REGISTRATION OF RADIOACTIVE SEALED SOURCES AND DEVICES
SAFETY EVALUATION OF DEVICE

NO.: NR-0112-D-809-S DATE: December 15, 2000 PAGE 1 OF 10

DEVICE TYPE: Mold Level Control

MODEL: LB 300 ML* or MLT* Series**
*ML-Lead shielded, MLT-Tungsten shielded
**Actual Model Nos. will vary with the type of installation.

DISTRIBUTOR: Apgee Corporation
Hopewell Business & Industrial Park
103 Corporation Drive
Aliquippa, PA 15001

MANUFACTURER: EG&G Berthold
Calmbacher Strasse 22- Postfach 160
D-7547 Wildbad 1
Germany

SEALED SOURCE MODEL DESIGNATION: EG&G Berthold, Drawing Nos. P2608-100 or P2608-101 (Cobalt-60).
Amersham Buchler, Drawing Nos VZ-287 and SK-1208.

ISOTOPE:	MAXIMUM ACTIVITY:
Cobalt-60	300 millicuries (11.1 GBq)
Cesium-137	500 millicuries (18.5 GBq)

LEAK TEST FREQUENCY: 6 months

PRINCIPAL USE: (D) Gamma Gauges

CUSTOM DEVICE: _____ YES __X__ NO

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DESCRIPTION:

The source housing for either the Cobalt-60 or Cesium-137 sources consist of a heavy cylindrical steel outer housing. This housing is lead-filled or contains tungsten shielding in such a way as to provide not only lateral shielding, but top and bottom shielding as well. Mounted eccentrically inside the shielding is a second steel cylinder which contains the source in its stainless steel jacket. This inner steel cylinder can be rotated 180°, and, in effect, acts as a rotating shutter.

The source housing is constructed to suit the type of installation at a customers facility. Hence, the housing varies in size to accommodate sources of various activities. Apgee reports that all devices are constructed so as to not exceed 100 mrem/hour at the surface of the housing. See Table 1 at the end of this section which shows shield size and source millicuries activity range.

In its closed position, the rod source is situated in the center of the shielding container, and is shielded equally in all directions. To open the shutter, the inner cylinder is rotated 180°, at which time the shielding will cover the sides and back, and the radiating beam will be directed across the mold towards the scintillation counter (detector) located opposite. In a basic installation, the shutter can be operated by using a special key which is inserted in the top of the housing. Permanent markings, showing the “open” and “closed” positions are shown on top of this housing. A mechanical interlock system is built in to prevent the holders from being put into the “open” position of, for any reason, the holders are removed from the intended use equipment (See attachments 7,8, and 9). In effect, the devices cannot be removed from the equipment unless the shutter is in the “closed” position. The system can also readily accommodate automatic opening/closure, utilizing actuation by air motors to operate these units (“devices”) as well and these can be furnished on special request. These air motors are spring loaded to return to “off” when not under positive air pressure. A lock-out plate can be used to lock the device in the “off” position (See Attachment 10).

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DESCRIPTION (Cont'd):

The shutter mechanism is operated by externally rotating the external square shaft, at the position indicator, 180°. This causes the inner steel cylinder (rotating shutter) containing the sealed source, to be rotated from the central position (where maximum shielding is obtained) to a position, in line with the "window" in the outer steel shell. It should be noted that both the rotating shutter and the outer steel casing are lead-filled or contain tungsten shielding and that the "window" is not an opening of any kind in the outer steel casing, but merely is a position allowing proper alignment of source and scintillation counter.

The cobalt source is constructed of a solid cobalt wire wrapped around a stainless steel dowel threaded at each end, the length of the wire determining the activity. Thus, the length of rod shaped capsule varies. The threaded dowel is screwed into the end caps of the source tube and then sealed by argon gas arc welding.

The cesium source is manufactured by Amersham Buchler of Germany. The isotope is fired on ceramic beads. The beads are then placed into a double capsulized source tube. Each bead has a known activity. The source tubes may vary in length to fit the source shields and activities as seen in Table 1 below. The source caps are sealed by argon gas welding.

