

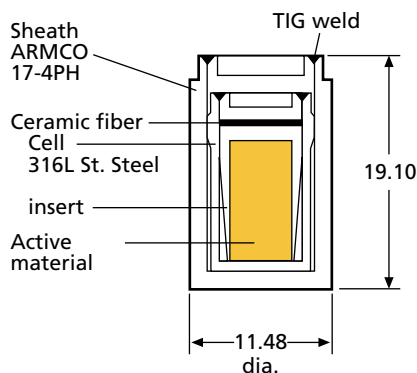
# 2 Ci Cesium-137 gamma well-logging Source model number CDC.CY4

## Description

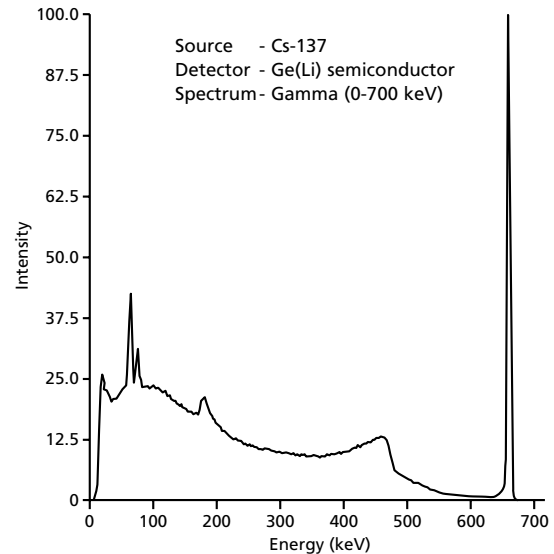
The CDC.CY4 2 Ci Cesium-137 gamma source is specifically designed to meet oil and mineral criteria. This source design is double encapsulated in an Armco 17-4ph stainless steel outer capsule and an AISI 316L inner capsule. The Cs-137 is contained in AEA Technology's unique ceramic matrix to ensure the integrity of the source. The Cs-137 ceramic is manufactured by firing a special Cs-137 compound, finely homogenized SiO<sub>2</sub> and strengthening agents in special casts. A uniform solid ceramic matrix is formed, incorporating the Cesium-137 radionuclide. This matrix is insoluble in almost every ordinary solvent, and immobilized for the most rugged type of abuse during use. AEA Technology has designed this source to be the safest possible encapsulation. This source is registered under model number CDC.CY4 by the NRC, and additionally meets the more stringent requirements of the Texas Regulations for Control of Radiation, Part 36.108(a)(3) and the Louisiana Administration Code 33:XV.2017.A.3.

AEA Technology sources are supplied with certified output measurements. This ensures that the sources supplied consistently meet the specifications required for formation density measurements—a considerable advantage over sources supplied by nominal content alone.

### X.2074



## Gamma Spectrum



## AEA Technology Features

- **Safety**  
All sources are of double encapsulated construction containing the activity in an insoluble and non-dispersible ceramic form. All sources are individually pressure tested to 25,000 psi.
- **Regulatory Approval**  
The CDC CY4 has been registered for well-logging applications by the US Nuclear Regulatory Commission (NRC). Additionally they meet the more stringent requirements of the Texas Regulations for Control of Radiation, Part 36. 108(a)(3) and the Louisiana Administration Code 33:XV.2017.A.3.
- **High Integrity Capsules**  
Only the highest quality stainless steel is used to produce the highest integrity capsules available. All components are built to satisfy criteria for oil well-logging as contained in ANSI N.542-1977. All incoming steels are quarantined in AEA Technology bonded warehouses until accepted by AEA Technology quality control.
- **Stable Output**  
Source to source output will not vary by greater than  $\pm 12\%$  and are usually within  $\pm 5\%$ . Tighter tolerances can be maintained on request. Source design ensures that activity will not move, so output varies with time, only by decay.
- **Loading Facilities**  
Source loading into customer designed bull-plugs or nose caps available upon request.
- **Measurement Assurance**  
AEA Technology participates in intercomparison programs with NIST and other national laboratories to assure output measurement accuracy.

