Conservation Council *of* New Brunswick
Conseil de conservation *du* Nouveau-Brunswick

Environmental impact assessment (EIA) for the installation of a small modular nuclear reactor (SMR) unit at the Point Lepreau Nuclear Generating Station near Maces Bay, N.B.

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Introduction

The submission is informed by the provisions of the Clean Environment Act and the Canadian Environmental Assessment Act. This submission is intended to offer observations regarding the scope of the Environmental Impact Assessment (EIA) pertaining to the proposed installation of a Small Modular Nuclear Reactor (SMR) unit at the Point Lepreau Nuclear Generating Station in close proximity to Maces Bay, New Brunswick.

The envisaged project encompasses the entire lifecycle of a commercial demonstration Advanced Small Modular Reactor (SMR) and is jointly undertaken by the New Brunswick Power Corporation (NB Power) in collaboration with ARC Clean Technology Inc. (ARC). This endeavor is situated at the Point Lepreau Nuclear Generating Station (PLNGS) site in Maces Bay, New Brunswick, herein referred to as "the project." The ARC SMR is designed as a modular, sodium-cooled fast reactor with an expected power generation capacity of 100-150 megawatts. The operational lifespan of this unit is estimated at 60 years, with NB Power being designated as the operator and license holder, while ARC fulfills the role of the technology developer. The project is anticipated to represent one of the initial commercial ventures in Canada focused on the establishment of an on-grid SMR facility.

The design of the ARC reactor draws inspiration from the knowledge and experience gained through the development and operation of the Experimental Breeder Reactor II (EBR-II) and the Fast Flux Test Facility in the United States.

The Conservation Council of New Brunswick, in its role, adopts a position of opposition regarding the advancement of nuclear energy, including the deployment of Small Modular Reactors (SMRs) are less cost-effective and less sustainable compared to renewable energy such as wind or solar.

Furthermore, the concept of SMRs is not novel, as small-scale reactors trace back to the early stages of nuclear reactor design and construction. Historical records indicate that in the 1950s, the U.S. Atomic Energy Commission sponsored the development of numerous small power reactors that would be suitable for rural and foreign applications. However, these reactors were eventually discontinued due to their inability to compete on economic grounds [1].

Throughout the seven decades following the inception of the first SMR, a total of 57 distinct designs and concepts have been conceived, developed, and in rare instances, constructed. However, a substantial proportion of these units, once established, have continued to operate without corresponding replacements [2].

In the assessment conducted by the Conservation Council, Small Modular Reactors increase environmental and social risks.

Questions for further consideration

The proposed SMR projects at Point Lepreau, situated within the Peskotomuhkatik homeland, are expected to exert significant and enduring effects on Indigenous rights. This is particularly relevant to areas where the nuclear industry intends to construct a deep geological repository for used nuclear fuel and other sites designated for intermediate radioactive waste. Additionally, the SMR projects will have profound and lasting impacts on the Bay of Fundy, the marine ecosystems it sustains, and the coastal communities [13].

It is imperative to safeguard both human and environmental interests, the following measures are proposed for inclusion in a comprehensive Environmental Impact Assessment (EIA) project content:

1. Early Environmental Consequences Assessment:

- The report should encompass the environmental ramifications from the project's initial stages.

