

Consultation on the Nuclear Industry Association's Application to Justify New Nuclear Power Stations

Response from the Nuclear Consultation Group (NCG)

1. Introduction – Concerns about the Consultation Process

The principle of justification means that 'no practice involving exposures to radiation should be adopted unless it produces sufficient benefit to the exposed individuals or to society to offset the radiation detriment it causes' (Defra, 2004). As presented in the consultation documents (DECC 2008a and 2008b), justification appears to be a narrow, technical process requiring a need to identify and calculate detriments and benefits. Moreover, it is a process that is complex and not easily accessible to widespread public and stakeholder engagement. The process is largely conducted and controlled within government with the Secretary of State for Energy and Climate Change being the justifying authority and therefore taking the decision as to whether a practice is justified.

The Nuclear Consultation Group (NCG) considers this process to be of fundamental importance in the consideration of whether the UK should proceed to build a new fleet of nuclear reactors. It follows that justification should be exposed to the widest possible review, going well beyond the internal dialogue among those with privileged access (officials, the nuclear industry and some concerned stakeholders) that has been the practice hitherto. That is why NCG has written to the relevant ministers, regulators and other bodies urging that the process be 'carried out in a way that is thorough, transparent, neutral and independent' (letter attached).

NCG considers that an integral component of the process should be an independent inquiry as allowed for under the regulations governing Justification.

NCG argues that a fuller consultation culminating in an inquiry is necessary to inspire public confidence in the process, and public trust in the governance of nuclear risk. As things stand, the timetable of the processes for decision making on new build is hurried, incoherent and minimises the time needed for effective and democratic consultation. In particular the Justification process appears to be flawed in the following respects:

- There are significant data gaps in the Nuclear Industry Association (NIA) Application, and insufficient data on which to base a reasoned judgement.
- The interrogation of the NIA Application by the Justifying Authority has not been challenging, seeking, or sufficient.

- The process will be concluded before other co-dependent processes, notably generic design assessment, are completed.
- Justification is regarded as a conclusive process thereby precluding further debate on substantive issues at the planning stage
- New nuclear build is treated as a practice based on 'evolutionary design' but, in terms of scale, involves quite new practices in the UK context, namely, the proliferation of very large nuclear stations together with radioactive waste stores including spent fuel in a number of vulnerable coastal locations
- The Secretary of State as Justifying Authority acts as both judge and jury in the case. As the promoter of nuclear energy he has a vested interest in the outcome of the process
- The consultation and methods of engagement with the public that are proposed are inadequate

NCG has been concerned at the inadequacy of previous consultations on nuclear energy (NCWG, 2008). In our submission on the Strategic Siting Assessment (SSA) criteria we observed that the consultation on the 2006 Energy Review was judged to be 'misleading', seriously flawed' and 'manifestly inadequate and unfair' (Sullivan Judgement, 2007). As a result a further consultation was undertaken and this was found by the Market Research Standards Board to be 'inaccurately and misleadingly presented or was imbalanced' (MRSB, 2008). We also criticised the consultation process on the SSA criteria itself (NCG, 2008).

We consider that Justification offers an opportunity for much more effective consultation and engagement on the fundamental issues than has been achieved previously. We, therefore, urge the government to seize it.

Our response goes on to consider the benefits and detriments of new nuclear energy.

2. Nuclear is not Necessary – Viable Energy Resources Exist

In its application the Nuclear Industry Association (NIA) focuses on 'the potentially very significant benefits to the UK in respect of the delivery of low carbon electricity and increased security of supply at affordable prices' (DECC, 2008b, p.3). The application does not rely on other potential economic benefits as part of its demonstration that the practice is justified. The claim being made is that new nuclear is an essential part of the energy mix essential to achieve the UK's carbon targets and to reduce dependency on imported fuels since nuclear may be categorised as 'effectively an indigenous source of electricity' (*Ibid*, p.17).

These claims are contestable. In the first place, nuclear is not an essential part of the mix. Viable alternatives to nuclear exist and are coming on stream. In terms of electricity supply, after a slow start, the UK now has over 3GW of wind capacity in place, and plans for up to 25GW offshore. Indeed the Carbon Trust report *Offshore Wind: Big Challenge, Big Opportunity* proposes even more offshore wind capacity- 29 GW by 2020. The rate of deployment elsewhere in the EU suggests that this could be achieved more rapidly than new nuclear build. The timescale for the proposed 8.6GW Severn Tidal Barrage would be similar to new nuclear. However, there are alternative tidal current flow options that could be deployed incrementally to the same ultimate total capacity at a faster rate, possibly at less total cost and, if in distributed networks around the UK coast, with higher overall capacity credit. Increasing contributions from PV solar and other micro-generation options are also likely, following the adoption of the new Feed-In Tariff. Overall we would see the 'Redpoint' Extended RO37 scenario as desirable as a starting point, leaving little room or justification for nuclear (BERR, 2008b).