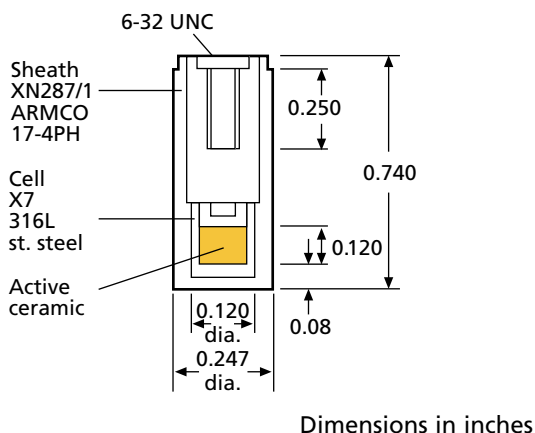
# 300mCi Cesium-137 gamma well-logging Source model number CDC.CY8

## Description

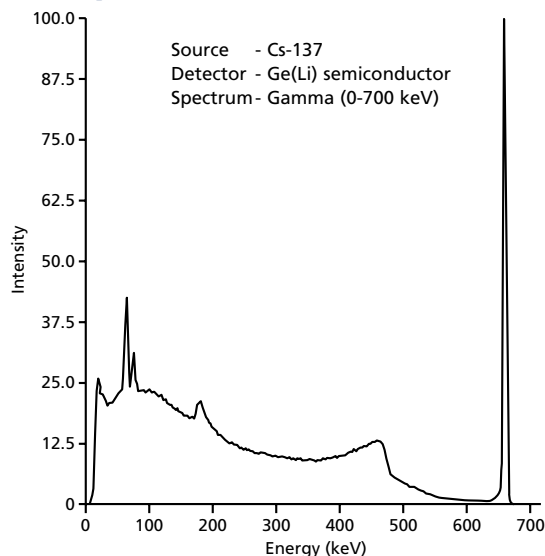
The CDC.CY8 300mCi Cesium-137 gamma source is specifically designed to meet oil and mineral logging criteria. The Cs-137 is contained in a fired ceramic ion exchange pellet which is doubly encapsulated in an Armco 17-4ph stainless steel outer capsule and AISI type 316L stainless steel inner capsule. The source is included in the NRC's sealed source and device registry as Model Number CDC.CY8, and is approved for well-logging under 10CFR39 requirements. Also each source is individually pressure tested to 25,000 psi to meet the more stringent requirements of the Texas Regulations for Control of Radiation, Part 36.108(a)(3) and the Louisiana Administrative Code 33:XV.2017.A.3.

AEA Technology sources are supplied with certified output measurements. This ensures that the sources supplied consistently meet the specifications required for formation density measurements – a considerable advantage over sources supplied by nominal content alone.

## X.2069



## Gamma Spectrum



## AEA Technology Features

- **Safety**  
All sources are of double encapsulated construction containing the activity in an insoluble and non-dispersible ceramic form. All sources are individually pressure tested to 25,000 psi.
- **Regulatory Approval**  
The CDC CY4 has been registered for well-logging applications by the US Nuclear Regulatory Commission (NRC). Additionally they meet the more stringent requirements of the Texas Regulations for Control of Radiation, Part 36. 108(a)(3) and the Louisiana Administration Code 33:XV.2017.A.3.
- **High Integrity Capsules**  
Only the highest quality stainless steel is used to produce the highest integrity capsules available. All components are built to satisfy criteria for oil well-logging as contained in ANSI N.542-1977. All incoming steels are quarantined in AEA Technology bonded warehouses until accepted by AEA Technology quality control.
- **Stable Output**  
Source to source output will not vary by greater than  $\pm 12\%$  and are usually within  $\pm 5\%$ . Tighter tolerances can be maintained on request. Source design ensures that activity will not move, so output varies with time, only by decay.
- **Loading Facilities**  
Source loading into customer designed bull-plugs or nose caps available upon request.
- **Measurement Assurance**  
AEA Technology participates in intercomparison programs with NIST and other national laboratories to assure output measurement accuracy.

# Am/Be Neutron well-logging

## Source model number AMN.CYn series

### Description

AEA Technology's AMN.CYn Am/Be Neutron sources are specifically designed to satisfy oil and mineral logging criteria. These sources have been registered by the NRC under AEA Technology model number AMN.CYn. The sources also meet the more stringent requirements of the Texas Regulations for Control of Radiation, Part 36.108(a)(3) and the Louisiana Administration Code 33:XV.2017.A.3. These source designs feature double encapsulation of the contained activity via a AISI Type 316L stainless steel inner capsule and an Armco 17-4pH stainless steel outer capsule and each source is constructed to individually meet or exceed a 25,000 psi pressure rating. AEA Technology individually pressure tests each source to 25,000 psi (30,000 psi on request).