2. Technical Details of Planned Activity:
    - Comprehensive specifications of the equipment used at all stages of the project.
    - Detailed descriptions of technological processes occurring during the project, including emissions and discharges into the atmosphere and water bodies.
    - A technical overview of the decommissioning process and its anticipated environmental impact.
3. Treatment Facilities and Ventilation Systems:
    - Identification and specifications of treatment facilities and ventilation systems.
    - Considerations for the number and types of treatment facilities and ventilation systems to be deployed.
4. Fuel Handling and Sodium Reactivity:
    - Safety measures for fuel transportation.
    - Plans for secure fuel storage at the Point Lepreau SMR unit
    - Strategies for managing sodium reactivity, addressing potential malfunctions and safety precautions.
    - Contingency plans in case of sodium-related accidents
    - Assessment of potential environmental and population impacts from sodium leaks, explosions, or accidents.
5. Waste Management:
    - Comprehensive analysis of waste generated by the SMR unit, specifying waste types and quantities
    - Identification of radioactive waste to be released into the atmosphere during operation
    - Inclusion of a list of all waste chemicals with their respective half-lives
    - Measures to mitigate waste dispersion risks
    - Detailed description of radioactive waste disposal methods
6. Removal and Transportation:
    - Description of the fuel supply routes for the plant
    - Specification of radioactive waste transport routes to geological repositories
    - Assessment of population and environmental impacts during waste transportation
    - Evaluation of discharges and emissions during accidents involving radioactive materials

- Environmental risk assessment for transportation under normal conditions and during accidents

7. Radiological Air Emissions:
    - Identification of emissions sources from the Point Lepreau SMR unit
    - Calculation of airborne emissions from the SMR unit
    - Assessment of emissions' interactions with natural resources
    - Identification of carcinogenic substances emitted during operation and their toxicity
    - Strategies for managing emitted gases
8. Compliance with Regulatory Limits:
    - Evaluation of whether emissions from the facility conform to regulatory standards and whether these standards are sufficiently stringent to prevent adverse environmental, health, and population impacts
9. Microclimatic Conditions Impact:
    - Assessment of the effect on microclimatic conditions, including the formation of elevated temperature zones during facility operation
10. Water Impact:
    - Specification of the required water intake for facility operation
    - Assessment of qualitative and quantitative characteristics of discharged water
    - Evaluation of impacts on groundwater and nearby water bodies
    - Consideration of elevated discharge water temperatures on physical properties and aquatic life
    - Description of temperature normalization measures
    - Assessment of potential changes in aquatic plant and animal populations
11. Radiation Contamination:
    - Analysis of radionuclide sources impacting agroecosystems under normal and emergency conditions
    - Detailed environmental monitoring program during facility operation
12. Public Health:
    - Assessment of the effects of electromagnetic and ionizing radiation on plant personnel
    - Evaluation of dangers and potential health risks during facility operation
13. Emergency Response:
    - Comparative assessment of environmental impacts under normal operation and during accidents
    - Identification of possible emergency scenarios and preventive measures
    - Provision of dose levels for initiating countermeasures
    - Calculation of region contamination in case of worst-case accident scenario

    - Formulation of an Emergency Response Plan, delineating responsibilities and technical means
    - Estimation of costs associated with compensating for population and environmental damage in case of accidents
14. Economic Assessment:
    - Estimation of costs throughout the project's lifecycle, including construction, operation, and decommissioning
    - Analysis of the economic impact on New Brunswick residents
    - Presentation of actual kW/h rates achievable through project operation
15. Research Methods and Data Sources:
    - Inclusion of all research methods and environmental impact assessment approaches
    - Identification of information sources used in the report, supporting the data and conclusions
16. Environmental monitoring during operation:
    - Formulate environmental monitoring programs, including waste management facilities, by monitoring soil, groundwater, surface water, air and vegetation on a regular and ongoing basis and making results publicly available in a timely manner

These comprehensive considerations aim to address the diverse aspects and potential impacts of the proposed SMR projects and should be integrated into the environmental assessment process to ensure the protection of both human and environmental well-being.

Radioactive waste

In accordance with the provided references and information, it is noted that Small Modular Reactors (SMRs), similar to conventional nuclear reactors, generate radioactive waste. Canada currently lacks a comprehensive strategy for the management of such waste.