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DESCRIPTION (Cont'd):

TABLE 1

	Shield size (Pb)		Source Activity Range [mCi (MBq)]
A.	100 mm (3.94")	A.	Co-60 to 1.7 (62.9) Cs-137 to 82 (3034)
B.	120 mm (4.72")	B.	Co-60 >1.7 (62.9), <4.5 (166.5) Cs-137 >82 (3034), <307 (11359)
C.	140 mm (5.51")	C.	Co-60 >4.5 (166.5), <9.0 (333) Cs-137 >307 (11359), <500 (18500)
D.	160 mm (6.30")	D.	Co-60 >9 (333), <17 (629) Cs-137 <500 (18500)
E.	180 mm (7.09")	E.	Co-60 >17 (629), <39 (1443) Cs-137 <500 (18500)
F.	200 mm (7.87")	F.	Co-60 >39 (1443), <85 (3145) Cs-137 <500 (18500)
G.	220 mm (8.66")	G.	Co-60 >85 (3145), <194 (7178) Cs-137 <500 (18500)
H.	240 mm (9.45")	H.	Co-60 >194 (7178), <300 (11100) Cs-137 <500 (18500)

LABELING:

The manufacturer/distributor states that each source housing will be labeled in accordance with the requirements of 10 CFR 20.1901.

These labels are made of aluminum or stainless steel and are riveted in place, or are made of mylar and secured in place with adhesive.

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DIAGRAMS:

See Attachments 1,2,3,4,5,6,7,8,9 and 10

CONDITION OF NORMAL USE:

The mold level control is designed to monitor the level of molten metal in a mold through the mold walls without actual contact with the fluid. The following is a brief description of the steel mill environments that the device might encounter:

- Temperature - the ambient temperature ranges from 122°F (50°C) to 176°F (80°C)
- Humidity - 50 to 100% (This moisture arises chiefly from steam coming from potable cooling H_2O)
- Atmosphere - atmosphere is non-corrosive. By NEMA (National Electrical Manufacture Association) standards, this area would not be classified as corrosive. The design of the equipment is such, that any elements in the atmosphere cannot enter into the device or source.
- Vibration - because of the slow operating speed of a continuous casting machine, vibration analysis is not required to be considered in the structural design of the machine on which this equipment will be mounted.

Experience has shown that the design of the equipment has been such as to totally unaffected by normal operations of the equipment on which it has been installed.

PROTOTYPE TESTING:

Apqee reports that each and every device is functionally tested prior to shipment for proper operations, including locking device and radiation leakage.

Destructive testing that has been carried out on prototype units are as follows:

- Dropping the device from a height of one meter without any detectable indication of radioactive leakage or significant mechanical damage.

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PROTOTYPE TESTING (Cont'd):

- Heating the device to temperature of 400°C (750°F) to check for lead leakage from the outer steel housing. The results were satisfactory, since no leakage of the molten lead was found. The manufacturer also reported that the source housing remained functional up to melting point of lead.

- According to the ANSI (N538) classification designation for a device, the device achieved a designation of ANSI 44-454-454-R3.

Additionally, the sources have been tested and have achieved a classification of ISO/C-65444 according to DIN 25426 (same ANSI N542-1977) and "Special Form" according to IAEA regulations. Reports on this are given the Bundesanstalt for Material Prufung of the German Government.

EXTERNAL RADIATION LEVELS:

The manufacturer states that the dose rates at the surface of the radioactive housing will not exceed 100 mrem/hr. See attachments 5 and 6 for typical levels.

QUALITY ASSURANCE AND CONTROL:

The manufacturer inspection checks each unit for shutter function within engineering specifications, each source housing is checked for radiation leakage and is swipe tested to demonstrate a removable contamination of less than .005 microcurie (185 Bq).

Each source prior to installation is also wipe tested, bubble tested and assayed for source strength. A copy of the QA procedures are on file with the NRC.

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LIMITATIONS AND/OR OTHER CONSIDERATIONS OF USE:

- This device shall be distributed only to persons specifically licensed by the NRC or an Agreement State.
- The device shall be leak tested at 6 month intervals using techniques capable of detecting 0.005 microcurie (185 Bq) of removal contamination.
- Handling, storage, use, transfer and disposal: To be determined by the licensing authority.
- This registration sheet and the information contained within the references shall not be changed without the written consent of the NRC.

SAFETY ANALYSIS SUMMARY:

The basic construction consists of a heavy outer steel container, the inside of which is filled with lead or tungsten. Mounted eccentrically inside the shielding is a second steel container with the stainless steel source, securely mounted in a vertical position.

The lead itself cannot escape even if molten since the container is completely closed. This permits full radiation protection, even if the temperature is higher than the lead melting point and the lead has been liquified. Tungsten shielding would be similarly contained. The outer steel container is also sufficiently strong to withstand the expansion of the lead at the 400-500°C (752-932°F) range. The overall construction of these units is such as to maintain full containment integrity. It is also impossible for the source to come loose and float at elevated temperature because the source is securely held in place in a special frame, securely welded to the steel inner cylinder. An additional certificate from the Federal Republic of German Materials Testing Institute stated that when the temperature went up over 1000°C (1832°F), no evidence of cracking was evident in the dye test.

