REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION- OF Device

NO. LA-0612-D-112-S DATE: January 21, 2000

DEVICE TYPE: Idustrial Radiography Exposure Device

MODEL: SPEC-300

MANUFACTURER: Source Production and Equipment Co., Inc.
113 Teal Street
St. Rose, Louisiana 70087

DISTRIBUTOR: Source Production and Equipment Co., Inc.
113 Teal Street
St. Rose, Louisiana 70087

ISOTOPE: Cobal-60 MAXIMUM ACTIVITY: 300 Curies (11,100 GBq)

SEALED SOURCE: G "Series"
MODEL DESIGNATION

SOURCE ASSEMBLY MODEL: G-70

LEAK TEST FREQUENCY: Annualy (Device for Depleted Uranium)
Six (6) months (Sealed source)

PRINCIPAL USE: A - Industrial Radiography for use under a specific license

CUSTOM SOURCE: _____Yes XXXX No

DESCRIPTION:

The model SPEC-300 exposure device is a mobile, Type 1 (ANSI N432) radiography exposure device designed for industrial radiography applications. It is used with

associated equipment consisting of a source assembly, control assembly, guide tube, and collimator. The control assembly is used to move the source assembly out of the exposure device to the end of the guide tube to perform radiography. At the conclusion of the radiogrphic procedure the source assembly is moved back into the device.

The device consists of a depleted uranium shield inside a welded stainless steel housing. The device housing consists of a 66 cm (26 inches) long X 35.6 cm (14 inches) wide X 32.1 cm (12.65 inches) high X 0.64 cm (1/4 inch) thick u-shaped stainless steel cover welded to a 66cm (26 inches) long X 35.6 cm (14 inches) wide X 5.6 cm (2 3/16 inches) high X 0.64 cm (1/4 inch) thick stainles steel u-shaped base plate.
A 36.8 cm (14 ½ inches) high X 34.3 cm (13 ½ inches) wide X 0.79 cm (5/16 inch) thick stainless steel plate (lock end bulkhead) supporting the lock box which contains the ASM/Lock Module , and the transport lock is welded at the lock end of the device.
A 36.8 cm (14 ½ inches) high X 34.3 cm (13 ½ inches) wide X 0.79 cm (5/16 inch) thick stainless steel plate (outlet end bulkhead) supporting the outlet panel is welded at the outlet end of the device.
All housing welds are welded along 100% of each joint length. There are four internal structural posts that connect the lock end and the outlet end bulkheads. Each structural post is 1 ½ inch OD (nominal) schedule 80 CRES pipe and is continuously welded to both bulkheads.
Attached to these structural posts are a hot top ring support and, on the opposite side, a dome top support providing additional shield support. The cavity between the diameter of the shield's hot top and the inside wall of the hot top ring is filled with a chocking material which makes a firm bond between the two materials. The dome top support on the opposite side is a welded vertical plate (base) adjacent to the left side of the shield. The welded base has a threaded hole where a ½ inch 20 set screw is installed. A copper pad is placed against the shield and the set screw is then tightened against the pad causing the shield to be in tight contact with the cradle support. To ensure the prevention of chemical, galvanic, eutectic formation or other reactions among device components, 0.66 cm (1/4 inch) thick copper pads are installed between the DU shield and the stainless steel structure.

The cast DU shield includes a curved S-tube that the source travels through. High Density polyurethane foam material fills the interior space between the depleted Uranium shield

and the device housing. The DU shield is secured in the SPEC-300 by two supports welded to the lock end and outlet end bulkheads.

The SPEC-300 exposure device has four on-off mechanisms (source locking/securing systems). (1) The exposure device lock, (2) the source lock, (3) the ASM (automatic securing mechanism), and (4) the transport lock. The ASM/Lock Module contains the exposure device lock, source assembly lock, and the automatic securing mechanism (ASM). It is installed inside the lock box that is bolted to the lock end bulkhead of the device.

The ASM / Lock Module can be replaced by authorized users without special training. The lock box must be removed from the device to remove the ASM/Lock Module. The lock box can be removed from the device only with the use of special tools provided by SPEC. Once the lock box is removed form the device, removal of the ASM/Lock Module from the lock box also requires the use of special tools, which discourages unauthorized removal of both assemblies. The ASM/Lock Module is a closed unit that requires no maintenance or lubrication by the user. It cannot be disassembled or repaired by the user. Only SPEC is authorized to perform maintenance or repair.

