

111<sup>TH</sup> CONGRESS  
1<sup>ST</sup> SESSION

# H. R. 3276

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## 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,*

1 **SECTION 1. SHORT TITLE.**

2 This Act may be cited as the “American Medical Iso-  
3 topes Production Act of 2009”.

4 **SEC. 2. FINDINGS.**

5 Congress finds the following:

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

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

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

1 operation of these foreign facilities for millions of  
2 critical medical procedures annually.

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

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

24 (6) The United States currently faces an acute  
25 shortage of molybdenum-99 and its decay product

1       technetium-99m due to technical problems which  
2       have seriously interrupted operations of foreign nu-  
3       clear reactors producing molybdenum-99.

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

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

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

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

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

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

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

1 States to low enriched uranium fuel, some of which  
2 are capable of producing molybdenum-99 for medical  
3 uses.

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

6 (a) **MEDICAL ISOTOPE DEVELOPMENT PROJECTS.—**

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

13 (2) **CRITERIA.—**Projects shall be judged against  
14 the following primary criteria:

15 (A) The length of time necessary for the  
16 proposed project to begin production of molyb-  
17 denum-99 for medical uses within the United  
18 States.

19 (B) The capability of the proposed project  
20 to produce a significant percentage of United  
21 States demand for molybdenum-99 for medical  
22 uses.

23 (C) The cost of the proposed project.

24 (3) **EXEMPTION.—**An existing reactor fueled  
25 with highly enriched uranium shall not be disquali-

1       fied from the program if the Secretary of Energy de-  
2       termines that—

3               (A) there is no alternative nuclear reactor  
4       fuel, enriched in the isotope U-235 to less than  
5       20 percent, that can be used in that reactor;

6               (B) the reactor operator has provided as-  
7       surances that, whenever an alternative nuclear  
8       reactor fuel, enriched in the isotope U-235 to  
9       less than 20 percent, can be used in that reac-  
10      tor, it will use that alternative in lieu of highly  
11      enriched uranium; and

12              (C) the reactor operator has provided a  
13      current report on the status of its efforts to  
14      convert the reactor to an alternative nuclear re-  
15      actor fuel enriched in the isotope U-235 to less  
16      than 20 percent, and an anticipated schedule  
17      for completion of conversion.

18              (4) AUTHORIZATION OF APPROPRIATIONS.—

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

23              (b) DEVELOPMENT ASSISTANCE.—The Secretary of  
24      Energy shall establish a program to provide assistance  
25      for—

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

4           (2) commercial operations using the fuels, tar-  
5           gets, and processes described in paragraph (1).

6           (c) URANIUM LEASE AND TAKE BACK.—The Sec-  
7           retary of Energy shall establish a program to make low  
8           enriched uranium available, through lease contracts, for  
9           irradiation for the production of molybdenum-99 for med-  
10          ical uses. The lease contracts shall provide for the Sec-  
11          retary to retain responsibility for the final disposition of  
12          radioactive waste created by the irradiation, processing,  
13          or purification of leased uranium. The lease contracts  
14          shall also provide for compensation in cash amounts equiv-  
15          alent to prevailing market rates for the sale of comparable  
16          uranium products and for compensation in cash amounts  
17          equivalent to the net present value of the cost to the Fed-  
18          eral Government for the final disposition of such radio-  
19          active waste, provided that the discount rate used to deter-  
20          mine the net present value of such costs shall be no great-  
21          er than the average interest rate on marketable Treasury  
22          securities. The Secretary shall not barter or otherwise sell  
23          or transfer uranium in any form in exchange for services  
24          related to final disposition of the radioactive waste from  
25          such leased uranium.



1 **SEC. 4. EXPORTS.**

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

5 “b. Effective 7 years after the date of enactment of  
6 the American Medical Isotopes Production Act of 2009,  
7 the Commission may not issue a license for the export of  
8 highly enriched uranium from the United States for the  
9 purposes of medical isotope production.

10 “c. The period referred to in subsection b. may be  
11 extended for no more than four years if, no earlier than  
12 6 years after the date of enactment of the American Med-  
13 ical Isotopes Production Act of 2009, the Secretary of En-  
14 ergy certifies to the Committee on Energy and Commerce  
15 of the House of Representatives and the Committee on  
16 Energy and Natural Resources of the Senate that—

17 “(1) there is insufficient global supply of molyb-  
18 denum-99 produced without the use of highly en-  
19 riched uranium available to satisfy the domestic  
20 United States market; and

21 “(2) the export of United States-origin highly  
22 enriched uranium for the purposes of medical iso-  
23 tope production is the most effective temporary  
24 means to increase the supply of molybdenum-99 to  
25 the domestic United States market.

1       “d. At any time after the restriction of export licenses  
2 provided for in subsection b. becomes effective, if there  
3 is a critical shortage in the supply of molybdenum-99  
4 available to satisfy the domestic United States medical iso-  
5 tope needs, the restriction of export licenses may be sus-  
6 pended for a period of no more than 12 months, if—

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

14           “(2) the Congress passes a Joint Resolution ap-  
15 proving the temporary suspension of the restriction  
16 of export licenses.

17       “e. As used in this section—

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

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

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

3           “(A) the fuel or target has been qualified  
4 by the Reduced Enrichment Research and Test  
5 Reactor Program of the Department of Energy;  
6 and

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

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

18 **SEC. 5. REPORT ON DISPOSITION OF EXPORTS.**

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

25           (1) their location;

1 (2) whether they are irradiated;

2 (3) whether they have been used for the pur-  
3 pose stated in their export license;

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

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

10 (6) their current physical and chemical forms;  
11 and

12 (7) whether they are being stored in a manner  
13 which adequately protects against theft and unau-  
14 thorized access.

15 **SEC. 6. DOMESTIC MEDICAL ISOTOPE PRODUCTION.**

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

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

25 “(1) the Commission determines that—

1           “(A) there is no alternative medical isotope  
2           production target, enriched in the isotope U-  
3           235 to less than 20 percent, that can be used  
4           in that reactor; and

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

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

15          “b. As used in this section—

16                 “(1) the term ‘alternative medical isotope pro-  
17                 duction target’ means a nuclear reactor target which  
18                 is enriched to less than 20 percent of the isotope U-  
19                 235;

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

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

1           “(B) use of the target will permit the large  
2           majority of ongoing and planned experiments  
3           and isotope production to be conducted in the  
4           reactor without a large percentage increase in  
5           the total cost of operating the reactor;

6           “(3) the term ‘highly enriched uranium’ means  
7           uranium enriched to 20 percent or more in the iso-  
8           tope U-235; 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          (b) TABLE OF CONTENTS.—The table of contents for  
15          the Atomic Energy Act of 1954 is amended by inserting  
16          the following new item after the item relating to section  
17          111:

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

18          **SEC. 7. ANNUAL DEPARTMENT OF ENERGY REPORTS.**

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

1 (1) For medical isotope development projects—

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

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

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

10 (D) how each project is expected to sup-  
11 port the increased production of molybdenum-  
12 99 for medical uses;

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

15 (F) the ultimate use of any Department of  
16 Energy funds used to support projects under  
17 section 3 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. 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 with molybdenum-99, such as



1 iodine-131 and xenon-133, are being used for  
2 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. 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.

Passed the House of Representatives November 5,  
2009.

Attest:

*Clerk.*

111<sup>TH</sup> CONGRESS  
1<sup>ST</sup> SESSION

**H. R. 3276**

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**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.