



September 2005

Comments on Environment Agency's Assessment Documents on Drigg¹

Summary and Recommendations

Greenpeace welcomes the Environment Agency's critical assessment of the BNFL Safety Cases on Drigg. Some of the EA's Conclusions and Recommendations (paragraphs 149 to 161 of its Assessment document) are however questioned. These are discussed below.

The EA Assessment concludes that BNFL's Safety Cases fail to make an adequate case for *continued* disposals of LLW at Drigg:

- From the EA's Assessment, the long-term continued use of the Drigg LLW facility is untenable because of likely future coastal erosion mainly due to sea level rise;
- The EA Assessment clearly reveals that estimated doses and risks to critical groups both from current Drigg operations and from post closure significantly exceed the legal dose constraint applied today; and

Drigg's days as a LLW site are clearly numbered, and it is merely a matter of time before Drigg is closed to further LLW disposals. Because of this it is recommended that:

- any future Authorisation for use of the site to manage low-level waste must be changed to storage only. The Agency should instruct BNGSL to establish and implement plans for this change of use;
- the waste stored there should be packaged using the most up to date methods and facilities built on the site to contain the waste; and
- an essential condition of future use of the site is that BNGSL (or any successor operator) must demonstrate it will meet the EA's criteria and targets as set out in its Guidance on Requirements for Authorisation (GRA) on radiation exposures and risk targets.

It is understood that some have advocated moving the waste. Such a proposal – if accepted - would be up the site operators (BNFL), site owners (NDA), the relevant regulatory agencies and Government departments to resolve. That the industry has disposed of waste at Drigg in unsatisfactory conditions, with little thought to potential future external influences on the site, is something the industry has to answer for.

Greenpeace recognizes that the closure of Drigg will have serious implications for the nuclear industry, the Nuclear Decommissioning Authority (NDA) and Government – particularly as it is expected there will be significant LLW arisings in the UK in the coming decades. For this reason

¹ Greenpeace UK's response to The Environment Agency's Assessment of BNFL's 2002 Environmental Safety Cases for the Low-Level Radioactive Waste Repository Drigg. NWAT/Drigg/05/001 (Version: 1.0- June 2005)

the EA's Assessment should be carefully considered by both the NDA, the Government and be taken into account during DEFRA's concurrent consultation on LLW policy.

Indeed, Greenpeace believes this matter should be referred to the Secretary of State for the Environment for their determination on whether the site remains a disposal facility or changes to a storage facility.

Greenpeace also believes the EA's findings have implications beyond that of the Drigg site. Many of the UK nuclear facilities are situated on beaches or close to the sea. For example, most of the Sellafield site is less than 100m from the sea and is only a few metres above mean sea level. The possibility exists that the Sellafield site could be under the sea in less than 100 years, and the NDA and Government will need to plan for this possibility.

Introduction – background documents

This note comments on two EA reports which assess two BNFL Safety Cases for the continued operation of the Drigg Low Level Waste Repository, and post closure of the site. These reports, both (more than 100 pages long), are titled

*“The Environment Agency's Assessment of BNFL's 2002 Environmental Safety Cases for the Low-Level Radioactive Waste Repository at Drigg” NWAT/Drigg/05/001
(Version: 1.0)*

“The Environment Agency's Explanatory Document to assist public consultation on proposals for the future regulation of disposals of radioactive waste on/from the Low-Level Waste Repository at Drigg, Cumbria operated by British Nuclear Group Sellafield Ltd.”

From this point the reports will be referred to as the EA Assessment and the EA Explanatory Document. Referenced paragraph numbers should be assumed to be from the Assessment.

Comments on background documents

The EA reports discussed in this response comment upon two Safety Cases prepared by BNFL² between 1997 and 2002 and sent to the EA to enable it to issue a single Authorisation for the LLW repository at Drigg. These Safety Cases are respectively entitled the “*BNFL 2002 Operational Environmental Safety Case (OESC)*” and the “*BNFL 2002 Post-Closure Safety Case (PCSC)*” for the Drigg LLW site.

Each of the two BNFL Safety Cases consists of

- a dozen very lengthy Level I reports,
- scores of lengthy Level II reports,

² On April 1, 2005, ownership of Drigg shifted from BNFL to the NDA. British Nuclear Group Sellafield Ltd (BNGSL), a subsidiary of BNFL became the operators of Drigg. BNGSL, unlike BNFL, is no longer responsible directly for policy development. This is now primarily the responsibility of the NDA Nevertheless, for the purposes of this note BNFL and BNGSL may be treated similarly.