As indicated in the text above, these sources are incorporated into mold level control equipment used in conjunction with continuous casters in steel producing facilities.

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SAFETY ANALYSIS SUMMARY (Cont'd):

The source itself is sealed in its stainless steel capsule which is contained in tightly closed housing shielded by lead or tungsten. This will give good protection against the normal mill atmosphere. Construction is such as to provide sufficient strength to withstand all normal operating conditions. The device is designed to maintain containment integrity, even under adverse conditions.

In as much as a large number of these units are in operation throughout the world, the manufacturer claims that its experience shows that the operational safety of the units demonstrated their durability and long trouble free life.

Based on the above and the information referenced below, we continue to conclude that the mold level control source housing is acceptable for distribution to specific licensees.

Furthermore, we conclude that the source housing will be expected to maintain its containment integrity for normal conditions of use and accidental conditions which might occur during uses specified in this certificate.

The U.S. manufacturer requested inactivation for this registration certificate and stated that 121 units were sold. However, the still-in-use figure is not available. Apgee Corp. will continue to perform all services, including source replacement and will no longer commercially distribute this product.

The State of Tennessee issued a registration certificate (TN-1031-D-108-S dated January 26, 2000) for the same device, but included features not specified in the NRC registration certificate such as:

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SAFETY ANALYSIS SUMMARY (Cont'd):

	Tennessee cert.	NRC cert.
Isotope	Co-60 only	Co-60 and Cs-137
Activity	0.5 Ci (18.5 GBq)	0.3 Ci (11.1 GBq) for Co-60 0.5 Ci (18.5 GBq) for Cs-137
Leak test frequency	3 years	6 months
Source housing material	Stainless steel or carbon steel	Carbon steel
Source diameter	80 to 200 mm (3.15 to 7.87")	100 to 240 mm (3.94 to 9.45")
Source length	300 to 1000 mm (11.81 to 39.37")	up to 1600 mm (62.99")
New locking mechanism	included	not specified
Spring-loaded detent	included	not specified

Regarding O-rings between bottom plate and the body of device, NRC Region I issued an Order Modifying License (dated April 9, 1999), requiring the following modifications: (1) O-ring to be replaced; (2) the inner cylinder (shutter) to be coated with "nuclear quality anti-seize" lubricant; (3) the bottom plates to be secured with self-locking washers; and (4) each customer to be instructed to conduct periodic maintenance on the devices, by June 5, 2000.

All of the devices without the modifications specified in the NRC Order were disposed of (sent back to Germany) and replaced with new devices meeting the TN registration certificate.

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REFERENCES:

The following supporting documents for the Berthold mold level control device are hereby incorporated by reference and made a part of this registry document:

- Swank Metacon Systems Company applications dated December 10, 1982, October 15, 1982, and May 20, 1983, with enclosures thereto.
- Swank Metacon Systems Company letters dated December 30, 1982, January 28, 1983, August 16, 1983, and October 25, 1983, with enclosures thereto.
- Berthold Systems, Inc., letter of May 29, 1985 transferring registration responsibility to Berthold Systems.
- Berthold Systems, Inc., letters dated June 10, 1985 and June 17, 1985, with attachments thereto.
- Apgee Corporation letter dated August 8, 1991, September 28, 1991, October 2, 1991, with enclosures thereto.
- Berthold Systems, Inc., letters dated March 28, 2000, and May 4, 2000.

ISSUING AGENCY:

U.S. Nuclear Regulatory Commission

Date: December 15, 2000 Reviewer: /RA/
Seung J. Lee

Date: December 15, 2000 Concurrence: /RA/
John P. Jankovich

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
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No: NR-0112-D-809-S DATE: December 15, 2000 ATTACHMENT 1

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
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No: NR-0112-D-809-S DATE: December 15, 2000 ATTACHMENT 2

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
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No: NR-0112-D-809-S DATE: December 15, 2000 ATTACHMENT 3

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No: NR-0112-D-809-S DATE: December 15, 2000 ATTACHMENT 4

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No: NR-0112-D-809-S DATE: December 15, 2000 ATTACHMENT 5

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
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No: NR-0112-D-809-S DATE: December 15, 2000 ATTACHMENT 6

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
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No: NR-0112-D-809-S DATE: December 15, 2000 ATTACHMENT 7

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
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No: NR-0112-D-809-S DATE: December 15, 2000 ATTACHMENT 8

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
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No: NR-0112-D-809-S DATE: December 15, 2000 ATTACHMENT 9

REGISTRY OF RADIOACTIVE SEALED SOURCES AND DEVICES
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