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From the President Lord Rees of Ludlow

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Dear Minister

The management of separated plutonium

The purpose of this letter is to urge the Government to develop and implement a strategy for the management of the UK's stockpile of separated plutonium as an integral part of its wider energy and radioactive waste policies.

The Royal Society first expressed concern about the lack of a strategy for managing the UK's growing stockpile of separated plutonium in a report in 1998. It urged the Government to commission a review. In the absence of such a review, the Society published a further report in 2007, *Strategy Options for the UK's Separated Plutonium*. It stressed that much had changed since 1998, including the emergence of human induced climate change and energy security as constraints on strategies for energy production and the possibility of new nuclear power stations in the UK. The UK's civil stockpile of over 100 tonnes of separated plutonium is the largest in the world. It is not only hazardous because of its high radiotoxicity, but is politically significant at a time when nuclear proliferation is a major issue. The *status quo* of continuing to maintain the stockpile is not an acceptable long-term option.

The Nuclear Decommissioning Authority (NDA) is in the process of submitting a report to the Government on the options for plutonium management. We have offered them a detailed commentary on their draft document. However, the NDA's remit is concerned exclusively with the management of the stockpile and its possible disposal as a waste. It does not include consideration of possible reuse of the plutonium as a fuel in a new generation of nuclear power stations. If much of the plutonium were used in this way, it could offer both economic benefit and a satisfactory long-term route for management of the plutonium stockpile, as the nature of the resultant wastes would offer greater safety and security against theft and diversion for weapons use. It is therefore important that all the options for plutonium management, including reuse as a fuel, are considered together in determining a long-term strategy, and that this principle is not undermined because of an arbitrary administrative boundary.



President Lord Rees of Ludlow OM
Executive Secretary Stephen Cox CVO

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excellence in science

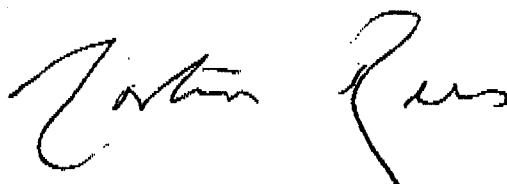
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We presume that the current plutonium stock, or its waste products after being used as a fuel, will ultimately be disposed of in a deep geological repository that is unlikely to be available prior to about 2040. Some options for plutonium management are currently apparent, but given the long time-frame, some will take time to become apparent, such as: whether new nuclear stations are licensed to burn plutonium; the technologies that become available for immobilisation of the plutonium waste prior to disposal; and the design of a geological repository. In this setting, it is important to identify the key decisions that will need to be made, when they need to be made, and what impacts they will have on future options, particularly where they may cut off specific options. Failure to consider these factors could result in significant avoidable costs.

One early decision that will need to be made as companies make long-term plans for a new generation of nuclear power stations is whether to include the option of using plutonium as a fuel. If these plans do not include this option, then this management route, which could provide both the best value plutonium waste strategy and at the same time provide a valuable fuel, could be excluded for the lifetime of the next generation of nuclear power stations.

I have included in the appendix to this letter a commentary on the important issues that we believe need to be considered in the future management of the plutonium stockpile. I would like to arrange for the Society's Plutonium Working Group to discuss their findings with you and your Department in more detail. We aim to be as open and transparent as possible in our policy work, so we intend to publish this letter on our website.

Yours sincerely



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Appendix 1 Major issues for a plutonium management strategy

1 Disposal criteria

The Russian Federation and USA have agreed to dispose of 68 tonnes of their surplus weapons-grade plutonium by converting it to the spent fuel standard by burning it in a nuclear power reactor, in which the residual plutonium is inaccessible for retrieval and weapon use. This is now the preferred standard for evaluating options for disposing of separated plutonium in a number of countries and has, in practice, become recognised as a *de facto* international standard for proliferation resistant disposition of separated plutonium. The NDA also recognises the importance of proliferation resistance when evaluating plutonium management options. However, it is unclear whether there exists any internationally accepted definition of proliferation resistance. A new study of these concepts, including reviews of relevant US analyses, would considerably assist decisions by the UK about plutonium management, as burning it in a reactor could well be an ideal management route prior to final disposal.

2 New nuclear power reactors

The introduction of new nuclear power stations in the UK would open up a set of management options, including the possible reuse of plutonium as a fuel, which would be an effective and technically proven management strategy. If new nuclear power stations are built in the UK, then the stockpile could be burned as Mixed Oxide (MOX) fuel to the spent fuel standard in a new generation of thermal reactors, providing that appropriate fuel manufacturing capacity was available. A future UK programme of Generation IV fast reactors, including possible alternative fuel cycles, such as the closed fuel cycle, could also convert the stockpile to the spent fuel standard if it did not prove possible to do so in thermal reactors prior to their introduction.

The realisation of this option would require plutonium to be used in a Mixed Oxide (MOX) fuel. Since the publication of its 2007 report, the Society has become aware of the extent of the underperformance of the UK's only MOX fabrication plant at Sellafield (the Sellafield MOX Plant, SMP), which, as currently configured, could not convert a significant quantity of the UK-derived plutonium into MOX fuel. The NDA indicates that the alternative to SMP is either to export the plutonium to a MOX fuel fabrication plant abroad or build a new plant in the UK. The export option is not credible due to the associated security risks and transport costs. If a new MOX plant were to be developed, its design should learn from successful commercial MOX plants operating internationally.

3 Energy security

Reusing the plutonium in new nuclear power reactors could significantly contribute to the UK's long term energy security. A growing number of other countries are seeking plans to increase their nuclear power

capacities, and there is a growing awareness of the carbon footprint and worker safety associated with uranium mining. These issues are likely to impact on the demand, price and supply of uranium.

A further alternative to direct disposal or reuse being considered would be to sell the UK's civil plutonium stockpile. Such an option would entail the loss of potential income from the use of MOX fuel to generate electricity. Much more importantly, it would be deeply controversial and face significant political challenges. Among other things, it could make it easier for both State and non-State actors to acquire the fissile material needed to proliferate. It is also unlikely that any buyer would take all the UK's plutonium. What would remain could contain complex plutonium-containing wastes that would still require an effective management strategy for its disposal.

4 Impact on a geological repository for radioactive wastes

All the management options identified by the NDA will require some plutonium to be disposed of in a geological repository. Options for plutonium management must therefore be incorporated into the UK nuclear waste strategy, including the design and operation of a UK geological repository. This should be addressed as a matter of urgency. A late decision to incorporate plutonium wasteforms in the repository after the design had been agreed or implemented could be very costly and difficult to accommodate. The Government must also consider the impact of international nuclear safeguard requirements on the design and operation of a geological repository. Although there are guidelines for the management of separated plutonium, currently no international standards exist for the disposal of plutonium in spent fuel.

5 Nuclear science base and skills

Part of the present strategic thinking about UK energy needs and safe disposal of nuclear waste must include a review of the staff, training and research needs in nuclear science and technology. This review will need to determine what future options would become impossible due to the loss of skills and whether it would be possible (and economic) to import these skills from overseas.