On the heat supply side, the proposed Renewable Heat Initiative should lead to expansion of new options like biogas production via waste gasification and AD, as well as solar thermal. For example, National Grid has suggested that renewable gas could meet up to 50% of residential heat demand by 2020. This is a market sector not available to nuclear, but crucial for reducing overall emissions.

The claim that nuclear is low carbon relative to fossil fuels also needs some qualification. Nuclear has a substantial carbon footprint when full fuel cycle is taken into account. There has been some debate about the figures, with up to 112–166 g CO₂/kWh being quoted by Storm van Leeuwen and Smith (www.stormsmith.nl), while industry estimates have suggested 1-3 grams of CO₂e/kWh. However, a systematic study of 103 lifecycle studies of the nuclear fuel cycle has found that, selecting only the most methodologically rigorous studies, typical lifecycle emissions from nuclear plants appeared to be about 66 gCO₂e/kWh (Sovacool (2008), pp.2940-2953). This is significantly larger than for most renewables.

If a large global nuclear programme emerges, recourse will have to be made to lower grade ores with, therefore increased use of (fossil) energy for extraction, transport and fuel processing. This would lead to emissions rising even further.

The idea that nuclear is effectively an indigenous source of electricity supply is also open to challenge. In future energy security may be affected by the need for uranium ore from overseas suppliers. Although it is claimed new uranium resources will be found as prices rise, reserves of high grade uranium ore may not allow for major expansion of nuclear generation on a global scale without leading to conflicts between user nations. In the longer term uranium supply cannot be taken for granted particularly if world wide reactor programmes are taken into account.

A further problem with nuclear is the potential for operational conflicts with renewables if both expand. If a large contribution is expected from renewables, as planned (up to 37GW or more by 2020), then, if nuclear is also expanded (to say 20 or 30GW), there will be a regular need to curtail the output of one or other, or both, during low electricity demand periods. In either case, this will undermine their economics. It may be possible to vary the nuclear output, so that it could play a role in providing balancing power for variable renewables like wind. Whether this is safe is unclear. Regular power shifting can stress reactors, and introduces other operational and safety issues, possibly reducing their operational lifetime, which would further undermine their economic viability.

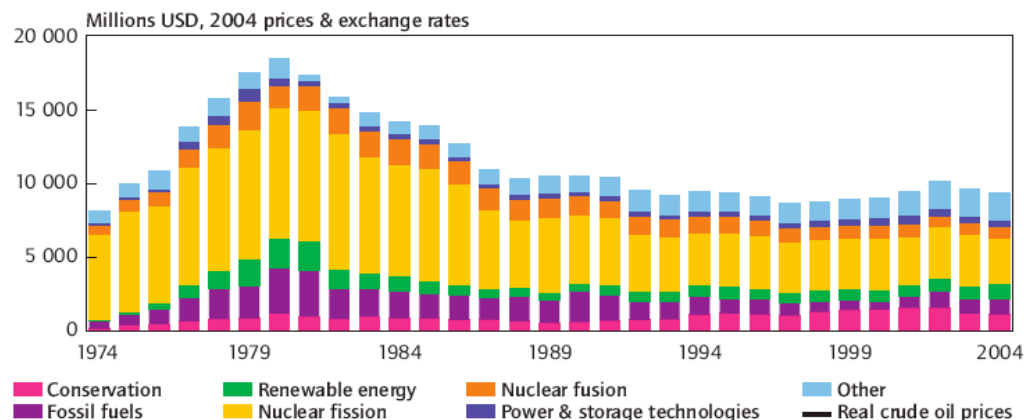
It would make more sense to use some of the existing fleet of low cost gas turbines for balancing, while we develop firm renewables like biomass for back-up in the longer term, coupled possibly with new energy storage facilities. In parallel we will hopefully see the development of smart grid/ interactive load management and a more decentralised pattern of energy supply. Inflexible nuclear plants cannot be easily run or justified in this more interactive and decentralised energy supply and demand system.

On the issue of need NCG concludes that nuclear energy is not an essential part of the energy mix and therefore the development of new nuclear stations is unnecessary and unjustifiable

2.1 Nuclear's Costs are Unjustifiable

Nuclear energy's opportunity costs are very high. An expansion of nuclear investment is likely to divert resources away from other energy options. Given inevitably limited overall funding and technical resources, there will be conflicts if both nuclear and renewables try to expand rapidly. Globally, nuclear continues to get the lion's share of funding (see figure below) and although something more like parity has been reached in the UK, at least in terms of government support, private sector funding may well go preferentially to the more familiar nuclear option. This already seems to have occurred. For example, AMEC has sold off its Wind Energy Ltd subsidiary, one of the largest wind developers in the UK, and is investing instead in the Sellafield nuclear complex, as part of the new consortium.

Figure 1. R&D budgets for IEA member country governments 1974-2004



Nuclear energy has been an unreliable option economically. Experience suggests nuclear will fail to meet construction targets and overrun on costs. Nuclear plant construction programmes have historically been typified by delays and consequent cost overruns, as indicated in Tables 1 and 2.

