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111TH CONGRESS
2^D SESSION**H. R. 3276****[Report No. 111-120]**

 IN THE SENATE OF THE UNITED STATES

NOVEMBER 6, 2009

Received; read twice and referred to the Committee on Energy and Natural
Resources

JANUARY 28, 2010

Reported by Mr. BINGAMAN, with amendments

[Omit the part struck through and insert the part printed in italics]

AN ACT

To promote the production of molybdenum-99 in the United States for medical isotope production, and to condition and phase out the export of highly enriched uranium for the production of medical isotopes.

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*

3 **SECTION 1. SHORT TITLE.**

4 This Act may be cited as the “American Medical Iso-
5 topes Production Act of ~~2009~~2010”.

1 **SEC. 2. FINDINGS.**

2 Congress finds the following:

3 (1) Molybdenum-99 is a critical medical isotope
4 whose decay product technecium-99m is used in ap-
5 proximately two-thirds of all diagnostic medical iso-
6 tope procedures in the United States, or 16 million
7 medical procedures annually, including for the detec-
8 tion of cancer, heart disease, and thyroid disease, in-
9 vestigating the operation of the brain and kidney,
10 imaging stress fractures, and tracking cancer stages.

11 (2) Molybdenum-99 has a half-life of 66 hours,
12 and decays at a rate of approximately one percent
13 per hour after production. As such, molybdenum-99
14 cannot be stockpiled. Instead, molybdenum-99 pro-
15 duction must be scheduled to meet the projected de-
16 mand and any interruption of the supply chain from
17 production, to processing, packaging, distribution,
18 and use can disrupt patient care.

19 (3) There are no facilities within the United
20 States that are dedicated to the production of mo-
21 lybdenum-99 for medical uses. The United States
22 must import molybdenum-99 from foreign produc-
23 tion facilities, and is dependent upon the continued
24 operation of these foreign facilities for millions of
25 critical medical procedures annually.

1 (4) Most reactors in the world which produce
2 molybdenum-99 utilize highly enriched uranium,
3 which can also be used in the construction of nuclear
4 weapons. In January 2009, the National Academy of
5 Sciences encouraged molybdenum-99 producers to
6 convert from highly enriched uranium to low en-
7 riched uranium, and found that there are “no tech-
8 nical reasons that adequate quantities cannot be
9 produced from LEU targets in the future” and that
10 “a 7-10 year phase-out period would likely allow
11 enough time for all current HEU-based producers to
12 convert”.

13 (5) The 51-year-old National Research Uni-
14 versal reactor in Canada, which is responsible for
15 producing approximately sixty percent of United
16 States demand for molybdenum-99 under normal
17 conditions, was shut down unexpectedly May 14,
18 2009, after the discovery of a leak of radioactive
19 water. It is unclear whether the National Research
20 Universal reactor will be able to resume production
21 of molybdenum-99.

22 (6) The United States currently faces an acute
23 shortage of molybdenum-99 and its decay product
24 technetium-99m due to technical problems which

1 have seriously interrupted operations of foreign nu-
2 clear reactors producing molybdenum-99.

3 (7) As a result of the critical shortage of molyb-
4 denum-99, patient care in the United States is suf-
5 fering. Medical procedures requiring technetium-99
6 are being rationed or delayed, and alternative treat-
7 ments which are less effective, more costly, and may
8 result in increased radiation doses to patients are
9 being substituted in lieu of technetium-99.

10 (8) The radioactive isotope molybdenum-99 and
11 its decay product technetium-99m are critical to the
12 health care of Americans, and the continued avail-
13 ability of these isotopes, in a reliable and affordable
14 manner, is in the interest of the United States.

15 (9) The United States should move expedi-
16 tiously to ensure that an adequate and reliable sup-
17 ply of molybdenum-99 can be produced in the
18 United States, without the use of highly enriched
19 uranium.