The transport lock is an independent locking system designed to provide the primary locking of the source assembly during transport and storage. It also provides locking of the source in the fully shielded position during the replacement of the ASM/Lock Module. This prevents the source assembly from being temporarily unlocked when the module is in the process of being replaced. The transport lock must be engaged before the lock box can be removed from the device to perform the module replacement procedure. The exposure device lock is located in the ASM/Lock Module. The lock is manually operated by a key. The lock is designed to prevent unlocking with a readily available substitute for the key. When the device is unlocked the key cannot be removed or inadvertently fall out when the device is in use. The key serves as a dust cover for the lock when the device is in use. The device must be locked before the key can be removed. The key must be removed to disconnect the control assembly from the exposure device. The key cannot be inadvertently left in the device when breaking down the equipment. The key's thumb grooves point to the "Lock" or "Unlock" positions that are permanently marked on both sides of the lock box to indicate the status of the device lock.

The source assembly lock is located in the ASM/Lock Module. It is manually operated by use of the operation lever on the control adapter of the control assembly. The control assembly must be properly attached to the exposure device to operate the source assembly lock. The control assembly can be attached to the exposure device only after the drive cable connector has been attached to the source assembly connector. The source assembly lock cannot be operated with a readily available substitute for the control assembly operating lever. The lock cannot be disengaged unless the exposure device has been unlocked first. The source assembly lock is linked to the ASM release plunger. When the source assembly lock is engaged the release plunger cannot be latched and the source assembly cannot be inadvertently unsecured. When the release plunger has been latched, the source assembly is in the unsecured state and is positioned to be cranked out of the device. The user may conveniently re-engage the source assembly lock by simply rotating the operating lever on the control adapter clockwise. This action will unlatch the release plunger activating the ASM and engage the source lock. During use of the device, the exposure device cannot be inadvertently locked when the source assembly lock is disengaged. The ASM automatically secures the source assembly when it is fully retracted into the device. Normal control assembly cranking speed and force is required to operate the ASM.

The ASM cannot be intentionally defeated by mechanical means. The source assembly is released form the ASM by the release plunger located at the top of the lock box. When the release plunger is in the depressed (down) position, the source is in the unsecured state. The release plunger automatically latches in the engaged (down) position. When the source assembly is cranked forward the release plunger automatically unlatches and returns (pops buck up) to its original position. The release plunger must be operated before each radiographic exposure operation.

The lock cap is a durable metal assembly that is manually attached to the control assembly boss located on the lock end of the device. It provides protection to the source assembly connector and limits ingress of foreign material when the device is in transport or storage.

The safety plug is a durable metal assembly that is manually used to limit ingress of foreign materials in the outlet nipple, to shield scattered radiation passing through the S-

tube, and to help secure the source assembly in the device during transportation in the event of an accident. When removed it may be temporarily stored in the storage outlet nipple located on the outlet end of the device.

The automatic securing (ASM) and locking mechanisms are installed at one end of the device and an outlet port (outlet nipple) is installed at the other end. The device weighs a maximum of 354 kg (780 pounds).

The stainless steel construction is designed to withstand all normal and reasonable foreseeable abnormal conditions of use.

The sealed source used for the G(70) source model , is a 300 Curies Cobalt 60 source . it is double encapsulated consisting of two cylindrically shaped capsules. The inner and outer capsule material is type 316L CRES. It has been assigned an ANSI classification of 77CC43515.

LABELING:

All the labeling used is described below. A copy of the labels is available in attachment 2.

Exposure Device Nameplate:

The Spec-300 nameplate is marked in accordance with ANSI N432-1980 section 4.2, and is made of permanently marked stainless steel.. The information including, SPEC's name, address, device model, serial number, curie capacity and radionuclide, mass of the depleted Uranium shield and the device weight. The size is approximately 19.7 cm(7-3/4 inches) wide and 11.1 cm (4-3/8 inches) high. The coloring is black lettering on yellow background with a magenta logo. It is attached to the device with stainless steel rivets.

