The proposal to use a Thorium fuel to be obtained from the US-based CCTE for use in PHWRs in India, instead of using indigenously available Thorium through DAE-based technology, raises strategic concerns

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Former Secretary to the Government of India

To

Dr. Ajit Kumar Mohanty
Chairman, Atomic Energy Commission (AEC)
&
Ex-officio Secretary, Department of Atomic Energy (DAE)

Dear Dr Mohanty,

NTPC is reported to have entered into a joint venture agreement with a US-based company, Clean Core Thorium Energy (CCTE) for exploring the "development and deployment of ANEEL™ (Advanced Nuclear Energy for Enriched Life), a Thorium-based fuel for use in domestic Pressurised Heavy Water Reactors (PHWRs), subject to approval from the respective Governments" (https://ntpc.co.in/media/press-releases/ntpc-and-ccte-advance-thorium-based-aneeltm-fuel-phwrs)

This report comes as a surprise, as DAE's scientists and engineers have been engaged in R&D work for several decades to operationalise the use of Thorium as a long-term fuel for power generation, as visualised by Homi J Bhabha, the architect of India's nuclear development strategy.

As recently as on 6-8-2025, refering to the use of Thorium as a fuel for power generation, the Minister in charge of the DAE stated in the Lok Sabha as follows:

"India follows a Nuclear Fuel Cycle, aligned with its three-stage nuclear power programme in order to optimally utilize India's limited uranium resources and to exploit its large thorium reserves for long term energy security. It involves the recovery and recycling of fissile and fertile material from spent nuclear fuel (SNF), rather than disposing it of as waste. This approach enables enhanced utilization of nuclear material resources, improves energy security, and minimizes high-level radioactive waste volumes. The programme aims to use domestic uranium in the Pressurised Heavy Water Reactors (PHWRs) and use plutonium obtained from the reprocessing of spent fuel of

PHWRs in Fast Breeder Reactors. Large scale use of thorium will subsequently follow, first to breed Uranium-233 from Th-232 and then utilize U-233 as fuel

Research on thorium utilization for the third stage of closed fuel cycle continues to be a high priority R&D area of the Department of Atomic Energy (DAE). In this regard, necessary R&D is being carried out in Bhabha Atomic Research Centre (BARC) and other research organisations attached with DAE. Some important highlights of these achievements and activities are the following:

1. **Thorium Oxide (Thoria) pellets contained in bundles have been used in the initial cores of PHWRs and valuable experience has been generated in operation and re-use of this irradiated thorium fuel. Thoria based fuels have also been irradiated in the research reactors of BARC. After such irradiation, these fuel elements have been examined in the laboratories at BARC for post-irradiation studies.**
2. **The irradiated Thoria pins of research reactors have been reprocessed to obtain Uranium-233. The recovered Uranium-233**

has been fabricated as fuel for the 30kW (thermal) KAMINI reactor, which is in operation at Indira Gandhi Centre for Atomic Research (IGCAR) at Kalpakkam. This is the only reactor in the world operating with Uranium-233 fuel.

3. **The technologies for fabrication of Thoria based fuel pellets, carrying Uranium-233, have been established at laboratory scale"**

In other words, the DAE's strategy to be entirely self-reliant in developing Thorium as a long-term fuel continued to remain unaltered till date. The DAE has invested its resources heavily on R&D activity associated with Thorium-based reactors for using Thorium, extracted from indigenous resources.

What surprises me is that, all of a sudden, a US-based company, Clean Core Thorium Energy (CCTE), guided and advised by those associated at the highest level in the past supervising DAE's R&D work on Thorium and by those associated closely with national security policy concerns, acompany financed partly by Inda-based investors, should post haste obtain US government's 10 CFR Part 810 License, almost coinciding with the passage of the SHANTI Act

and join hands with a non-nuclear CPSE, NTPC, to experiment its Aneel Thorium (bundled with with Uranium) fuel in NPCIL's own PHWRs. (https://www.globenewswire.com/news-release/2025/09/03/3143584/0/en/CCTE-Secures-10-CFR-Part-810-License-Advancing-US-India-Civil-Nuclear-Cooperation.html).

I am not sure whether NTPC has kept NPCIL fully in the picture, though it proposes to use the latter's reactors to host Aneel fuel.

As early as on 27th December, 2024, i.e. more than a year ago, NTPC and CCTE issued a joint press statement announcing their intent to explore development/ deployment of "ANEEL™" a Thorium based fuel for PHWRs. This implies that NTPC and CCTE had been negotiating such a joint venture for quite some time even prior to 27th December, 2024.

How is it that the DAE had not adequately briefed the Minister to disclose such an important development to the Parliament, when he provided information to the latter on the use of Thorium fuel?

Does it imply that the results of the commendable R&D effort of the DAE's scientists and engineers in developing Thorium fuel would no longer be available for deployment in India's PHWRs, which form the backbone of india's nuclear power development?

Now that the proposal is to deploy Thorium fuel from a US-based company in PHWRs, does it imply that the US would exercise oversight on its use in NPCIL's PHWRs? The use of such a fuel in NPCIL's PHWRs would necessarily result in CCTE becoming privy to sensitive infrmation relating to the use of heavy water etc. Has the DAE examined that aspect carefully?

While the NTPC-CCTE joint venture presently envisages the use of Aneel fuel imported from the US, it visualises the same Aneel fuel being developed at a later stage from indigenously available Thorium resources. Since the use of Aneel fuel technology is subject to restrictions under the US granted 10 CFR Part 810 License, it may also imply extending US regulatory oversight to the use of Thorium extracted from domestic sources. That may raise serious

strategic concerns for India. Has the DAE examined this aspect adequately?

Section 20 of the erstwhile Atomic Energy Act precluded DAE's scientists from applying for patents for their individual R&D contribution. I find that the DAE did file two applications in August, 2021 for obtaining patents in Canada and Australia for the contribution made by its scientists on "a process for the Production of Thorium Phosphate" and it is not clear as to ithe present status of those applications (https://dae.gov.in/patents-filed-by-department-of-atomic-energy/)

Considering the enormous R&D effort put in by DAE's scientists and engineers on Thorium fuel, I am surprised that the DAE had not fully claimed intellectual property rights for such effort.

On the other hand, the promoters of CCTE have already obtained patents for their Aneel fuel in the US and elsewhere.

Have the DAE and the AERB carried out a techno-economic appraisal of the proposed Aneel fuel?

The Canadian Nuclear Safety Commission (CNSC) has carried out a preliminary regulatory design assessment of CCTE's ANEEL fuel for intended use in Canada's CANDU (PHWR) nuclear reactors (https://www.cnsc-ccsn.gc.ca/eng/reactors/power-plants/pre-licensing-vendor-design-review/preliminary-design-assessment-ccte/) and CNSC has not yet given its final approval for using Aneel. Has the AERB contacted CNSC in that regard?

I request the DAE to address each one these concerns carefully, apprise the Union Cabinet, the Parliament and the public at large of the imoplications from the national interest pointy of view.

Now that the SHANTI Act has opened the floodgates to the entry of private players, including foreign players, in the hitherto prohibited area of nuclear power development, the concerns I have raised above assume great importance.

I am afraid that as a result of the recent amendments made to the mineral laws to permit private mining of beach sands containg Monazite and as a result of the recently enacted SHANTI Act, the nation may be deviating

significantly from the vision set out by Homi J Bhabha for promoting self-reliance in the arena of nuclear energy. This is something that the Parliament and the public should take note of.

Yours sincerely,

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Visakhapatnam
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