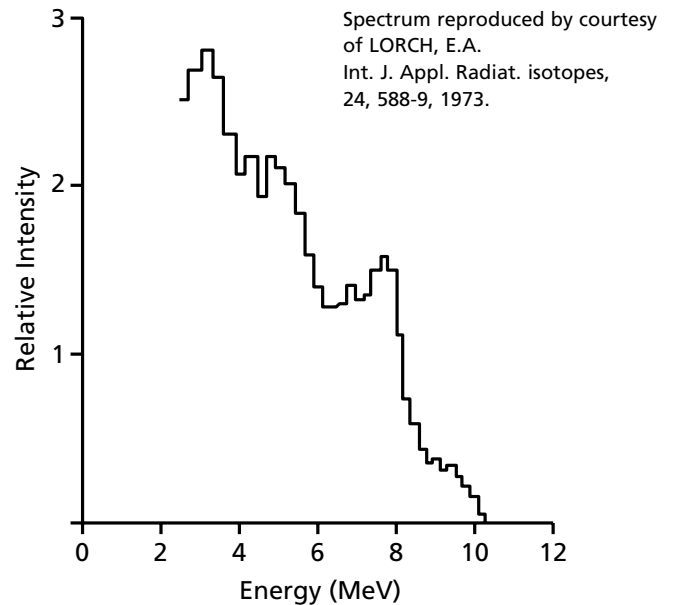
AEA Technology's Am/Be mix is prepared by a method unique to AEA Technology, which minimizes self-absorption of alpha particles within the AmO<sub>2</sub> powder and maximizes the neutron output. AEA Technology sources produce more neutrons per Curie. This mixture is pressed under conditions chosen to ensure that the Beryllium does not segregate after manufacture; the source will deliver constant neutron output over time and does not require regular recalibration. Additionally, sources will be supplied from AEA Technology with tighter source to source specifications than those manufactured by conventional methods. This helps save many hours of calibration time over the life of a tool.

### AEA Technology

- **Safety**  
All sources are of double encapsulated construction. AEA Technology pressure tests each source to 25,000 psi (30,000 psi upon request).
- **Regulatory Approval**  
The AMN.CYn series have been registered as suitable for well-logging applications by the US Nuclear Regulatory Commission (NRC). Additionally, they comply with requirements of the Texas Regulations for Control of Radiation, Part 36.108(a)(3) and the Louisiana Administration Code 33:XV.2017.A.3.

### Neutron spectrum

<sup>241</sup>Am/Be source made and measured at AEA Technology using a stilbene crystal and pulse shape discrimination.



- **High Integrity Capsules**  
Only the highest quality stainless steel is used to produce the highest integrity capsules available. All components are built to satisfy criteria for oil well-logging as contained in ANSI N.542-1977. All incoming steels are quarantined in AEA Technology bonded warehouses until accepted by stringent AEA Technology quality control requirements.
- **High Neutron Output**  
AEA Technology ensures higher neutron output than conventional sources via superior Americium and Beryllium mixing technology.
- **Stable Neutron Outputs**  
Optimized conditions are used to prepare Am/Be pellets, to ensure neutron outputs will not change with time.
- **Loading Facilities**  
Source loading into custom designed bull-plugs or nose caps.
- **Measurement Assurance**  
AEA Technology participates in intercomparison programs with NIST and other national laboratories to assure neutron output measurement accuracy.

## Product Specification

Isotope: Americium-241

Licensing: Registered as NRC model No. AMN.CYn series

Half Life: 433 years

Recommended working life: 15 years

ANSI/ISO classification: E66544 (minimum)

Closure Method: Tungsten Inert Gas Welding

Pellet Composition: <sup>241</sup>Americium Oxide powder mixed with Beryllium powder and pressed into a pellet under pressure.

Capsule Materials: Armco 17-4pH stainless steel outer capsule/AISI Type 316L inner capsule.

Pressure Rating: 25,000 psi, (30,000 psi available on request).

Source Identification: Each source bears engraved data for identification and traceability. Additional labeling as required in the Texas Regulations for control of Radiation, Part 36.108(a)(3) and the Louisiana Administration Code 33:XV.2017.A.3. can be added if needed.

Specific Activity: ~3Ci/gm

Certification: Documentation that source has passed Quality Assurance and Measurement Tests is provided.

Chemical Purity: Highest grade <sup>241</sup>Americium Oxide available.