20 (10) Other important medical isotopes, includ-
21 ing iodine-131 and xenon-133, can be produced as
22 byproducts of the molybdenum-99 fission production
23 process. In January 2009, the National Academy of
24 Sciences concluded that these important medical iso-
25 topes “will be sufficiently available if Mo-99 is avail-

1 able". The coproduction of medically useful isotopes
2 such as iodine-131 and xenon-133 is an important
3 benefit of establishing molybdenum-99 production in
4 the United States without the use of highly enriched
5 uranium, and these coproduced isotopes should also
6 be available for necessary medical uses.

7 (11) The United States should accelerate its ef-
8 forts to convert nuclear reactors worldwide away
9 from the use of highly enriched uranium, which can
10 be used in nuclear weapons, to low enriched ura-
11 nium. Converting nuclear reactors away from the
12 use of highly enriched uranium is a critically impor-
13 tant element of United States efforts to prevent nu-
14 clear terrorism, and supports the goal announced in
15 Prague by President Barack Obama on April 5,
16 2009, to create "a new international effort to secure
17 all vulnerable nuclear material around the world
18 within four years".

19 (12) The United States is engaged in an effort
20 to convert civilian nuclear test and research reactors
21 from highly enriched uranium fuel to low enriched
22 uranium fuel through the Global Threat Reduction
23 Initiative. As of September 2009, this program has
24 successfully converted 17 reactors in the United
25 States to low enriched uranium fuel, some of which

1 are capable of producing molybdenum-99 for medical
2 uses.

3 **SEC. 3-2. IMPROVING THE RELIABILITY OF DOMESTIC MED-**
4 **ICAL ISOTOPE SUPPLY.**

5 (a) MEDICAL ISOTOPE DEVELOPMENT PROJECTS.—

6 (1) IN GENERAL.—The Secretary of Energy
7 shall establish a program to evaluate and support
8 projects for the production in the United States,
9 without the use of highly enriched uranium, of sig-
10 nificant quantities of molybdenum-99 for medical
11 uses: *shall establish a technology-neutral program—*

12 *(A) to evaluate and support projects for the*
13 *production in the United States, without the use*
14 *of highly enriched uranium, of significant quan-*
15 *tities of molybdenum-99 for medical uses;*

16 *(B) to be carried out in cooperation with*
17 *non-Federal entities; and*

18 *(C) the costs of which shall be shared in ac-*
19 *cordance with section 988 of the Energy Policy*
20 *Act of 2005 (42 U.S.C. 16352).*

21 (2) CRITERIA.—Projects shall be judged against
22 the following primary criteria:

23 (A) The length of time necessary for the
24 proposed project to begin production of molyb-

1 denum-99 for medical uses within the United
2 States.

3 (B) The capability of the proposed project
4 to produce a significant percentage of United
5 States demand for molybdenum-99 for medical
6 uses.

7 (C) The cost of the proposed project.

8 (3) EXEMPTION.—An existing reactor fueled
9 with highly enriched uranium shall not be disquali-
10 fied from the program if the Secretary of Energy de-
11 termines that—

12 (A) there is no alternative nuclear reactor
13 fuel, enriched in the isotope U-235 to less than
14 20 percent, that can be used in that reactor;

15 (B) the reactor operator has provided as-
16 surances that, whenever an alternative nuclear
17 reactor fuel, enriched in the isotope U-235 to
18 less than 20 percent, can be used in that reac-
19 tor, it will use that alternative in lieu of highly
20 enriched uranium; and

21 (C) the reactor operator has provided a
22 current report on the status of its efforts to
23 convert the reactor to an alternative nuclear re-
24 actor fuel enriched in the isotope U-235 to less

1 than 20 percent, and an anticipated schedule
2 for completion of conversion.