Table 1 Construction time of nuclear power plants worldwide

Period of reference	Number of reactors	Average construction time (months)
1965-1970	48	60
1971-1976	112	66
1977-1982	109	80
1983-1988	151	98
1995-2000	28	116
2001-2005	18	82

Source: Clerici (2006): European Regional Study Group, the Future Role of Nuclear Energy in Europe, World Energy Council, Alexandro Clerici, ABB Italy, 13th June 2006 and for post 2000 figures, calculation based

Table 2 Average reactor costs increases over expected levels in the USA

1966-1967	209 per cent.
1968-1969	294 per cent.
1970-1971	348 per cent.
1972 -1973	318 per cent.
1974 -1975	381 per cent.
In 1976 (end of programme)	169 per cent.

www.prospect-magazine.co.uk/article_details.php?id=10336

The pattern indicated in Table 2 meant that the US expansion programme at one stage involved 75 reactors with combined initial construction budgets of US\$45 billion, but actual construction costs ran to US\$145 billion. Similar patterns occurred elsewhere. For example, in India, the last ten reactors built averaged construction cost of 300% above budget. And in the UK, the cost of building the Sizewell B PWR went up from £1.7bn to £3.7bn during construction.

That this problem has not been overcome seems to have been confirmed by the cost overruns that have occurred with the first EPR being built in Finland. In 2008, French company Areva, one of the plant's main contractors, announced that costs for the new reactor have risen from €3 bn to €4.5 bn. The second EPR, being built in Flamanville in France has also had significant cost overruns. As a result, the cost of power produced will be around 20% more than planned - around 55 euros a megawatt hour, instead of the 46 euros/MWh announced when the project was launched in May 2006.

NCG considers that the opportunity costs of nuclear combined with the proven tendency to significant cost increases and overruns make a new nuclear programme unjustifiable.

2.2 Nuclear Economics – Unjustifiable Subsidies

The 2003 White Paper on energy stated:

‘Although nuclear power produces no carbon dioxide, its current economics make new nuclear build an unattractive option and there are important issues of nuclear waste to be resolved. Against this background, we conclude it is right to concentrate our efforts on energy efficiency and renewables. We do not, therefore, propose to support new nuclear build now. But we will keep the option open’ (DTI, 2003, p.44).

Only three years later in 2006, despite an apparent deterioration in nuclear economics, despite no evidence of a deterioration in the economics of energy efficiency and renewables and despite no significant progress having been made on nuclear waste disposal, the government reversed this position.

Since this reversal, the government has repeatedly stated that it will be the private sector that decides whether new nuclear plants will be built and that no subsidies will be provided. For example in the energy green paper of 2006:

‘It will be for the private sector to initiate, fund, construct and operate new nuclear plants and to cover the full cost of decommissioning and their full share of long-term waste management costs.’ DTI, 2006, p.17)

By the time of the 2008 White Paper on nuclear power a clear policy reversal had occurred:

‘The Government believes new nuclear power stations should have a role to play in this country’s future energy mix alongside other low carbon sources’ (BERR, 2008a p.5)

Prime Minister Gordon Brown stated to the BBC that,

‘ We will have to do more than simply replace existing nuclear capability in Britain.’

The government’s ambiguity is difficult to understand. On the one hand it is saying that nuclear power is an essential element of the UK’s energy mix, but on the other, it appears to be saying that if private investors choose not to build nuclear plants, it will do nothing to persuade them. If, say, no investment is forthcoming in 4-5 years when the regulatory and planning processes have been completed, is it really credible that the government, having put nearly a decade of political and financial effort into getting new nuclear plants built, will simply walk away? Or will subsidies and guarantees, suitably disguised to minimise public protests, then be offered

The reality is that even if private industry can be persuaded, by whatever means, to build nuclear power plants, the public will have to accept that if significant technical or commercial problems are encountered, taxpayers are

likely to be left with a liability that could easily be counted in tens of billions of pounds. If there is a significant accident, taxpayers will have to foot the bill for the range of costs that will be incurred. If the company building the plant encounters financial difficulties and cannot meet its financial obligations, for example on decommissioning, the taxpayer will have to pay. The risk from accidents was illustrated by the Chernobyl disaster, where costs in the order of hundreds of billions of pounds had to be met by taxpayers of the countries affected. However, the commercial risks have also been illustrated in the UK. In 2002, the privatised nuclear generation company collapsed and the government chose to rescue it at a cost to taxpayers which the government estimated was about £11.5bn. The failure to make adequate provisions and to safeguard the provisions made, has left taxpayers with a liability in the order £80bn to pay for decommissioning existing nuclear facilities.

Whilst the government has stated that it will not provide subsidies and guarantees, it has already offered the nuclear industry a price for waste disposal that will be fixed on the day construction starts. This can only be seen as an 'insurance policy' for nuclear developers and to suggest, as the government does, that this is not a subsidy is to suggest that insurance policies do not carry premiums.