- hundreds of Level III reports, and
- thousands of Level IV reports

with each descending level containing more technical detail. Taken together, these documents occupy hundreds of feet of library shelving. However only Levels I and II reports were readily available to the EA. The Safety Cases, voluminous as they are, are not exhaustive, as a number of important information exchanges took place after 2002 between BNFL and the EA which are briefly alluded to in the EA reports.

Consequently the BNFL Safety Cases are extraordinarily lengthy, and their inordinate detail and complexity made their review difficult. It is notable that a team of EA reviewers took nearly 3 years to do this (NB but only three months was granted for NGOs and others to comment on them). Of course, detailed scientific examination of the safety of industrial operations is to be welcomed, but the BNFL Safety Cases are so excessively voluminous that, as the EA points out, essential elements of BNFL's thinking were lost in the maze of reports. In addition, despite (or because of) their inordinate lengths, important matters were insufficiently addressed by BNFL in its Safety Cases which required the EA to seek additional information from BNFL after the safety cases had been sent to the EA in 2002.

It is difficult to avoid the impression that the massive lengths and multiple layers of ever-deepening detail of the Safety Cases represent attempts at obfuscation. At the very least, they indicate an institutional inability or unwillingness to structure and write reports succinctly. Greenpeace understands that during the drafting of the BNFL Safety Cases, a dozen independent consultants were requested to peer review various drafts of the Post Closure Safety Case (PCSC) and the peer reviewers made repeated requests and recommendations to BNFL to clarify and simplify the structure and content of PCSC reports. See (Hill and Irvine, 2003). It is understood these requests were largely ignored by BNFL; with only a few of the reviewers' recommendations implemented.

MAIN FINDING 1: Likely Destruction of Drigg by Coastal Erosion

The Drigg site is approximately 300m from the sea and lies about 8m above mean sea level. The most important finding from the BNFL PCSC is that the Drigg LLWR is "likely to be destroyed by coastal erosion in 500 to 5,000 years" [paragraph 157 (ii)]. This conclusion is accepted by the Agency. This assessment is derived from projections developed by the UN Intergovernmental Panel on Climate Change (IPCC, 2001) using computer models on future sea level rises driven by climate change.

The Technical Summary of the Report of Working Group 1 of the IPCC (2001) has projected a mean sea-level rise of 0.11m - 0.77m by the year 2100. Some coastal erosion in Cumbria is expected to occur without sea level rise: paragraph A2.11 of the EA Explanatory Document states "... BNGSL suggests that the repository might be eroded even if present-day sea level remains constant, but that repository destruction would be even more likely if sea level rises." However most erosion is expected to be due to future sea level rises.³

The important question is – how soon are such sea level rises likely to occur? The PCSC provides various estimates – eg, a rise of 1m to 10m during the next 1,000 years [paragraph 127]; and 500 to 5,000 years [paragraph 157 (ii)]. The EA seems however reticent in its own comments on the matter.

³ These in turn will be mostly the result of thermal expansion of the seas and the possible melting of the Greenland icecap and (to a lesser extent) the Antarctic icecap due to global warming.

In fact, as revealed in various Level III and Level IV documents, pessimistic (but not unreasonable) projections indicate (predict?) sea level rises of a metre or so within the next 100 to 200 years which could result in the termination of the facility earlier than planned.

The above documents and their findings are not referred to in the EA Assessment, but were seen by one of the people Greenpeace asked to provide information for this response. It is understood the documents were sent to the EA in the peer review report (Hill and Irvine, 2003). The 100 year figure is also mentioned in the Draft Report on the Low Level Waste Management Policy Review Stakeholder Workshop.

Nevertheless, buried in the EA Assessment there are hints that the situation may be worse than the 500 to 5,000 years indicated by BNFL. For example, paragraph 129 states

‘Although ... coastal erosion rates and sea-level changes at Drigg are uncertain, BNFL indicates that the destruction of the LLWR by coastal erosion is likely. BNFL states *‘this ... to be a high priority ... on the basis of both likelihood and consequence’* ...

This sentence contains an important footnote (number 19) which states

‘BNFL’s more recent paper on coastal erosion confirms the view that destruction of the LLWR by coastal erosion cannot be discounted and implies that it may actually be more likely than is implied by BNFL in the 2002 safety cases.’