3 (4) *PUBLIC PARTICIPATION AND REVIEW.*—*The*
4 *Secretary of Energy shall—*

5 (A) *develop a program plan and annually*
6 *update the program plan through public work-*
7 *shops; and*

8 (B) *use the Nuclear Science Advisory Com-*
9 *mittee to conduct annual reviews of the progress*
10 *made in achieving the program goals.*

11 ~~(4)~~(5) *AUTHORIZATION OF APPROPRIATIONS.*—

12 There are authorized to be appropriated to the Sec-
13 retary of Energy for carrying out the program under
14 paragraph (1) \$163,000,000 for the period encom-
15 passing fiscal years 2010 through 2014.

16 (b) *DEVELOPMENT ASSISTANCE.*—*The Secretary of*
17 *Energy shall establish a program to provide assistance*
18 *for—*

19 (1) *the development of fuels, targets, and proc-*
20 *esses for domestic molybdenum-99 production that*
21 *do not use highly enriched uranium; and*

22 (2) *commercial operations using the fuels, tar-*
23 *gets, and processes described in paragraph (1).*

24 (c) *URANIUM LEASE AND TAKE BACK.*—*The Sec-*
25 *retary of Energy shall establish a program to make low*

1 enriched uranium available, through lease contracts, for
2 irradiation for the production of molybdenum-99 for med-
3 ical uses. The lease contracts shall provide for the Sec-
4 retary to retain responsibility for the final disposition of
5 radioactive waste created by the irradiation, processing,
6 or purification of leased uranium. The lease contracts
7 shall also provide for compensation in cash amounts equiv-
8 alent to prevailing market rates for the sale of comparable
9 uranium products and for compensation in cash amounts
10 equivalent to the net present value of the cost to the Fed-
11 eral Government for the final disposition of such radio-
12 active waste, provided that the discount rate used to deter-
13 mine the net present value of such costs shall be no great-
14 er than the average interest rate on marketable Treasury
15 securities. The Secretary shall not barter or otherwise sell
16 or transfer uranium in any form in exchange for services
17 related to final disposition of the radioactive waste from
18 such leased uranium.

19 **SEC. 4.3. EXPORTS.**

20 Section 134 of the Atomic Energy Act of 1954 (42
21 U.S.C. ~~2160d(b)~~2160d) is amended by striking subsections
22 b. and c. and inserting in lieu thereof the following:

23 “b. Effective 7 years after the date of enactment of
24 the American Medical Isotopes Production Act of
25 ~~2009~~2010, the Commission may not issue a license for the

1 export of highly enriched uranium from the United States
2 for the purposes of medical isotope production.

3 “c. The period referred to in subsection b. may be
4 extended for no more than ~~four~~ 6 years if, no earlier than
5 6 years after the date of enactment of the American Med-
6 ical Isotopes Production Act of ~~2009~~2010, the Secretary
7 of Energy certifies to the Committee on Energy and Com-
8 merce of the House of Representatives and the Committee
9 on Energy and Natural Resources of the Senate that—

10 “(1) there is insufficient global supply of molyb-
11 denum-99 produced without the use of highly en-
12 riched uranium available to satisfy the domestic
13 United States market; and

14 “(2) the export of United States-origin highly
15 enriched uranium for the purposes of medical iso-
16 tope production is the most effective temporary
17 means to increase the supply of molybdenum-99 to
18 the domestic United States market.

19 “d. *To ensure public review and comment, the develop-*
20 *ment of the certification described in subsection c. shall be*
21 *carried out through announcement in the Federal Register.*

22 “~~d~~.e. At any time after the restriction of export li-
23 censes provided for in subsection b. becomes effective, if
24 there is a critical shortage in the supply of molybdenum-
25 99 available to satisfy the domestic United States medical

1 isotope needs, the restriction of export licenses may be
2 suspended for a period of no more than 12 months, if—

3 “(1) the Secretary of Energy certifies to the
4 Congress that the export of United States-origin
5 highly enriched uranium for the purposes of medical
6 isotope production is the only effective temporary
7 means to increase the supply of molybdenum-99 nec-
8 essary to meet United States medical isotope needs
9 during that period; and

10 “(2) the Congress ~~passes~~*enacts* a Joint Resolu-
11 tion approving the temporary suspension of the re-
12 striction of export licenses.