SMRs, proposed for deployment across Canada, are expected to generate diverse types of radioactive waste. Certain proposed SMR models entail the extraction of plutonium from irradiated fuel, thereby intensifying concerns regarding weapons proliferation and introducing new categories of radioactive waste with elevated hazards in terms of handling and disposal. Presently, the federal government does not possess a detailed policy or strategy concerning the management of radioactive waste, nor has it identified a design or location for a deep underground repository—where industry envisions the storage of high-level radioactive waste for extended periods, spanning hundreds of thousands of years.

Contrary to the notion that SMRs produce reduced waste, it is found that they may, in fact, generate up to 30 times more radioactive waste per unit of electricity produced than traditional nuclear power plants. This finding is articulated by researchers who caution that due consideration must be given to waste management and disposal, which may be currently overlooked as policymakers and developers expedite plans for new nuclear infrastructure [3].

An examination of waste streams from SMRs reveals key distinctions in terms of volume and chemical/physical reactivity when compared to Light Water Reactors (LWRs). These distinctions impact the available options for waste management and disposal. SMRs are characterized by an inherently higher neutron leakage, which suggests that, in comparison to LWRs, they are less efficient in terms of generating, managing, and eventually disposing of key radionuclides present in nuclear waste [4].

The excess volume of waste associated with SMRs is attributed to the use of neutron reflectors and chemically reactive fuels and coolants in their designs. Moreover, SMRs do not substantially reduce the production of geochemically mobile fission products such as 129I, 99Tc, and 79Se, which are known contributors to radiation exposure in repository designs [4].

The chance of a neutron leakage in SMRs is considerably higher than that in larger reactors of a similar type. Both water and non-water-based SMRs exhibit increased neutron leakage when compared with gigawatt-scale Light Water Reactors (LWRs). This excess waste volume possesses distinct chemical and physical properties from Pressurized Water Reactor (PWR) waste, thereby influencing their management and ultimate disposal [4].

The fundamental process underlying the operation of an SMR, nuclear fission, inevitably results in the production of radioactive substances. The generation of radioactive waste is intrinsically tied to the production of nuclear energy, irrespective of the reactor type employed. It is pertinent to note that, despite decades of well-funded research, a viable means of safely managing nuclear waste remains elusive, primarily due to a combination of social and technical challenges [5].

Waste streams from SMRs are notably different from those of existing reactors. Molten salt- and sodium-cooled SMRs employ highly corrosive and pyrophoric fuels and coolants, which, following irradiation, become highly radioactive. The relatively high concentrations of 239Pu and 235U in low-burnup SMR Spent Nuclear Fuel (SNF) raise concerns about recriticality in these chemically unstable waste streams. Consequently, waste from SMRs susceptible to exothermic chemical reactions or nuclear criticality in contact with water or repository materials is deemed unsuitable for direct geological disposal. Such waste requires treatment, conditioning, and appropriate packaging before geological disposal, thereby introducing additional costs, radiation exposure risks, and proliferation pathways [4].

In consideration of these aspects, SMR designs present a substantial net disadvantage with regard to nuclear waste disposal activities and are found to be incompatible with existing nuclear waste disposal technologies and concepts [4].

The volume of waste, although a significant factor, is not the sole determinant of the geological repository size needed for waste burial. Heat production and waste composition also play pivotal roles in this regard [6]. SMRs, which are fueled by plutonium, necessitate the processing of spent fuel, often involving reprocessing plants that may generate increased quantities of various types of radioactive waste.

Additionally, the concept of building multiple reactors at a single site, as proposed for SMRs, is seen as a strategy to reduce costs by capitalizing on shared infrastructure. However, this approach increases the risk that an accident at one unit could trigger accidents at other reactors or complicate preventive actions. The presence of multiple reactors increases the cumulative radioactive inventory, potentially rivaling that of a larger reactor. Shared systems may introduce vulnerabilities and dependencies, further enhancing risks associated with SMR deployment [5].

The construction and operation of the proposed ARC-100 reactor carries the risk of widespread radioactive contamination in the vicinity of the Bay of Fundy in the event of an accident.