In addition, the EA points out (see paragraph 6.43 (eighth indent) of the Explanatory Document) that in BNFL reports sent to the EA after the PCSC report

‘BNGSL has not justified ... changes in parameter values and assumptions from the 2002 PCSC. In particular,.....the selection of a single, lower coastal erosion rate from a highly uncertain range.’

Much depends of course on the rate of melting of the Greenland and Antarctic icecaps which, if fully realised, would result in global sea level rises of >10m. The distinct possibility of such sea level rises from icecap melting due to increasing global greenhouse gas emissions was discussed at a recent DEFRA-sponsored Conference “Avoiding Dangerous Climate Change” held on February 1-3, 2005 at the Meteorological Office Conference Centre, Exeter. See <http://www.stabilisation2005.com/programme.html>

These findings raise fundamental questions about the utility of the Drigg facility, and the policy of continuing to receive LLW disposals at Drigg. The findings clearly impact on NDA and Government policies on LLW (and CoRWM’s and DEFRA’s work): the matter is not simply a regulatory issue. With regard to this it is noted that the NDA has begun to recognize problems with the Drigg site and has raised some of these in its Draft Strategy Document (section 2.3) [http://www.nda.gov.uk/Our_Business--Strategy_-_Draft_for_Consultation--Commercial_Operations_and_Assets_\(895\).aspx?pg=895](http://www.nda.gov.uk/Our_Business--Strategy_-_Draft_for_Consultation--Commercial_Operations_and_Assets_(895).aspx?pg=895)

Indeed it is for the above reasons, that DEFRA is, inter alia, undertaking a consultation on LLW policy, which is taking place concurrent with the present EA review of Drigg. See UCL, 2005 for the Report on the Low Level Waste Management Policy Review Stakeholder Workshop which discusses coastal erosion - possibly “within 100 years”. See <http://peoplescienceandpolicy.com/llw/papers.html>

Given the amounts of LLW that will be produced in the future, under current plans (and possible industry expansion), the Drigg debacle has major implications for public confidence in LLW disposal and provision for Intermediate Level Waste, High Level Waste, spent nuclear fuel and other radioactive materials.⁴

MAIN FINDING 2: BNFL Safety Cases Fail

The EA concludes that BNFL's Safety Cases fail to make an adequate case for continued disposals of LLW because: (paragraph 157)

- i. doses/risks from existing disposals to members of the public in the future significantly exceed current regulatory targets
- ii. the LLWR is likely to be destroyed by coastal erosion.
- iii. insufficient consideration is given to optimisation, i.e. to demonstrate impacts will be ALARA.

The EA makes many criticisms of BNFL's Safety Cases throughout its Assessment. For example, paras 111 to 115 are severely critical of BNFL's use of supportive arguments, considering many of them to be "irrelevant, misleading or inaccurate" (paragraph 112). The EA adds that BNFL's practices of comparing doses with background levels and citing risks as being tolerable were "misleading" [paragraph 112 (ii) and (iii)]. The NRPB has consistently said that radiation exposures from naturally occurring sources cannot be used to justify those from human activities.

The EA's most wide-ranging criticism of BNFL's Safety Cases is contained in paragraph 160 which states

"We acknowledge that the success of the UK nuclear clean-up programme depends on LLW disposal capacity being available. BNFL argues that continued disposal of LLW at Drigg is in the national strategic interest and is likely to remain so for some decades. However, BNFL has not yet demonstrated that the wider benefits to the UK from continued LLW disposal on the site outweigh the potential future impacts...we expect BNFL to undertake a comprehensive options study, which includes a full evaluation of the social and economic impacts of the different options."

In other words, after spending £millions of taxpayers' money and 5 years' drafting possibly one of the lengthiest and most complex Safety Cases ever carried out, the EA is in effect saying that BNGSL has failed and has to go back to square one and do it all over again.⁵

MAIN FINDING 3: Target Risks and Dose Constraints significantly exceeded

⁴ For the most recent estimates of the UK's radioactive waste inventory under different scenarios see the Committee on Radioactive Waste Manage website <http://www.corwm.org.uk/pdf/1279%20-%20Task%20088%20CoRWM%20Inv%20July%202005%20Final.pdf>

⁵ We note one commentator has estimated the cost of the review to date is £10 million. See http://www.jacksonconsult.com/pdfs/Drigg_Review.pdf

BNFL's 2002 PCRSA (Post-Closure Radiological Safety Assessment- part of the PCSC) states that estimated risks will exceed the fatal risk target of 10^{-6} (1mSv) per year for several scenarios and potential exposure pathways. If Drigg were destroyed by coastal erosion, risks were assessed at approximately 10^{-4} per year. For groups reoccupying areas contaminated by excavated trench wastes, BNFL's PCSC estimated radiation doses of 30 mSv/y for exposure to wastes of average specific activity, corresponding to a risk of 2×10^{-3} per year. The risks were mainly due to long-lived uranium and thorium wastes buried in the Drigg trenches in 1985 some of which in the EA's view was ILW and not LLW [paragraph 121 (iii)].