13 *“e.f.* As used in this section—

14 “(1) the term ‘alternative nuclear reactor fuel
15 or target’ means a nuclear reactor fuel or target
16 which is enriched to less than 20 percent in the iso-
17 tope U-235;

18 “(2) the term ‘highly enriched uranium’ means
19 uranium enriched to 20 percent or more in the iso-
20 tope U-235;

21 “(3) a fuel or target ‘can be used’ in a nuclear
22 research or test reactor if—

23 “(A) the fuel or target has been qualified
24 by the Reduced Enrichment Research and Test

1 Reactor Program of the Department of Energy;
2 and

3 “(B) use of the fuel or target will permit
4 the large majority of ongoing and planned ex-
5 periments and isotope production to be con-
6 ducted in the reactor without a large percentage
7 increase in the total cost of operating the reac-
8 tor; and

9 “(4) the term ‘medical isotope’ includes molyb-
10 denum-99, iodine-131, xenon-133, and other radio-
11 active materials used to produce a radiopharma-
12 ceutical for diagnostic, therapeutic procedures or for
13 research and development.”.

14 **SEC. 5.4. REPORT ON DISPOSITION OF EXPORTS.**

15 Not later than 1 year after the date of the enactment
16 of this Act, the Chairman of the Nuclear Regulatory Com-
17 mission, after consulting with other relevant agencies,
18 shall submit to the Congress a report detailing the current
19 disposition of previous United States exports of highly en-
20 riched uranium, including—

- 21 (1) their location;
22 (2) whether they are irradiated;
23 (3) whether they have been used for the pur-
24 pose stated in their export license;

1 (4) whether they have been used for an alter-
2 native purpose and, if so, whether such alternative
3 purpose has been explicitly approved by the Commis-
4 sion;

5 (5) the year of export, and reimportation, if ap-
6 plicable;

7 (6) their current physical and chemical forms;
8 and

9 (7) whether they are being stored in a manner
10 which adequately protects against theft and unau-
11 thorized access.

12 **SEC. 6.5. DOMESTIC MEDICAL ISOTOPE PRODUCTION.**

13 (a) IN GENERAL.—Chapter 10 of the Atomic Energy
14 Act of 1954 (42 U.S.C. 2131 et seq.) is amended by add-
15 ing at the end the following new section:

16 “SEC. 112. DOMESTIC MEDICAL ISOTOPE PRODUC-
17 TION. a. The Commission may issue a license, or grant
18 an amendment to an existing license, for the use in the
19 United States of highly enriched uranium as a target for
20 medical isotope production in a nuclear reactor, only if,
21 in addition to any other requirement of this Act—

22 “(1) the Commission determines that—

23 “(A) there is no alternative medical isotope
24 production target, enriched in the isotope U-

1 235 to less than 20 percent, that can be used
2 in that reactor; and

3 “(B) the proposed recipient of the medical
4 isotope production target has provided assur-
5 ances that, whenever an alternative medical iso-
6 tope production target can be used in that reac-
7 tor, it will use that alternative in lieu of highly
8 enriched uranium; and

9 “(2) the Secretary of Energy has certified that
10 the United States Government is actively supporting
11 the development of an alternative medical isotope
12 production target that can be used in that reactor.

13 “b. As used in this section—

14 “(1) the term ‘alternative medical isotope pro-
15 duction target’ means a nuclear reactor target which
16 is enriched to less than 20 percent of the isotope U-
17 235;

18 “(2) a target ‘can be used’ in a nuclear re-
19 search or test reactor if—

20 “(A) the target has been qualified by the
21 Reduced Enrichment Research and Test Reac-
22 tor Program of the Department of Energy; and

23 “(B) use of the target will permit the large
24 majority of ongoing and planned experiments
25 and isotope production to be conducted in the

1 reactor without a large percentage increase in
2 the total cost of operating the reactor;

3 “(3) the term ‘highly enriched uranium’ means
4 uranium enriched to 20 percent or more in the iso-
5 tope U-235; and

6 “(4) the term ‘medical isotope’ includes molyb-
7 denum-99, iodine-131, xenon-133, and other radio-
8 active materials used to produce a radiopharma-
9 ceutical for diagnostic, therapeutic procedures or for
10 research and development.”.