Isotopic Purity: 95%

Nominal activity Ci	Emission GBq	Capule type	Product code	Model no.
3	111	X2064	AMN.2643	AMN.CY3
5	185	X2064	AMN.2645	AMN.CY3
3	111	X2065	AMN.2653	AMN.CY4
5	185	X2065	AMN.2655	AMN.CY4
5	185	X2066	AMN.2665	AMN.CY5
3	111	X2067	AMN.2673	AMN.CY7
5	185	X2067	AMN.2675	AMN.CY7
10	370	X2007	AMN.2071	AMN.CY10
20	740	X2007	AMN.2072	AMN.CY10

## Nuclear Data: Americium-241

half-life	type of decay	Particle energies and transition probabilities		Electromagnetic transitions	
		energy MeV	transition probability	photon energy MeV	photons emitted per disintegration
(433y)	α	5.387	1.60%	0.026	2.500%
		5.442	12.50%	0.033	0.100%
		5.484	85.20%	0.043	0.100%
		5.511	0.20%	0.0595	35.300%
		5.543	0.34%	0.099	0.020%
		others low		0.103	0.020%
				0.125	0.004%
		others low			
		Np L X-rays ~40% (0.012-0.022)			

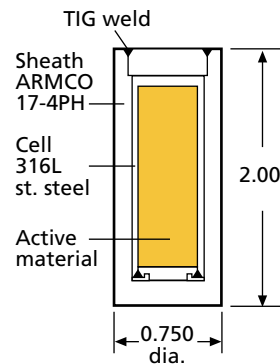
## Source emission data

Neutron emission: ~2.2 x 10<sup>6</sup> n/sec per Ci

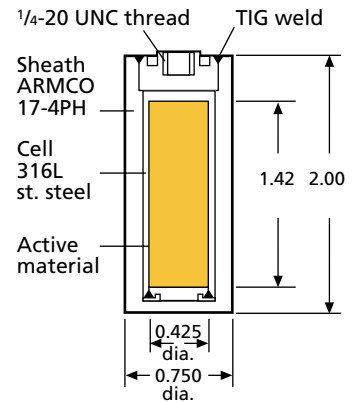
γ-exposure rate: ~2.5mR/hr at 1m per Ci

Neutron does rate: 2.2mrem/hr at 1m per Ci

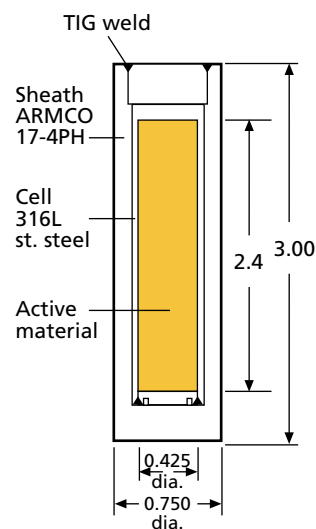
### X.2064



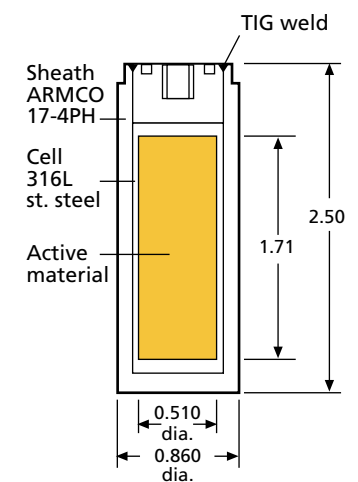
### X.2065



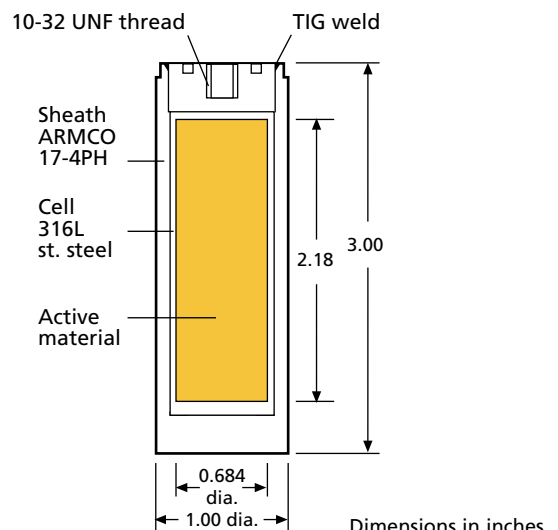
### X.2066



### X.2067



### X.2007



Dimensions in inches

B50