The long-distance transportation of radioactive nuclear waste to a geological repository presents elevated costs and accident risks. For instance, the transport distance from Point Lepreau to the geological repository could exceed 2,000 kilometers. The frequency of accidents involving transport vehicles and freight trains introduces uncertainties and concerns regarding the safety of these operations, particularly in proximity to populated areas and waterways.[7]

In light of these considerations, there is a compelling argument for retaining decommissioned nuclear reactors and their associated waste at their current locations to avert potential catastrophic incidents. The transportation and abandonment of nuclear waste can have adverse effects on the rights, environments, and activities of the affected populace. Given the potential for long-term environmental contamination and risks to living organisms, the containment and careful maintenance of radioactive waste, with continuous monitoring, is advocated.

The potential reductions in the size, lasting impact, and radioactivity of nuclear waste achieved through advanced fuel cycles don't provide significant benefits when planning a storage site for long-lived nuclear waste. The success of such a storage site depends on various factors, including the natural environment, the chemistry of the waste, and how radiation is distributed throughout the fuel cycle system, rather than just the waste's size and radioactivity. It's important to note that there are currently no operational waste storage sites for nuclear waste from commercial nuclear power plants anywhere in the world. This is primarily because of the significant challenges, both technical and social, associated with proposed solutions. Therefore, any community hosting a Small Modular Reactor (SMR) might essentially be agreeing to manage nuclear waste for an extended period, possibly spanning centuries.

HALEU (High Assay Low Enriched Uranium)

The Canadian Nuclear Safety Commission (CNSC) lacks prior experience with High Assay Low-Enriched Uranium (HALEU) due to its absence from commercial reactors in Canada. HALEU fundamentally differs from the natural (unenriched) uranium employed by CANDU reactors and the low-enriched uranium used in light-water reactors worldwide [8].

The ARC-100 design necessitates the use of enriched uranium fuel known as HALEU (High Assay Low-Enriched Uranium). Notably, HALEU differs from the natural uranium used in CANDU reactors and the low-enriched uranium prevalent in global light-water reactors [8]. Enriched fuel, including HALEU, contains a higher concentration of U-235 uranium, which can sustain a nuclear chain reaction. While the fuel for contemporary light-water reactors is typically enriched to no more than 5 percent, HALEU is enriched within the range of 5 to 20 percent. Specifically, the ARC-100 design calls for the use of HALEU with up to 15.5 percent enrichment [8].

It is essential to acknowledge the Experimental Breeder Reactor II (EBR-II), the inspiration for the ARC design, operated exclusively in a research setting and was never integrated into a commercial electricity grid. This operational limitation stemmed from the fact that the EBR-II reactor used uranium fuel enriched up to 65 percent, which approaches the threshold for weapons-grade fuel and is not permitted for use in commercial power reactors. Commercial power reactors are constrained to using fuel enriched to 20 percent or less. As previously mentioned, the ARC-100 design mandates the utilization of HALEU fuel enriched to less than 20 percent [8].

Historical attempts to commercialize sodium-cooled reactors span more than five decades, involving more than $50 billion of investment. These endeavors have been marked not only by failures but also by several perilous fires and explosions, largely attributable to the reactivity of sodium coolant. Presently, there is no operational commercial sodium-cooled reactor that uses fuel enriched to less than 20 percent [8].

The recent geopolitical developments, such as Russia's invasion of Ukraine, have elevated the priority of ensuring energy supply security and avoiding the repercussions of rising energy prices. Given the significant role played by Russia as a major energy exporter, it is anticipated that further increases in energy prices will ensue. As a result, there is an imperative need to swiftly and economically reduce dependence on fossil or nuclear fuels, particularly those sourced from Russia.

