

EXPORT LICENSE

NRC FORM 250P
(12/10)

NRC LICENSE NO.: PXB184.01

Page 1 of 5

NRC DOCKET NO.: 11006143

LICENSE EXPIRES: May 31, 2017



United States of America
Nuclear Regulatory Commission
Washington, D.C. 20555

Pursuant to the Atomic Energy Act of 1954, as amended, and the regulations issued by the Nuclear Regulatory Commission (NRC) pursuant thereto, and in reliance on statements and representations heretofore made by the applicant/licensee, this license is hereby issued authorizing the licensee to export the byproduct materials listed below, subject to the terms and conditions herein. This license is only valid if the licensee or 'Other Party(ies) to Export' maintain the requisite NRC or Agreement State domestic license(s).

<p align="center">LICENSEE</p> <p>Halliburton Energy Services Attn: DJ Johnson 3000 N. Sam Houston Parkway E. Houston, TX 77032 APPLICANT'S REFERENCE: HES3171</p>	<p align="center">ULTIMATE FOREIGN CONSIGNEE(S)</p> <p align="center">Listed on Page 3 thru 5</p>
<p align="center">INTERMEDIATE CONSIGNEE(S) IN FOREIGN COUNTRY(IES)</p> <p align="center">NONE</p>	<p align="center">OTHER PARTY(IES) TO EXPORT</p> <p align="center">Listed on Page 3 thru 5</p>

COUNTRY(IES) OF ULTIMATE DESTINATION: Angola, India, and Pakistan

**CONDITIONS, NOTES, AND DESCRIPTIONS OF 10 CFR PART 110, APPENDIX P,
BYPRODUCT AND SOURCE MATERIALS TO BE EXPORTED**
(NOTE: SEE PAGE 2 FOR DEFINITIONS OF CATEGORY 1 AND CATEGORY 2)

Export to Angola of Category 2 and lesser quantities of Am-241, Am-241/Be and Cs-137; Category 3 quantities of Cf-252 and Cs-137, Category 5 quantities of Co-60; and sub-millicurie quantities of Co-57 and Th-232, for use in oil and gas well logging operations, is authorized. Export to India and Pakistan of Category 2 and Category 3 quantities of Am-241/Be and Cf-252, and Category 3 quantities of Cs-137, for use in oil and gas well logging operations, is authorized. This license does not authorize the export of Th-232 to India or Pakistan. When combined for shipping, these sources may aggregate to a Category 2 quantity. See **Pages 4 and 5 for total number of sources and maximum activity levels for each source.**

Sealed sources will remain in the custody of either Halliburton Energy Services or an authorized ultimate foreign consignee at all times, and when not in use, will be stored in a secure facility controlled either by Halliburton Energy Services or an authorized ultimate foreign consignee.

Licensee is responsible for compliance with all applicable export, and other domestic regulatory requirements, including all terms and conditions of domestic material possession licenses. Licensee, if not already submitted with your application, must submit information required by 10 CFR § 110.32(d) and pertinent documentation required by 10 CFR § 110.32(g) at least **24 hours prior to shipment**. See Page 2 for Mandatory Pre-shipment Notifications.

Licensee shall submit by February 1 of each year one copy of a report of all americium shipments (under this license or under a general license) during the previous calendar year required by 10 CFR § 110.54(b). The report must include: (1) a description of the material, including quantity; (2) approximate shipment dates; (3) a list of recipient countries, end users, and intended use keyed to the items shipped. This license replaces PXB184.00 and amends its authority by: 1) extending the expiration date from September 30, 2016 to May 31, 2017; 2) revising the list of "Ultimate Foreign Consignees"; and 3) adding an additional "Ultimate Foreign Consignees."

Neither this license nor any right under this license shall be assigned or otherwise transferred in violation of the provisions of the Atomic Energy Act of 1954, as amended.

This license is subject to the right of recapture or control by Section 108 of the Atomic Energy Act of 1954, as amended, and to all of the other provisions of said Acts, now or hereafter in effect and to all valid rules and regulations of the NRC.

