

117TH CONGRESS  
2D SESSION

# S. 4242

To provide for the preservation and storage of uranium-233 to foster development of thorium molten-salt reactors, and for other purposes.

---

## IN THE SENATE OF THE UNITED STATES

MAY 18 (legislative day, MAY 17), 2022

Mr. TUBERVILLE (for himself and Mr. MARSHALL) introduced the following bill; which was read twice and referred to the Committee on Energy and Natural Resources

---

## A BILL

To provide for the preservation and storage of uranium-233 to foster development of thorium molten-salt reactors, and for other purposes.

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 “Thorium Energy Secu-  
5 rity Act of 2022”.

6 **SEC. 2. FINDINGS.**

7 Congress makes the following findings:

8 (1) Thorium molten-salt reactor technology was  
9 originally developed in the United States, primarily

1 at the Oak Ridge National Laboratory in the State  
2 of Tennessee under the Molten-Salt Reactor Pro-  
3 gram.

4 (2) Before the cancellation of that program in  
5 1976, the technology developed at the Oak Ridge  
6 National Laboratory was moving steadily toward ef-  
7 ficient utilization of the natural thorium energy re-  
8 source, which exists in substantial amounts in many  
9 parts of the United States, and requires no isotopic  
10 enrichment.

11 (3) The People's Republic of China is known to  
12 be pursuing the development of molten-salt reactor  
13 technology based on a thorium fuel cycle.

14 (4) Thorium itself is not fissile, but fertile, and  
15 requires fissile material to begin a nuclear chain re-  
16 action. This largely accounts for its exclusion for nu-  
17 clear weapons developments.

18 (5) Uranium-233, derived from neutron absorp-  
19 tion by natural thorium, is the ideal candidate for  
20 the fissile material to start a thorium reactor, and  
21 is the only fissile material candidate that can mini-  
22 mize the production of long-lived transuranic ele-  
23 ments like plutonium, which have proven a great  
24 challenge to the management of existing spent nu-  
25 clear fuel.

1           (6) Geologic disposal of spent nuclear fuel from  
2 conventional nuclear reactors continues to pose se-  
3 vere political and technical challenges, and costs  
4 United States taxpayers more than \$500,000,000  
5 annually in court-mandated payments to electrical  
6 utilities operating nuclear reactors.

7           (7) The United States possesses the largest  
8 known inventory of separated uranium-233 in the  
9 world, aggregated at the Oak Ridge National Lab-  
10 oratory.

11           (8) Oak Ridge National Laboratory building  
12 3019 was designated in 1962 as the national reposi-  
13 tory for uranium-233 storage, and its inventory  
14 eventually grew to about 450 kilograms of separated  
15 uranium-233, along with approximately 1,000 kilo-  
16 grams of mixed fissile uranium from the Consoli-  
17 dated Edison Uranium Solidification Program (com-  
18 monly referred to as “CEUSP”), divided into ap-  
19 proximately 1,100 containers.

20           (9) The Defense Nuclear Facilities Safety  
21 Board issued Recommendation 97-1 (relating to  
22 safe storage of uranium-233) in 1997 because of the  
23 possibility of corrosion or other degradation around  
24 the storage of uranium-233 in a building that was  
25 built in 1943.

1           (10) In response, the Department of Energy  
2 published Decision Memorandum No. 2 in 2001 con-  
3 cluding that no Department of Energy programs  
4 needed uranium-233 and directed that a contract be  
5 placed for disposition of the uranium-233 inventory  
6 and decommissioning of its storage facility.

7           (11) The Department of Energy awarded a con-  
8 tract for the irreversible downblending of uranium-  
9 233 with uranium-238 and its geologic disposal in  
10 Nevada, which downblending would create a waste  
11 form that would pose radiological hazards for hun-  
12 dreds of thousands of years, rather than to consider  
13 uranium-233 as a useful national asset.

14           (12) All 1,000 kilograms of CEUSP uranium-  
15 233-based material have been dispositioned (but not  
16 downblended) but those containers had little useful  
17 uranium-233 in them. The majority of separated  
18 and valuable uranium-233 remains uncontaminated  
19 by uranium-238 and suitable for thorium fuel cycle  
20 research and development. That remaining inventory  
21 constitutes the largest supply of uranium-233 known  
22 to exist in the world today.

23           (13) The United States has significant domestic  
24 reserves of thorium in accessible high-grade deposits,  
25 which can provide thousands of years of clean en-

1       ergy if used efficiently in a liquid-fluoride reactor  
2       initially started with uranium-233.