The ARC-100 reactor design hinges on High Assay Low-Enrichment Uranium (HALEU) fuel, which is presently exclusively supplied by Russia. HALEU is enriched to levels of up to 20 percent, as opposed to the customary 5 percent enrichment level in uranium used by most nuclear plants. Notably, only TENEX, a subsidiary of the Russian state-owned nuclear energy company Rosatom, currently offers HALEU commercially [9].

Given the current reliance on Russia for the supply of HALEU and the likelihood of sanctions affecting the availability of Russian fuel in the foreseeable future, Canada currently lacks the capacity to produce HALEU fuel. Although the United States is gearing up to manufacture HALEU for the purpose of supplying SMR designs developed within their borders, there remains uncertainty regarding the availability of HALEU to support reactor projects in Canada in the coming decades.

In light of the expected unavailability of planned HALEU fuel within the specified time frame, the ARC-100 project may need to explore alternative fuel sources. It should be noted that the utilization of HALEU introduces an elevated risk of accidental criticality, or an uncontrolled chain reaction, in used fuel—a risk that is virtually non-existent with the natural uranium fuel used in CANDU reactors currently operational at Point Lepreau.

"Breeder" reactors

In the United States, the first and only commercial sodium-cooled breeder reactor, Fermi-1, experienced a catastrophic meltdown in 1966 due to a series of failures. Similarly, historical performance records indicate challenges with high-temperature, gas-cooled reactors. Sodium is highly reactive and contact with air or water results in explosions and flames. As a consequence, sodium reactors have faced persistent challenges associated with fires and leaks.

Sodium-bonded spent nuclear fuel differs from spent nuclear fuel in conventional commercial nuclear reactors. It contains highly reactive metallic sodium, and often includes metallic uranium and plutonium, both of which pose potential reactivity hazards. In some instances, highly enriched uranium may also be present. The presence of metallic sodium presents significant challenges in managing and ultimately disposing of this spent nuclear fuel. For instance, metallic sodium reacts vigorously with water, leading to the production of explosive hydrogen gas and corrosive sodium hydroxide, both of which could affect the operation of a geological repository.[10]

One of sodium's principal drawbacks is its violent reactivity with water and its propensity to ignite when exposed to air. Steam generators, which separate molten sodium and high-pressure water using thin metal components, have proven to be problematic features in breeder reactors. Any breach in these systems results in reactions that can lead to tube ruptures and significant sodium-water fires.

A considerable proportion of liquid-sodium cooled reactors have experienced extended shutdowns due to sodium fires. Russia's BN-350 reactor, for instance, had a major sodium fire incident. In response, the subsequent BN-600 reactor was designed with separate bunkers for steam generators to contain sodium-water fires. It also included an additional steam generator to allow for the repair of fire-damaged units while the reactor continued to operate, utilizing the spare unit. Between 1980 and 1997, the BN-600 reactor experienced 27 sodium leaks, 14 of which resulted in sodium fires.[11]

Furthermore, leaks from pipes into the surrounding atmosphere have resulted in serious fires. Japan's prototype fast reactor, Monju, had a significant sodium-air fire incident in 1995, leading to repeated delays in restarting the reactor. As of the end of 2009, the reactor remained shut down. Breeder reactors in France, such as Rapsodie, Phenix, and Superphenix, as well as the United Kingdom's Dounreay Fast Reactor (DFR) and Prototype Fast Reactor (PFR), have all encountered substantial sodium leaks, some of which caused severe fires.[11]

Additionally, Canada has not constructed any sodium-cooled reactors, and the Canadian Nuclear Safety Commission has not conducted evaluations of such reactor designs.[12]

One common rationale for designating a nuclear reactor as a breeder is the intention to extract substantial quantities of plutonium from used fuel through a process known as reprocessing, with the aim of reusing the plutonium as new fuel in a reactor. The ARC-100 is classified as a "breeder" reactor because it is designed with the intent to reprocess used fuel.[13]

However, reprocessing used nuclear fuel, which entails the extraction of plutonium, is presently prohibited in Canada due to concerns about nuclear weapons proliferation. Canada has informally refrained from reprocessing since the 1970s, following India's nuclear weapon test, which utilized plutonium derived from a "peaceful" nuclear reactor that Canada had contributed. Moreover, reprocessing is regarded as a security liability with questionable economic benefits. The perceived need to adopt reprocessing technologies, especially to prepare non-traditional spent fuels for storage and disposal, represents a significant drawback compared to light water reactors.