The government's reversal in policy on nuclear power and its apparent increase in commitment towards nuclear are all the more difficult to explain given the significant deterioration in the forecast economics of nuclear power. In 2001, in a supporting paper for the White Paper, which concluded that nuclear power economics were not attractive, the assumption on construction cost was about US\$2000/kW, then about £1000/kW. The 2008 White Paper used a construction cost estimate of £1250/kW. This is way below estimates coming from US utilities and other authoritative studies. In 2008, most construction cost estimates were in the range US\$5000-8000 or at an exchange rate of £1=US\$1.50, £2500-4000, two to three times the government's estimate.

If, as the government implies, this was just a matter for private companies and if it was the shareholders of the companies building new nuclear plants that bore the risk, this would be of no concern to taxpayers. However, as the past decade has clearly demonstrated, taxpayers generally end up with major liabilities counted in billions of pounds if wrong investment decisions are made. The profitability of nuclear depends on the stability of energy markets and the assumptions of costs over the long-run, something very hard to justify over the sixty year lifetimes of nuclear plants. The possibility of government support or subsidy cannot be ruled out.

The prospective need for subsidy to support and maintain a new nuclear programme is an unjustifiable use of public resources

Although not part of the case for justification the economic benefits of new nuclear in the form of jobs or profits are often cited. However, it must be recognised that there will also be economic detriments caused by the blight and negative image associated with nuclear activity. Although difficult to

calculate these detriments are relevant parts of any exercise in determining the case for nuclear energy. This leads us to reaffirm our overall conclusion:

That the case for nuclear energy as a small part of the future energy mix is insufficient to justify the practice and is, in any case, far outweighed by the detriments

3. New Designs - Untried and Unacceptable Risks

In its application the NIA states that, 'The justification stage is too early a point for the evolutionary reactor types, which are at the heart of the proposed new practice, to have been through a full licensing assessment against the NII criteria' (*Ibid* p.48). This statement confirms our concern that the decision on justification is likely to be premature since it is dealing with what are, in effect, new and untried practices including the management of spent fuel for which there is no established long term solution. We are especially concerned that the new high burnup spent fuel presents risks and problems of management that must be fully examined before authorisation or justification can be contemplated. The total radioactivity build up is much greater and occurs over a longer time-scale than that from existing practices. This leads us to conclude that the so-called evolutionary designs should be classified as a new type of practice.

We, therefore, strongly support the government's preliminary view stated in the consultation document that 'the proposed class of type of practice (or the individual designs) proposed in the NIA application should not be considered as "existing practices" since we think it arguable that there are material differences between the proposed class(es) or type(s) of practice and the existing practices' (DECCa, p. 21)

The NCG considers the proposed practices raise a series of unanswered questions concerning risks, costs and detriments that require detailed analysis and consultation before any decision on justification can be made. We outline these concerns in what follows.

Two years ago, calling for a "clear and robust" plan for radioactive waste and decommissioning from new build in the UK the IAEA executive director was quoted in *The Independent*, "The spent-fuel issue is the most critical one for nuclear. It will not develop if there is not a credible and satisfactory answer to the management of spent fuel and one which is convincing for the public. "

Waste management and disposal is regarded as an integral part of the one single practice of nuclear power generation so we have to consider all detriments, including that from the waste, before allowing any new nuclear programme. All detriments have to be considered beforehand, but there are no details of the high burnup spent fuel, the spent fuel pools and racking, the additional onsite storage facilities, encapsulation plants, emplacement machines or the specification of the shielding to be employed at each stage. Indeed no decisions have been disclosed about how the requesting parties

intend to store the fuel (wet or dry) over the 100 year cooling period required by the NDA before disposal.

There is no information on how interim stores that have to last 160 years are protected from terrorist attacks.

There is insufficient experience of the very long term integrity of either high burnup spent fuel elements, or their wet and dry containments, necessary to ensure the possibility of safe retrieval of fuel elements for encapsulation to be assured. Experience of undamaged 37,000mWd/tU fuel over 14 years does not give the required level of assurance.

In the absence of a clear and robust plan for the management of radioactive wastes and spent fuel over a period of at least 160 years there can be no justification for the new practices proposed in the application by the NIA

The plant operator is unlikely to be in existence 100 years after the income stream has ceased and 'reworking' of failed fuel elements will fall to future generations. It is therefore impossible to gauge all the health detriments except to note that retrieval, encapsulation and emplacement will be undertaken in the far distant future by generations that will have received no benefit from the practice. This transfer of 'burdens of cost, effort and worker radiation dose' to future generations violates the principle of intergenerational equity and cannot be justified.

There is no justification for passing the burden of management of wastes from new and untried practices to future generations

High burnup spent fuel of the type proposed is twice as radioactive and twice as hot as spent fuel from reactors such as Sizewell B. Even after 50 years cooling high burnup spent fuel emits more neutrons per second than Sizewell B spent fuel (30,000 MWd/tU) one year after discharge.