3           (14) Recently (as of the date of the enactment  
4       of this Act), the Department of Energy has chosen  
5       to fund a series of advanced reactors that are all de-  
6       pendent on initial inventories and regular resupplies  
7       of high-assay, low-enriched uranium.

8           (15) There is no domestic source of high-assay,  
9       low-enriched uranium fuel, and there are no avail-  
10      able estimates as to how long the development of a  
11      domestic supply of that fuel would take or how ex-  
12      pensive such development would be.

13          (16) The only viable source of high-assay, low-  
14      enriched uranium fuel is through continuous import  
15      from sources in the Russian Federation.

16          (17) The political situation with the Russian  
17      Federation as of the date of the enactment of this  
18      Act is sufficiently uncertain that it would be unwise  
19      for United States-funded advanced reactor develop-  
20      ment to rely on high-assay, low-enriched uranium  
21      since the Russian Federation would be the primary  
22      source and can be expected to undercut any future  
23      United States production, resulting in a dependency  
24      on high-assay, low-enriched uranium from the Rus-  
25      sian Federation.

1           (18) The United States has abandoned the de-  
2           velopment of a geologic repository at Yucca Moun-  
3           tain and is seeking a consenting community to allow  
4           interim storage of spent nuclear fuel, but valid con-  
5           cerns persist that an interim storage facility will be-  
6           come a permanent storage facility.

7           (19) Without a closed fuel cycle, high-assay,  
8           low-enriched uranium-fueled reactors inevitably will  
9           produce long-lived wastes that presently have no dis-  
10          position pathway.

11          (20) The United States possesses enough ura-  
12          nium-233 to support further research and develop-  
13          ment as well as fuel the startup of several thorium  
14          reactors. Thorium reactors do not require additional  
15          fuel or high-assay, low-enriched uranium from the  
16          Russian Federation.

17          (21) Continuing the irreversible destruction of  
18          uranium-233 precludes privately funded development  
19          of the thorium fuel cycle, which would have long  
20          term national and economic security implications.

21 **SEC. 3. SENSE OF CONGRESS.**

22          It is the sense of Congress that—

23               (1) it is in the best economic and national secu-  
24               rity interests of the United States to resume devel-  
25               opment of thorium molten-salt reactors that can

1 minimize long-lived waste production, in consider-  
2 ation of—

3 (A) the pursuit by the People’s Republic of  
4 China of thorium molten-salt reactors and asso-  
5 ciated cooperative research agreements with  
6 United States national laboratories; and

7 (B) the present impasse around the geo-  
8 logical disposal of nuclear waste;

9 (2) that the development of thorium molten-salt  
10 reactors is consistent with section 1261 of the John  
11 S. McCain National Defense Authorization Act for  
12 Fiscal Year 2019 (Public Law 115–232; 132 Stat.  
13 2060), which declared long-term strategic competi-  
14 tion with the People’s Republic of China as “a prin-  
15 cipal priority for the United States”; and

16 (3) to resume such development, it is necessary  
17 to relocate as much of the uranium-233 remaining  
18 at Oak Ridge National Laboratory as possible to  
19 new secure storage.

20 **SEC. 4. DEFINITIONS.**

21 In this Act:

22 (1) CONGRESSIONAL DEFENSE COMMITTEES.—  
23 The term “congressional defense committees” has  
24 the meaning given that term in section 101(a) of  
25 title 10, United States Code.

1           (2) DOWNBLEND.—The term “downblend”  
2 means the process of adding a chemically identical  
3 isotope to an inventory of fissile material in order to  
4 degrade its nuclear value.

5           (3) FISSILE MATERIAL.—The term “fissile ma-  
6 terial” refers to uranium-233, uranium-235, pluto-  
7 nium-239, or plutonium-241.

8           (4) HIGH-ASSAY, LOW-ENRICHED URANIUM.—  
9 The term “high-assay, low-enriched uranium” (com-  
10 monly referred to as “HALEU”) means a mixture  
11 of uranium isotopes very nearly but not equaling or  
12 exceeding 20 percent of the isotope uranium-235.

13           (5) TRANSURANIC ELEMENT.—The term  
14 “transuranic element” means an element with an  
15 atomic number greater than the atomic number of  
16 uranium (92), such as neptunium, plutonium, ameri-  
17 cium, or curium.

18 **SEC. 5. PRESERVATION OF URANIUM-233 TO FOSTER DE-**  
19 **VELOPMENT OF THORIUM MOLTEN-SALT RE-**  
20 **ACTORS.**

21           The Secretary of Energy shall preserve uranium-233  
22 inventories that have not been contaminated with ura-  
23 nium-238, with the goal of fostering development of tho-  
24 rium molten-salt reactors by United States industry.