11 (b) TABLE OF CONTENTS.—The table of contents for
12 the Atomic Energy Act of 1954 is amended by inserting
13 the following new item ~~after the item relating to section~~
14 ~~111:~~ *at the end of the items relating to chapter 10 of title*
15 *I:*

“Sec. 112. Domestic medical isotope production.”.

16 **SEC. 7.6. ANNUAL DEPARTMENT OF ENERGY REPORTS.**

17 The Secretary of Energy shall report to Congress no
18 later than one year after the date of enactment of this
19 Act, and annually thereafter for 5 years, on Department
20 of Energy actions to support the production in the United
21 States, without the use of highly enriched uranium, of mo-
22 lybdenum-99 for medical uses. These reports shall include
23 the following:

24 (1) For medical isotope development projects—

1 (A) the names of any recipients of Depart-
2 ment of Energy support under ~~section 3~~ *section*
3 *2* of this Act;

4 (B) the amount of Department of Energy
5 funding committed to each project;

6 (C) the milestones expected to be reached
7 for each project during the year for which sup-
8 port is provided;

9 (D) how each project is expected to sup-
10 port the increased production of molybdenum-
11 99 for medical uses;

12 (E) the findings of the evaluation of
13 projects under section ~~3(a)(2)~~ *2(a)(2)* of this
14 Act; and

15 (F) the ultimate use of any Department of
16 Energy funds used to support projects under
17 ~~section 3~~ *section 2* of this Act.

18 (2) A description of actions taken in the pre-
19 vious year by the Secretary of Energy to ensure the
20 safe disposition of radioactive waste from used mo-
21 lybdenum-99 targets.

22 **SEC. 8.7. NATIONAL ACADEMY OF SCIENCES REPORT.**

23 The Secretary of Energy shall enter into an arrange-
24 ment with the National Academy of Sciences to conduct
25 a study of the state of molybdenum-99 production and uti-

1 lization, to be provided to the Congress not later than 5
2 years after the date of enactment of this Act. This report
3 shall include the following:

4 (1) For molybdenum-99 production—

5 (A) a list of all facilities in the world pro-
6 ducing molybdenum-99 for medical uses, includ-
7 ing an indication of whether these facilities use
8 highly enriched uranium in any way;

9 (B) a review of international production of
10 molybdenum-99 over the previous 5 years, in-
11 cluding—

12 (i) whether any new production was
13 brought online;

14 (ii) whether any facilities halted pro-
15 duction unexpectedly; and

16 (iii) whether any facilities used for
17 production were decommissioned or other-
18 wise permanently removed from service;
19 and

20 (C) an assessment of progress made in the
21 previous 5 years toward establishing domestic
22 production of molybdenum-99 for medical uses,
23 including the extent to which other medical iso-
24 topes ~~coproduced~~ *that have been produced* with

1 molybdenum-99, such as iodine-131 and xenon-
2 133, are being used for medical purposes.

3 (2) An assessment of the progress made by the
4 Department of Energy and others to eliminate all
5 worldwide use of highly enriched uranium in reactor
6 fuel, reactor targets, and medical isotope production
7 facilities.

8 **SEC. 9.8. DEFINITIONS.**

9 In this Act the following definitions apply:

10 (1) **HIGHLY ENRICHED URANIUM.**—The term
11 “highly enriched uranium” means uranium enriched
12 to 20 percent or greater in the isotope U-235.

13 (2) **LOW ENRICHED URANIUM.**—The term “low
14 enriched uranium” means uranium enriched to less
15 than 20 percent in the isotope U-235.

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