THIS LICENSE IS INVALID UNLESS SIGNED BELOW
BY AUTHORIZED NRC REPRESENTATIVE

NAME AND TITLE:

David L. Skeen
David L. Skeen, Deputy Director
Office of International Programs

DATE OF ISSUANCE: May 20, 2015

MANDATORY PRE-SHIPMENT NOTIFICATIONS PER 10 CFR PART 110.50(c)

The following Prior Shipment Notifications must be made to both the NRC and, in case of exports, the government of the importing country in advance of each shipment:

Prior Shipment Notifications to the NRC are to be emailed to hoo.hoc@nrc.gov (preferred method) or faxed to the NRC at 301-816-5151. In the subject line of the email or on the fax cover page include: "10 CFR 110.50(c) Notification." For technical assistance, use the same e-mail address or call 301-816-5100.

Prior Shipment Notifications to the government of the importing country must be emailed or faxed to the appropriate foreign government authorities. To locate the point-of-contact for international Prior Shipment Notifications see: <http://www-ns.iaea.org/downloads/rw/imp-export/import-export-contact-points.pdf>. In the subject line of the email or on the fax cover page include: "NOTIFICATION TO THE IMPORTING STATE PRIOR TO SHIPMENT OF CATEGORY 1 OR 2 RADIOACTIVE SOURCES." For technical assistance or for countries not listed, contact the Office of International Programs' export/import staff at 301-415-2344.

Table 1: Appendix P to Part 110.50 Category 1 and Category 2 Radioactive Material Threshold Limits

Radioactive Material	Category 1		Category 2	
	Terabequerels (TBq)	Curies (Ci) ¹	Terabequerels (TBq)	Curies (Ci) ¹
Americium-241 (Am-241)	60	1,600	0.6	16
Americium-241/Beryllium (Am-241/Be)	60	1,600	0.6	16
Californium-252 (Cf-252)	20	540	0.2	5.4
Curium-244 (Cm-244)	50	1,400	0.5	14
Cobalt-60 (Co-60)	30	810	0.3	8.1
Cesium-137 (Cs-137)	100	2,700	1.0	27
Gadolinium-153 (Gd-153)	1,000	27,000	10.0	270
Iridium-192 (Ir-192)	80	2,200	0.8	22
Plutonium-238 ² (Pu-238)	60	1,600	0.6	16
Plutonium-239/Beryllium ² (Pu-239/Be)	60	1,600	0.6	16
Promethium-147 (Pm-147)	40,000	1,100,000	400	11,000
Radium-226 ³ (Ra-226)	40	1,100	0.4	11
Selenium-75 (Se-75)	200	5,400	2.0	54
Strontium-90 (Y-90)	1,000	27,000	10.0	270
Thulium-170 (Tm-170)	20,000	540,000	200	5,400
Ytterbium-169 (Yb-169)	300	8,100	3.0	81

Calculation of Shipments Containing Multiple Sources or Radionuclides:

The 'sum of fractions' methodology for evaluating combinations of radionuclides being transported is to be used when import or export shipments contain multiple sources or multiple radionuclides. The threshold limit values used in a sum of the fractions calculation must be the metric values (i.e., TBq).

I. If multiple sources and/or multiple radionuclides are present in an import or export shipment, the sum of the fractions of the activity of each radionuclide must be determined to verify the shipment is less than the Category 1 or 2 limits of Table 1, as appropriate. If the calculated sum of the fractions ratio, using the following equation, is greater than or equal to 1.0, then the import or export shipment exceeds the threshold limits of Table 1 and the applicable security provisions of this part apply.

II. Use the equation below to calculate the sum of the fractions ratio by inserting the actual activity of the applicable radionuclides or of the individual sources (of the same radionuclides) in the numerator of the equation and the corresponding threshold activity limit from the Table 1 in the denominator of the equation. Ensure the numerator and denominator values are in the same units and all calculations must be performed using the TBq (i.e., metric) values of Table 1.

R1 = activity for radionuclides or source number 1
R2 = activity for radionuclides or source number 2
RN = activity for radionuclides or source number n

AR1 = activity limit for radionuclides or source number 1
AR2 = activity limit for radionuclides or source number 2
ARN = activity limit for radionuclides or source number n

$$\sum_1^n \left[\frac{R_1}{AR_1} + \frac{R_2}{AR_2} + \frac{R_n}{AR_n} \right] \geq 1$$

¹ The values to be used to determine whether a license is required are given in TBq. Curie (Ci) values are provided for practical usefulness only and are rounded after conversion.