DEVICE TYPE: Idustrial Radiography Exposure Device

Exposure Device Caution Label:

The SPEC-300 caution label meets the requirements of ANSI N432 –1980 section 4.1 and 10 CFR 20.203. It states "**Caution- Radioactive Material – Do Not Handle – Notify Civil Authorities if found**". It is made of permanently marked (etched or embossed) stainless steel. The label is yellow with a magenta trefoil and black lettering. The size is 10.8 cm (4-1/4 inches) wide and 8.9 cm (3-1/2 inches) high. It is attached to the device with stainless steel rivets.

Exposure Device warning Label

The SPEC-300 warning label consists of two separate labels located on the top of the device between the lifting eyes. The labels are made of stainless steel that is permanently marked (etched or embossed) with red lettering, and are attached with stainless steel rivets. The size is approximately 13.3 cm (5-1/4 inches) wide and 3.2 cm (1-1/4 inches) high. The labels state:

WARNING – DANGER

Radiation may cause radiation burns, sickness, cancer, genetic defects, and death. This device may be used only by authorized and monitored individuals who have been trained in the use of this device, the proper use of survey instruments, and radiation safety. This device must be used in strict compliance with operating and emergency procedures and applicable regulations. It must be used with a calibrated survey instrument at all times. Trainees, helpers and assistants must work under the direct surveillance of a radiographer.

Source Identification Tag:

The SPEC-300 has provision for the attachment of a source tag meeting the requirements of 10 CFR 34.20 (b) (1) and ANSI N432-1980 section 4.2. The source tag identifies the isotope, source model, serial number, activity, manufacturer, and date of manufacture. It measures approximately 6.7 cm (2-5/8 inches) wide and 1.9 cm (3/4 inches high. It is attached to the top of the device by stainless steel screws. A source tag is provided with each source.

DEVICE TYPE: Idustrial Radiography Exposure Device

Associated equipment Marking:

The components critical to the safe operation of the system will be marked in accordance of ANSI N432-1980

Drive cable connector:

The drive cable connector is permanently marked with a three 930 character alphanumeric code (one letter and two numerals). The marking is stamped inside the crimped region on the body of the swaged-on connector. The characters are 1/32 inch in height.

Control Adapter:

The control adapter is marked with a seven (7) or eight (8) digit numerical code. The digits are stamped on the flat plate portion of the control adapter and are 1/32 inch in height.

Source Assembly Connector:

The source assembly connector is permanently marked with six digit alphanumeric code (two letters and four numbers). The marking is engraved on the body of the source connector.

Control Assembly Connector:

The control assembly pistol grip cover plate is permanently marked with the words "expose" and "retract" with arrows to indicate the respective direction of cranking motion. To expose or retract the source assembly in accordance with ANSI N432-1980 Section 6.1.2. The marking is stamped on the top and bottom of the cover-plate.

DIAGRAM:

See attachments 1, 2, and 3.

DEVICE TYPE: Idustrial Radiography Exposure Device

CONDITIONS OF NORMAL USE:

The SPEC-300 exposure device is intended for all typical isotope radiography operations at temporary job sites or at fixed locations in permanent facilities. It is expected to be used in areas with a broad range of environmental conditions. It will operate properly within a temperature range of –40 degrees Fahrenheit to +180 degrees Fahrenheit and all levels of humidity. The device is highly resistant to corrosion from typical industrial and environmental atmospheres. The devise is not intended for use underwater. If used underwater the device must be installed in a protective enclosure or other precautions should be taken to prohibit m prohibit damage from slow corrosion.
Vibration encountered as a result of normal use, handling, storage and transportation will have no impact on the device or its safety features.

PROTOTYOE TESTING:

Prototype testing was performed on the SPEC-300 in accordance with ANSI N432-1980 Standard. Other tests were developed by SPEC when test instructions were not were not specified in the standard, yet required performance verification, are included.
The following tests were performed:

ANSI shielding Efficiency test in accordance with ANSI 432-1980, section 8.1 and SPEC's test instruction EGO9.

ANSI Endurance Test in accordance with ANSI N432 –1980, section 8.9. and SPEC's test instruction EG10. A six (6) foot pound torque value was used as a minimum as allowed by and in accordance with 10CFR 34.20 (e). According to SPEC, users are prohibited from using automatic control assembly operating equipment that delivers more than 4 foot pound of torque.