The alternative reliance on interim storage on each site for at least 160 years, makes above ground storage vulnerable to terrorism during that period, and all storage facilities, above and below ground, vulnerable to inundation by rising sea levels and storm surges.

Encapsulation and disposal of such fuel may prove impossible after only 50 years cooling because of the neutron radiation. It is not clear from the information submitted how the designers intend to shield workers and public once the spent fuel is no longer shielded by eight metres of borated water. Government policy that operators encapsulate fuel on each site, while being preferable in terms of ensuring operators rework failed fuel elements, may not be enforceable after the income stream has ceased. There is no information on who is to undertake the encapsulation, where it is to be done, or even how it is to be done (wet or dry).

The management of high burnup fuels is likely to be complex, difficult and potentially dangerous to workers and public and, in NCG's view, is unjustifiable

The NDA have only recently received sufficient information on the characteristics of the spent fuel to be disposed of, so there is no 'assessment of disposability'. If disposal of high burnup spent fuel goes ahead after 50 years, twice as many KBS3 disposal canisters may be required, spread out over a larger area in order to avoid overheating the Geological Disposal Facility. Independent estimates of the footprint of such a repository suggest that up to 12 sq km might be required, in addition to the 4 sq km of the 'legacy' repository. Alternative reliance on interim storage on each site for at least 160 years would allow sufficient cooling for a smaller repository, but would require the legacy repository to remain open long after it should be shut. It is inevitable that because of the characteristics of high burnup spent there will be a requirement for a second repository. There is no acknowledgement of this in the Application.

The result is that there is insufficient information, on practically all aspects of spent fuel management and disposal, to make a justification determination.

NCG concludes that there can be no justification for new nuclear build unless it has been conclusively demonstrated to the satisfaction of the public that all the new practices can be safely operated and maintained

4. Radioactive Waste – No Solution, No Justification

The practices proposed by the NIA each involve the long term storage of radioactive wastes, including highly radioactive spent fuel, at the reactor site. We have referred to the technical problems and consequent risks of storing these wastes in the previous section. Our concern here is with the methods of management and the time-scales that are likely to be involved. The conclusion of the Flowers Report in 1976 remains relevant today. It stated that 'there should be no commitment to a large programme of nuclear fission power until it has been demonstrated beyond reasonable doubt that a method exists to ensure the safe containment of long-lived, highly radioactive wastes for the indefinite future' (RCEP, 1976).

It remains the case that there is no established long-term management route for intermediate and high activity wastes. It is accepted that, in so far as it has to be managed, spent fuel is regarded as a waste. Current policy, following the recommendations of the first Committee on Radioactive Waste Management's (CoRWM 1) recommendation supports geological disposal as the best available approach within the present state of knowledge. However, CoRWM's recommendation only applies to legacy wastes. CoRWM also stated that a separate process was required for new build and would need to consider 'a range of issues including the social, political and ethical issues of a deliberate decision to create new nuclear wastes' (CoRWM, 2006, p.14). Among these issues would be the size of the potential inventory and the time-

scales for disposal. No such process has been undertaken or is in prospect. Instead, it appears that government believes it is technically possible to dispose of new build waste through geological disposal and that, by implication, it is not necessary to distinguish between legacy and new build wastes in the search for an acceptable solution.

In any event, the process for achieving a long-term solution is in its very early stages and there can be no certainty that a repository site will be identified, let alone secured and implemented. There is, as yet, no deep repository developed anywhere in the world for the disposal of high activity wastes. While Finland has made some progress and the process is, at present, moving forward in Sweden and France, the Yucca Mountain project in Nevada, USA is facing obstacles and the WIPP facility in New Mexico only receives transuranic military wastes. In most other countries, including Germany, Japan and Spain, progress has been slow and intermittent.

On the basis of contemporary experience world wide as well as in the UK NCG believes there is no long term management solution for radioactive wastes that is sufficiently advanced or credible to enable justification for a new build programme.

CoRWM 1's recommendations, as accepted by government, recognised that 'A robust programme of interim storage must play an integral part in the long-term management strategy' (CoRWM, 2006, p.13). The NIA application indicates that the minimum period of storage on site at the new reactors would be 70 years, that is the 60 years of reactor operation followed by a minimum 10 year delay before disposal. This assumption seems to us heroic. Even the industry is assuming a period of 100 years before disposal and site clearance would take far longer. It is quite conceivable that spent fuel and other wastes will remain on site indefinitely since no final solution is in prospect and may never be. A period far longer than 100 years is conceded by some observers within the nuclear industry. In addition final decommissioning and restoration of sites could take up to another 100 years beyond removal of the spent fuel. Even if a repository were to become available it is still conceivable that sites will not be finally cleared for a period of at least 200 years.