The use of HALEU fuel or alternative fuels derived from nuclear weapons is associated with heightened security risks and nuclear weapons proliferation concerns, particularly in the context of plutonium reprocessing. These concerns will inevitably lead to increased secrecy surrounding the ARC-100 project. Heightened secrecy is expected to reduce transparency and limit sharing of information, making it more challenging for residents of New Brunswick to ask questions and make informed decisions regarding the role of nuclear power and the activities of nuclear operators in the province. Furthermore, the transportation of HALEU fuel or alternative nuclear materials through New Brunswick raises safety and security issues.[14]

SMRs are more expensive than other energy sources

SMRs are deliberately reverting to the smaller scales characteristic of the 1950s and 1960s, scales that were previously attempted but ultimately abandoned due to their lack of economic viability, even with standardized reactors deployed on submarines and aircraft carriers.

A study conducted in Canada has revealed that the cost of generating energy from small nuclear reactors can be up to ten times higher than that of renewable energy sources. Over the past decade, the costs associated with constructing solar, wind power, and battery storage facilities have substantially decreased, while the expenses tied to building new nuclear reactors have risen. Consequently, the construction of small reactors is projected to be even more costly per unit of power in comparison to their larger counterparts [15].

In the current landscape, smaller nuclear plants are expected to be more unprofitable than larger plants. To illustrate this, an SMR with a power capacity of 200 megawatts would entail a construction cost roughly equivalent to 40% of that required for a 1000-megawatt reactor, yet it would generate only 20% of the electricity output. Consequently, the 200 MW SMR would incur roughly double the cost per megawatt of capacity. Similarly, the operational expenses of an SMR would also be higher per megawatt of capacity when compared to a large reactor due to diseconomies of scale. Both of these factors will culminate in a higher cost per unit of electricity generated. While these power laws may not provide exact cost calculations, they do highlight the economic challenges inherent to smaller reactor sizes.[16]

The majority of early small reactors constructed in the United States were retired prematurely due to their inability to compete on economic grounds.

Advocates of small modular and advanced nuclear reactor designs frequently argue that their innovations significantly differ from current reactor technologies. Two corollaries arise from this argument. Firstly, the lack of experience with these novel designs leads to greater uncertainty in cost estimates and construction timelines, which may result in substantial cost overruns typical of "First of a Kind" projects. Secondly, the introduction of new designs implies that the process of obtaining safety approvals should be more rigorous and consequently more costly, especially within a well-structured and effective regulatory system.[16]

For the cost of electricity from SMRs to reach parity with that from large reactors, the same SMR design would need to be manufactured in large quantities, amounting to thousands, to justify the corresponding cost. Economies of scale necessitate the construction of hundreds or thousands of identical units to be as cost-effective as a larger reactor.

The outlook for cost reductions in nuclear power is grim. In the United States and France, the two countries with the largest nuclear reactor fleets, later-constructed reactors actually incurred higher costs than their earlier counterparts. If this trend persists for SMRs, it implies that small reactors of a similar design will never catch up in terms of cost-effectiveness with larger reactors.[16]

Nuclear power generates fewer jobs per unit of energy output than renewable energy sources such as solar and wind. This design approach aims to reduce the number of operators, primarily due to the significant cost challenges that nuclear power faces. Some envision a future in which nuclear reactors operate in a fully automated or minimally staffed manner. Consequently, SMRs and advanced nuclear technologies are expected to yield fewer jobs per unit of electricity output (in megawatt-hours) when compared to other energy technologies.