It is highly questionable whether the EA could authorize continued use of a site knowing that without remedial action (e.g. putting all the waste in stores) that people could be exposed radiation doses of 30milliSieverts (mSv) in the future – when the legal maximum now is 1mSv per. This would certainly breach CoRWM's criteria of not undertaking practices on waste disposal which place a greater burden on future generations than that experienced by the current generation – the generation which has created the waste.

The EA considered that predicted risks from Drigg for several scenarios and potential exposure pathways - in fact exceeded the EA's target "by a significant margin" [paragraph 121 (i)]. Indeed, some of BNFL's dose estimates lay in the range for which the ICRP (1998b) suggested, '*...intervention [e.g., clean-up actions to reduce impacts] may be necessary and should certainly be considered*'. BNFL's highest calculated dose estimates were close to the 100 mSv/y level, above which the ICRP suggested, '*...intervention will almost always be justified under nearly any conceivable circumstance*'. [paragraph 121 (ii)]

The EA considers that radiation risks were dominated by long-lived U and Th wastes in the Drigg trenches, some of which could be regarded as ILW (see reference BNFL 2002g, page 59). Such wastes would not be regarded as suitable for disposal in a near-surface facility today. The scope for reducing their long-term impacts was limited. For example, risks would only be reduced by 15% by the sum of chemically conditioning the trenches and reducing water infiltration through the cap. To achieve significant risk reductions, it would be necessary to remove the U and Th wastes. However the 2002 PCSC did not "present an adequate assessment of the social and economic factors associated with waste disposal to demonstrate that the calculated levels of dose and risk are ALARA". This in the EA's view was "a significant omission" [paragraph 121 (v)].

These dose and risk estimates indicate that Drigg can be neither safely operated at present nor safely closed under BNGSL's current estimates. These estimates also question whether BNGSL should be granted a new Authorisation for the continued operation of Drigg at present, as paragraph 157 states BNFL's OESC Safety Case fails to make an adequate case for continued disposals of LLW at Drigg.

MAIN FINDING 4: Insufficient LLW Capacity at Drigg

The above comments on the need for a review of LLW policy are reinforced by the EA's statement (paragraph 161) as follows

- (a) "The volume of LLW that will be produced in the UK during nuclear power plant decommissioning is likely to far exceed the capacity of the LLWR (RWMAC 2003).
- (b) BNFL acknowledges that, depending on the assumptions made, the capacity of the repository to receive Ra-226 and U-234 may already be exceeded by past disposals.

- (c) There is an urgent need, therefore, to identify the most appropriate national strategy for the future management of the UK's LLW, including the consideration of the possible need for one or more alternative disposal sites...“

It will be necessary to ensure that the concurrent LLW policy consultation being conducted for DEFRA receives the EA's Drigg assessments and Greenpeace's comments on the EA assessments.

MAIN FINDING 5: ALARA not observed and BPEO not demonstrated

In paragraphs 122 and 153, the EA concludes that BNFL's 2002 Safety Cases do not demonstrate that the levels of risk and dose associated with wastes in the Drigg trenches are as low as reasonably achievable (ALARA). In particular, risks are significantly affected by uranium and thorium disposals in the trenches prior to 1985. Clearly the EA is worried about these disposals of uranium and thorium wastes: BNGSL should consider means of repackaging these wastes more safely. In addition, the EA expresses concern that BNFL has not demonstrated that LLW disposal at Drigg represents the BPEO for the management of the UK's LLW (paragraph 115). The EA recommends that BNGSL should carry out further ALARA/BPEO work to ensure that current doses and future risks after closure meet current regulatory criteria.

The EA states (paragraph 159) that as part of its ALARA work, BNGSL should consider a range of realistic risk management options evidently not considered by them. These include

- iv. constructing a thicker, more robust, cap over the disposals;
- v. future disposal of only certain categories of waste (eg, short-lived wastes);
- vi. removal of the long-lived wastes in the trenches contributing most to risk;
- vii. extending the active management period of the LLWR beyond 150 years; and
- viii. combinations of the above.