A long period of interim storage extending well into the next century presents two fundamental problems. One is that it is assumed stores will be built to last 100 years. Beyond that period it will be necessary to build new or replacement stores quite aside from the repackaging or encapsulation that will be necessary. It may prove particularly difficult and expensive to maintain spent fuel stores over very long time-scales. The creation of a central or regional stores is a possibility and will raise further problems of transportation. The safe management of stores for the indefinite future places a considerable burden of cost, risk and effort on future generations. NCG believes that current plans for new build almost entirely neglect the detriments that will be experienced by future generations as a result of the very long term storage of radioactive wastes that is conceivable.

The second problem is that the sites for new nuclear stations will become increasingly vulnerable. Most of the sites to be nominated are in coastal locations where forecasts of sea level rise, storm surges and coastal processes indicate an increasing possibility of severe inundation. The trend in forecasts is towards more frequent and severe events and higher sea level rise within the 100 year range. Beyond this uncertainty increases and the situation is likely to get progressively worse. The combination of worsening conditions and longer time-scales for storage could lead to an unmanageable and dangerous exposure to radioactivity for areas near the new build sites, a situation likely to worsen over time.

NCG concludes it would be unfair and impractical to impose the detriments arising from long term interim storage on future generations. It would be difficult, if not impossible, to maintain long-term interim stores into the far future in conditions which are progressively deteriorating. In NCG's judgement it is inconceivable that long term interim storage is justifiable.

5. Security – Clear, Present and Unjustifiable Risk

Security concerns the need to protect the population and environment against the possibility of damage to facilities and consequent release of radioactivity. There are three areas of concern covered in the NIA application. These are: protection against natural forces; protection against major accident; protection against diversion, proliferation and terrorist attack. In each case the NIA claims that the risks of detriments are very small. In NCG's view, however low the probability of the risk, in the event of a release occurring the consequences could be very high indeed. It is not too much of an exaggeration to say that, in some cases, the consequences could be catastrophic.

Therefore, we conclude that the dangers inherent in the operation of nuclear plant and the consequences of accidental or deliberate release of radioactivity are so great that the development of new nuclear plant cannot be justified.

Protection of Plant from Natural Forces. We have set out above our concerns that many of the favoured sites for new nuclear stations are in locations vulnerable to sea level rise, storm surge and coastal processes. The NIA application claims that the implications of more severe conditions have been taken into account and that the 'technologies enveloped in the application are already highly robust with substantial capability to withstand extreme events..' (DECCb, p.99). Flood protection measures will be installed and the level of protection reviewed every ten years and must be compatible with other sea defences in the area. Moreover, they will remain 'until operation has ceased and wastes in interim storage have been removed from the site' (*Ibid*, p.100)). We are extremely concerned about this claim since it appears not to take into account the very long-time scales over which wastes (and decommissioning operations) may remain on site and the continuing deterioration of conditions in terms of sea level rise and storm surges that will occur over the longer

term. The detriments that could occur as a result of nuclear facilities overwhelmed by long term climatic events that have not been taken into account are likely to be very significant.

The NIA concludes, 'It can be seen that the risks from climate change will not materially change the very low risks from reactor technologies within the envelope of this application and so any potential detriment is very low' (*Ibid*, p.100). We find this statement complacent and uninformed particularly when the risks outweigh the envelope of the application (in terms of time-scales and climate changes) are taken into account.

In our judgement the potential detriments from the impacts of climate change on a new build programme make the proposed new practice unjustifiable.

Protection against major accident. With respect to the possibility of severe accident the proposal is similarly disingenuous. The NIA comments that the operating experience accumulated since Chernobyl has exceeded all preceding operating experience of civilian nuclear power plant. It goes on to claim that 'This testifies to the effectiveness of the governance arrangements now in place' (7.25). The reasoning here is, presumably, that lessons have been learned and that severe accidents can never happen again. Of course, this is only true until an accident on this scale does occur. In other words there can be no rational basis for the claim since the possibility of an accident occurring at some point somewhere cannot be ruled out.

The NIA recognises that a severe accident could have major economic consequences, unacceptable radiological effects and would create anxiety even if it occurred outside the UK. With the spread of reactors world-wide the possibilities of accidents are liable to increase. If a major accident were to occur there might well be pressures to shut down reactors everywhere or, at least, to halt the development of new reactors as occurred in the aftermath of Chernobyl.

The risk to people, the environment and to the nuclear programme of a major accident cannot be discounted and is a major reason why the development of new nuclear plants cannot be justified.

Protection from proliferation and terrorist attack. On the issue of proliferation and diversion of materials the application maintains that the risks are 'very low' given the safeguards and the technical difficulties of appropriating and using materials from civil facilities. The possibility of a successful terrorist attack is minimised by buildings which are 'amongst the most robust civil structures in the world and have a multi-layered defence' (*Ibid*, p.101). Nuclear sites are heavily guarded, under surveillance and the capability of armed response is a requirement. Quite aside from the threat to civil liberties this poses, the need for such draconian defensive measures isolates the nuclear industry from most other energy technologies especially renewables which achieve a much less offensive relationship to the community. Whatever claims are made about the ability to defend against terrorism there must

always be the possibility, however remote, of a successful breach of security arrangements or attack on facilities.