Immobilization test was performed based on the criteria referenced in ANSI N43.9-1991 and ISO CD 3999-1996, with SPEC's test instruction EG14.

DEVICE TYPE: Idustrial Radiography Exposure Device

ANSI Accidental drop test. (nine meter drop test and one meter drop test in accordance with ANSI N432-1980 section 8.4 and SPEC's test instruction EG18.

The associated equipment were tested in fulfillment of the 10 CFR 34.20(a) (1) requirement that included the guide tube, control assembly, and source assembly. All test were performed based on ANSI N432-1980 standards except for the source assembly connector test. For the connector test SPEC has developed an Accidental Disconnect test that is intended to greatly exceed reasonably foreseeable abnormal conditions that could cause a source assembly disconnect.

EXTERNAL RADIATION LEVELS:
Radiation levels were based on measurement with a 34.4 Curies Cobalt-60 source in the device. Extrapolation of the results to a 300 Curie source yielded the following results.

The maximum radiation levels expected when the 300 Curies is in the device with the safety plug and lock cap are in place are:

Distance (inches)	mR/hr (mSV/hr)
0cm (0)	198 (1.98)
5cm (2)	122 (1.22)
30 cm (11.8)	16 (0.16)
100 cm (39.4)	3.5 (0.035)

When the safety plug is removed from the nipple (outlet end) the scattered radiation from the source through the S-tube is unshielded. This opening is used to install a swab (Q-tip) into the S-tube to perform the wipe test. The procedure should be completed within few seconds, and the dose to the fingers will be minimal and well within the allowable dose limit for extremities.

After four successive nine meters fall tests followed by the puncture test, accidental radiation levels at and around all the surfaces of the device did not exceed the

maximum allowable limits. The highest dose rates were around the outlet nipple. An exposure of 2760 mR/hr was measured at the surface and a 56 mR/hr was measured at one meter away from the nipple.

QUALITY ASSURANCE AND CONTROL:

The SPEC-300 exposure device is manufactured under the control of the SPEC Quality Assurance Program. It has been issued a Quality Assurance Program approval for Radioactive Material Packages number 0102 by the U.S. Nuclear regulatory Commission. The Quality Assurance Program encompasses the design, fabrication, assembly, testing, use, repair, and maintenance of radioactive material packages, exposure devices, sources, and associated equipment. Reports of defects must be reported in accordance with 10CFR part 21.
Each SPEC-300 exposure device is provided with a QA Final Inspection Certificate. The certificate records the radiation profile of the device at the surface and at one meter from all six surfaces extrapolated to 300 curies. It certifies the results of the device operation inspection performed in accordance with SPEC-300 Operation Checkout List, an audit of all fabrication and QA inspection records, and a visual inspection of marking and labeling.

LIMITATIONS AND/OR OTHER CONSIDERATIONS OF USE:

1. Users of the SPEC-300 device are required to be specifically licensed by the NRC or an Agreement State to perform industrial radiography.

2. The individual users of the device must be specifically authorized and formally trained in the use of this device as well as being knowledgeable and trained on the use of survey instruments and radiation safety.

3. The SPEC-300 must be used in strict compliance with the Licensee's operating and emergency procedures and must follow all applicable regulations.

DEVICE TYPE: Idustrial Radiography Exposure Device

4. Trainees, helpers and assistants must work under the direct surveillance of a radiographer.

5. When not in use, the safety plug and lock cap must be installed in the device.

6. The approved source assembly, SPEC G-70, shall not be subjected to environmental or other conditions of use that exceed the ANSI N542-1977 classification of 77C43515.

7. This registration sheet and information contained within the references shall not be changed without the written consent of the State of Louisiana, Department of Environmental Quality.

REVIEWER'S NOTE:

1. Only specifically authorized and trained individuals should be near the device when it is being used to perform radiography. Shipping, receiving and transport personnel will be near the device once it has been properly prepared for safe handling by unmonitored individuals. The device is not intended to be near unmonitored members of the public who are not involved in the above mentioned activities.

2. The only parts of the SPEC-300 which are allowed to be removed by the licensee are the ASM lock module and the outlet panel assembly. SPEC does not authorize any repair to these components by licensees. The components may only be replaced (not repaired) by the licensee. The licensee must provide clear protocol for anyone who perform replacement and other maintenance, and what intervals.

