two (2) Source Pigtails when inspected under magnification while viewing through our Hot-Cell viewing window, indicated that there was no mechanical damage imparted to either capsule assembly as result of tests.

F. RECOMMENDATIONS

Due to the severity of the Thermal Test, (Oil Fire), we would suggest that anyone performing this test, do so in a very isolated area, removed from any flammable equipment or buildings. It is also recommended that trained professional fire-fighting personnel and equipment, be on hand to terminate the test, and for obvious safety reasons. The heat intensity of this test is so overwhelming, that it is impossible to approach the flame with conventional hand-held fire extinguishers, when attempting to extinguish the flame after the thirty (30) minute exposure.

G. CONCLUSION

It is our opinion that both of these containers satisfactorily met the Type "B" test requirements of The International Atomic Energy Agency, and that they be certified as such by assignment of individual Certification Marks as issued by the U.S. Department Of Transportation, (D.O.T.). We desire that this certification

M P Santoro July 24, 1973
Michael P. Santoro
Product Manager, Nuclear

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or permit be acceptable for both domestic and export shipments.

Since the Model 520 Iriditron is an Exposure Device, used in Industrial Radiography, and the Spent Uranium Source Changer is a shipping Container for transporting new replacement sources to our customers, and the returning of decayed sources to our Phoenixville facility for ultimate disposal, it is hoped that this type "B" certification will not require that our domestic customers register with the D.O.T. to enable authorized receipt, use, or transshipment of these containers. (They are D.O.T. 55 Spec. containers, and we do not feel that our domestic customers should be burdened with additional registration, simply because we tested and proved that the containers will withstand the more rigorous tests of Type "B" packaging.)

H. SPECIAL FORM MATERIAL

(a) The Spent Uranium Source Changer and the Model 520 Iriditron, will be used only as shielded containers for the isotope Iridium-192 in solid metallic form. The wafers of Iridium-192 are encapsulated into stainless steel capsules using a 1770°F silver braze, (Eutectic Welding Alloys Company, #1807), for the sealing process. The sealed sources are decontaminated and leak tested prior to insertion into the shielding units.

(b) To date we have distributed over 7400 Iridium-192 Sealed Source Capsules of this design to licensed recipients.

(c) The isotope Iridium-192 in solid metallic form, is an noble metal and meets all the requirements of melting point, sublimation, percussion friability, low solubility or dissolution, and chemical stability tests, as outlined in the International Atomic Energy Agency regulations. Since we encapsulate no wafers of metallic Iridium-192 which have any dimension less than 0.5 mm, the radioactive material in itself is Special Form.

I. REQUEST FOR APPROVALS

(a) We request that the Spent Uranium Source Changer be certified as a Type "B" package for shipping Special Form, Sealed Sources of Iridium-192, up to, but not exceeding, 300 Curies.
Specific Activity Range: 300 To 400 Curies/gram

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Michael P. Santoro
Product Manager, Nuclear

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(b) We request that the Model 520 Iriditron be certified as a Type "B" package for shipping Special Form, Sealed Sources of Iridium-192, up to, but not exceeding, 120 Curies.
Specific Activity Range: 300 To 400 Curies/gram.

(c) We request that our Iridium-192 Isotope be certified as Special Form Shipment and/or Special Form Material.

W. P. Santoro July 24, 1973
Michael P. Santoro
Product Manager, Nuclear

REVISION #1. APPENDIX "A" (ADDED 5-8-80)

ADDITIONAL DROP TEST PERFORMED TO MODEL 520 SHIELD TO INSURE THAT FORCE OF IMPACT OCCURRED TO MOST VULNERABLE PART OF THE DEVICE.

(a) Date of Test: April 2, 1975

(b) Description of Test: 30 ft. free drop onto unyielding target consisting of 6 inch thick flat steel plate.

(c) Orientation of Device: A guy wire was employed to maintain proper orientation to assure that maximum damage occurred to the locking mechanism and protruding seal plug connector.

(d) Test Specimen: The 520 shield was the same unit which had previously been subjected to sequential drop, puncture, and fire exposure when qualifying the unit for Type "B" Packaging.

RESULTS & OBSERVATIONS

(a) After Impact: The locking mechanism remained locked---The protruding seal plug connector was slightly deformed---And the guy wire still maintained the 520 shield in a vertical attitude.

(b) After removing guy wire, deformed seal plug connector was removed---
There was no evidence of any damage to the source pigtail connector---And the source pigtail assembly was still retained in the proper locked, stored position.

(c) Conclusion: Results of this test clearly demonstrates the inherent stability of the Model 520 shield and that the device would withstand tests of this severity.

Michael P. Santoro May 8, 1980.
Michael P. Santoro
General Manager, Nuclear Products.