In view of this NCG concludes that the possible detriments arising from a successful terrorist attack warrant the further development of nuclear energy unjustifiable.

6. Nuclear Safety – Unjustifiable Harm to Human Health

Health detriments from nuclear operations are a key component of the justification process. As DECC notes, 'Justification is a requirement of EU law under which before any new class or type of practice involving ionising radiation can be introduced it must first undergo a high-level, generic assessment to determine whether its overall benefits outweigh any associated health detriments' (DECCa, Consultation document para. 2). The NIA Application rehearses sets of standardised arguments in support of the notion that health effects from the operation of nuclear reactors have an acceptable impact on the health of proximal communities and populations. This view is problematic for a number of reasons.

The NIA Application states that the likelihood of someone living close to the station dying as a result of a reactor accident is one in 25 million per year, but provides no detailed information to support this. The Application has nothing to say about health detriment from possible exposures following any potential terrorist attack on nuclear facilities. Since 9/11, this horrible possibility cannot be discounted or ignored.

Health detriments from radiation exposures following accident, incident or attack on reactors render new nuclear build unjustifiable.

Recent research suggests that there are real concerns that infants and children living near nuclear facilities may be subject to greater cancer and leukaemia risk.

There is a proven, highly significant, universally acknowledged, and on-going 10-fold childhood leukaemia excess near the reprocessing plant of Sellafield. There has also been a significant 8-fold increased incidence of childhood leukaemia in Caithness near the Dounreay reprocessing plant in Scotland, and a statistically significant childhood leukaemia excesses were found in the West Berkshire region near the Atomic Weapons Establishment (AWE) at Aldermaston, and former USAF Greenham Common.

COMARE have published 8 influential reports on these radioactive environmental risk controversies. Without exception, all of the COMARE reports have concluded that none of the excess childhood leukaemia's or cancers in the local population could possibly be explained by exposure to radioactive emissions resulting from normal operations of those nuclear facilities. Interestingly, although about half of the members of the 2004 Committee Examining Radiation Risk from Internal Emitters (CERRIE) were concerned that raised rates of cancer and leukaemia near nuclear plants in Sellafield and Dounreay 'may well be linked to radio-nuclides from nuclear

facilities'; COMARE's document on the work of CERRIE did not respond to this concern.

However, the radiation risk and health debate is ongoing. A very recent case 2007 control investigation of the German Childhood Cancer Registry (GCCR), carried out on behalf of the Federal Office for Radiation Protection in 41 districts in the vicinity of the 16 nuclear power plant sites in Germany between 1980 and 2003, found that risk of tumour or leukaemia in children under 5 years of age significantly increases the closer they live to a nuclear power plant.

There are real concerns that infants and children living near nuclear facilities may be subject to greater cancer and leukaemia risk.

One of the most significant recent radiation-biology findings concerns the acknowledged phenomena of 'genomic instability'. Genomic instability research has demonstrated a novel alpha particle irradiation effect at low levels. Although the underlying mechanisms (molecular, genetic and cellular) for this phenomenon are not fully understood, the single most important implication of genomic instability is the potential for enhanced germ-line mutation.

Not only does genomic instability suggest that radiation health effects are potentially far more widespread, but risks potentially arise after exposure to doses far lower than current safety limits allow. The number and complexity of the biological effects of differing qualities of radiation tends to bring into question the concept of dose.

The implications of genomic instability are many and varied. Since these changes are unpredictable they are potentially implicated in a range of diseases other than cancer, e.g. immune suppression and degenerative diseases - thus traditional epidemiological methods may fail to pick up this link since the level of effect is too uneven, and the numbers of diseases (potentially induced) so wide.

Since current radiation risk standards are subject to large levels of fundamental scientific uncertainty, and may underestimate risk to public health, it would be unjustifiable to subject critical groups and the general public to further radiological insult through new nuclear build in the UK.

7. Environmental Impacts – Detriments over Time and Space

Environmental impacts are included in the application for completeness, 'to provide a full picture of the benefits and detriments involved in the proposed practice, and to demonstrate that they do not significantly erode the overall benefit' (6.3). It is argued that the environmental impacts are broadly similar to those that would result from any large scale electricity generation project. The implication is that such impacts really do not have to be taken into account in the assessment of justification.

NCG disagrees that the impacts are similar to other large scale electricity generating projects. Nuclear is different in at least three respects. First, the sites for nuclear stations tend to be remote, rural and often coastal locations whereas coal and gas generating stations are usually closer to load centres. Second, the impacts from nuclear generation persist over much longer time scales, extending well beyond station closure into the phase of radioactive waste management and decommissioning. Third, nuclear power stations produce radioactivity which has quite specific environmental impacts on ecological systems as a result of emissions to air and discharges to sea. As a consequence of these characteristics the environmental detriments from nuclear are widely dispersed and have continuing impact on generations into the far future. This feature of interspatial and intergenerational diffusion applies to all the various impacts – noise, traffic, marine life and so on – that are covered in the application.