These EA suggestions, although proposed in an attempt to be helpful, are somewhat problematic because they all assume that the facility will not be destroyed by coastal erosion for at least another 100 years. This is an unwise assumption, as it gives too many hostages to fortune. As regards option (i) - a better cap, the EA itself (in paragraph 155) states

“...improvements to the engineered system are unlikely to result in significant long-term improvement in performance, because the durability of engineered barriers ...cannot be guaranteed over the necessary timescales (e.g. >500 years). Furthermore, it is not sustainable to assume the LLWR will be managed indefinitely.”

The nuclear industry and the Government have to answer how they will respond to the problems at Drigg - without simply trying to move the waste to another area or continue with 'business as usual' which is plainly unsustainable. Certainly, steps have to be taken soon in order to maximize safety at the site through ending disposal and moving towards a robust storage and management system.

Other issues:

Regulatory: If Drigg becomes a storage site rather than a disposal site, under current legislation it would move out of the EA's area of responsibility and into the NII's sphere of responsibility (apart from liquid discharges from the site). Greenpeace hopes that this will not deter the EA making the recommendation that Drigg become a storage site.

It may be that DEFRA would want to reconsider whether or not to give the Environment Agencies legal responsibility for waste stores, rather than leaving the institutional arrangements to be dealt with by memorandums of understanding between NII and the Environment Agencies. We believe there should be clear institutional control (i.e. via the operators) and regulatory control (i.e. one agency covering the storage sites – with input from other relevant bodies).

Sellafield: The findings have implications outside the spheres of low level waste and the Drigg site, as many UK nuclear facilities are situated very close to the sea. For example, most of the Sellafield site is less than 100m from the sea and is only a few metres above mean sea level. Sellafield is important in this debate not only because most of the UK's LLW arisings emanate from Sellafield processes but because it is the site of many hazardous processes involving highly radioactive materials. Some commentators have claimed the 5m sea wall at Sellafield will protect the site. Such comments are ill-informed: the sea wall is designed to provide protection against temporary storms or tidal surges and would not withstand permanent sea level rises. Indeed the EA itself recognised this point as regards Drigg. Paragraph 157 states

“...we consider improvements to the engineered system are unlikely to result in significant long-term improvement in performance, because the durability of engineered barriers (such as sea defences) cannot be guaranteed over the necessary timescales...”

The stark possibility exists that the Sellafield site or parts of it could be under the sea in less than 100 years (depending on what sea-level rise scenarios are applied). The NDA and Government need to plan for this possibility.

Conclusions

In view of the extreme length of the BNFL Safety Cases, the EA's review is welcomed for penetrating their labyrinthine verbiage and critically assessing them in a relatively clear way. However some of the EA's "Key Conclusions and Recommendations" (see paragraphs 149 to 161 of the Assessment) are questioned and require further discussion.

The EA concludes that BNFL's Safety Cases fail to make an adequate case for continued disposals of LLW at Drigg. The EA Assessment clearly reveals that estimated doses and risks to critical groups both from current Drigg operations and from post closure do not meet the required dose constraint and risk target. An important condition is that BNGSL should not be granted a further Authorisation for its Drigg operations under present operations and changes must be made to move it to being a storage site. All operations must meet – at the very least - the EA's criteria and targets as set out in its Guidance on Requirements for Authorisation (GRA). In particular, estimated doses and risks to critical groups from current operations and post closure must meet the EA's required limits: at present they do not.

Clearly, from the EA's Assessment, the Drigg waste facility is untenable because of its location near to the sea. Drigg's days as a LLW disposal site are therefore numbered and it should be closed to further LLW disposals. BNGSL should not be granted an unlimited Authorisation. Any Authorisation should be time-limited, and should require BNGSL to establish plans for the orderly closure of the facility as a disposal site as soon as possible.

The impending need for the closure of Drigg as a disposal facility has important policy implications for the Nuclear Decommissioning Authority and for Government. Therefore the EA's Assessment needs to be carefully considered by both. The EA Assessment should also be considered during DEFRA's present consultation on LLW policy.

The EA's findings also have implications beyond Drigg. For example, most of the Sellafield facility is less than 100m from the sea and is only a few metres above mean sea level. The possibility exists that the Sellafield site could be under the sea in less than 100 years, and the NDA and Government will need to plan for this possibility.

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