3. The SPEC-300 exposure device is not intended to be used as a component of other products, but it may be used as part of a system if it does not compromise the design safety of the device.

4. The SPEC-300 device is expected to have a useful life of 10 to 50 years depending on the frequency of usage and maintenance.

5. The SPEC –300 device does not have a source position indicator of any type. A calibrated and checked survey meter should be used to monitor the radiation levels as long as the device is in use, and to assure the source is in its shielded position when the device is not in use.

6. The user must apply their own label to satisfy the requirements of section 34.20(b)(1)(v), 10 CFR part 34(or the equivalent Agreement State regulation).

SAFETY ANALYSIS SUMMARY:

1. The control assembly in the SPEC-300 device allows the user to operate the device at safe distances. It has two conduit sheets with a minimum distance of 25 feet. SPEC recommends that the users limit the exposure to radiation by operating the device using the longest control assembly practical for the radiographic procedure.

2. The SPEC-300 is designed to prevent access to the radioactive source by unauthorized personnel such as the public by the use of different design features that contribute to the prevention of unauthorized access.

3. The safety plug limits ingress of foreign material in the outlet nipple, and helps to shield scattered radiation passing through the S tube, and helps secure the source assembly in the device during transportation.

4. The source is shielded by a depleted uranium shield that provides shielding in all direction. With the source assembly capsule in the fully shielded position, approximately 12.5 cm (5 in) of depleted uranium shielding is present all around the radioactive source.

5. The ASM/lock module cannot be removed without special tools. Users are not

authorized to disassemble or repair the unit.

6. The exposure device lock is operated by a metal circular key for which there is no readily available substitute. When the device is unlocked the key cannot be removed. Also the key must be removed to disconnect the control assembly from the device.

7. The source assembly lock cannot be operated until the control assembly has been properly connected to the source assembly and device. The lock cannot be disengaged unless the exposure device has been unlocked. The lock is linked to the release plunger. The release plunger must latch to release the source.

8. The automatic securing mechanism secures the source assembly whenever the source is fully retracted into the device.

9. The locking ball is larger than the orifice at the lock end of the ASM housing. This prevents the source assembly from being pulled out of the device toward the lock end even when the source assembly and device locks are not engaged.

10. During transport, the transport lock must be engaged with the source assembly.

11. The device has four convenient holes located at the top corners of each housing protective flange. The tie down holes provide a sturdy means to attach security harness, and permanent installation mounts. The tie down holes may be used for lifting the device and will support 25 times the weight of the device.

12. Two pivoting lifting eyes are located at the top of the device for attaching lifting cables, harness or other lifting attachments. They will support 25 times the weight of the device.

13. Caution and warning labels are attached to the device which explain the hazards of radiation and also list the basic safety instructions to be followed by the user.

Based on the above information, The Radiation Licensing Section of the Louisiana

NO. LA-0612-D-112-S DATE: January 21, 2000

DEVICE TYPE: Idustrial Radiography Exposure Device

Department of Environmental Quality, believes that, the device will perform as intended under all likely conditions of use and any reasonably foreseeable abnormal conditions when all the procedures are followed as described in the Manual and all the restrictions imposed by SPEC are observed.

REFERENCES:
This Certificate of Registration is based on information and test data contained in the following support documents, which are hereby incorporated by reference and made a part of this registry document:

Application for Radiation Safety Evaluation and Device Registration, Revision No (0). Model SPEC-300 Radiography Exposure Device and Associated Equipment, dated July 20, 1999.

Supplement No. 1 dated November 23, 1999.

SPEC-300 Industrial Radiography Exposure Device Component and Assembly Drawings (Appendix 1).

Meeting with Mr. Kenny Carrington of SPEC and Soumaya Ghosn at DEQ on November 2, 1999.

Supplement No. 2 dated January 4, 2000.

Supplement NO. 1 dated January 21, 2000.

Faxed letter from SPEC on February 2, 2000.

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
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NO. LA-0612-D-112-S DATE: January 21, 2000

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ISSUING AGENCY:

State of Louisiana, Department of Environmental Quality, Office Environmental Services, Permits Division, Radiation Licensing section

Date: 1/21/00 Reviewed By: Soumaya Ghosn Soumaya Ghosn

Date: 1/21/00 Concurrence: James W. Sanford James W. Sanford, Ph.D.

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