In addition, there are impacts that have not been covered. Most of the sites favoured for new nuclear power stations are in environmentally sensitive areas, often with national and international designations for habitat, wetland, ecological or landscape quality. This feature increases the environmental detriment created by nuclear energy. There are specific radiological detriments caused to environmental systems which NCG believes should be dealt with at the generic stage of justification rather than left to site specific examination alone.

NCG considers that nuclear power stations create environmental impacts that are additional to those inherent in any electricity generating system by virtue of siting in environmentally sensitive areas and the long time scales over which nuclear activities will persist. NCG believes the environmental detriments arising from nuclear energy are a significant issue for justification.

8.0 Socio-Economic Effects – Detriments may outweigh Benefits

The Application stresses the ‘significant benefits to the local economy around sites and to the UK nuclear supply chain’ (8.36). These are envisaged in terms of job creation and regenerative impacts in remote locations. However, a balanced assessment requires that socio-economic detriments are also considered. Nuclear development may be incompatible with existing activities or a deterrent to inward investment. It must be recognised that nuclear power carries negative perceptions and connotations which may impact on other parts of the local economy. It may be that proposals for new build will have an adverse effect on property values. These detriments are likely to be elevated once construction commences and later when operations begin. Blight will remain so long as there is a presence of nuclear activity on a site, including decommissioning and cleanup.

In terms of quality of life it might be argued that new nuclear power transgresses the principle of sustainable development in that it creates a burden on future generations. Sustainability is not simply an economic issue,

it may also be related to notions of well-being. By this we mean those aspects of living which contribute to the community's sense of identity, development and positive self-image. It may be argued that nuclear power plants tend to present a negative image through their association with threat, danger and fear.

Consequently, the economic and social disbenefits especially to the local economy must be included in any assessment for Justification.

9.0 Conclusion – Ethics, Democracy and Effective Consultation

NCG's response sets out the case against justification of the new practices that are the subject of the NIA's application to justify new nuclear power stations. We have argued that nuclear energy cannot be justified in the face of the very substantial detriments it creates. However, even if the benefits to energy security and carbon reduction are recognised these are, in our judgement, relatively insignificant and far outweighed by the radiological and economic risks inherent in nuclear energy. In particular we argue that the persistence of risk into the far future and the possibility of severe impacts at any time are, in themselves, persuasive reasons why an extension of nuclear energy must be resisted. On grounds of intergenerational equity alone it is unethical, in our judgement, to impose a burden of cost, risk and effort on generations who will experience no benefits but suffer detriments.

The NIA's application quotes the government's conclusions on ethical issues as expressed in the White Paper on Nuclear Power.

'On balance, we believe that not taking action now on climate change..raises more significant inter-generational challenges in terms of climate change related CO₂ and on-going security of energy supplies, than does the management of radioactive waste. Thus, the Government concludes that the balance of ethical considerations does not warrant ruling out the option of new nuclear power stations' (BERR, 2008)

We profoundly disagree with this statement. Nuclear energy is likely to be, at best, a relatively short-term option to deal with an emerging energy gap and the need for carbon reduction. Its contribution to both these problems is likely to be small and, we have argued, attainable by other means. But the long-term implications of embarking on a new nuclear programme in terms of risks and radioactive waste are very substantial. We do not think radioactive waste should be considered alongside climate change. Radioactive waste is long-lived and dangerous *per se*. In terms of the dread it provokes, the dangers of proliferation it harbours and the risks of disease and death it contains, it deserves to be treated independently. Climate change and radioactive waste are difficult to compare not least because of the very long time scales involved with radioactive waste. The problem of radioactive waste will persist long after the consequences of climate change.

It is clear that climate change and nuclear energy raise fundamentally different ethical issues. By suggesting that nuclear new build should be discussed in terms of the need to address climate change the government is framing the discussion in a particular way, one that is likely to privilege the case for nuclear energy.

Finally, NCG is concerned about the implications of the Justification process for democratic participation. The process is relatively obscure, conducted within government and not fully exposed to open and public engagement. Very little effort has been made to ensure that relevant stakeholders, for example, local authorities or community groups are informed and encouraged to respond. The fundamental importance of this stage in the decision making process has not been adequately promoted by government. By underplaying the importance of the process and failing to encourage wider participation Justification may be perceived as a necessary but largely predetermined exercise. The role of the Secretary of State as Justifying Authority tends to confirm this suspicion. It seems unlikely that an outcome other than that of justifying the new practices is possible.

NCG believes the approach adopted by government is undemocratic and unresponsive to the concerns and anxieties of stakeholders and citizens, especially those who are confronted with the possibility of new nuclear power stations in their community. We believe the process should be opened up to a much more far reaching engagement and scrutiny through an inquiry to ensure that all relevant processes, especially the GDA, are concluded before a decision is made. In our view a more open and inclusive process is necessary to ensure public acceptability and confidence in the decision making process.

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On behalf of the Nuclear Consultation Group

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