1 **SEC. 6. STORAGE OF URANIUM-233.**

2 (a) REPORT ON LONG-TERM STORAGE OF URANIUM-  
3 233.—Not later than 120 days after the date of the enact-  
4 ment of this Act, the Secretary of Energy, in consultation  
5 with the heads of other relevant agencies, shall submit to  
6 Congress a report identifying a suitable location for, or  
7 a location that can be modified for, secure long-term stor-  
8 age of uranium-233.

9 (b) REPORT ON INTERIM STORAGE OF URANIUM-  
10 233.—Not later than 120 days after the date of the enact-  
11 ment of this Act, the Chief of Engineers shall submit to  
12 Congress a report identifying a suitable location for secure  
13 interim storage of uranium-233.

14 (c) REPORT ON CONSTRUCTION OF URANIUM-233  
15 STORAGE FACILITY AT REDSTONE ARSENAL.—Not later  
16 than 240 days after the date of the enactment of this Act,  
17 the Chief of Engineers shall submit to Congress a report  
18 on the costs of constructing a permanent, secure storage  
19 facility for uranium-233 at Redstone Arsenal, Alabama,  
20 that is also suitable for chemical processing of uranium-  
21 233 pursuant to a public-private partnership with thorium  
22 reactor developers.

23 (d) FUNDING.—Notwithstanding any other provision  
24 of law, amounts authorized to be appropriated or other-  
25 wise made available for the U233 Disposition Program for  
26 fiscal year 2022 or 2023 shall be made available for the

1 transfer of the inventory of uranium-233 to the interim  
2 or permanent storage facilities identified under this sec-  
3 tion.

4 **SEC. 7. INTERAGENCY COOPERATION ON PRESERVATION**  
5 **AND TRANSFER OF URANIUM-233.**

6 The Secretary of Energy, the Secretary of the Army  
7 (including the head of the Army Reactor Office), the Sec-  
8 retary of Transportation, the Tennessee Valley Authority,  
9 and other relevant agencies shall—

10 (1) work together to preserve uranium-233 in-  
11 ventories and expedite transfers of uranium-233 to  
12 interim and permanent storage facilities; and

13 (2) in expediting such transfers, seek the assist-  
14 ance of appropriate industrial entities.

15 **SEC. 8. REPORT ON USE OF THORIUM REACTORS BY PEO-**  
16 **PLE'S REPUBLIC OF CHINA.**

17 Not later than 180 days after the date of the enact-  
18 ment of this Act, the Comptroller General of the United  
19 States, in consultation with the Secretary of State, the  
20 Secretary of Defense, and the Administrator for Nuclear  
21 Security, shall submit to Congress a report that—

22 (1) evaluates the progress the People's Republic  
23 of China has made in the development of thorium-  
24 based reactors;

1           (2) describes the extent to which that progress  
2           was based on United States technology;

3           (3) details the actions the Department of En-  
4           ergy took in transferring uranium-233 technology to  
5           the People's Republic of China; and

6           (4) assesses the likelihood that the People's Re-  
7           public of China may employ thorium reactors in its  
8           future navy plans.

9   **SEC. 9. REPORT ON MEDICAL MARKET FOR ISOTOPES OF**  
10                                   **URANIUM-233.**

11           Not later than 180 days after the date of the enact-  
12           ment of this Act, the Director of the Congressional Budget  
13           Office, after consultation with institutions of higher edu-  
14           cation and private industry conducting medical research  
15           and the public, shall submit to Congress a report that esti-  
16           mates the medical market value, during the 10-year period  
17           after the date of the enactment of this Act, of actinium,  
18           bismuth, and other grandchildren isotopes of uranium-233  
19           that can be harvested without downblending and destroy-  
20           ing the uranium-233 source material.

21   **SEC. 10. REPORT ON COSTS TO UNITED STATES NUCLEAR**  
22                                   **ENTERPRISE.**

23           Not later than 180 days after the date of the enact-  
24           ment of this Act, the Director of the Congressional Budget  
25           Office, after consultation with relevant industry groups

1 and nuclear regulatory agencies, shall submit to Congress  
2 a report that estimates, for the 10-year period after the  
3 date of the enactment of this Act, the costs to the United  
4 States nuclear enterprise with respect to—

5 (1) disposition of uranium-233;

6 (2) payments to nuclear facilities to store nu-  
7 clear waste; and

8 (3) restarting the manufacturing the United  
9 States of high-assay, low-enriched uranium.

○