Conversely, the high salaries of nuclear jobs result in elevated operating costs for nuclear power plants. Even if the capital and fueling costs of the reactor are negligible, the cost of electricity generated by a nuclear power plant will be nearly three times higher than that of newly constructed solar or wind power plants. Given the declining costs of solar and wind power, this disparity is expected to widen from the theoretical proposal stage to a licensed and constructible design. The unfavorable economics of power plants imply that any construction of nuclear power facilities will likely rely on substantial government subsidies. Consequently, the number of jobs generated in such projects will be quite limited.[16]

Nuclear weapons

The proliferation issue is exacerbated by SMRs in several ways. Firstly, numerous SMR designs necessitate the use of fuel with elevated levels of uranium-235 or plutonium. Secondly, many SMR designs are anticipated to yield larger quantities of plutonium per unit of electricity in comparison to current reactors. Thirdly, in the unlikely event that the global market for SMRs attains the magnitude asserted by their proponents, countries lacking prior nuclear technology may acquire some of the technical means to pursue nuclear weapons development [5].

It is important to note that all reactors produce plutonium as a byproduct in their fuel, but breeder reactors necessitate the recycling of plutonium, involving the separation of plutonium from the intensely radioactive fission byproducts in the spent fuel. This process renders the plutonium more accessible to potential nuclear weapon producers. Breeder reactors, along with the separation of plutonium from the spent fuel of conventional reactors to supply initial fuel for breeder reactors, thereby contribute to proliferation concerns. This reality was starkly demonstrated in 1974 when India employed the first separated plutonium from its breeder reactor program to orchestrate a "peaceful nuclear explosion." Breeders themselves have also been exploited to produce plutonium for weapons. For instance, France used its Phenix breeder reactor to generate weapon-grade plutonium within its blanket. Furthermore, India's decision to abstain from subjecting its breeder reactors to international safeguards as part of the U.S.-India nuclear accord has raised apprehensions about its potential for similar actions [11].

While High-Assay Low-Enriched Uranium (HALEU) is generally deemed impractical for direct utilization in a nuclear weapon, it presents a more attractive option for nuclear weapons development when compared to the Low-Enriched Uranium (LEU) employed in Light Water Reactors (LWRs).

Conclusion

In conclusion, the proliferation risks associated with the extraction of highly enriched uranium and plutonium, which are the primary nuclear explosive materials in the world's arsenals, are both obvious and grave. Plutonium has become the most widely used nuclear explosive material, and its potential use in triggering H-bombs adds to the concerns. Moreover, the theft of these materials, once produced, poses a significant threat as they can be used to create powerful nuclear weapons or explosive devices with relative ease.

Reprocessing, while intended to manage radioactive waste, actually increases the complexity of waste management. It generates new waste types, including low-level waste and plutonium-contaminated waste, in addition to raising the overall volume of nuclear waste by a factor of 20 or more. Furthermore, the extensive processing of intensely radioactive spent fuel using volatile chemicals presents heightened risks of radionuclide release when compared to safer storage methods such as thick metal or concrete casks.

In light of these considerations, it is clear that reprocessing is not a viable solution to reduce the need for radioactive waste storage or long-term management. The associated proliferation risks and increased waste complexity make it a less favorable option when compared to alternative radioactive waste management and storage approaches.

In the assessment conducted by the Conservation Council, Small Modular Reactors increase environmental and social risks. While there are more efficient and cost-effective technologies available, if nuclear technologies are pursued, it is imperative that they are implemented with the utmost focus on safety and proper management. Ensuring that there are no risks or potential damage to local populations, or the environment is of paramount importance. Stringent safety measures, comprehensive regulatory oversight, and responsible waste management practices must be an integral part of any nuclear endeavor to mitigate potential hazards and protect both people and the environment.

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