² The limits for exports of Pu-238 and Pu-239/Be can be found in § 110.21.

³ Discrete sources of Radium-226.

SOURCES AUTHORIZED FOR SHIPPING TO ANGOLA

ISOTOPE	ACTIVITY	NUMBER OF ISOTOPE	MAXIMUM ACTIVITY PER ISOTOPE	END USE
Am-241	150 mCi	14	2.1 Ci	Geographical Exploration Oil and Gas Well Logging
Co-57	3 mCi	100	300 mCi	Geographical Exploration Oil and Gas Well Logging
Cs-137	1600 nCi	12	19,200 nCi	Geographical Exploration Oil and Gas Well Logging
Cs-137	500 nCi	12	6,000 nCi	Geographical Exploration Oil and Gas Well Logging
Th-232	5 uCi	10	50 uCi	Geographical Exploration Oil and Gas Well Logging
Th-232	2.5 uCi	10	25 uCi	Geographical Exploration Oil and Gas Well Logging
Cs-137	1.78 Ci	12	21.36 Ci	Geographical Exploration Oil and Gas Well Logging
Cs-137	1.5 Ci	12	18 Ci	Geographical Exploration Oil and Gas Well Logging
Am-241	50 nCi	14	700 nCi	Geographical Exploration Oil and Gas Well Logging
Am-241	50 Ci	14	700 Ci	Geographical Exploration Oil and Gas Well Logging
Am-241/Be	15 Ci	14	210 Ci	Geographical Exploration Oil and Gas Well Logging
Am-241/Be	19 Ci	14	266 Ci	Geographical Exploration Oil and Gas Well Logging
Am-241/Be	15 Ci	14	210 Ci	Geographical Exploration Oil and Gas Well Logging
Am-241/Be	500 mCi	17	8.5 Ci	Geographical Exploration Oil and Gas Well Logging
Co-60	1 uCi	100	100 uCi	Geographical Exploration Oil and Gas Well Logging

SOURCES AUTHORIZED FOR SHIPPING TO INDIA

ISOTOPE	ACTIVITY	NUMBER OF ISOTOPE	MAXIMUM ACTIVITY PER ISOTOPE	END USE
Cs-137	2 Ci	18	36 Ci	Geographical Exploration Oil and Gas Well Logging
Am-241/Be	19 Ci	10	190 Ci	Geographical Exploration Oil and Gas Well Logging
Am-241/Be	20 Ci	5	100 Ci	Geographical Exploration Oil and Gas Well Logging
Am-241/Be	15 Ci	14	210 Ci	Geographical Exploration Oil and Gas Well Logging
Cf-252	18 mCi	12	216 mCi	Geographical Exploration Oil and Gas Well Logging
Cs-137	55 mCi	12	660 mCi	Geographical Exploration Oil and Gas Well Logging

SOURCES AUTHORIZED FOR SHIPPING TO PAKISTAN

ISOTOPE	ACTIVITY	NUMBER OF ISOTOPE	MAXIMUM ACTIVITY PER ISOTOPE	END USE
Cf-252	18 Ci	2	36 Ci	Geographical Exploration Oil and Gas Well Logging
Cf-252	18 Ci	2	36 Ci	Geographical Exploration Oil and Gas Well Logging
Cf-252	18 Ci	4	72 Ci	Geographical Exploration Oil and Gas Well Logging
Cs-137	2 Ci	4	8 Ci	Geographical Exploration Oil and Gas Well Logging
Cs-137	2 Ci	4	8 Ci	Geographical Exploration Oil and Gas Well Logging
Cs-137	2 Ci	8	16 Ci	Geographical Exploration Oil and Gas Well Logging
Cs-137	2 Ci	4	8 Ci	Geographical Exploration Oil and Gas Well Logging
Cs-137	2 Ci	4	8 Ci	Geographical Exploration Oil and Gas Well Logging
Cs-137	2 Ci	8	16 Ci	Geographical Exploration Oil and Gas Well Logging
Am-241/Be	8 Ci	2	16 Ci	Geographical Exploration Oil and Gas Well Logging
Am-241/Be	8 Ci	2	16 Ci	Geographical Exploration Oil and Gas Well Logging
Am-241/Be	8 Ci	4	32 Ci	Geographical Exploration Oil and Gas Well Logging

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